

The role of written action plans in childhood asthma

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Purpose of review

The aim of this article is to examine the evidence for the effectiveness of a written action plan as an important element of guided self-management and to identify key features associated with its effectiveness in children and adolescents.

Recent findings

Various written action plans are available for use; however, few have been specifically designed or validated for children. Strong, but limited pediatric evidence confirms that the addition of a written action plan to guided self-management education significantly improves outcome. Use of daily controller medication, with no step-up therapy other than as needed inhaled β_2 -agonist, best prevents asthma exacerbations. Symptom-based appear superior to peak-flow based written action plans. The paucity of pediatric trials does not permit the identification of other key features that enhance the dispensing of written action plans by healthcare professionals or uptake of recommendations by children, adolescents and their parents.

Summary

Written action plans are effective tools to facilitate self-management. While step-up therapy is not superior to daily controller medication, symptom-based are superior to peak-flow based action plans for preventing exacerbations, other key features associated with effectiveness have yet to be identified.

Keywords

asthma, children, self-management, written action plan

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Introduction

To achieve optimal control of asthma symptoms, patients with asthma should know how to prevent and manage deteriorating symptoms and acute exacerbations [1]. Guided self-management, which includes asthma education, regular medical review, self-monitoring, and written action plan (WAP), clearly reduces asthma morbidity [2]. In adults, a reduction by one-third or more has been shown in hospital admissions, acute care visits, missed days of work and night awakenings [2]. Only more recently, has self-management education been proven effective in children, with improvement in lung function and feelings of self-control and reductions in emergency department visits and school absenteeism [3]. Such findings have reinforced the universal recommendation of providing a WAP to all individuals affected with asthma [1,4–7]. Yet, although 65% of parents have discussed with their physicians an individual management plan for their child [8], national and international surveys reveal that fewer than 20% of patients have received a WAP [9–14].

While comprehensive self-management education undoubtedly reduces asthma morbidity, the contribution of each element to the overall benefit has been ques-

tioned. In adults, less intensive asthma education [15] or the omission of regular medical review [16] resulted in more acute care visits than with optimal guided management. Since a reduction in some elements of self-management is associated with less impact, the benefit provided by the use of WAP deserves to be clarified [17]. In an adult Cochrane review comparing guided self-management to usual care, the magnitude of effect appears smaller in interventions without, compared to those with, an action plan [2]. An adult trial, however, failed to show any difference between verbal and written action plans [18]. Clearly, there is a need to examine the benefit conferred by a WAP in head-to-head comparisons to address the following questions: What is the individual contribution of the WAP to the overall benefit of guided self-management? In the absence of the other elements of self-management, does the provision of a WAP confer any advantages? In children and adolescents, what elements of the format and content are essential? Should the WAP be modified according to the age of the child or for different settings?

The objective of this review is to examine the evidence for effectiveness for the independent contribution of a WAP as an important element of guided

self-management and to identify key content and format features of the plan associated with effectiveness in children and adolescents.

Methods

We conducted a literature search of *Medline*, *EMBASE*, and *CINAHL*, the Cochrane Library and Google between 1980 to December 2007 with the following keywords: (educat* OR self-manag* OR action plan* OR written action plan* OR treatment plan* OR written treatment plan* OR self care OR discharge plan* OR written discharge plan* OR management plan*) AND (child* OR paediat* OR pediat* OR infant OR toddler OR young OR school).

Definition of written action plan

Written action or self-management plans are a set of written instructions intended to stay in the hands of patients to assist in the management of a condition. The definition of a WAP for asthma has evolved over recent years from a document intended to deal primarily with asthma deterioration to one detailing instructions regarding daily preventive management to maintain asthma control; when and how to modify medications in response to worsening asthma; and when and how to access the medical system in response to worsening asthma [1]. The increasing recognition of daily preventive therapy as the most effective means to curtail exacerbations has appropriately shifted the focus to preventive management. To be enacted, the WAP must include a self-assessment component. Finally, the action plan should be individualized to the patient's asthma severity, control, and treatment. This individualization is also important to the patient as it increases the confidence in, and perceived efficacy of, the action plan [19]. As poor physician/patient communication can impair care [20], there is evidence that increased time spent on asthma education (from 15 to 30% of the consultation) is associated with greater adherence to medications (from less than 50 to 100%) [8]. In this context, the WAP may be seen as a simple tool to standardize and enhance the retention of the information communicated between healthcare professionals and patients, thus maximizing guided self-management.

Review

We address six themes that are relevant to the discussion of written action and their role in the management of childhood asthma namely the independent contribution of WAPs as add-on or single intervention of guided self-management; instructions recorded on the WAP; preformatted WAPs; key features of an effective WAP; key features to increase the delivery of WAPs by healthcare professionals; and provision of a WAP in different settings.

Independent contribution of written action plans to guided self-management

Two systematic reviews of randomized controlled trials have examined the independent contribution of a WAP to asthma self-management with regards to adherence to treatment and health outcomes [21,22]. Toelle and colleagues [22] identified three adult trials comparing the provision or not of a WAP. In one study [23], canister weighting of inhaled steroids did not identify any group difference in compliance, although use of the peak-flow based WAP was associated with a reduction in emergency department visits. Other studies [24,25] failed to consistently measure adherence in both groups, but reported an increase in perceived self-efficacy [25]. With no meta-analysis because of inconsistencies in reported outcomes, it remains unclear if a WAP improves adherence, asthma control, lung function, or healthcare utilization in adults. In pediatrics [21], only one trial compared the provision of a WAP to no WAP with all co-interventions, namely asthma education and therapy, remaining similar [26]. This 3-month randomized controlled trial included 68 children aged 5–12 years with mild to moderate asthma who were recruited from an outpatient setting. The provision of a peak-flow based WAP significantly reduced the number of acute care visits, school days missed, nocturnal awakenings, and symptoms compared to the control group. The strength of the associations raises no doubt as to the independent contribution of a WAP as key element of guided self-management education in these children. Yet, with only one pediatric trial, the study must be replicated in preschool-aged children and adolescents, in different settings and with other types of action plan to examine the generalizability of findings. Of note, those four trials examined the efficacy of the WAP when provided along with other components of guided self-management namely, asthma education [23,25], regular medical review [24], or both [26]. To our knowledge, no trial has examined the use of a WAP as sole intervention to improve adherence and health outcomes [21]; a pediatric study in progress may shed more light on this issue in the near future [27].

Instructions recorded on the written action plans

The efficacy of the WAP depends not only on the uptake but also on the validity of recommendations. Although a detailed review of asthma management is beyond the scope of this review, the structure of the WAP must allow the recording of effective therapeutic recommendations.

Preventive maintenance management

National and international guidelines recommend the use of daily controller medication for all children with asthma, with the exception of those with very mild

intermittent asthma. The increasing importance of recording daily preventive management on a WAP is underlined by the following two observations. First, over the past 10 years, the trend of guidelines has clearly evolved towards recommending earlier daily treatment for patients with milder asthma [1]. Indeed, we now recognize that many atopic children with apparent intermittent exacerbations may have unrecognized mild persistent asthma and are thus at risk for permanent airway limitation due to airway remodeling [28]. Secondly, strong evidence has identified maintenance inhaled steroids as the most effective therapy not only to improve asthma control but also to prevent airway remodeling [28] and asthma exacerbations [29–31].

Step-up therapy during exacerbation: fast-acting bronchodilator

All children with asthma should receive a prescription and instructions for use of a fast-acting bronchodilator as relief medication [1]. The preferred bronchodilators are clearly inhaled fast-acting β_2 -agonists such as albuterol and terbutaline. They are best administered as needed rather regularly [32], with metered-dose inhaler with spacer rather than nebulizers, even for young children [33]. The recommended home dosages are two to four puffs of 100 μ g albuterol (or equivalent) every 4 h, if needed [1]. In case of severe deterioration, some may feel comfortable recommending a higher dose or frequency before an urgent medical visit.

Dose doubling of inhaled steroids

Despite its popularity, increasing the dose of inhaled steroids during exacerbations has not been shown superior to continuing the maintenance dose in both children or adults [34–36]. In adults receiving combination therapy with inhaled steroids and formoterol, the use of adjustable (SMART) therapy appears as a promising option [37]. This strategy has yet to be tested in children, although an undefined number of adolescents aged 12 years and above may have been included in adult studies. Consequently, at present, increasing the dose of inhaled steroids is not indicated as a means to step-up therapy during exacerbations.

Oral steroids

While oral steroids are generally recommended in the home management of asthma deterioration in adults [1,38], the evidence supporting such practice in pediatrics is weaker. The home administration of oral steroids at the onset of deterioration was originally tested in a nonrandomized controlled trial of children, published in the 1980s [39] when optimized treatment was far from current standards. The nonrandomized design, patient self-selection into treatment groups, and use of suboptimal co-interventions such as oral orciprenaline, raised serious questions about the efficacy of this strategy in the current

therapeutic context. In the few subsequent randomized trials testing this strategy in children, the efficacy of oral steroids initiated at home have yielded conflicting results [40,41]. Moreover, the safety of this procedure has yet to be examined. In view of the possible association between the fatal varicella and oral steroids [42–45], it is prudent to recommend that all asthmatic children be adequately vaccinated, particularly for varicella if susceptible. Because of the potential for abuse, it appears safe to recommend the prescription of only one short course of oral steroids at a time, with no refill, and a repeat assessment after each utilization. Before recommending parent-initiated oral steroids to curtail exacerbations, physicians should carefully weigh the risks and benefits, particularly in young children who have not completed their immunization schedule and in whom the efficacy of this strategy remains controversial [41,46]. Moreover, the real-life application of strategy remains difficult due to the reluctance of treating physicians to prescribe [46] or for children to take [47], the oral steroids preparation, even if prescribed as part of a written action plan.

Preformatted written action plans

Clearly, the delivery of written self-management plans requires additional time and effort on the part of physicians, particularly so when the instructions are handwritten on a blank piece of paper. Indeed, two reasons raised by healthcare professionals for not providing WAPs are lack of time and unavailability of WAP during visit [10]. To our knowledge, there are no trials comparing the efficacy of a WAP written on a blank sheet of paper or on a preformatted document. In theory, use of preformatted WAPs should contribute to harmonize practice and facilitate its delivery. Although most health professionals recognize the purpose of self-management plans, they have limited knowledge as to what to include to optimize communication with patients.

Key features of an effective written action plan

Adult trials

Few studies have focused on identifying the key elements of an effective action plan. In a systematic review of randomized controlled trials, Gibson and Powell [38] reported three elements of a self-management plan associated with favorable outcomes in adults: use of two to four steps; treatment of exacerbations with inhaled and oral steroids; and peak flow monitoring using personal best values. The aggregated trials compared the use of action plans as part of comprehensive self-management programs that included self-monitoring and regular medical review with usual care alone. It therefore remains unclear whether the improved outcomes were due to the format of the self-management plan *per se*, the recommended management, the asthma

education and medical review, or their combination. In a second Cochrane review [22] that aggregated five trials, symptom-based were superior to peak-flow based plans for reducing unscheduled medical visits but not for preventing acute care visits and oral steroid courses, where discordant findings were observed between studies. The authors concluded that there was insufficient evidence to demonstrate the superiority of symptoms or peak-flow based action plans.

Pediatric trials

A Cochrane review of pediatric randomized controlled trials compared the efficacy of different types of plans to identify the key elements of an effective action plan [48•]. Only four trials [49–52] were identified, all comparing symptoms to peak-flow-based WAPs, with other co-interventions remaining similar. These trials focused on school-aged children, with one study including adolescents [52]. Patients were recruited from primary [52] or secondary [49–51] care outpatient settings, and presented with a whole spectrum of asthma severity. Children assigned to a symptom-based plan had a 27% lower risk of exacerbations requiring an acute care visit (Fig. 1). The effect was large as only nine children needed to receive a symptom-based plan to prevent one acute care visit. Symptom monitoring was preferred by children, with no clear parental preference. Children assigned to peak flow-based action plans experienced less symptomatic days (by a half day per week) over those

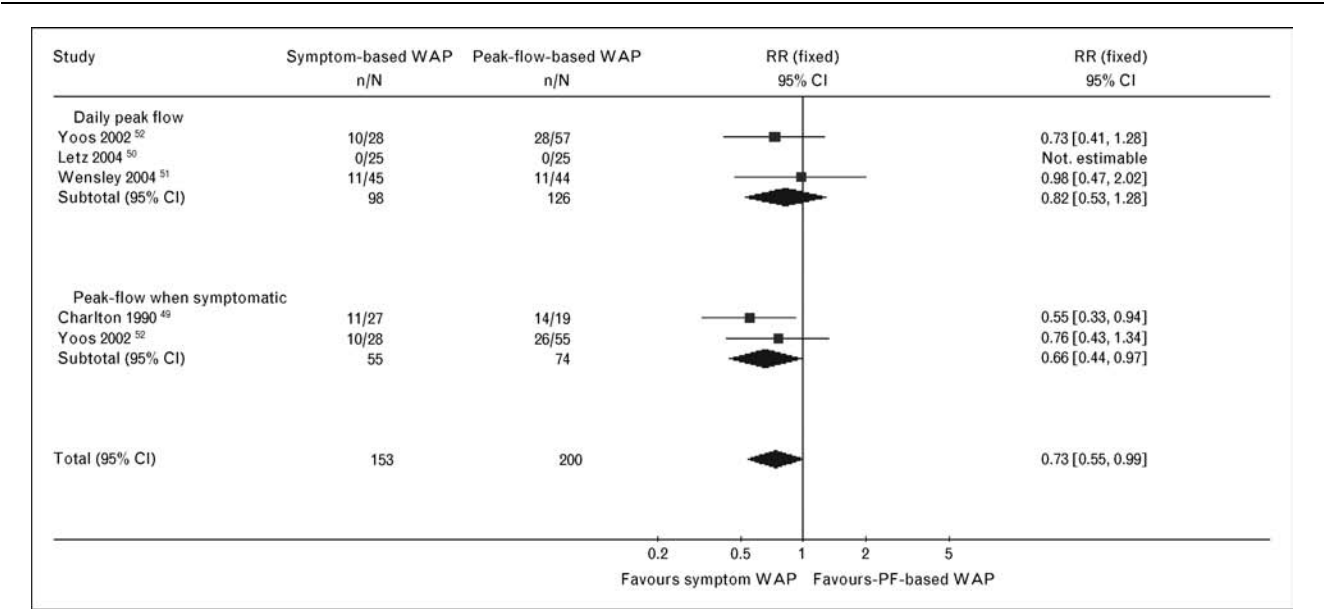
managed with a symptom-based plan. While the authors concluded that there was a superiority of symptom-based over peak flow-based WAP for preventing acute care visits, they raised caution in the interpretation of these findings. Indeed, whether the observed superiority is conferred by greater adherence to the monitoring strategy, earlier identification of deteriorations, or lower threshold for presentation to acute care settings, remains to be determined. Clearly, the use of symptom-based WAP is effective in pediatrics and should probably be preferred.

The design of these trials did not allow for the head-to-head comparison of other features in terms of format or instructions. These effective WAPs, however, shared similar characteristics: they generally had three steps, identified by street light colors (green, yellow, red), using similar wording for step identification. Whether these action plans would be enhanced by a more sophisticated design with pictorial features, a validated asthma control instrument or nonpharmacological recommendations remains to be determined.

Characteristics of existing written action plans

A huge number of preformatted pediatric WAPs are available for use. Those that have been recommended by international and national guidelines can generally be found on several websites. In addition, many institutions

Figure 1 Pooled relative risk of children who experienced at least one exacerbation requiring an emergency room visit for asthma (one count per patient) comparing use of symptom-based to peak-flow based written action plans



Trials are stratified according to the recommended peak flow monitoring namely daily or only when symptomatic. The width of the horizontal line represents the 95% confidence interval around the point estimate (black square). The size of the point estimate represents the relative weight (% weight) of each trial in the pooled summary estimate (diamond). The vertical line is the line of no effect (relative risk = 1.0). Reproduced with permission [48••].

or organizations worldwide have designed their own action plan. Acknowledging that a comprehensive review of all existing action plans is impossible, some examples have been referenced hereafter [53–66]. The overwhelming majority of WAPs have three color-coded steps with relatively similar control zone description and write-in-the-blank sections for medications. Our purpose was to focus on the published pediatric WAPs that had undergone a formal development or validation process.

The characteristics of action plans that encourage self-management in school-aged children are likely to be different from that of adults. Indeed, a large survey of nurse specialists in respiratory and pediatric asthma centers in the United Kingdom [67], concluded the importance of an action plan specifically adapted to children through appropriate language, pictorial design, and concepts, providing opportunities for individualization, allowing the child to state his or her personal objectives, and clearly identifying the role of the user. Consequently, a WAP that is based on expert opinion and has integrated the input of children and their parents should stand a better chance as communication tool. It would appear that most action plans recommended by national guidelines were developed *ad hoc*, with no apparent formal validation in children (Table 1). To our knowledge, only three action plans have published their development process, all of which included some feedback from the children (Table 2). One action plan was designed specifically for aboriginal children and adults, with very low literary skills; it included a small validation study that comprised five children. The other two pediatric WAPs were conceived simultaneously. Their initial design was based on scientific evidence, feedback from international experts, and the Milnes and Callery prototype to maximize self-management in children [67]. It was revised in an iterative fashion until 85% clarity and perceived usefulness were achieved in children and their parents [68]; one version was designed for office use [56], the other for discharge following an acute care visit [57]. The latter is currently being tested for its effectiveness in improving adherence and asthma control in a pediatric randomized controlled trial [27].

Validation of the WAP can vary from simple assessment of clarity or perceived usefulness with children [68], parents or family [68,69], and healthcare professionals [68,70] to formal documentation of efficacy (i.e., adherence to recommendation) in a randomized controlled trial [26,49–52]. All five pediatric WAPs validated in the context of a clinical trial were developed *ad hoc* by the investigators [26,49–52]; with three trials publishing the WAP in the report [26,49,50] (Table 3). The publication of two ongoing trials testing novel pediatric WAPs may shed more light on key features associated with effectiveness [27,71].

Key features to increase the delivery of written action plans by healthcare professionals

While most of the focus of WAPs has been on improving adherence to treatment and asthma control, it must be recognized that WAPs may confer part of their effectiveness through two important mechanisms, namely, the increased adherence of physicians to guidelines recommendations, and the increasing dispensing of WAPs to patients. Indeed, it would make sense that, similar to clinical practice pathways [72–75], use of WAPs would improve the quality of physicians' prescribing [76]. To our knowledge, this has not yet been reported.

In face of the appallingly low ownership of WAPs by children and adolescents, an effective WAP would yield very little benefit if not associated with a higher dispensing by healthcare professionals. Several interventions to improve asthma management including the dispensing of WAPs by healthcare professionals, have yielded various results [77–79]. Although healthcare professionals prefer simple and user-friendly WAPs with pictures and easy readability [70], we were unable to identify any trials examining features of the action plan that may increase its dispensing by healthcare professional (e.g. preformatted, pull-down menu, triplicates, or patient prompting). Thus, future studies testing pediatric action plans should monitor their impact on the quality of recommendations and the frequency of WAP dispensing by physicians.

Provision of a written action plan in different settings (acute care and school)

Traditionally, WAPs are delivered in the context of a clinic visit, while discharge instructions pertaining to the treatment of the exacerbation are dispensed following an acute care visit. Although a 2001 pediatric Cochrane review failed to support a beneficial impact of asthma education following an acute care visits in children [80], insufficient power or suboptimal guided self-management education may well be at play. The aggregation of the eight trials yielded a nonsignificant 25% reduction in repeat emergency room visits and hospital admissions in children receiving asthma education. Some trials showed clear reduction in hospital admission [81,82] and acute care visits [81] while others [83–85] did not. The heterogeneity between trials in the provision of the various elements of guided self-management education, including written action plans, made it difficult to assess the relative efficacy of optimal versus suboptimal self-management education. Until this review is updated, it makes sense that patients with higher morbidity, that is, those treated for an acute exacerbation, should be prioritized for receiving guided self-management, and not only discharged instructions for the current

Table 1 Examples of preformatted English written action plans, available on-line for children or adults

Organization	Name of WAP and website	Target	Key features
Children Asthma Society of Canada Canada	Asthma Action Plan http://www.asthma.ca/adults/control/pdf/AsthmaActionPlan_ENG.pdf	Designed for children, aged not specified	Three color 'traffic light' style Symptom-based Also available in French
Asthma New Zealand	Asthma Emergency Action Plan for Children Under 5 Asthma Management Plan for Young People Asthma Care Plan for your child http://www.asthma-nz.org.nz/downloads.aspx http://www.asthma-nz.org.nz/pdf/Asthma%20Emergency%20Plan.pdf	Designed for children under 5 years and their caregiver Designed for school-aged children and teens Designed for parents	Three zones; not color coded Four color-coded zones One zone Symptom-based on how parents can recognize 'mild' worsening symptoms; 'moderate' worsening symptoms and severe symptoms and what to do
Lung Association New Zealand			
Asthma UK UK	Under 5s Action Plan http://www.asthma.org.uk/document.rm?id=203	Designed specifically for children under 5 years	Five page action plan containing one page for personal and professional contact information; and one for each of the four zones Symptom-based
Children and adults Spencer Gulf Rural Health School, Indigenous Asthma Innovative Management Australia	Every Day asthma http://www.nationalasthma.org.au/HTML/management/action_plans/print/everyday_aap2007.pdf	Children and adults	Pictorial style: (1) Faces to depict feeling well, not as well and not well; (2) Sun and moon to depict time of day Symptom-based
Conseil du Médicament, Government of Quebec Canada	Action Plan for Asthma http://www.cdm.gouv.qc.ca/site/download.php?aa872568847d8ab948719bca088a0b55	Designed specifically for children aged 1–17 years and their parents, applicable to adults	Three color 'traffic light' style Symptom-based with optional peak flow monitoring Also available in French
Conseil du Médicament, Government of Quebec Canada	Action Plan for Asthma Attacks http://www.cdm.gouv.qc.ca	Designed specifically for children aged 1–17 years and their parents, applicable to adults	Specific to instructions upon discharge from an acute care setting Three color 'traffic light' style Symptom-based with optional peak flow monitoring Also available in French
Australian Government Department of Health and Ageing Australia	My Asthma Action Plan http://www.asthmanz.org.au/assets/146/File/Asthma_Action_Plan_2007(1).pdf	Lower age limit not specified	Four colour-coded zones Symptom-based with best peak-flow cut-off for children over 12 years old and adults
National Asthma Council Australia	NAC Asthma Action Plan	Lower age limit not specified	Three color 'traffic light' style

(continued overleaf)

Australia	http://www.nationalasthma.org.au/HTML/management/action_plans/print/aap_Sept2007.pdf	Asthma Action Plan	Updated guidelines include the distinct treatment recommendations for children ages 5–11 years old	Symptom-based with best peak-flow cut-off for children over 12 years old and adults Three color 'traffic light' style
National Institute of Health (NIH) USA	http://www.nlm.nih.gov/health/public/lung/asthma/actionplan_text.htm	Symbicort SMART Action Plan	12 years and older Specifically for patients using the combination medication Symbicort maintenance and reliever therapy	Peak-flow monitoring with symptom recognition Three color 'traffic light' style Tear off pad style Two WAPs available: (1) Symptom-based, or (2) Peak-flow based
Unspecified target audience (adults and/or children) Family Physician Airway Group Canada Canada	http://www.asthmaguidelines.com/patient_tools.html	Asthma Action Plan	Lower age limit not specified	Three color 'traffic light' style Symptom-based with peak-flow monitoring
American Academy of Family Physicians USA	http://familydoctor.org/online/etc/medialib/famdoc/docs/asthma.Par.0001.File.dat/asthma_AdultActionPlan.pdf	Asthma Action Plan	Lower age limit not specified	Three color 'traffic light' style Symptom-based and peak-flow monitoring
American Lung Association USA	http://www.lungusa.org/att/cf/%7B7A8D42C2-FCCA-4604-8ADE-7F5D5E762256%7D/AAP.PDF	Asthma Action Plan	Lower age limit not specified	Available in English and Spanish Three colour 'traffic light' style Peak-flow cut-off with symptoms recognition Available in English and Spanish

The table is not meant as an exhaustive list but as display of examples of written action plan (WAP) readily available from the Internet.

Table 2 Preformatted pediatric written action plans whose formal development process was published

Organization	Name of WAP	Key features	Design	Validation
Spencer Gulf Rural Health School, Indigenous Asthma Innovative Management Australia	Every Day Asthma [61]	Pictorial style: (1) Faces to depict feeling well, not as well and not well; (2) Sun and moon to depict time of day Designed for children and adults with poor literacy skills Symptom-based	Systematic literature review, narrative summaries Revised iteratively with feedback from the 30 enrolled patients aged 2 to 74 years	Pre and postintervention study in 19 patients, including five children aged less than 10 years Only five patients (aged not specified) completed the self-confidence survey Results not conclusive
Conseil du Médicament, Government of Quebec Canada	Action Plan for Asthma [56]	1-page (recto-verso) Three color 'traffic light' style Pictorial style: Faces to depict feeling well, not as well and not well Grade 2 reading level (7 years old) Symptom-based with optional peak flow monitoring Triplicate document with prescription and a medical chart copy to facilitate dispensing Self-monitoring using validated Asthma Quiz for Kids Additional five nonpharmaceutical recommendations (environment, adherence, self-assessment, regular medical follow-up, and asthma education) Available in English and French	Prototype was elaborated following surveys of asthma educators from the UK, and Quebec, Canada consensus guidelines, literature review and expert opinion from an international consultant committee Iterative revision with feedback from school-aged children and parents of children aged 1 to 17 years until 85% clarity was achieved	Final version tested for clarity, applicability and perceived usefulness in children aged 7–17 years and parents of children aged 1–17 years [68]
Conseil du Médicament, Government of Quebec Canada	Action Plan for Asthma Attacks [57]	Specific to instructions upon discharge from an acute care setting Key features as above. Available in English and French	As above	Final version tested for clarity, applicability and perceived usefulness in children aged 7–17 years and parents of children aged 1–17 years [68] RCT in the acute care setting in progress [27]

RCT, randomized controlled trial; WAP, written action plan.

Table 3 Pediatric written action plans validated in the context of a clinical trial

Author/Organization	Name of WAP	Key features	Design	Validation
Validated Agrawal <i>et al.</i> [26]	Individualized asthma home-management plan	Three color 'traffic light' style	Ad hoc	Randomized controlled trial of 66 children aged 5–12 years, comparing the WAP to no WAP, in addition to standard asthma therapy including education.
India		Peak-flow based WAP Available in English		
Wensley <i>et al.</i> [51]	Two WAPs: (1) Peak flow management plan (2) Symptom only management plan	Three color 'traffic light' style	Ad hoc	Randomized controlled trial of 90 children aged 7–14 years, comparing a peak-flow WAP to a symptom-based WAP
		Symptom-based WAP Peak-flow based WAP Available in English		
Leitz <i>et al.</i> [50]	No name provided for the WAP	Three color 'traffic light' style	Ad hoc	Randomized controlled trial of 50 children aged 6–12 years, comparing symptom-based and peak-flow based WAP
USA		Language and reading level at the 6th grade reading level or roughly that of an 11-year old Symptom-based WAP Peak-flow based WAP Available in English		
Charlton <i>et al.</i> [49]	Two WAPs: (1) Peak flow management plan (2) Symptom only management plan	Four steps for peak flow monitoring action plan and five step for symptom-based WAP	Ad hoc	Randomized controlled trial of 46 children aged less than 16 years, comparing the peak-flow WAP to the symptom-only WAP
		Symptom-based WAP Peak-flow based WAP Available in English		
Yoos <i>et al.</i> [52]	Three WAPs: (1) Peak flow management plan (2) Symptom only management plan (3) Symptom-time peak expiratory flow rate plan	Three color 'traffic light' style Symptom-based WAP: symptom recognition plus signs and symptoms of distress which were specific to the each child after child was trained in subjective symptom recognition Peak-flow based WAP: established zones based on personal best peak flow reading of the patient	Unclear	Randomized controlled trial of 168 children aged of 6–19 years, comparing a peak-flow WAP to symptom-based WAP and a symptom-time peak expiratory flow rate
USA				

(continued overleaf)

Author/Organization	Name of WAP	Key features	Design	Validation
Ongoing validation Ducharme <i>et al.</i> [27] Canada	Action Plan for Asthma Attacks	Specific to instructions upon discharge from an acute care setting Key features as described in Table 1 Available in English and in French	Prototype was elaborated following surveys of asthma educators from the UK, and Quebec, Canadian consensus guidelines, literature review and expert opinion from an international consultant committee; iterative revision with feedback from school-aged children and parents of children aged 1–17 years until 85% clarity was achieved	Randomized controlled trial of 219 children aged 1–17 years discharged following an acute care visit – completed.
Adams [71] USA	Pictorial asthma action plan	Fully pictorial asthma action plan for younger children, low-literacy families, or non-English speaking families	Unclear	Randomized controlled trial of 80 children aged 6–18 years in recruitment phase a

WAP, written action plan.

exacerbations. A visit to an acute care setting provides the opportunity to initiate long-term chronic care management in children that suffer the highest asthma morbidity, an approach that has been successful in adults [76].

The availability of a WAP at school allows the school personal to confidently initiate appropriate management of the exacerbations [86,87]. Barriers to their use must be anticipated. On one hand, some physicians do not see the relevance of WAP in the management of acute episodes in schools [88]. On the other hand, school-based programs of self-management have reported difficulty in implementation, with no significant impact on asthma morbidity [89]. Clearly, more research is needed in the implementation and role of WAPs in the school setting.

Conclusion

WAPs including self-monitoring and self-management are an essential part of guided self-management in both adults and children, albeit the strength of the evidence in the latter is weaker. WAPs should include not only instructions in case of deterioration but importantly recommendations for daily management, which remains the most effective means to prevent exacerbations in children. While various WAPs are available, very few of them having been specifically designed for, and validated in, children. Symptom-based WAPs appear superior to peak-flow based ones in the pediatric setting. As evidence-based recommendations have been insufficiently incorporated in practice and adopted by patients, use of WAPs should be tested for their efficacy, not only in improving patient compliance and asthma control, but also for improving healthcare professionals’ adherence to recommendations and dispensing of the WAP. Several randomized controlled trials examining the efficacy of pediatric WAPs will provide more insight into the characteristics of WAPs associated with greater impact. Until then, WAPs appear as important tools to facilitate self-management, self-assessment, and communication between children, parents, and healthcare professionals.

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References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 210–211).

1 Global Initiative for Asthma. Global strategy for asthma management and prevention [updated 2007]. www.ginasthma.org. [Accessed 11 December 2007]

- 2 Gibson PG, Powell H, Coughlan J, *et al.* Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev* 2002; (3):CD001117.
- 3 Guevara JP, Wolf FM, Grum CM, Clark NM. Effects of educational interventions for self management of asthma in children and adolescents: systematic review and meta-analysis. *BMJ* 2003; 326:1308–1309.
- 4 Anonymous. *Asthma Management Handbook* 2002. 5th ed. Melbourne: National Asthma Campaign; 2002.
- 5 British Thoracic Society. *British guidelines on the management of asthma*. London: British Thoracic Society; 2005.
- 6 Lemiere C, Bai T, Balter M, *et al.* Adult asthma guidelines update 2003. *Can Respir J* 2004; 11:9A–18A.
- 7 National Asthma Education and Prevention Program. *NAEEP Expert Panel Report*. Bethesda: NAEPP; 2008.
- 8 Global asthma physician and patient (GAPP) survey. 2005. <http://www.gapp-survey.org/media-key-findings.html>. [Accessed 22 January 2008]
- 9 Sheares BJ, Du Y, Vazquez TL, *et al.* Use of written treatment plans for asthma by specialist physicians. *Pediatr Pulm* 2007; 42:348–356.
- 10 Partridge MR. Written asthma action plans. *Thorax* 2004; 59:87–88.
- 11 Fitzgerald JM, Boulet LP, McIvor RA, *et al.* Asthma control in Canada remains suboptimal: the reality of asthma control (TRAC) study. *Can Respir J* 2006; 13:253–259.
- 12 Ruffin RE, Wilson D, Southcott AM, *et al.* A South Australian population survey of the ownership of asthma action plans. *Med J Aust* 1999; 171:348–351.
- 13 McNally AJ, Frampton C, Garrett J, Pattemore P. Application of asthma action plans to childhood asthma: national survey repeated. *N Z Med J* 2004; 117:U932.
- 14 Ly CD, Dennehy CE. Emergency department management of pediatric asthma at a university teaching hospital. *Ann Pharmacother* 2007; 41:1625–1631.
- 15 Cote J, Bowie DM, Robichaud P, *et al.* Evaluation of two different educational interventions for adult patients consulting with an acute asthma exacerbation. *Am J Respir Crit Care Med* 2001; 163:1415–1419.
- 16 Kauppinen R, Sintonen H, Tukiainen H. One-year economic evaluation of intensive vs conventional patient education and supervision for self-management of new asthmatic patients. *Respir Med* 1998; 92:300–307.
- 17 Lefevre F, Piper M, Weiss K, *et al.* Do written action plans improve patient outcomes in asthma? An evidence-based analysis. *J Fam Pract* 2002; 51:842–848.
- 18 Baldwin DR, Pathak UA, King R, *et al.* Outcome of asthmatics attending asthma clinics utilising self-management plans in general practice. *Asthma in General Practice* 1997; 5:31–32.
- 19 Beauchesne MF, Levert V, El TM, *et al.* Action plans in asthma. *Can Respir J* 2006; 13:306–310.
- 20 Moffat M, Cleland J, van der Molen T, Price D. Poor communication may impair optimal asthma care: a qualitative study. *Fam Pract* 2007; 24:65–70. Using qualitative research methods, this study examined healthcare professionals' views towards asthma guidelines and self-management plans. Mainly, healthcare providers had positive attitudes towards guidelines and self-management plans when deemed suitable by the individual. Healthcare professionals, however, reported lacking necessary communication skills for dealing with patient asthma control issues. Poor professional–patient communication accounts for much of the poor uptake of self-management plans and guideline use in general practice and primary care.
- 21 Zemek R, Bhogal SK, Ducharme FM. What's the plan? A systematic review of randomised controlled trials examining written action plans in children. *Arch Dis Child* (in press).
- 22 Toelle BG, Ram FS. Written individualised management plans for asthma in children and adults. *Cochrane Database Syst Rev* 2002; (3):CD002171.
- 23 Cowie RL, Revitt SG, Underwood MF, Field SK. The effect of a peak flow-based action plan in the prevention of exacerbations of asthma. *Chest* 1997; 112:1534–1538.
- 24 Jones KP, Mullee MA, Middleton M, *et al.* Peak flow based asthma self-management: a randomised controlled study in general practice. *British Thoracic Society Research Committee*. *Thorax* 1995; 50:851–857.
- 25 van der Palen J, Klein JJ, Zielhuis GA, *et al.* Behavioural effect of self-treatment guidelines in a self-management program for adults with asthma. *Patient Educ Couns* 2001; 43:161–169.
- 26 Agrawal SK, Singh M, Mathew JL, Malhi P. Efficacy of an individualized written home-management plan in the control of moderate persistent asthma: a randomized, controlled trial. *Acta Paediatr* 2005; 94:1742–1746.
- 27 Ducharme FM, Zemek R, Chalut D, *et al.* Does the use of a new written action plan increase short-term adherence to prescribed medication and asthma control in children treated for an asthma attack in the emergency department: a randomized controlled trial. www.clinicaltrials.gov/ct2/show/NCT00381355?term=written+action+plan+AND+asthma&rank=1. [Accessed 22 January 2008]
- 28 Bush A. Phenotype specific treatment of asthma in childhood. *Paediatr Respir Rev* 2004; 5 (Suppl A):S93–S101.
- 29 Adams NP, Bestall JC, Jones PW, *et al.* Inhaled fluticasone at different doses for chronic asthma in adults and children. *Cochrane Database Syst Rev* 2005; (3):CD003534.
- 30 Adams NP, Bestall JC, Lasserson TJ, *et al.* Fluticasone versus placebo for chronic asthma in adults and children. *Cochrane Database Syst Rev* 2005; (4):CD003135.
- 31 Ducharme FM, Di Salvo F. Antileukotriene agents compared to inhaled corticosteroids in the management of recurrent and/or chronic asthma in adults and children. *Cochrane Database of Systematic Reviews* 2004; (1):CD002314.
- 32 Walters EH, Walters J. Inhaled short acting beta2-agonist use in chronic asthma: regular versus as needed treatment. *Cochrane Database Syst Rev* 2003; (2):CD001285.
- 33 Cates CJ, Crilly JA, Rowe BH. Holding chambers (spacers) versus nebulisers for beta-agonist treatment of acute asthma. *Cochrane Database Syst Rev* 2006; (2):CD000052.
- 34 Fitzgerald JM, Becker A, Sears MR, *et al.* Doubling the dose of budesonide versus maintenance treatment in asthma exacerbations. *Thorax* 2004; 59:550–556.
- 35 Garrett J, Williams S, Wong C, Holdaway D. Treatment of acute asthmatic exacerbations with an increased dose of inhaled steroid. *Arch Dis Child* 1998; 79:12–17.
- 36 Volovitz B, Nussinovitch M, Finkelstein Y, *et al.* Effectiveness of inhaled corticosteroids in controlling acute asthma exacerbations in children at home. *Clinical Pediatrics* 2001; 40:79–86.
- 37 Fitzgerald JM, Sears MR, Boulet LP, *et al.* Adjustable maintenance dosing with budesonide/formoterol reduces asthma exacerbations compared with traditional fixed dosing: A five-month multicentre Canadian study. *Can Respir J* 2003; 10:427–434.
- 38 Gibson PG, Powell H. Written action plans for asthma: an evidence-based review of the key components. *Thorax* 2004; 59:94–99.
- 39 Brunette MG, Lands L, Thibodeau L-P. Childhood asthma: prevention of attacks with short-term corticosteroid treatment of upper respiratory tract infection. *Pediatrics* 1988; 81:624–629.
- 40 Harris JB, Weinberger MM, Nassif E, *et al.* Early intervention with short courses of prednisone to prevent progression of asthma in ambulatory patients incompletely responsive to bronchodilators. *J Pediatr* 1987; 110:627–633.
- 41 Oommen A, Lambert PC, Grigg J. Efficacy of a short course of parent-initiated oral prednisolone for viral wheeze in children aged 1–5 years: randomized controlled trial. *Lancet* 2003; 362:1433–1438.
- 42 Silk HJ, Guay-Woodford L, Perez-Atayde AR, *et al.* Fatal varicella in steroid-dependent asthma. *J Allergy Clin Immunol* 1988; 81:47–51.
- 43 Kasper WJ, Howe PM. Fatal varicella after a single course of corticosteroids. *Pediatr Infect Dis J* 1990; 9:729–732.
- 44 Patel H, Macarthur C, Johnson D. Recent corticosteroid use and the risk of complicated varicella in otherwise immunocompetent children. *Arch Pediatr Adolesc Med* 1996; 150:409–414.
- 45 Dowell SF, Bresee JS. Severe varicella associated with steroid use. *Pediatrics* 1993; 92:223–228.
- 46 Stevens CA, Wesseldine LJ, Couriel JM, *et al.* Parental education and guided self-management of asthma and wheezing in the preschool child: a randomized controlled trial. *Thorax* 2002; 57:39–44.
- 47 Warman KL, Silver EJ, McCourt MP, Stein RE. How does home management of asthma exacerbations by parents of inner-city children differ from NHLBI guideline recommendations? *Pediatrics* 1999; 103:422–427.
- 48 Bhogal S, Zemek R, Ducharme FM. Written action plans for asthma in children. *Cochrane Database Syst Rev* 2006; (3):CD005306. This review examines the net impact of providing a written action plan to children with asthma and their children. Based on four clinical trials with 355 children, symptom-based WAPs were compared to peak flow-based WAPs with all other co-interventions were similar. This meta-analysis details several implications for practice, and proposes implications for research to further assess the efficacy of WAPs. To date, this is the first systematic review of randomized controlled trials to examine the efficacy of WAPs in the pediatric population only.

- 49 Charlton I, Charlton G, Broomfield J, Mullee MA. Evaluation of peak flow and symptoms only self management plans for control of asthma in general practice. *BMJ* 1990; 301:1355–1359.
 - 50 Letz KL, Schlie AR, Smits WL. A randomized trial comparing peak expiratory flow versus symptom self-management plans for children with persistent asthma. *Pediatric Asthma Allergy and Immunology* 2004; 17:177–190.
 - 51 Wensley D, Silverman M. Peak flow monitoring for guided self-management in childhood asthma: a randomized controlled trial. *Am J Respir Crit Care Med* 2004; 170:606–612.
 - 52 Yoos HL, Kitzman H, McMullen A, *et al.* Symptom monitoring in childhood asthma: a randomized clinical trial comparing peak expiratory flow rate with symptom monitoring. *Ann Allergy Asthma Immunol* 2002; 88:283–291.
 - 53 Asthma Action Plan. Asthma Society of Canada [updated 2008]. http://www.asthma.ca/adults/control/pdf/AsthmaActionPlan_ENG.pdf. [Accessed 22 January 2008]
 - 54 Asthma Emergency Action Plan for Children Under 5. Asthma New Zealand Lung Association. [updated 2008]; <http://www.asthma-nz.org.nz/download-s.aspx>. [Accessed 23 January 2008]
 - 55 Under 5s Action Plan. Asthma UK [updated 2008]. <http://www.asthma.org.uk/document.rm?id=203>. [Accessed 22 January 2008]
 - 56 Action Plan for Asthma. Conseil du Médicament, Government of Quebec [updated 2008]. <http://www.cdm.gouv.qc.ca/site/download.php?f=001accabc2093e7efd8cb34e6772f2c>. [Accessed 23 January 2008]
 - 57 Action Plan for Asthma Attacks. Conseil du Médicament, Government of Quebec [updated 2008]; <http://www.cdm.gouv.qc.ca>. [Accessed 22 January 2008]
 - 58 Asthma Action Plan. National Institutes of Health (NIH) [updated 2008]. http://www.nhlbi.nih.gov/health/public/lung/asthma/actionplan_text.htm. [Accessed 22 January 2008]
 - 59 My Asthma Action Plan. Australian Government [updated 2008]. [http://www.asthmansw.org.au/assets/146/File/Asthma_Action_Plan_2007\(1\).pdf](http://www.asthmansw.org.au/assets/146/File/Asthma_Action_Plan_2007(1).pdf). [Accessed 22 January 2008]
 - 60 NAC Asthma Action Plan. National Asthma Council Australia Ltd [updated 2008]. http://www.nationalasthma.org.au/HTML/management/action_plans/print/aap_Sept2007.pdf. [Accessed 22 January 2008]
 - 61 Spencer Gulf Rural Health School, Pika Wiya Health Service and Asthma SA, as part of an Indigenous Asthma Innovative Management. Every day asthma [updated 2008]. http://www.nationalasthma.org.au/HTML/management/action_plans/print/everyday_aap2007.pdf. [Accessed 22 January 2008]
 - 62 Family Physician Airway Group. Asthma action plan [updated 2008]. http://www.asthmaguidelines.com/patient_tools.html. [Accessed 22 January 2008]
 - 63 American Academy of Family Physicians. Asthma action plan [updated 2008]; http://familydoctor.org/online/etc/medialib/famdoc/docs/asthma.Par.0001.-File.dat/asthma_AdultActionPlan.pdf. [Accessed 22 January 2008]
 - 64 American Lung Association. Asthma action plan [updated 2008]; <http://www.lungusa.org/att/cf/%7B7A8D42C2-FCCA-4604-8ADE-7F5D5E762256%7D/AAP.PDF>. [Accessed 22 January 2008]
 - 65 Symbicort SMART Action Plan (Symptom-based). Symbicort [updated 2008]. http://www.nationalasthma.org.au/HTML/management/action_plans/print/SMART_aapsymptom.pdf. [Accessed 22 January 2008]
 - 66 Symbicort SMART Action Plan (Peak-flow based). Symbicort [updated 2008]. http://www.nationalasthma.org.au/HTML/management/action_plans/print/SMART_aapPEF.pdf. [Accessed 22 January 2008]
 - 67 Milnes LJ, Callery P. The adaptation of written self-management plans for children with asthma. *J Adv Nurs* 2003; 41:444–453.
 - 68 Ducharme F, Noya F, McGillivray D, *et al.* Two for one: a self-management plan coupled with a prescription sheet for children and adults with asthma. *Can Respir J* (in press).
 - 69 Feuillet-Dassonval C, Gagnayre R, Rossignol B, *et al.* Written asthma action plans: a useful tool for self-management. *Arch Pediatr* 2005; 12:1788–1796.
 - 70 Bibb SC, Norwood R, Meyer JF. Factors associated with healthcare professionals' choice of written asthma management plans. *Mil Med* 2007; 172:1058–1064.
- This descriptive study examined the factors associated with healthcare professional's choice of WAP. Healthcare professionals prefer WAP that included pictures, are readability, user-friendly and simple. These are factors that should be considered when creating WAP to increase dispensing of the plan.
- 71 Adams CD. Relative effectiveness of pictorial and written asthma action plans for pediatric asthma. www.clinicaltrials.gov [updated 2008]. <http://clinicaltrials.gov/ct2/show/NCT00136305?term=asthma+action+plan&rank=1>. [Accessed 22 January 2008]
 - 72 Norton SP, Pusic MV, Taha F, *et al.* Effect of a clinical pathway on the hospitalisation rates of children with asthma: a prospective study. *Arch Dis Child* 2007; 92:60–66.
 - 73 Thomson O'Brien MA, Oxman AD, Davis DA, Haynes RB, Freemantle N, Harvey EL. Educational outreach visits: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2000; (2):CD000409.
 - 74 Davis RS, Bukstein DA, Luskin AT, *et al.* Changing physician prescribing patterns through problem-based learning: an interactive, teleconference case-based education program and review of problem-based learning. *Ann Allergy Asthma Immunol* 2004; 93:237–242.
 - 75 Doherty SR, Jones PD. Use of an evidence-based implementation strategy to implement evidence-based care of asthma into rural district hospital emergency departments. *Rural Remote Health* 2006; 6:529.
 - 76 Lougheed MD, Moosa D, Finlayson S, *et al.* Impacts of a provincial asthma guidelines continuing medical education project: The Ontario Asthma Plan of Action's Provider Education in Asthma Care Project. *Can Respir J* 2007; 14:111–117.
- This study evaluated baseline knowledge, preferred learning format and satisfaction with a comprehensive educational program to improve the management of adult asthma in the emergency room setting. During the continuing education workshop, healthcare professions identified several important needs, including the development of written action plans. On the postreflective evaluations, reported use of WAPs increased. This study suggested that continuing education should be considered in dissemination and implementation initiatives. A follow-up study on practice and health outcomes is ongoing.
- 77 Clark NM, Gong M, Schork MA, *et al.* Long-term effects of asthma education for physicians on patient satisfaction and use of health services. *Eur Respir J* 2000; 16:15–21.
 - 78 Halterman JS, Fisher S, Conn KM, *et al.* Improved preventive care for asthma: a randomized trial of clinician prompting in pediatric offices. *Arch Pediatr Adolesc Med* 2006; 160:1018–1025.
 - 79 Boychuk RB, Demesa CJ, Kiyabu KM, *et al.* Change in approach and delivery of medical care in children with asthma: results from a multicenter emergency department educational asthma management program. *Pediatrics* 2006; 117:S145–S151.
 - 80 Haby MM, Waters E, Robertson CF, *et al.* Interventions for educating children who have attended the emergency room for asthma. *Cochrane Database Syst Rev* 2001; (1):CD001290.
 - 81 Vesseldine LJ, McCarthy P, Silverman M. Structured discharge procedure for children admitted to hospital with acute asthma: a randomised controlled trial of nursing practice. *Arch Dis Child* 1999; 80:110–114.
 - 82 Madge P, McColl J, Paton J. Impact of a nurse-led home management training programme in children admitted to hospital with acute asthma: a randomised controlled study. *Thorax* 1997; 52:223–228.
 - 83 Garrett J, Fenwick JM, Taylor G, *et al.* Prospective controlled evaluation of the effect of a community based asthma education centre in a multiracial working class neighbourhood. *Thorax* 1994; 49:976–983.
 - 84 Charlton I, Antoniou AG, Atkinson J, *et al.* Asthma at the interface: bridging the gap between general practice and a district general hospital. *Arch Dis Child* 1994; 70:313–318.
 - 85 Mitchell EA, Ferguson V, Norwood M. Asthma education by community child health nurses. *Arch Dis Child* 1986; 61:1184–1189.
 - 86 Cornman DH. Asthma focus group report: School nurses. Hartford: City of Hartford Health Department; 2001.
 - 87 McLaughlin T, Maljanian R, Kornblum R, *et al.* Evaluating the availability and use of asthma action plans for school-based asthma care: a case study in Hartford, Connecticut. *J Sch Health* 2006; 76:325–328.
 - 88 O'Keefe EB. Asthma management in schools: Report of physician focus group and key informant interviews. Hartford: City of Hartford Health Department; 2003.
 - 89 Gerald LB, Redden D, Wittich AR, *et al.* Outcomes for a comprehensive school-based asthma management program. *J Sch Health* 2006; 76:291–296.