House dust mite avoidance measures for perennial allergic rhinitis: a systematic review of efficacy

Aziz Sheikh and Brian Hurwitz

SUMMARY

Perennial allergic rhinitis is a common chronic disorder that results most frequently from sensitivity to house dust mites. National and international guidelines for the management of allergic rhinitis recommend that house dust mite avoidance measures be considered in all patients with house dust mite-provoked rhinitis. To assess the benefit and harm of measures designed to reduce house dust mite exposure in the management of house dust mite-sensitive allergic rhinitis, published and unpublished randomised controlled trials were systematically searched. A methodological assessment of trial quality was conducted using the Cochrane approach. Four trials satisfied the inclusion criteria, all of which were small and judged to be of poor quality. The results indicate that, when compared with controls, significant reductions of allergen load can be achieved by physical and chemical means, but there is little evidence at present that these reductions translate into sustained improvements in clinical outcomes. No serious adverse effects were reported from the interventions.

Keywords: *house dust mites; allergen avoidance; perennial allergic rhinitis; systematic review.*

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Introduction

PERENNIAL allergic rhinitis affects up to 5% of the general population in western countries, and its prevalence is rising.[1-3] It is responsible for 3% of general practice consultations in the United Kingdom (UK) and for considerable morbidity and costs to health services.[4,5]

Traditionally, perennial allergic rhinitis has been managed by advising regular use of nasal corticosteroids and/or oral antihistamines. Other treatments include topical anticholinergic agents, mast cell stabilisers, and, in more severe cases, systemic corticosteroids or immunotherapy. Allergen avoidance has also been a significant dimension of specialist management of allergic rhinitis, and in recent years general practitioners (GPs) have been urged to recommend allergen avoidance measures as part of the management of the condition.[6-7] Internationally accepted clinical guidelines now recommend that house dust mite avoidance measures be considered in people with house dust mite-provoked rhinitis.[8-10]

Although use of house dust mite control measures in the management of perennial rhinitis is logical, this approach has received only patchy uptake as a result of concerns regarding its practicality, effectiveness, and cost effectiveness. Techniques to decrease house dust mite exposure can be classified as physical (heating, ventilation, freezing, washing, barrier methods, air filtration, vacuuming, and ionisers), or chemical (acaricides), or a combination of these approaches. To ascertain the usefulness of house dust mite control measures in the management of perennial allergic rhinitis, the literature was reviewed systematically and the evidence that has emerged from randomised controlled trials was analysed.

Method

Search strategy

To identify randomised controlled trials, a search was carried out in the MEDLINE (from 1966 to 2000), EMBASE (from 1980 to 2000), and Central databases. Searches were performed using the Cochrane optimal search strategy for identifying randomised controlled trials, using the search terms 'dust' and 'mite*' or 'allerg*' and 'rhinit*' in the title, abstract, or keyword fields. No restrictions on language of publication were employed. The bibliographies of each paper were checked for further references. Attempts were made to contact the primary author of each study identified to ascertain additional trials.

Inclusion criteria

As some house dust mite control measures are impossible

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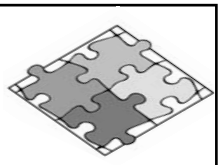

What do we know?

Perennial allergic rhinitis is a common chronic disorder that is most frequently owing to house dust mite sensitivity. Although current guidelines for the management of allergic rhinitis recommend that house dust mite avoidance measures be considered in all people with house dust mite-provoked rhinitis, the effectiveness of such interventions is unknown.

What does this paper add?

This systematic review shows that although allergen reduction strategies are effective in reducing domestic house dust mite load, as yet there is very little clinical evidence to suggest that this load reduction translates into sustained improvement in patient outcomes.

to blind for, unblinded randomised trials in which house dust mite control measures were compared with either placebo or other types of control measures were accepted. It was stipulated that trial participants should have had a diagnosis of house dust mite allergic rhinitis made by a qualified clinician, the diagnosis having been confirmed by an objective test, such as skin prick testing, allergen-specific IgE concentrations, or provocation testing.[11]

Data analysis and synthesis

Two independent reviewers checked all of the titles and abstracts identified from the searches and obtained full texts of all studies of possible relevance for independent assessment. We decided which of these trials satisfied the inclusion criteria and graded their methodological quality using the Cochrane approach, which involves a detailed assessment of the quality of randomisation (allocation concealment) and risk of bias.[12] In addition, the quality of each study was documented according to the following parameters: baseline differences between experimental groups, diagnostic criteria used, and length of follow-up.

One reviewer performed data extraction using a standardised form, and the second reviewer independently checked this process. It had been intended to undertake a formal meta-analysis; however, this proved impossible because of the absence of relevant data on dispersion around effect sizes in published reports of trials. Trial authors were contacted in an attempt to obtain these data but with no success in terms of the information required. Results were therefore summarised in a narrative overview.

Results

Search results

Of the 49 abstracts retrieved from electronic searches, five papers reporting randomised controlled trials were considered to be of possible relevance to this investigation.[13-17] Two of these papers reported data from the same trial.[14,15] All four identified trials satisfied the inclusion criteria (Figure 1).[13,15-17] Attempts to contact authors failed to retrieve any additional trials.

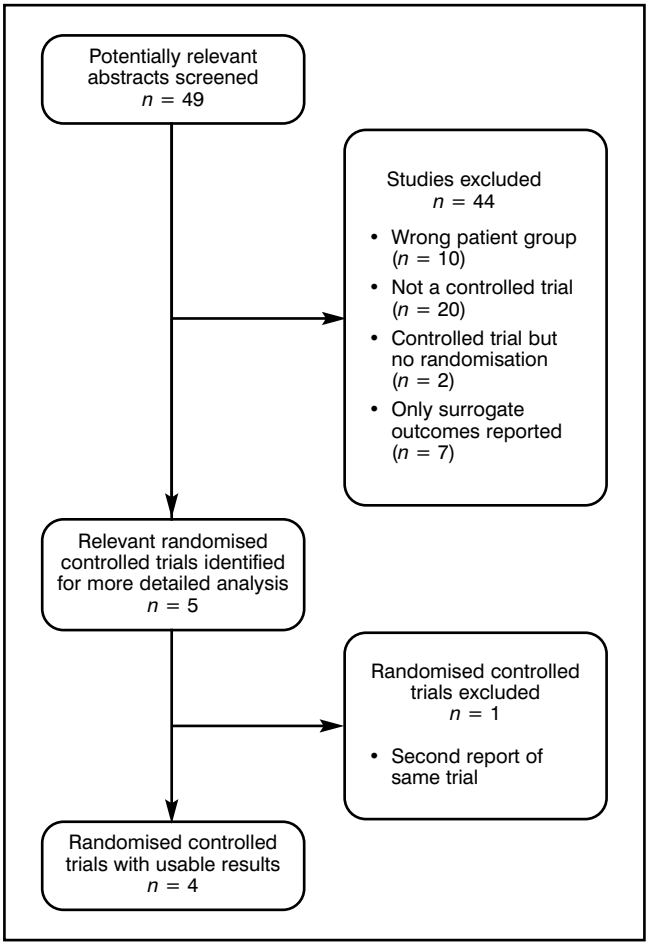

Figure 1. QUORUM systematic review flow diagram.

Description of studies and main findings

The main findings are presented in this section and Table 1, and full descriptions of included studies are reported elsewhere.[18]

The four studies recruited a total of 122 subjects with evidence of house dust mite-provoked respiratory disease, aged between four and 61 years of age. In three studies, inclusion criteria stipulated that subjects were required to have a proven diagnosis of house dust mite-sensitive rhinitis.[13,15,17] However, in the study by Bernstein *et al,* subjects with a diagnosis of house dust mite-sensitive rhinitis or asthma, or both, were recruited. House dust mite sensitivity in each of these studies was established using objective tests, such as skin prick testing and measures of serum-specific IgE. Only two of the studies employed a double-blind randomised controlled trial,[13,16] of which one was a cross-over design[13] and the other a parallel group design.[16] The other two randomised studies employed an open controlled[17] and a double-blind, matched pair, controlled design.[15] Important methodological limitations were identified in each of the four studies.[18]

The studies assessed the efficacy of chemical (acaricide) and physical (high efficiency particulate air filter and barrier bedding) interventions for reducing house dust mite load. Kniest *et al* compared the effectiveness of intensive home

Table 1. Included studies.

Study	Methods	Participants	Interventions	Outcomes	Allocation concealment
Reisman 1990	Double-blind crossover randomised controlled trial	Forty subjects aged between six and 61 years with perennial allergic rhinitis and/or asthma and confirmed allergy to house dust mites	Group 1: high efficiency particulate air filter loaded with an active Enviracaire filter for four weeks, followed by placebo for four weeks. Group 2: same as Group 1 but order of active and placebo filters reversed	Particulate counts in bedroom air Symptom and medication scores Patients' subjective responses to treatment	B
Kniest 1991	Double-blind matched pair controlled trial	Twenty subjects aged between 12 and 36 years with house dust mite-sensitive rhinitis Divided into matched pairs on clinical and environmental parameters and then arbitrarily allocated to one of the two interventions	Twelve months of intensive home cleaning, either with or without the addition of acaracide (solidified benzylbenzoate) Daily symptoms and medication scores	Physician assessment Total and mite-specific IgE Blood and nose eosinophils	C
Kniest 1992	Double-blind matched pair controlled trial	Twenty subjects aged between 12 and 36 years with house dust mite-sensitive rhinitis. Divided into matched pairs on clinical and environmental parameters and then arbitrarily allocated to one of the two interventions	Twelve months of intensive home cleaning, either with or without the addition of acaracide (solidified benzylbenzoate)		D
Bernstein 1995	Double-blind randomised controlled trial	Thirty-two children aged between four and 12 years with either allergic rhinitis or asthma or both, and confirmed mono-allergy to house dust mites	Bedroom sprayed with either Acardust acaricide or placebo on days 0 and 90	Daily rhinitis and asthma symptom scores, medication use, twice-weekly peak expiratory flow, and monthly clinical assessment House dust mite antigen concentration at days 0, 90, and 180	B
Moon 1999	Open randomised controlled trial	Thirty subjects aged between six and 31 years with confirmed house dust mite-sensitive rhinitis and no other concomitant allergy to common aeroallergens	All subjects continued normal rhinitis treatment In addition, they received either verbal advice on allergen avoidance or provision of the following bedroom-based interventions for four weeks: vinyl mattress cover, daily wet cleaning of floor, fortnightly boil washing of top bedding cover and removal of soft furnishings	Change in house dust mite load and daily rhinitis symptom scores from baseline and between groups	B

cleaning for 12 months, with or without the addition of acaricide.[14,15] In the study by Bernstein *et al,* bedrooms were cleaned regularly throughout the study period, this cleaning regimen being supplemented on two occasions with either acaricide or placebo spray.[16] Reisman *et al* compared the effectiveness of bedroom use of a high efficiency particulate air filter (filtering at 300 cubic feet/minute) fitted with an active Enviracaire filter for four weeks, with the same filtering device fitted with placebo filters for four weeks.[13] In contrast, in the study by Moon *et al,* the active intervention was confined to each participant's bedroom and consisted of the researcher wrapping the mattress in a vinyl cover, washing the top bedding cover at 55ºC fortnightly, removing soft furnishings, and wet cleaning the bedroom floor every day. The control group received only verbal instructions regarding ways of reducing house dust mite exposure. All participants

continued to use existing rhinitis treatments throughout the four-week trial period.

Three of the four studies assessed the impact of the intervention on house dust mite load, and in each of these studies a significantly greater reduction in dust mite load was effected in the active treatment arm when compared with the control intervention.[13,16,17]

Each of the four studies used some form of symptom and/or medication score as their primary outcome measure of interest. Reisman *et al* reported that aggregated 12-hour rhinitis and asthma symptom and medication scores over the final two weeks of treatment were lower after active than after placebo filtration (day = 8.79 versus 10.38, night = 8.28 versus 9.90) with the Wilcoxon matched pairs rank sum test suggesting that active filtration resulted in significant reduction of symptom and medication scores for 24-hour nasal congestion and discharge, eye irritation, and upper airway scores. Eleven participants reported improvement with active filtration, seven with placebo, and 14 reported no change in symptoms.

Outcome measures of interest in the study by Kniest *et al* were: the three-month median of summed daily symptom scores for each two-week period; use of medication scores after the second, third and fourth three-month period of the study; and physicians' assessments of whether each subject's overall condition had improved.[14,15] All participants completed the study and reported no toxic effects. Twelve months after treatment, three-month symptom scores (at 0 to 3 months versus 9 to 12 months) were lower in the acaricide cleaner group compared with the control group (matched pairs, $P = 0.025$). Absolute values of symptoms were not reported, but categorised as improved, no change, or worse, based upon the ratio of medians in each of the last three-quarters of the study to the median value of patient symptom scores in the first quarter of the study. Physicians' assessments showed more patients in the acaricide group improved than in the control group (start to end, $P = 0.05$) but comparison in matched pairs showed no difference. Only four of the 10 patients in the acaricide group reported daily medication use, compared with six of the 10 patients in the placebo group.

All children in the Bernstein study completed an individual daily score card for asthma and rhinitis symptoms (a composite score was used, and it was therefore not possible to distinguish between asthma and rhinitis symptoms), medication taken, and additional symptoms (each scaled on a range of 0 to 3).[16] Peak flow rate was recorded twice weekly and all children were examined monthly for peak expiratory flow and forced expiratory volume in one second. Doctors' and patients' opinions of clinical symptoms were recorded according to the same scales (0 to 3). Three children dropped out owing to poor compliance. All symptoms of nasal secretion (i.e. the symptom complex of sneezing/lacrimation/itching) and medication use diminished more quickly on a log time scale in the Acardust-treated group than in the placebo group. Over the six-month period, mean combined rhinitis and asthma symptom scores decreased more in the Acardust group than in the placebo group on the following aggregated symptom dimensions: daily activity disruption, patients' overall evaluation of symptoms, and doctors' evaluation of symptoms.

The main clinical outcome measure of interest in the study by Moon *et al* was that of changes in nasal symptom scores between 0 to 9 (0 = no symptoms, 9 = severe symptoms).[17] This was an open study; therefore, to minimise the chances of bias, clinical evaluation was performed according to a predefined protocol, which was not actually described, but reference was made to a paper by Okuda.[19] It is, nonetheless, unclear from this report whether the nurse assessing clinical outcome was blinded to treatment group. Also unclear is whether any changes were made to the medical treatment received by participants during the course of the trial. Only one subject was lost to follow-up. There were no adverse effects reported. Mean daily rhinitis symptom scores fell in the experimental group from 5 at baseline to 2.1 (standard deviation was not presented) after four weeks of active treatment (mean difference = –2.9, $P = 0.001$) compared with a change from a mean of 4.2 at baseline to 3.9 (standard deviation not presented) at the end of the trial (mean difference = –0.3, $P > 0.05$). Comparison of change in nasal symptom scores between active and control groups showed that the bedroom environmental measures undertaken conferred significant benefit (–2.9 versus -0.3, 95% confidence interval [CI] of difference not presented, $P = 0.026$).

Discussion

In the vast majority of patients with house dust mite-sensitive rhinitis, diagnosis and treatment take place in primary care. The four trials conducted to date have used interventions designed to reduce bedroom house dust mite loads in patients' own homes. Each of these studies was small and omitted presentation of power calculations. Furthermore, each provided insufficient information to allow retrospective power calculations to be performed. Although the studies selected by this review included both children and adults, it is unclear how representative the study participants actually were of house dust mite-allergic perennial rhinitis sufferers in the general population. In two of the four studies, patients were recruited with either rhinitis or asthma or both conditions; presentation of results was poor and did not allow efficacy of the intervention on rhinitis symptoms to be disentangled from effects on asthma symptoms.[13,17] In the study by Moon *et al,* participants were recruited from a tertiary allergy clinic, the majority (52%) of whom were receiving immunotherapy treatment that continued throughout the trial, strongly suggesting that the group studied suffered considerably greater disease severity than that usually observed in the general population of sufferers.[17]

All trial results point towards the employed interventions resulting in statistically significant reductions in house dust mite load, although without agreement on the minimal concentration of house dust mites needed to provoke symptoms in already sensitised individuals it is unclear whether these studies achieved clinically important reductions. The studies included in this review all suggest that such interventions may reduce some rhinitis symptoms, but it is not possible to reliably estimate the magnitude or the clinical significance of this likely reduction, as the trials all employed different medication and/or symptom scores, none of which,

as far as we are aware, have been formally validated or assessed for reliability.[20] However, the instruments used in these studies could, together with the high quality work undertaken by Juniper *et al* on developing the Rhinitis Quality of Life Questionnaire, form the basis for developing a validated symptom score for use in future studies.[21] In the study by Moon *et al*, routine provision of advice on measures to reduce exposure to house dust mites in the control group either failed to decrease house dust mite load or (more importantly) failed to reduce clinical symptoms of rhinitis, raising important questions about the generalis ability of this particular environmental intervention in routine clinical care.[17] Costs were not documented in any of the trials.

Certain documented measures appear to reduce house dust mite load in bedrooms at home. Further randomised controlled trials are required to determine the effectiveness of house dust mite control measures in perennial allergic rhinitis sufferers who are not judged to be in need of referral. Ideally, these should be conducted in patients not receiving concomitant medical therapy, to allow the effectiveness of the control measures to be determined reliably. Such trials need to be adequately powered (and may therefore have to be multicentred), they need to be generalisable, to use validated outcome measures, and to have a sufficiently long follow-up (more than six months), to allow clinically meaningful results to be obtained. In the context of the management of a chronic disease, such as rhinitis, patients representative of the distribution of disease severity in the community should be recruited and a broad range of outcomes studied, including quality of life measures, school/work absences, and usage of other medication.[22] On the basis of best current evidence reviewed here it is not possible to endorse routine use of house dust mite avoidance measures in the treatment of perennial allergic rhinitis, for which nasal corticosteroids and systemic antihistamines remain the first-line treatments of choice.[23]

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