



Effective Health Care Program

Effectiveness of Indoor Allergen Reduction in Management of Asthma

Evidence Summary

Objectives and Rationale for Review

This report summarizes a systematic review, “Effectiveness of Indoor Allergen Reduction in Management of Asthma,” and identifies needs for future research. This was one of the six high priority topics within asthma identified by a National Heart, Lung, and Blood Institute Advisory Council Asthma Expert Working group.¹

The objective of the systematic review is to assess the effectiveness of allergen reduction interventions on asthma outcomes in adults and children.

Background

Control of environmental factors that may contribute to asthma is one of the four components of asthma management. Many common indoor inhalant allergens have been associated with increased risk of asthma exacerbations, including animal dander, house dust mites (HDMs), mice, cockroaches, and mold.² Numerous interventions have been designed to reduce exposure to allergens in the environment where patients with asthma live, work, learn, play, and sleep.³ These interventions include use of acaricides (HDM pesticides), air purification systems, carpet removal or vacuuming, use of specially designed mattress covers and pillowcases, mold removal, pest control techniques, and containment or removal of family pets.

Purpose of Review

To evaluate the effectiveness of indoor allergen reduction interventions on asthma outcomes.

Key Messages

- Evidence for single interventions designed to reduce indoor allergen exposure on asthma outcomes is lacking.
- Multicomponent interventions that bundle more than one strategy may improve some asthma outcomes, but it is unclear if specific combinations are more effective than others.
- Multicomponent interventions that include high-efficiency particulate air-filtration (HEPA) vacuums or pest control reduce exacerbations and improve quality of life.
- The evidence for both single and multicomponent interventions does not address many other important outcomes, including asthma-related health care utilization, pulmonary physiology, and asthma-related quality of life.

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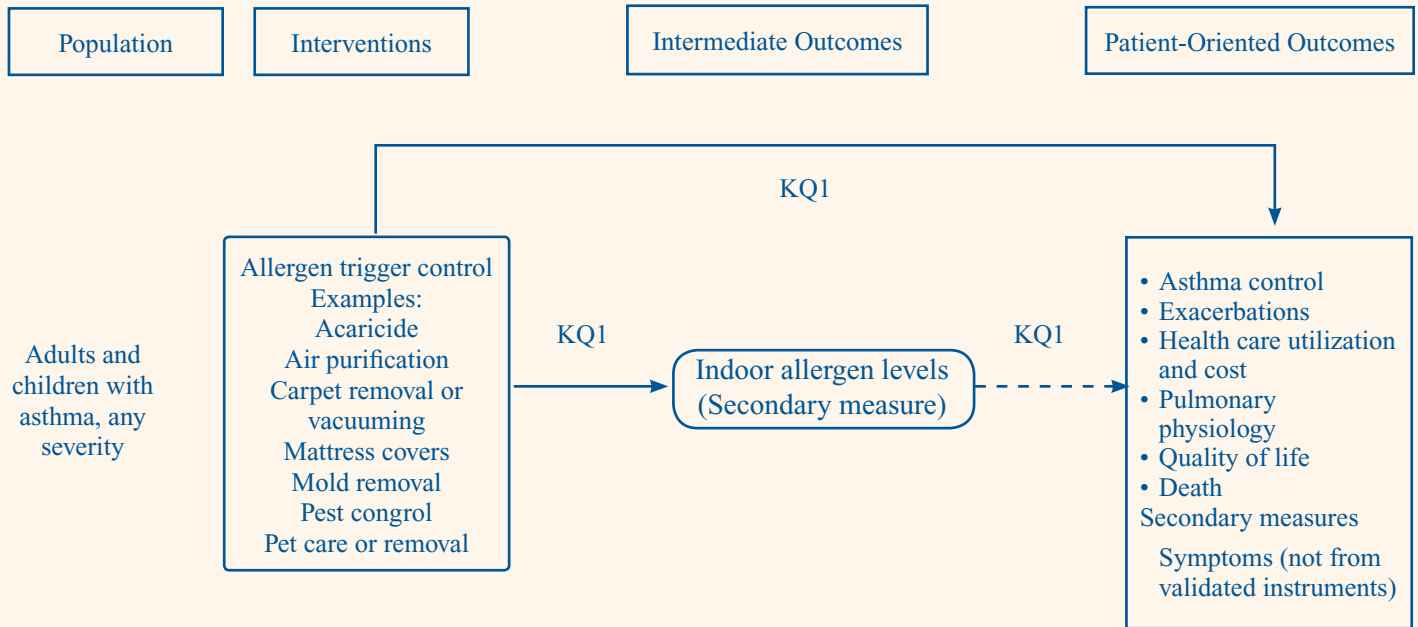


This report’s main objective is to conduct a systematic review of the benefits and harms of interventions to reduce indoor inhalant allergens for the management of asthma in adults and children. In this review, we address the following Key Question:

Among individuals with asthma, what is the effectiveness of interventions to reduce or remove exposures to indoor inhalant allergens on asthma control, exacerbations, quality of life, and other relevant outcomes?

Figure A shows the analytic framework.

Figure A. Analytic framework for indoor allergen reduction in the management of asthma



KQ=Key Question
Dashed line indicates theoretical relationship

Data Sources

MEDLINE®, Embase®, PubMed®, CINAHL®, the Cochrane Library, and the gray literature were searched through April 21, 2017. The systematic review protocol is available online at <https://effectivehealthcare.ahrq.gov/ehc/products/643/2318/asthma-nonpharmacologic-treatment-protocol-161004.pdf>, and is registered in PROSPERO (<http://www.crd.york.ac.uk/PROSPERO>), with the registration number CRD42017055547.

Results

Thirty-eight comparative studies (n= 3,243) assessed individual (single component) interventions, and 30 comparative studies (n=4,907) assessed multicomponent interventions. The key findings of the review are listed below along with the strength of evidence (SOE).

- The evidence that either single or multicomponent interventions intended to reduce allergen exposure improve asthma outcomes is limited by a lack of high quality studies. Overall strength of evidence (SOE) for most comparisons and outcomes was either low, inconclusive, or no studies were available.

- No high or moderate strength evidence found improvement in patient-oriented outcomes resulting from single component interventions.
- Overall, multicomponent interventions performed better than single component interventions.
- Multicomponent strategies that included high-efficiency particulate air-filtration (HEPA) vacuums reduced exacerbations and improved quality of life (moderate SOE), while strategies that included mattress covers improved nonvalidated measures of respiratory symptoms (high SOE), and strategies that included pest control reduced exacerbations (moderate SOE).
- Mattress covers, when used without other interventions, did not affect asthma control (moderate SOE), exacerbations (moderate SOE), health care utilization (high SOE), pulmonary physiology (high SOE), quality of life (high SOE), or nonvalidated measures of respiratory symptoms (high SOE), despite reducing the allergen burden detected on mattress surfaces (moderate SOE).
- Qualitative comparative analysis affirmed the general lack of robust findings of improved outcome effects. No single allergen interventions were determined to be necessary or sufficient for effectiveness. Multicomponent bundles were characterized by substantial heterogeneity, and no conclusions about the effectiveness of specific combinations were supported by the evidence.
- Important limitations of the evidence base include population heterogeneity (e.g., patient age and asthma severity), infrequent reporting of validated asthma outcome measures, poor data reporting, and variation in how interventions were implemented.
- Further research is needed examining indoor allergen reduction interventions in comparative studies with sufficient population sizes to detect clinically meaningful differences in relevant and validated asthma outcomes.

Discussion

We identified 60 randomized controlled trials (RCTs) and 8 additional studies (4 nonrandomized trials and 4 pre-post studies) that examined 8 types of interventions, alone or in combination, to reduce allergen levels in the home and improve the wellbeing of patients with asthma.

There was a high level of heterogeneity across studies, particularly related to patient characteristics such as allergen sensitization and disease severity, and the combinations of treatments examined, that limited our ability to assess the generalizability of our findings to the overall population of people with asthma. Other factors affecting the applicability of the results included potential exposure to indoor allergens in settings outside the home, as well as exposure to outdoor allergens or non-allergen irritants. We also found that few studies reported critical, discrete, validated outcome measures, which have established thresholds for clinical significance. The relative paucity of studies using current, standardized measures limited our interpretation of the primary outcome measures.

The overall evidence base is characterized by a lack of conclusive, consistent, high- or moderate-strength evidence that either favors interventions to reduce exposure to allergens, or demonstrates that these strategies have no effect. However, we note the critical distinction between a lack of evidence and evidence of no effect. Throughout this review, we found that the evidence base lacks sufficient high-quality studies to inform useful conclusions for the interventions evaluated. This does not indicate that the interventions are ineffective, but rather highlights the need for additional research.

Several evidence gaps could benefit from future research. First, there is insufficient information about several types of interventions, used alone or as part of multicomponent strategies. A substantial need exists for high-quality RCTs examining the effect of HEPA vacuums, pest control, carpet removal, pet removal, and mold removal. Research is also needed to evaluate multicomponent interventions more efficiently by standardizing sets of strategies that could be tested as bundles. The evidence base could also be evaluated with greater precision if outcome reporting were improved and standardized. For example, important, standardized measures of asthma control, exacerbations, healthcare utilization, and quality of life were often unreported in the included studies. We also need further research on the interaction between the effect size of outcome measures and meaningful clinical improvement.

Since asthma can significantly affect overall health and quality of life, patients and their families may be motivated to adopt interventions that are not physically invasive, such as use of mattress covers or air purifiers, to augment pharmacologic treatment. It is important for clinicians to consider the complexity of the patient population and the

limitations of the evidence identified. Clinicians may also find it helpful to consider the severity of a patient's asthma and the extent of previous symptoms and exacerbations.

Conclusions

The evidence base addressing allergen-reduction interventions for patients with asthma spans 40 years and 4 continents and has included more than 7,000 patients. However, few conclusions can be reached about the effectiveness of interventions designed to reduce allergens in the home. Multicomponent interventions that include HEPA vacuums or pest control may be effective for reducing exacerbations and improving quality of life, although results were inconclusive for validated measures of asthma control. For many critical outcomes across the interventions, evidence was insufficient due to too few studies. Moreover, results that were conclusive tended to suggest lack of clinical effect. The evidence base as a whole is insufficient to support meaningful conclusions about the effectiveness of many widely used products and strategies for improving patient outcomes by reducing environmental allergen exposure. Further research on many critical questions is needed. Future research should address these evidence gaps with comparative studies that enroll enough patients to detect clinically meaningful improvements in relevant, validated asthma outcomes.

References

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Full Report

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