



Does self-management prevent severe exacerbations?

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Purpose of review

Despite effective therapies, asthma outcomes remain suboptimal. Education in self-management is crucial to maintaining control in a variable condition such as asthma and reducing the risk of severe asthma exacerbations, hospitalizations and deaths. This review considers the evidence for supported self-management.

Recent findings

Recent systematic reviews have clarified and confirmed the major benefits from effective self-management education, but have also shown that implementation is rare in routine practice, with consequent avoidable morbidity and mortality. Recent research has focused on the most effective ways of delivering and supporting self-management in different patient groups and has clarified the relative effectiveness of the different components. Self-management support using new digital technologies has been investigated.

Summary

All clinicians treating patients with asthma should be supporting their patients to understand and manage their own condition. Optimal self-management incorporates education, provision of a personalized asthma action plan and is supported by regular professional review. Action plans in a written or digital format should advise on recognizing deterioration and the actions to take, including when to seek professional help, appropriate changes in medication dose or commencing rescue oral steroids. Action plans should be personalized and agreed by the patient, and provided in a culturally tailored form.

Keywords

asthma, digital intervention, education, implementation, self-management

INTRODUCTION

Self-management has been defined by the US Institute of Medicine as ‘the tasks that individuals must undertake to live with one or more chronic conditions. These tasks include having the confidence to deal with medical management, role management and emotional management of their conditions’ [1]. In the context of a variable condition such as asthma, the importance of being confident to ‘deal with the medical management’ is central to regaining control in the event of deteriorating symptoms in order to prevent potentially severe exacerbations and hospital admissions. Core information includes how to recognize the early symptoms of loss of control and what action to take include adjusting existing treatment, commencing emergency treatment and/or seeking timely professional advice. The UK National Review of Asthma Deaths revealed that approximately half the people who died with asthma during the year of the review had not received any professional care: in one-third of the people, there was no record that they had tried to seek assistance [2^{*}]. The review concluded

that wider use of personal asthma action plans had the potential to facilitate appropriate action and thereby prevent some deaths from asthma.

The Kaiser pyramid (Fig. 1) is a widely accepted model that stratifies the management of people with long-term conditions according to the complexity of their healthcare needs [3,4]. The relative importance of self-management compared with professional care at each level has been proposed as low for those with complex problems, and high for those with a well controlled condition, with ‘equally

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KEY POINTS

- Self-management education is effective in people with asthma of all ages except preschool children.
- Optimal self-management incorporates education, provision of a personalized asthma action plan and support by regular professional review.
- Self-management programmes are most effective when tailored to a format comprehensible and culturally appropriate to the patient concerned.
- Asthma action plans need to be personalized and agreed by patient and clinician, and recorded in a retrievable written or digital form to which the patient can refer when needed.
- Currently, despite strong evidence of effectiveness, most people with asthma have not been provided with education in self-management or with an action plan.

shared care' in the middle level [5]. Crucial to supporting self-management is communication across the professional/patient boundary: both timely seeking of help by patients and provision of flexible access by healthcare services [4].

In this study, we describe the evidence for supported self-management as a core component of the care of people living with asthma, discuss the impact in different populations and the essential components of self-management support. We then consider the challenge of implementation and potential role of digital solutions.

EFFECTIVENESS OF SELF-MANAGEMENT

In the literature that has been developing over three decades, there is overwhelming evidence that supported self-management improves asthma control, reduces exacerbations and admissions and improves quality of life (QOL) [6^{***}]. A Cochrane review including 36 studies and 6090 adults showed a reduction in hospital admissions from 11% in control groups to 7% in groups given asthma self-management education [relative risk (RR) 0.64; 95% confidence interval (95% CI) 0.50–0.82] (Fig. 2) [7]. Benefits were greatest in adults with a previous admission, reducing future admission risk from 26 to 14% (RR 0.50; 95% CI 0.27–0.91) [8]. Other benefits include significant reductions in emergency department (ED) visits; unscheduled doctor appointments; days off work or school and improved quality-of-life, and occur in populations recruited from primary and/or secondary care (see Table 1 for details).

International and national guidelines [9–11] reflect this with unequivocal recommendations to offer self-management support. The research focus has shifted in four directions: the impact in subgroups, essential components, implementation and digital self-management support.

EFFECTIVENESS OF SELF-MANAGEMENT IN SPECIFIC SUBGROUPS

Is self-management equally effective in all, or are there subgroups in whom it is inappropriate or needs to be structured differently?

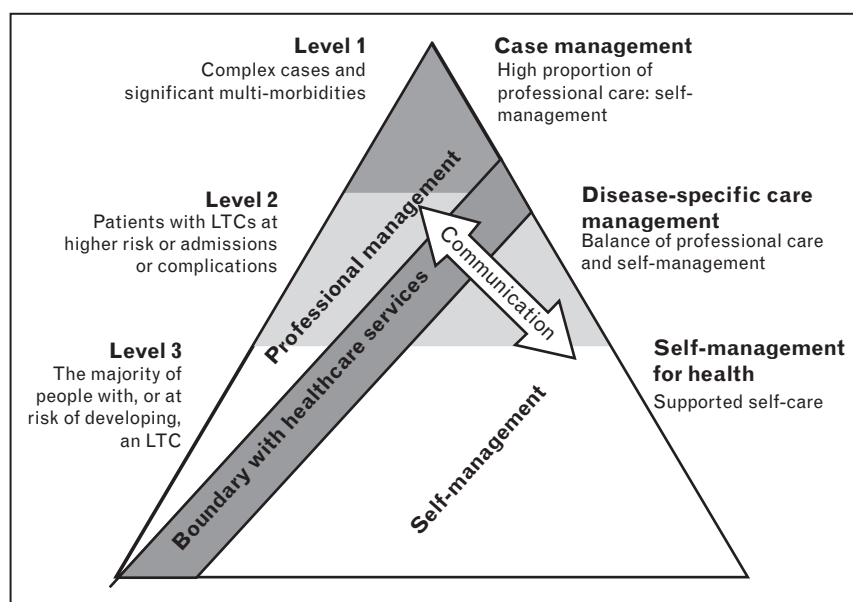


FIGURE 1. The inter-relationship of professional and self-management of long-term conditions. This version of the Kaiser pyramid comes from [4].

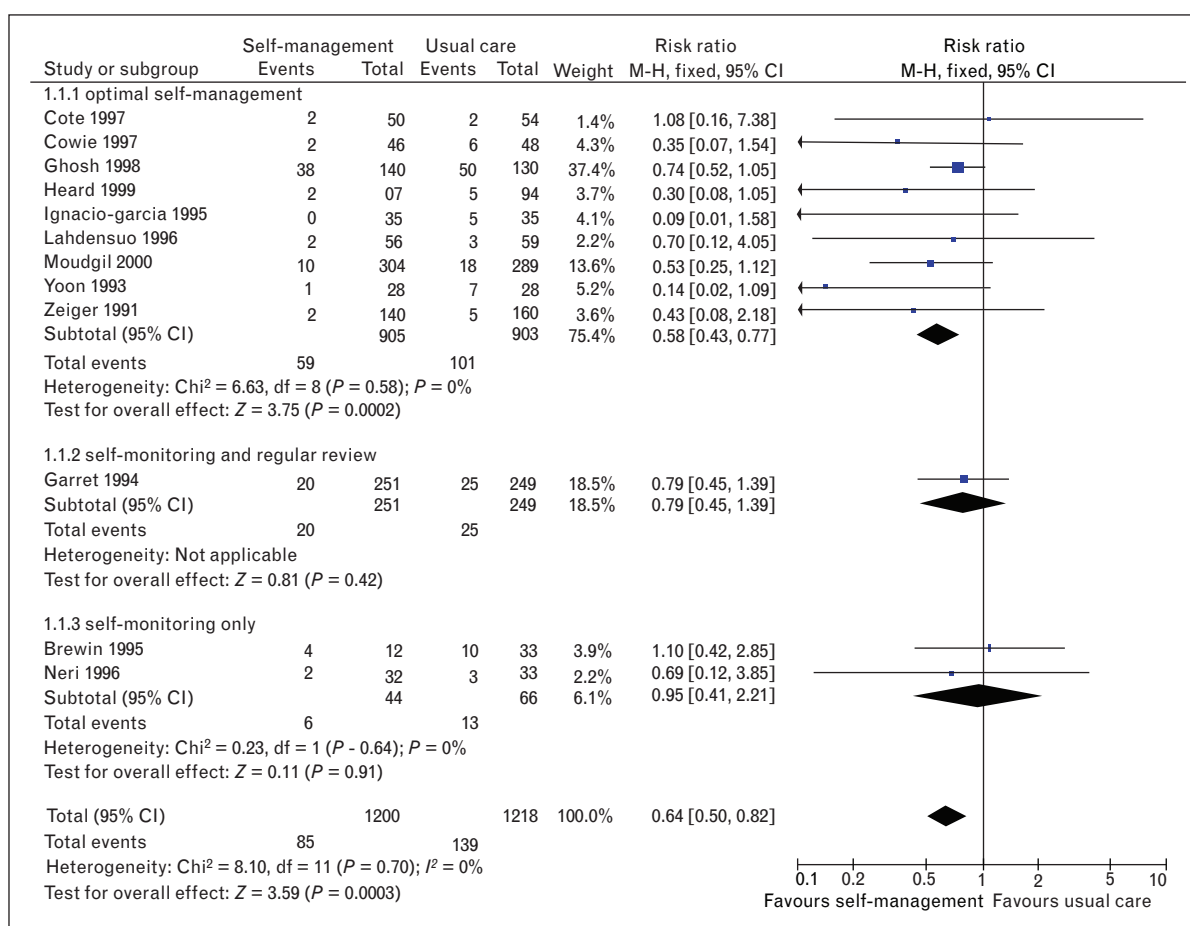


FIGURE 2. Meta-analysis of the proportion of subjects hospitalized comparing self-management with usual care. Adapted with permission from [7].

Ethnicity

The challenges in ethnic minority groups were highlighted in a UK trial recruiting from both European and Asian communities, which investigated a programme encompassing peak expiratory flow monitoring and written action plans [12]. Appropriate language translations were used, but without culturally specific materials. The intervention reduced admissions, GP consultations and oral steroid courses, but only in the white Europeans, not in the Asians. A systematic review used data from four studies (617 patients) to compare generic with culturally specific asthma self-management interventions in minority ethnic communities [13], concluding that culturally specific programmes improved quality-of-life and (in one study) reduced hospitalizations in children: RR 0.32, 95% CI 0.15–0.70.

Simply translating materials is not enough: the content and presentation need to be tailored to the specific culture.

Deprivation and inner city populations

Inner city populations frequently have poor outcomes and score badly in indices of deprivation and health literacy. A recent review assessed multifaceted self-management educational studies in US inner city communities [14]. Impact on hospitalization, ED attendances and unscheduled appointments varied, but overall three-quarters of the 24 studies reported reduced emergency care. The importance of team-based specialty clinics and long-term follow-up after acute care were highlighted, and ‘cultural tailoring’ as opposed to just ‘translating’ existing programmes was advocated.

Children

Self-management education aimed at children and carers is highly effective (Table 1). A systematic review (38 studies, 7843 children) showed that self-management education for the parent(s) and/or child resulted in a reduced hospitalization

Table 1. Summary of findings from key systematic reviews

Outcome	Effect size	Systematic review
Asthma self-management education delivered to adults with asthma:		
Reduced hospital admissions	RR 0.64 (95% CI 0.50–0.82)	Data derived from a systematic review including 36 studies, 6090 people with asthma [7]
Reduced emergency room visits	RR 0.82 (95% CI 0.73–0.94)	
Reduced unscheduled doctors' visits	RR 0.68 (95% CI 0.56–0.81)	
Reduced days off work or school	RR 0.79 (95% CI 0.67–0.93)	
Reduced unscheduled doctors' visits	RR 0.68 (95% CI 0.57–0.81)	
Improved quality of life	SMD 0.29 (95% CI 0.11–0.47)	
Authors' conclusions: Education in asthma self-management that involves self-monitoring by either peak expiratory flow or symptoms, coupled with a regular medical review and a written action plan improves health outcomes for adults with asthma		
Asthma self-management education delivered to children, and/or their parents:		
Reduced emergency room visits	SMD –0.21 (95% CI –0.33 to –0.09)	Data derived from a systematic review including 32 studies, 3706 children with asthma [9]
Reduced absenteeism from school	SMD –0.14 (95% CI –0.23 to –0.04)	
Reduced days with restricted activity	SMD –0.29 (95% CI –0.33 to –0.09)	
Improved self-efficacy	SMD 0.36 (95% CI 0.15–0.57)	
Improved lung function	SMD 0.50 (95% CI 0.25–0.75)	
Reduced disturbed nights	SMD –0.34 (95% CI –0.62 to –0.05)	
Reduced hospital admissions (in children with moderately severe asthma)	SMD –0.08 (95% CI –0.21 to 0.05)	
Authors' conclusions: Asthma self-management education programmes in children improve a wide range of measures of outcome. Self-management education directed to prevention and management of attacks should be incorporated into routine asthma care.		
Asthma self-management education delivered to children who had attended the emergency department, and/or their parents:		
Reduced hospital admissions	RR 0.79 (95% CI 0.69–0.92)	Data derived from a systematic review including 38 studies, 7843 children with asthma [10]
Reduced emergency room visits	RR 0.73 (95% CI 0.65–0.81)	
Reduced unscheduled doctors' visits	RR 0.68 (95% CI 0.57–0.81)	
Authors' conclusions: Asthma education aimed at children and their carers who present to the emergency department for acute exacerbations can result in a lower risk of future emergency department presentation and hospital admission.		

95% CI, 95% confidence interval; RR, relative risk; SMD, standard mean difference.

risk (RR 0.79; 95% CI 0.69–0.92) [15]. The risk of ED attendances was reduced by a quarter, giving a ‘number needed to treat’ of between 7 (high risk populations) and 55. Other reviews concur that self-management programmes reduce the impact of childhood asthma, with reduced restricted days and school absenteeism [16].

However, such programmes have not been shown to improve outcomes in preschool children. In a UK trial [17], supported self-management with a written personalized action plan delivered to preschool children with a previous admission or ED attendance did not reduce subsequent admissions, ED attendance or GP consultations above usual care. The authors speculated that this reflected phenotypes of wheezy toddlers, many having viral-associated wheeze responding poorly to asthma medications. In a US study, a full asthma assessment and/or a home educator session to improve parents’ skills failed to

improve exacerbations or hospitalizations compared with usual care [18]. Either self-management education is ineffective in this age group or the right programme has yet to be investigated.

Self-management education may be school-based, often combined with activities to raise asthma awareness amongst teachers and children. A review identified 25 studies of diverse interventions including group classes, individual education, interactive computer programmes, targeted at children and/or parents and/or classmates, and delivered by professionals, asthma educators or peers [19]. Unsurprisingly results vary, but most studies found improved knowledge of asthma (seven of 10), self-efficacy (six of eight), self-management behaviours (seven of eight) and some favourable effects on quality-of-life (four of eight), day symptoms (five of 11), nights symptoms (two of four) and school absences (five of 17).

Elderly

Specific challenges in providing self-management education for older people include multi-morbidity [20], sometimes including cognitive impairment. Although older people were included in many self-management trials, none have specifically addressed the needs of those with multi-morbidity. A recent observational study in asthmatic individuals aged over 60 years [21] reported that adherence was frequently low (38%), inhaler technique poor and use of self-monitoring or trigger avoidance uncommon, indicating a need for effective self-management education. However, an Australian pilot study of an online asthma self-management support programme for older people reported an increase in asthma knowledge, asthma control and quality-of-life [22] and high acceptability and feasibility. There is a need for further studies investigating effective self-management strategies in older and multi-morbid patients.

EFFECTIVENESS OF THE COMPONENTS OF SELF-MANAGEMENT EDUCATION

Self-management support is a complex intervention, and a key question is which components are essential. The concept of 'optimal self-management' has been proposed, incorporating education, provision of a personalized asthma action plan and supported by regular professional review [7].

Peak expiratory flow monitoring

Many older self-management plans were based on regular PEF monitoring, but is this necessary? A systematic review including 15 studies (2460 adults) concluded that symptom-based action plans were equally effective as PEF-based plans for all outcomes, including hospitalization [23]. In children, symptom-based plans are superior to PEF-based strategies [24].

If PEF is used, action plans should use personal best (as opposed to predicted) PEF, with two to four action points and recommendations about medication use [25]. A post-hoc analysis [26[¶]] reported a peak flow of less than 60% of personal best predicted exacerbations 1 day before their occurrence (sensitivity 78%, specificity 99%), supporting it as an action point for commencing oral steroids [10]. Increased Symptoms as well as PEF less than 80% predicted exacerbations 5 days before onset (sensitivity 100%, specificity 87%), supporting this as a threshold for increasing inhaled steroids.

Although current evidence suggests that symptom-based plans are generally equally effective, there may be a subgroup of patients with low symptom and bronchoconstriction perception [27,28] in whom PEF monitoring is advantageous.

Professional support for self-monitoring

Qualitative research has highlighted patients' need for flexible access to professional support and advice on self-management, either face-to-face, telephone or by e-mail [5]. The more components of the chronic care model (i.e. teaching self-management skills, providing decision support, delivery system design and clinical information systems [3,29]) included within the service, the greater is the impact on adherence [30]. A 14-item taxonomy of components of effective self-management has been developed from quantitative systematic reviews [6[¶]], encompassing information, action plans, monitoring, regular review, skills training and rehearsal, provision of resources and access to advice that healthcare providers will need to consider in developing services. Effective self-management requires regular professional support, with at least an annual review of the action plan [7].

Components of action plans

An action plan is designed to support appropriate patient actions and behaviours as their asthma changes. Although 'templates' for action plans exist in guidelines [9,10] and patient education websites [31–33], these need to be personalised to be appropriate, comprehensible and acceptable to the individual patient. Although the core content is well defined, the action plan needs to be agreed with the patient and personalized to accommodate clinical variation, personal preferences, tailored to cultural and social beliefs, and encompass the strategies enabling the patient to live with asthma [34]. Very simple plans advising when to contact a health professional may be appropriate for some, but for others, more detailed advice on alterations in medication dosage or on commencing patient-held oral steroid courses may be preferred. A systematic review identified that effective plans typically used two to four action points and included recommendations about increasing (or recommencing) inhaled steroids and/or oral steroids in exacerbations [25]. The traditional advice of doubling the dose of inhaled steroids if symptoms or lung function deteriorate may be insufficient [35]. Larger increases (e.g. quadrupling) may be effective [36,37].

IMPLEMENTING SUPPORTED SELF-MANAGEMENT

Despite this extensive evidence, implementation of self-management remains poor, with only about a quarter of people with asthma owning a personalized asthma action plan [38–40]. Barriers are both practical (e.g. time, no available paper plans [39]) and conceptual (scepticism [39,41], mismatch between professionals' patient priorities [34]).

A review of effective implementation highlighted the importance of organizational factors in promoting self-management [42]. Simple organizational strategies such as including blank action plans in a mailing inviting attendance for review increased clinic attendance and proportion of people given plans [43]. A nurse-led telephone-delivered self-management programme [44] reported improvements in the proportion of preventer to reliever medication, though no impact on emergency healthcare.

A recent synthesis of the qualitative evidence [45[¶]] identified the importance of professional education to promote partnership working and communication. Training alone, however, is insufficient, and organizational support, particularly to encourage newly trained professionals, is needed [46,47]. National programmes combining professional training with engagement of patient organizations in the context of a policy drive to improve asthma care can promote self-management, reduce admissions and asthma deaths [48,49].

DIGITALLY SUPPORTED SELF-MANAGEMENT

A key factor in effective self-management is provision of information in a format that the patient can retain and refer to when needed, traditionally as a written action plan. Most people nowadays are used to accessing digital information through computers or smart phones for work and leisure. The convenience, anonymity and repeatability of digital support can potentially improve accessibility and utilization of action plans. In addition, 'smart' systems can personalize information for individual preferences and triggers.

Smartphone and 'app'-based supported self-management in asthma

A recent Cochrane review including two studies (408 participants) of self-management 'apps' for asthma [50[¶]] assessed their effectiveness when delivered via smartphone or tablet compared with paper-based diaries. One encouraged participants to record daily symptoms, medication and PEF through their mobile phone, with feedback of automatically calculated control and self-management recommendations [51]. The other studied participants with poorly controlled asthma who recorded symptoms and PEFs twice daily, and received immediate feedback as a traffic light display [52]. The combined results were inconclusive; in the first, the 'app' was associated with improved quality-of-life, lung function and reduced ED attendances, while in the

second, symptom scores, asthma-related quality-of-life and resource use were similar between groups. Neither found differences in adherence to action plans or occurrence of complications. The review concluded that evidence is insufficient to determine whether 'apps' are better than written plans, but there was no suggestion that the digital interventions were inferior to the evidence-based written approach.

Internet-based self-management in asthma

A number of studies have investigated Internet-based strategies in asthma, although most involve clinicians remotely assessing data and advising on management, so are examples of telehealthcare rather than self-management support. A Cochrane review [53] found no evidence of a clinically important impact on quality-of-life from telehealthcare, but some evidence of fewer admissions in people with severe asthma. A review of trials evaluating interactive asthma educational programmes [54] found that they improved at least one clinical outcome in six of the nine studies: reduced hospitalization (one study), reduced ED attendances (one), reduced reliever use (one), reduced asthma symptoms (five), improved lung function (two) and improved asthma knowledge (four). A study [55] of 200 adults with persistent asthma compared an Internet-based self-management programme including weekly symptom monitoring, automated treatment advice, online and group education and remote web communications, with usual care. Improvements were seen in quality-of-life, symptoms and lung function (but not exacerbations) over 12 months and sustained over a further 18 months [56[¶]]. A cross-over study of young adults reported that web-based management was feasible, well tolerated and preferred by patients with improved short-term outcomes [57]. Two professionally supported web-based interventions aimed at adolescents with asthma [58,59], reported fewer symptom-days, symptom-nights, school days missed, restricted-activity days and hospitalizations in this often challenging age group. A further study of Internet-based support in adolescents with poorly controlled asthma [60] reported improved quality-of-life and symptoms after 3 months (but not after 12 months) in comparison with written self-management advice.

Digital asthma self-management

A recent broad 'review of reviews' of digital asthma self-management interventions [61^{¶¶}] identified 10 systematic reviews analysing 19 clinical trials. The

interventions, degrees of professional involvement, duration and populations were heterogeneous, so meta-analysis was not attempted. Reassuringly, no evidence of harm was found. Studies that reported knowledge or activity limitation showed improvement in the intervention groups, and the interventions improved markers of self-care, quality-of-life and medication use in some but not all studies. Effects on symptoms and school absences were equivocal, with no evidence of overall benefits on lung function, or health service use. The authors concluded that 'digital self-management interventions show promise ... but understanding the "reach" of such interventions is difficult'.

CONCLUSION

Supported self-management of asthma including personalized asthma action plans reduces severe exacerbations of asthma. There is a large body of evidence that demonstrates reductions in hospital admissions, ED visits and unscheduled care, as well as improving asthma control and QOL. The only subgroup in which currently available action plans do not work are preschoolchildren. Self-management programmes for different ethnic groups need to be culturally specific.

Implementation in routine practice is challenging. Training and incentivising professionals and providing resources are important, but organizational support is crucial to enable change. Increasingly digital systems, such as Internet or mobile phone based action plans, are being explored as potential mechanisms for facilitating self-management support.

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Conflicts of interest

H.P. chairs the self-management evidence review group for the BTS SIGN asthma guideline.

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