

PRACTICE OPTIONS FROM BEYOND OUR PAGES

Breathing New Life Into Mite-Impermeable Bedcovers

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Practice Options from Beyond Our Pages focuses on identifying, critiquing, and placing into context research studies published in other journals that have the potential to change our clinical practices. It is written by Allergy-Immunology Fellows partnered with faculty members, and does not require an invitation for submission. This feature is coordinated by Editorial Board members Matthew Rank, MD and Julie Wang, MD.

REFERENCE

Murray CS, Foden P, Sumner H, Shepley E, Custovic A, Simpson A. Preventing severe asthma exacerbations in children: a randomized trial of mite-impermeable bedcovers. *Am J Respir Crit Care Med* 2017;196:150-8.

BACKGROUND

Current recommendations regarding mite allergen control for patients with asthma are conflicting and are largely based on adult populations. For adults and children, the National Asthma Education and Prevention Program Expert Panel Report 3 recommends encasing mattresses and pillows with mite-impermeable covers and washing bedding weekly in more than 130°F water.¹ In contrast, the Global Initiative for Asthma (GINA) 2017 Global Strategy for Asthma Management and Prevention states that there is limited evidence in children, but not adults, of clinical benefit for allergen avoidance measures in allergen-sensitized patients with asthma.² Similarly, a 2008 Cochrane Database review of adult and pediatric studies on dust mite control measures does not recommend mite avoidance measures for mite-sensitized patients with asthma.³ Given these inconsistent recommendations, a well-conducted, randomized controlled trial of mite control measures in children with asthma with dust mite allergy could help guide clinician recommendations.

METHODS

This study is a randomized, double-blind, placebo-controlled trial of a single intervention (mite-impermeable bedcovers) in mite-sensitized children aged 3 to 17 years with physician-diagnosed asthma. Participants were recruited from 14 pediatric centers in Northwest England after having presented to the hospital with an asthma exacerbation. Sensitization was determined by a positive (≥ 3 mm than negative control) skin prick test result to house dust mite. Other allergens tested included cat, dog, grass, *Aspergillus*, and tree

pollen; however, not all children were tested to all allergens (exact numbers not specified). The participants were randomized in a 1:1 fashion to receive either mite-impermeable or placebo bedcovers (pillow, mattress, and duvet covers) and they were followed for 12 months. Telephone interviews with the primary caregiver were conducted at 1, 4, 8, and 12 months. Der p 1 levels were measured in dust samples collected from the child's mattress and lounge floor at baseline and 12 months. The primary outcome was severe asthma exacerbation, which was defined as (1) a hospitalization or emergency department (ED) visit due to asthma requiring systemic oral corticosteroids (OCSs) or (2) the use of OCS or an increase from the baseline dose of OCS for at least 3 days. Secondary outcomes included change in controller medication from baseline, and quality of life (Pediatric Asthma Caregiver's Quality of Life Questionnaire completed by parents, with Mini PAQLQ completed in addition by children 7 years or older) and asthma control (Asthma Control Questionnaire completed for children 6 years or older).

RESULTS

A total of 149 children were randomized to the treatment group and 138 to the placebo group. Their baseline characteristics were similar. The mean age was approximately 7 years. Participants were predominantly male and white, with between 20% and 50% having comorbid hay fever, eczema, and/or food allergy. More than 40% in each group had a household member who smoked. All participants were sensitized to mite, with 40% to 46% being sensitized to mite only. The median number of positive skin prick test results was 1. More than 50% were on GINA step 1 or 2, equivalent to low-dose inhaled corticosteroids or less.

The 2 components of the primary outcome, (1) hospitalization or ED visit requiring oral steroids and (2) increase in oral steroids/oral steroid burst, were analyzed separately using intention-to-treat analysis; 29.3% (36 of 123) in the treatment group versus 41.5% (49 of 118) in the placebo group had a hospitalization or ED visit requiring OCS due to asthma (odds ratio, 0.58; 95% CI, 0.34-0.99; $P = .047$). Time to first severe exacerbation requiring hospital/ED attendance was longer in the treatment group ($P = .04$). However, there was no difference in the use of OCS for 3 days or more (given in a hospital encounter, by the primary doctor, or use of home rescue-pack) between the 2 groups (48.8% in the treatment group and 50.0% in the placebo group; $P = .85$). Per-protocol analysis revealed similar results, with 27.7% (28 of 101) in the treatment group versus 41.1% (44 of 107) in the placebo group having a hospitalization or ED visit requiring OCS due to asthma ($P = .042$). Likewise,

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there was no difference between groups in OCS use (48.5% vs 50.5%; $P = .78$).

For the secondary outcomes, both groups had an improvement in quality-of-life scores, with no difference between the groups. The treatment group had an improvement in asthma control, but this was not statistically different than the placebo group; 10.7% of participants in the active group increased their GINA treatment step during the study versus 14.5% of participants in the placebo group ($P = .37$).

Post hoc analyses stratified by age, sensitization to mite only, in-home smokers, GINA treatment step, and deprivation index suggested that younger participants (age ≤ 10 years), those living in a smoke-free home, and those with the greatest deprivation index tended to have a greater reduction in risk of hospital/ED presentation in response to the intervention than did older children, those living in homes with smokers, and those with less deprivation, respectively, but these differences were not statistically significant.

Der p 1 levels in mattress dust were reduced 84% in the treatment group, with no change in the placebo group ($P < .001$). Der p 1 lounge floor dust levels were unchanged in both groups.

Critical appraisal

Previous studies of mite avoidance in children with asthma have been mixed, with some showing little to no evidence of efficacy⁴⁻⁷ and others demonstrating beneficial effects on inhaled steroid doses,⁸ symptom days,⁹ bronchial hyperresponsiveness,¹⁰ and acute visits.¹¹ In this randomized clinical trial, mite-impermeable bedcovers as a single intervention reduced the risk of hospitalizations and ED visits requiring oral steroids among mite-sensitized, asthmatic children, suggesting that environmental interventions aimed at dust mite exposure reduction may be an important component of asthma management in similar populations. Notably, the mite-impermeable bedcovers were very effective in reducing mite allergen levels in the mattresses, and it is possible that this degree of exposure reduction is necessary to observe a clinical effect. In fact, dust mite interventions in previous “negative” trials either did not report levels⁴ or did not achieve reduction in dust mite exposure.⁵ The findings also suggest that targeting a single allergen may have clinical benefit, and adds to the recent literature on single allergen interventions^{12,13} that challenges the notion that home-based allergen interventions should target multiple allergens to be effective.^{1,9}

Interestingly, although a beneficial effect on hospitalizations and ED visits requiring oral steroids was observed, there was no effect on oral steroid use overall, indicating that the intervention primarily affected the likelihood of presenting to the hospital or the ED with an exacerbation and not the risk of exacerbation. It is possible that presenting to the hospital or the ED with an exacerbation represents a more severe exacerbation, so that the mite-proof bedcovers were effective in reducing the risk of the more severe exacerbations, but not less severe exacerbations. The severity of exacerbations, however, was not reported, so the reason for the difference in the intervention’s effect between the 2 outcomes is not clear.

Children with mite-impermeable covers had 45% lower risk of hospitalization and ED visit requiring oral steroids versus placebo covers. For comparison, in the Childhood Asthma

Management Program study, inhaled corticosteroids (budesonide 400 μ g daily) were associated with a 43% lower rate of hospitalization and 45% lower rate of urgent care visits for children with mild-to-moderate asthma compared with the placebo drug. In a clinical trial of omalizumab as add-on therapy, omalizumab reduced the exacerbation rate by 43% compared with placebo for children with a history of exacerbations and on at least medium-dose inhaled corticosteroid. An important caveat when comparing these studies is that their designs and populations vary, so that direct comparisons are not possible. However, mite-impermeable covers in this study appeared to have effects on hospitalizations and ED visits that are similar to those observed with controller medications.

One limitation was that a high percentage of children were sensitized only to mite, so that it is possible that mite-impermeable bedcovers would not be effective in a population of children sensitized to multiple allergens.

Recommendation

Mite-impermeable covers should be considered for mite-sensitized children with asthma with a history of exacerbations. Reduction in hospitalization or ED visits is likely to be the greatest in young children (≤ 10 years).

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