

House dust mite control measures for asthma (Review)

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ABSTRACT

Background

The major allergen in house dust comes from mites. Chemical, physical and combined methods of reducing mite allergen levels are intended to reduce asthma symptoms in people who are sensitive to house dust mites.

Objectives

To assess the effects of reducing exposure to house dust mite antigens in the homes of people with mite-sensitive asthma.

Search strategy

Cochrane Airways Group trials register, and PubMed and The Cochrane Library (last searches June 2004), reference lists.

Selection criteria

Randomised trials of mite control measures vs placebo or no treatment in asthmatic people known to be sensitive to house dust mites.

Data collection and analysis

Two reviewers applied the trial inclusion criteria, assessed their quality and extracted the data independently. Study authors were contacted to clarify information.

Main results

Forty-nine trials (2733 patients) were included; the number of patients has more than doubled since the last version of this review. Thirty-one trials assessed physical methods, ten assessed chemical methods, and eight a combination of chemical and physical methods. Despite the fact that many trials were of poor quality and would be expected to exaggerate the reported effect, we did not find an effect of the interventions. For the most frequently reported outcome, peak flow in the morning (1339 patients), the standardised mean difference was -0.02 (95% confidence interval (CI) -0.13 to 0.08). There were no statistically significant differences either in number of patients improved (relative risk 1.01, 95% CI 0.80 to 1.27), asthma symptom scores (standardised mean difference -0.01, 95% CI -0.10 to 0.13), or in medication usage (standardised mean difference -0.05, 95% CI -0.18 to 0.09).

Authors' conclusions

Chemical and physical methods aimed at reducing exposure to house dust mite allergens cannot be recommended. It is doubtful whether further studies, similar to the ones in our meta-analysis, are worthwhile. If other types of studies are considered, they should be methodologically rigorous and use other methods than those used so far, with careful monitoring of mite exposure and relevant clinical outcomes.

PLAIN LANGUAGE SUMMARY

Chemical and physical methods of reducing mite allergen levels seem to lack an effect in people with asthma

The major allergen in house dust comes from mites. Chemical and physical methods of reducing mite allergen levels are intended to reduce asthma symptoms in people who are sensitive to house dust mites. The review did not find an effect of control measures to reduce the exposure to mites or their products.

BACKGROUND

Asthma is a chronic inflammatory disorder of the airways. The prevalence has increased over the years and it is now the commonest chronic disease among children. The treatment of asthma is both pharmacological, including immunotherapy (Abramson 1995; Vervloet 1990), and non-pharmacological. Non-pharmacological treatment often involves environmental procedures such as elimination of allergens in the patient's surroundings (Colloff 1992).

Exposure to different allergens can trigger asthma attacks in sensitised individuals. House dust is a mixture containing many different allergens, but the major allergen is derived from mites, especially the species *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*. A common site for house dust mites is the bed, where pillows, quilts and mattresses often serve as reservoirs for the allergen. Carpets and upholstered furniture may also contain high mite levels (Platts-Mills 1989; Tovey 1992). A recent review examined the evidence for a wide range of methods of allergen avoidance (Custovic 1998). The authors concluded that environmental control of allergens, although difficult, should be an integral part of the overall management of sensitised patients. Some of this evidence was derived from observational studies, including some in which patients were moved to high altitudes or hospitals, whereupon their symptoms improved. These measures were not tested by randomised trials, however, and in any case are not feasible for most patients.

The belief that reduction of the mite antigen levels could reduce asthma symptoms is based largely on a priori reasoning. Different methods for reducing mite exposure have been tried, for example chemical methods, physical methods and combinations of these (Platts-Mills 1989). We have previously published a systematic review that failed to find an effect of such methods (Gøtzsche 1998).

OBJECTIVES

To study whether patients with asthma who are sensitised to house dust mites benefit from measures designed to reduce their exposure to mite antigen in the home.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

Randomised trials; we accepted reports in any language. Since some mite control measures are impossible to blind, we accepted non-blinded trials.

Types of participants

The participants were all diagnosed as having bronchial asthma by a physician. Their mite sensitisation was assessed by skin testing, bronchial provocation tests or serum assays for specific IgE antibodies.

Types of intervention

Test: a) chemical (acaricides), b) physical (for example vacuum-cleaning, heating, ventilation, freezing, washing, barrier methods, air-filtration and ionisers), c) combinations of these.

Control: placebo or no treatment.

Types of outcome measures

Subjective well-being.

Asthma symptom scores.

Medication usage.

Days of sick-leave from school/work.

Number of unscheduled visits to a physician/hospital.

FEV1 (Forced expiratory volume in one second).

PEFR (Peak expiratory flow rate).

PC20 (Provocative concentration that causes a 20% fall in FEV1).

SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: Cochrane Airways Group methods used in reviews.

The Cochrane Airways Group asthma register was searched for the term mite* in all fields (last search Jan 2004). *The Cochrane Library* was searched with the terms mite* and asthma* (last search June 2004). MEDLINE (PubMed) was searched with the terms mite* AND asthma*, combined with one or more of the following: clinical-trial [pt] OR clinical-trials [MeSH] OR placebo* OR comparative-study [MeSH] OR random* OR control* OR blind* (last search June 2004). There was no restriction by language. The bibliography of each trial report was checked for additional references.

METHODS OF THE REVIEW

Two of the authors independently selected the trials for inclusion, assessed their quality, and extracted the data. All assessments were open. The quality of allocation concealment was judged according to the Cochrane Collaboration guidelines. When it was not stated at what time of the day the peak flow had been recorded, we assumed it was in the morning. Any ambiguities were resolved by discussion. When necessary we contacted trial authors for clarification.

Statistical methods We calculated 95% confidence intervals (CI) with a fixed effect model. Heterogeneity was calculated with the chi square and the I square test. If there was heterogeneity (P

< 0.10), the reasons were explored. Since the results from cross-over trials were usually reported by the authors in summary form, as if they had come from a group comparative trial, we analysed these data accordingly, assuming that no important carry-over effects had occurred. We decided not to enter paired data from cross-over trials using the generic inverse variance method, since rather few data were reported in this format and since it would require that all other data should also be so analysed in order to present summary estimates for each outcome. Paired data were only available for some of the cross-over trials and not for all the recorded variables, but when continuous data were presented on different scales, for example peak expiratory flow rate (PEFR) and forced expiratory volume in one second (FEV1) could be given either as absolute values or as per cent of predicted values, we used the standardised mean difference. With this method, the difference in effect between two treatments is divided by the standard deviation of the measurements. By that transformation, the effect measures become dimensionless and outcomes from trials which have used different scales may therefore often be combined. Data on well-being and asthma symptom scores were reported in a number of different ways, but as these two outcome measures were closely related or even equivalent, we summarised categorical data in the well-being category (number of patients who improved) and continuous data (which mostly concerned asthma symptoms) in the asthma symptoms score category. The authors had usually analysed PC 20 after logarithmic transformation, since the data were highly skew. We meta-analysed the data accordingly, and when the authors had converted their means and standard deviations from the logarithmic scale to the arithmetic scale, we converted them back again (Bland 1996). We excluded PC20 data which had not been analysed after logarithmic transformation.

When several options were available for medication, we used bronchodilators. When data were recorded at several points in time, we used the longest observation period during which the patients were still on randomised treatment, unless confounding occurred, for example by a planned reduction in dose of inhaled steroids.

We did not adjust for baseline differences, since, in the long run, over a number of trials, inequalities occurring despite the randomisation would be expected to equal each other out. Furthermore, baseline recordings were not always available. If we had made adjustments when possible, we would therefore have risked biasing the review, since it may be assumed that investigators are inclined to show baseline differences and adjust for them when this procedure favours the experimental treatment. It has been shown that bias occurring during data analysis is very common and almost without exception favours the new treatment over the control treatment (Gøtzsche 1990).

DESCRIPTION OF STUDIES

We included 49 trials (2733 patients) which is an addition of 21 trials since the last update of our review (Gøtzsche 2001). Eleven of the trials were new (Halken 2003; Htut 2001; Lee 2003; Luczynska 2003; Matthys 1996; Popplewell 2000; Rijssenbeek 2002; Sheikh 2002; Thiam 1999; Warner 2000; Woodcock 2003), and ten were listed as excluded in our last update as they contained no usable data (Charpin 1990; Frederick 1997; Howarth 1992; Jooma 1995; Korsgaard 1983; Manjra 1994; Shapiro 1999; Sooltangos 1992; van der Heide 1997B; van der Heide 1999). It is more correct to include such studies, however, because they illustrate the potential for outcome reporting bias, i.e. the omission or incomplete reporting of outcomes that were not statistically significant (Chan 2004). Outcomes were often unreported, or were reported in a way that did not allow us to use them in a meta-analysis. The most frequently reported and useful outcome was PEFR in the morning (1339 patients); in the previous version of this review (Gøtzsche 2001) only 565 patients contributed to this outcome. Length of the intervention and follow-up varied from two weeks to one year.

All trials but six had used skin prick testing for diagnosis of mite sensitivity. Extracts used were *Dermatophagoides pteronyssinus* and/or *Dermatophagoides farinae* apart from two trials where subjects were tested with unspecified 'house dust extract' (Maesen 1977; Zwemer 1973). In three trials, sensitivity was established by specific serum IgE (Luczynska 2003; van der Heide 1999; Woodcock 2003), in two trials by either skin prick testing or IgE (Rijssenbeek 2002; Thiam 1999), and in one trial published only as an abstract, the means of diagnosis was not given (Howarth 1992).

Thirty-one trials used physical methods to reduce exposure to mites, ten used chemical methods, and eight used a combination of chemical and physical methods (see table: Characteristics of included studies). Mite reduction occurred in 13 trials (Carswell 1996; Charpin 1990; Cloosterman 1999; Dorward 1988; Frederick 1997; Halken 2003; Htut 2001; Huss 1992; Rijssenbeek 2002; Shapiro 1999; Walshaw 1986; Warner 1993; Woodcock 2003), reduction was unsuccessful in 24 and was not measured or reported in the remaining 12 trials.

METHODOLOGICAL QUALITY

The randomisation method was rarely described, and even using rather broad criteria, only eight trials reported adequate concealment of allocation: sealed, opaque envelopes (Cinti 1996; Shapiro 1999), computer program (Halken 2003), sealed envelopes with consecutive numbers (Kroidl 1998), centralised, using numbers generated from a random numbers table (Sheikh 2002), computer using minimisation (van der Heide 1997B; van der Heide 1999), coordination centre, using minimisation (Woodcock 2003). All eight trials with adequate concealment of allocation were also re-

ported to have been blinded, although in at least one trial, the attempted blinding was not perfect (Halken 2003; Gøtzsche 2003), and in another, the intervention frequency differed between the groups (Shapiro 1999). One trial maintained the blinding during data analysis (Sheikh 2002).

Ten trials had a cross-over design (Antonicelli 1991; Burr 1976; Burr 1980B; Frederick 1997; Maesen 1977; Matthys 1996; Mitchell 1980; van der Heide 1999; Verrall 1988; Warburton 1994; Warner 1993; Zwemer 1973). The remaining were group comparative trials.

RESULTS

We did not find an effect of control measures to reduce the exposure to mites or their products.

The total number of patients who improved after the experimental interventions was very similar to the corresponding number in the control groups, relative risk 1.01 (95% CI 0.80 to 1.27).

Asthma symptom scores were very heterogeneous ($P = 0.0004$ for test of heterogeneity, I^2 -square 63%). The heterogeneity was caused by two small trials of poor quality (Thiam 1999; Zwemer 1973). The standardised mean difference for all trials was -0.03 (95% CI -0.14 to 0.08). After exclusion of the two trials of poor quality, the heterogeneity disappeared ($P = 0.19$) and the standardised mean difference was -0.01 (95% CI -0.10 to 0.13).

Medication usage was very similar in the experimental and control groups. The standardised mean difference was -0.05 (95% CI -0.18 to 0.09). Data for chemical methods were given in only one trial (Dietemann 1993) in which medication usage was significantly larger in the experimental group than in the control group (0.89 , 95% CI 0.02 to 1.75). This finding is of doubtful value, however, since the standard deviation was unusually low and may have been erroneous. If this trial is excluded, the standardised mean difference is -0.07 (95% CI -0.21 to 0.06).

For FEV1, the standardised mean difference was 0.11 (95% CI -0.06 to 0.29). In one trial, unusually large variations in FEV1 from visit to visit were reported which indicates that the data may not have been reliable (Thiam 1999). If this trial is excluded, the standardised mean difference is 0.08 (95% CI -0.09 to 0.26).

For peak flow in the morning, the standardised mean difference was -0.02 (95% CI -0.13 to 0.08). Peak flow in the evening was only reported in nine very small trials. The standardised mean difference was -0.10 (95% CI -0.36 to 0.16).

PC 20 was only reported in 13 small trials, the standardised mean difference was 0.03 (95% CI -0.16 to 0.21).

Only two trials reported on unscheduled visits to a physician or hospital, or on missed work or school days. In the largest trial

included in our review, 38 patients required a hospital visit or a course of oral steroids in the intervention group and 27 in the control group; number of days of work missed was 0.10 versus 0.23 (95% CI for difference -0.28 to 0.009) (Woodcock 2003). A small cross-over trial of poor quality reported that none of twelve subjects missed school during the treatment period, as opposed to three during the control period; however, there was no mention of reasons for missing school or data on another six randomised patients (Zwemer 1973).

DISCUSSION

We were unable to demonstrate any clinical benefit to mite-sensitive asthmatics of measures designed to reduce mite exposure. This finding has been considerably strengthened in the present version of our review as the number of patients in the trials has more than doubled since the last update (Gøtzsche 2001). It is not likely that we missed a clinically relevant effect, since the total number of patients in the trials was quite large. The most commonly used outcome, morning peak flow, is related to the severity of the asthma, and peak flow measurements did not suggest any worthwhile effect. This can be seen more clearly if the difference in morning peak flow is translated into the most commonly used unit, L/min. With a standard deviation of 100 L/min (in accordance with the meta-analysis graph) and a control group peak flow of 300 L/min, the experimental group peak flow would be 298 L/min (95% confidence interval 287 to 308 (L/min)). A similarly narrow confidence interval around no effect was seen for asthma symptoms.

When there is no indication of an effect of an intervention, subgroup analyses should not be performed, since they would be expected to be seriously misleading. We discuss below, however, strengths and limitations of the trials.

Adherence to the applied measures was rarely evaluated, but successful mite reduction was obtained in several trials, including the biggest one (Woodcock 2003) that contributed 628 patients of a total of 1339 to the measurements of morning peak flow. It should be noted, however, that mite reduction was determined in different ways in the various studies. Some recorded mite counts and some measured antigen levels, using dust samples from different sources, and the reductions reported do not necessarily correspond to a similar reduction in the patients' exposure. For example, removing mites from the surface of mattresses and pillows does not affect the mite content of blankets or duvets, and merely killing the mites does not necessarily reduce airborne mite antigen, if nothing is done to remove the faecal particles that contain it. A potential reservoir for mites is the scalp, and it has been suggested that neglect of this source may explain the failure of many trials of mite eradication (Naspitz 1997).

It seems unlikely that the initial mite levels were already too low for any reduction to be effective. It has been shown that quite low allergen concentrations can affect bronchial responsiveness (Ihre 1988; Ihre 1993) and the concentrations were such as would usually be considered to represent a risk to mite-sensitive asthmatics. Allergen levels varied between the studies, and there was a wide range of concentrations in each study, so that some subjects' exposure may have been very low, but this was uncommon.

Potential sources of bias should be considered. The randomisation methods were rarely described. It is therefore likely that some studies were not truly randomised, or that the allocation was not adequately concealed, which are defects that would be expected to lead to bias in favour of a treatment effect. Most trials were very small, and our sample of trials may therefore have been influenced by publication bias, which usually exaggerates the effect of treatment. The reporting of the data was often poor, for example many trials only reported that there were no significant differences between the intervention and the control groups. This lack of proper reporting would also be expected to lead to bias in favour of a treatment effect. In a comparison of 102 trial protocols with subsequent publications it was shown that the chance that an outcome was fully reported was twice as high if the result was statistically significant (Chan 2004). It should also be noted that on a few occasions it was necessary to correct the originally reported data, for example in one trial we could not confirm a reported significant effect on mite allergen level (Geller-Bernst 1995).

We tried carefully to avoid bias during data extraction, for example by making blinded decisions when several options were available. On a few occasions, however, we could not select the data in a neutral fashion but had to choose data which favoured the alternative hypothesis (i.e. that interventions are effective), for example in the trials by Carswell and Reiser (see table Characteristics of included studies). For the biggest trial (Woodcock 2003), we selected data after six rather than 12 months, in accordance with the authors' power calculation, since this part investigated the effects of allergen reduction on asthma symptoms and was not confounded by the planned reduction of steroids (there was also significant allergen reduction after six months, but not after 12 months). Further, there was no indication that we had excluded trials with positive results (see table Characteristics of excluded studies). We therefore believe that we have not favoured the null hypothesis of no treatment effect in our meta-analysis; if anything, we have favoured the alternative hypothesis.

Physical interventions may need to be applied repeatedly before the reduction in allergen levels is sufficient to be effective. However, the lack of effect was also apparent in the subgroup of trials with long treatment duration or follow-up, and if the interventions were effective, one would expect to see at least some effect also in short-term trials as mite allergen causes a Type 1 hypersensitivity reaction.

We conclude that the trials of current chemical and physical methods aimed at reducing exposure to house dust mite allergens failed to find an effect. The house dust mite is the allergen to which asthmatics are most frequently sensitive, and the acute effects of exposure on the symptoms of asthma are well established. The explanation that we find most plausible is therefore that the methods we have reviewed do not adequately reduce mite antigen levels as it seems inherently implausible to suggest that complete removal of a major provoking agent would be ineffective. It is important to remember, however, that mite-sensitive asthmatic patients are usually sensitive to other allergens, so that successful elimination of only one allergen may have limited benefit, whatever its success.

AUTHORS' CONCLUSIONS

Implications for practice

Chemical and physical methods aimed at reducing exposure to house dust mite allergens cannot be recommended.

Implications for research

It is doubtful whether further studies, similar to the ones in our meta-analysis, are worthwhile. In particular, it should be noted that several of the trials had used very extensive mite eradication and avoidance schemes, involving many different measures applied simultaneously. If other types of studies are considered, we suggest that they should be methodologically rigorous and use other methods than those used so far, with careful monitoring of mite exposure and relevant clinical outcomes.

POTENTIAL CONFLICT OF INTEREST

One of the authors (MB) is also lead author on three of the included trial reports.

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* Indicates the major publication for the study

T A B L E S**Characteristics of included studies**

Study	Antonicelli 1991
Methods	Cross-over trial. Randomisation method: not described. Not blind (apart from PD20). Physical.
Participants	N=9 (9 in analyses). Mean age 16 yr (range 10-28). Skin positive to D pter and D far.
Interventions	Test : HEPA-filter (Enviracaire) in bedroom for 8 wks. Control : none. Each period lasted 8 weeks.
Outcomes	Daily symptom score (scale 0-3), medication score, FEV1, PEFR morning and evening, PD20.
Notes	No reduction in mite allergens (ELISA). Additional data from author. For asthma symptoms, we selected daytime wheeze blindly as the most relevant variable (other variables yielded closely similar results). Medication usage: salbutamol. FEV1 and PEFR from Table 2.
Allocation concealment	B – Unclear

Study	Bahir 1997
Methods	Randomisation method: not described. Double-blind.

Characteristics of included studies (Continued)

	Chemical.
Participants	N=40 children (30 in analyses), age range 6-17 yr). Skin positive to D pter and/or D far.
Interventions	Test: acaricide (esdepallethin 0.9% and piperonyl butoxide 7.2%). Control: placebo (and a third control group). 6 months.
Outcomes	Daily symptom score, use of beta-2 agonists, FEV1, morning and evening PEFR, Acarex test.
Notes	No reduction in mite allergens (guanine determination). The authors' fig. 3 indicates SEM which must be an error, should have been SD as for other data.
Allocation concealment	B – Unclear

Study Burr 1976

Methods	Cross-over trial. Randomisation method: not described. Not blind. Physical.
Participants	N=32 (32 in analyses). Mean age: 33 yr. Positive skin tests to D pter.
Interventions	Test: initial vacuum cleaning of the bed and laundering; enclosure of the mattress with a plastic cover for 6 weeks. Control: no such interventions.
Outcomes	Medication used during the past 24 hours, morning PEFR.
Notes	No assessment of mite reduction. Data from Table II.
Allocation concealment	B – Unclear

Study Burr 1980A

Methods	Randomisation method: not described. Blind assessment. Physical.
Participants	N=55 children (53 in analyses). Age range 5 -14 yr. Skin positive to D pter.
Interventions	Test: visited by a nurse, extensive scheme with vacuum cleaning, laundering, beating in open air, removal of toys, etc. Placebo: visited by a nurse, given a placebo treatment that consisted mainly of removal of dust in the living-room. 8 weeks.
Outcomes	Numbers improved, PEFR morning and evening.
Notes	No reduction in mite counts or mite antigen. Numbers improved: much better or better from Table 3. Peak flow was measured as coefficient of variation and was therefore omitted (very similar results were obtained in test and control groups).
Allocation concealment	B – Unclear

Study Burr 1980B

Methods	Cross-over. Randomisation method: not described. Not blind. Physical.
Participants	N=21 children from trial Burr 1980A who still complained of symptoms.
Interventions	Test: new sleeping bag, pillow and blanket, mattress enclosed in an impervious plastic bag, other bedding enclosed or renewed, vacuum-cleaning of carpets in the bedroom.

Characteristics of included studies (Continued)

	Control: as in Burr 1980A Each period lasted 1 month.
Outcomes	Mothers asked whether the patients were better during test or control period, PEFR morning and evening.
Notes	No reduction in mite counts. Peak flow was measured as coefficient of variation and therefore omitted (very similar results were obtained in test and control period).
Allocation concealment	B – Unclear

Study	Carswell 1996
Methods	Randomisation method: not described. Double-blind. Combination.
Participants	N=70 children (49 in analyses). Mean age 9.9 yr. Pos skin test D pter.
Interventions	Test: Acarosan powder and foam, Medivac filter vacuum cleaner, allergen exclusion covers, bed linen washed weekly at 60 degrees C. Control: chalk dust and water spray, cotton placebo covers, bed linen washed weekly at 40 degrees C. 24 wks.
Outcomes	Numbers improved (no. randomised minus no. with symptoms in Fig. 5 minus no. without symptoms at baseline), asthma symptoms, medication usage, PEFR measured in four different 2 wk periods, FEV1 (only reported after 24 weeks), PC20.
Notes	Mite antigen level (ELISA) fell in bedding. Data reported after 2, 6 and 24 weeks. FEV was only reported after 24 weeks. We used 6 weeks data for PEFR which was only reported accurately at this time (house dust mite removal was most effective after 6 weeks and there was a significant effect in bronchial sensitivity after 6 weeks, but not after 24 weeks).
Allocation concealment	B – Unclear

Study	Chang 1996
Methods	Randomisation method: not described. Not blind. Chemical.
Participants	N=26 (11 children and 15 adults, 26 in analyses). Pos skin test to mite allergen.
Interventions	Test: acaricide (Acarosan) to mattresses and carpets in bedroom. Control: no acaricide. 3 months.
Outcomes	Daily symptoms, medication, FEV1, morning and evening PEFR, PC20.
Notes	No mite antigen reduction (ELISA).
Allocation concealment	B – Unclear

Study	Charpin 1990
Methods	Randomisation method: table provided by laboratory. Double blind. Chemical.
Participants	N=42 (11 only had rhinitis). Numbers in analyses not clear. Mean age 27 yr. Pos skin prick test.
Interventions	Test: Acardust (synthetic pyrethrinoid + piperonyl butoxide) sprayed once on bed linen and in room. Control: no acaricide. 3 months.
Outcomes	Global assessment by patient and doctor, morning and evening PEFR, number of attacks.

Characteristics of included studies (Continued)

Notes	Reduction in mite allergen. No data on dispersion (PEFR in the morning was 435 in the test group, 437 in the control group; doctor's global assessment was 3.1 vs 2.8 on a 10 cm analogue scale).
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Allocation concealment	C – Inadequate
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Study Chen 1996

Methods	Randomisation method: not described. Double-blind. Physical.
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Participants	N=56 (35 in analyses). Age range 5-14 yr). Positive to DP1.
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Interventions	Test: Microstop (impermeable polyurethane coated nylon ticking). Control: new, conventional polyurethane mattresses (there was a second control group as well). 12 months.
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Outcomes	Asthma symptoms and morning and evening PEFR.
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Notes	No reduction in mite counts. Odd that randomisation leads to 29, 29 and 15 patients. Two exclusions unclear, we allocated one to each group.
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Allocation concealment	B – Unclear
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Study Cinti 1996

Methods	Randomisation method: sealed opaque envelopes. Double-blind. Physical.
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Participants	N=20 (20 in analyses). Mean age 30 yr (range 10-69). RAST or skin test positive for D pter or D far.
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Interventions	Test: "mite-proof" mattress and pillow covers. Placebo: covers of cotton. 12 weeks.
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Outcomes	Daily symptom scores, number of acute episodes, medications, eosinophil cationic protein, PEFR.
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Notes	No assessment of mite counts. Additional data supplied by author.
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Allocation concealment	A – Adequate
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Study Cloosterman 1999

Methods	Randomisation method: statistician informed investigators, open list of random numbers, open to investigators. Blind to patient and technician. Combination.
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Participants	N=204 (157 in analyses). Mite sensitivity diagnosed at an allergy laboratory.
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Interventions	Test: Acarosan and mite impermeable covers for mattresses. Control: water and cotton covers. 20 weeks.
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Outcomes	Asthma symptoms, medication use, FEV1, morning and evening PEFR, PC20.
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Notes	Mite antigen reduction achieved (ELISA). Table 2 and figg. 4 and 5 used for data on symptoms and peak flow.
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Allocation concealment	C – Inadequate
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Study Dietemann 1993

Methods	Randomisation method: not described. Double-blind.
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Characteristics of included studies (Continued)

	Chemical.
Participants	N=26 (23 in analyses). Mean age 35 yr (range 13 to 58). Positive skin test to D pter, RAST pos.
Interventions	Test: solidified benzyl benzoate and tenside agents at the beginning and after 6 months. Control: placebo powder. 1 year.
Outcomes	Asthma symptoms (VAS 0-10), medication score (0-3), FEV1, FVC, FEF25-75, PEFr morning and evening, clinical score (0-4).
Notes	No reduction in mite allergens (guanine determination and ELISA). Values after treatment calculated from percentage change and baseline values. SDs calculated from confidence intervals at baseline, assuming they were the same after treatment, which is reasonable, based on other trials.
Allocation concealment	B – Unclear

Study **Dorward 1988**

Methods	Randomisation method: not described. Blinded assessment. Combination.
Participants	N=21 (18 in analyses). Age range 13-53 yr. Pos skin tests to D pter.
Interventions	Test: liquid nitrogen, vacuum cleaning, other cleaning, washing, airing, damp dusting; plants, soft toys, cushions and upholstered furniture removed. Control: normal cleaning activities. 8 weeks.
Outcomes	Asthma symptom score (VAS 0-10), daily number of puffs of salbutamol, PEFr morning and evening, PC20, S-IgE.
Notes	Mite counts significantly reduced. For PC20, we used the logarithmic values for the means from Table 2 and calculated their SDs from Fig. 2.
Allocation concealment	B – Unclear

Study **Ehnert 1992**

Methods	Randomisation method: not described. Test 1: double-blind, chemical. Test 2: not blind, combination.
Participants	N=24, 8 in each group (21 in analyses). Age range 7-15 yr. Skin pos D pter and D far pos serum IgE.
Interventions	Test 1: mattresses treated with benzyl benzoate, carpets treated with powder on day 0 and after 4 and 8 months. Vacuum cleaning after 4 hrs. Test 2: polyurethane covers and tannic acid 3% on carpets. Control: placebo foam. 1 year.
Outcomes	PC20.
Notes	No reduction in mite allergens (ELISA). A within group significant change was reported for the encasing group for PC20, but the time trends for the three groups were not compared.
Allocation concealment	B – Unclear

Study **Frederick 1997**

Methods	Cross-over. Randomisation method: not described. Single-blind. Physical.
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Characteristics of included studies (Continued)

Participants	N=31. Children aged 5-15 yr. Pos skin prick test and/or IgE.
Interventions	Test: covers (Intervent) for mattress, duvet and pillow, wiped down weekly. Control: polycotton covers. Each period lasted 3 months.
Outcomes	Asthma symptoms, medication use (bronchodilators), FEV1, PEFR morning and evening, PC20.
Notes	Reduction in mite allergens. No useful data (medians and ranges), PEFR in the morning was 257 vs 282.
Allocation concealment	B – Unclear

Study Geller-Bernst 1995

Methods	Randomisation method: not described. Double blind. Combination.
Participants	N=32 (14 in most analyses). Age range 4-12 yr. Pos skin tests only to house dust mites.
Interventions	Test: change of bedsheet and blanket, dust removal with damp cloth, vacuuming of carpets and furniture, sprays on day 0 and 90 with Acardust. Control: placebo spray. 6 months.
Outcomes	Asthma symptoms (0-3), medication use, FEV1, PEFR, doctor's and patient's opinion of clinical symptoms, serum IgE.
Notes	No reduction in mite allergens. No useful data.
Allocation concealment	B – Unclear

Study Gillies 1987

Methods	Randomisation method: not described. Not blind. Physical.
Participants	N=26 (25 in analyses). Age range 6-16 yr. Skin pos D pter.
Interventions	Test: enclosing of mattresses and pillows, pets and soft toys excluded from bedroom, synthetic bedding employed, damp dusting, vacuum cleaning. Control: no such measures. 6 weeks.
Outcomes	Asthma symptoms, medication requirements, PEFR morning and evening, PC20, serum IgE.
Notes	No reduction in mite counts. PC20 values omitted since they were calculated arithmetically. No useful data.
Allocation concealment	B – Unclear

Study Halken 2003

Methods	Randomisation method: computer program, stratified by 4 factors. Described as double blind, but the covers were different. Physical.
Participants	N=60 (47 in analyses). Children aged 5-15 yr. Pos skin prick test.
Interventions	Test: mattress and pillow encasings coated with semi-permeable polyurethane (Allergy Control). Controls: placebo encasings. 12 months.
Outcomes	Medication usage, FEV1, PEFR, asthma symptoms, PC20. Dose of inhaled steroids was reduced during the trial at lowest effective dose.
Notes	Reduction in mite allergens. Complicated randomisation, baseline imbalance for asthma symptoms suggests inadequate randomisation, but there are no measures of dispersion such as SD and the authors did not

Characteristics of included studies (Continued)

provide information on the randomisation and on other variables that were measured at baseline such as peak flow despite being asked to do so in a letter we published in the journal, and to which they responded. Data in the trial report are different from data shown in a previous poster presentation.

Allocation concealment	A – Adequate
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Study	Howarth 1992
Methods	Randomisation method: not described. Double blind. Physical.
Participants	N=35 (number in analyses not reported, some had rhinitis). Age 13-23 yr. Pos skin prick test.
Interventions	Test: covers of mattress, duvet and pillow. Control: placebo covers. 6 weeks.
Outcomes	Asthma symptoms.
Notes	Very promising abstract, but never published and author did not respond to our letters.
Allocation concealment	D – Not used

Study	Htut 2001
Methods	Randomisation method: open table of random numbers. Double blind. Physical.
Participants	N=30 in trial report, N=33 in previous abstract (23 in analyses). Age 18-45 yr. Positive skin prick test.
Interventions	Test 1: steam cleaning once of mattresses and duvets, and new pillows. Test 2: same treatment, but in addition, a ventilation system (Nuair) was installed in bedrooms. Control: sham steam cleaning. 1 year.
Outcomes	PD20.
Notes	Reduction in mite allergens. We combined the two test groups for meta-analysis.
Allocation concealment	C – Inadequate

Study	Huss 1992
Methods	Randomisation method: not described. Not blind. Physical.
Participants	N=52 (52 in analyses). Age range 18-75 yr. Skin positive to D far or D pter.
Interventions	Test: computer assisted instruction in addition to conventional mite avoidance instruction (encasing mattresses, box springs and pillows, removing carpeting and upholstered furniture, laundering bedding, controlling indoor temperature (<70 degrees F) and humidity (<45% RH)). Control: verbal and written guidance. 12 weeks.
Outcomes	Asthma symptoms, medication usage (inhaled bronchodilator use), FEV1.
Notes	Reduction in mite allergens (ELISA). Authors report that there was no difference for FEV1, but give no data.
Allocation concealment	B – Unclear

Study	Jooma 1995
Methods	Randomisation method: open table of random numbers.

Characteristics of included studies (Continued)

	Not blind. Combination.
Participants	N=60 (not all included in analyses, numbers not stated). Children aged 6-14 yr. Pos skin prick test.
Interventions	Test 1: mattress and pillow covers (Allergy Control Products) + tannic acid to carpets every 8 weeks. Test 2: acaricide (benzylbenzoate + bromopol) applied to carpets and mattresses. Control: none. 6 months.
Outcomes	PC20.
Notes	No reduction in mite allergens. No useable data, no significant changes in PC20.
Allocation concealment	C – Inadequate

Study	Korsgaard 1983
Methods	Randomisation method: not described. Not blind. Physical.
Participants	N=51 (46 in analyses). Median age 30 yr. Pos skin prick test and IgE, and bronchial provocation test for mite extract.
Interventions	Test: vacuum cleaning and wash of bed linen twice weekly, new synthetic quilts and pillows, bedroom aired for 20 min daily and permanently half-open window . Control: none. 12 weeks.
Outcomes	PEFR morning and evening, use of bronchodilator, asthma symptoms.
Notes	No reduction in mite counts on mattress, but reduction on bedroom floor. Data presented as medians and interquartile ranges. Morning PEFR 490 vs 460 (P=0.33), evening PEFR 490 for both groups (P=0.82); less symptoms in test group (P=0.02).
Allocation concealment	B – Unclear

Study	Kroidl 1998
Methods	Randomisation method: sealed envelopes with consecutive numbers. Double-blind. Chemical.
Participants	N=118 (78 in analyses). Age range 8-50 yr. Skin test and RAST positive to D pter.
Interventions	Test: acaricide, benzyl benzoate (Acarosan). Control: cleaning product without acaricide. 1 year.
Outcomes	Well-being, PC20, RAST, changes in skin prick test.
Notes	No assessment of mite reduction. Drop-outs not described per group but provided by author: 18 vs 22 patients.
Allocation concealment	A – Adequate

Study	Lee 2003
Methods	Randomisation method: not described. Not blind. Physical.
Participants	N=60 (42 in analyses). Age: most were above 30 yr. Positive skin prick test.
Interventions	Test: outer cotton bed covers, boiled 10 min every 14 days. Disinfection bedding with a minimum of 3 h sunlight every 14 days.

Characteristics of included studies (Continued)

	Control: no intervention. 4 weeks.
Outcomes	PEFR morning and evening, frequency of 6 different asthma symptoms.
Notes	No reduction in mite allergens. Frequency of 6 different asthma symptoms not used in our meta-analysis due to lack of a severity score and of an acceptable way of combining the data (SD far bigger than mean for most symptoms, i.e. a gross violation of the Gaussian assumption)
Allocation concealment	B – Unclear

Study	Luczynska 2003
Methods	Randomisation method: statistical program generated a list of 1's and 2's where patient number were written; not adequately concealed as blinding could be broken. Double-blind. Physical.
Participants	N=58, only 45 started the trial, and only 31 in analyses. Age 18-54. Serum IgE >0.7kU/L specific for mite antigen in all patients.
Interventions	Test: allergen-impermeable Micro fibre bedcovers (Allerguard) on bed, blankets and pillows. Control: sham bedcovers. 1 year.
Outcomes	PEFR morning and evening, number of days with chest tightness, quality of life, asthma attacks and medication use.
Notes	No reduction in mite allergens. Data not shown for medication use and asthma attacks. No significant differences in number of days with chest tightness and quality of life (the former favoured the test, the latter the control); data not entered in our meta-analysis as it is not straightforward how these two measures of asthma symptoms should be combined.
Allocation concealment	C – Inadequate

Study	Maesen 1977
Methods	Cross-over trial. Randomisation method: unclear, a table of random numbers was used. Double-blind. Physical.
Participants	N=30 (28 in analyses). 25 adults (15-55 yr) and 5 children (7-14 yr). Pos skin test and bronchial provocation test to house dust.
Interventions	Test: air-filtration apparatus. Control: placebo (the filter was covered with plastic). Each period lasted 1 month.
Outcomes	Subjective improvement, medication usage, PEFR morning and evening.
Notes	No assessment of mite reduction.
Allocation concealment	B – Unclear

Study	Manjra 1994
Methods	Randomisation method: unclear, "system of random numbers" after matching for 3 factors. Not blind. Chemical.
Participants	N=60 (59 in analyses). Children aged 5-12 yr. Pos skin prick test.
Interventions	Test 1: detergent (Metsan) for carpets and bedding. Test 2: Metsan + acaricide (Acarosan) for carpets and bedding.

Characteristics of included studies (Continued)

	Control: none. 3 months.
Outcomes	PC20.
Notes	No mite reduction in mattresses. PC20 given as medians, no difference between the groups. Patients not divided on treatment groups. The first author did not answer our letter.
Allocation concealment	B – Unclear

Study	Marks 1994
Methods	Randomisation method: not described. Blinded participants. Combination.
Participants	N=39 (35 in analyses). Age range 13-60 yr. All but two subjects had a positive skin test to D pter.
Interventions	Test: tannic acid/acaricide solution (Allersearch) + impermeable covers on mattress, pillows and duvets. Control: inactive placebo spray. 6 months.
Outcomes	Symptom score (0-10), FEV1, PEFR morning and evening, PD20.
Notes	No reduction in mite allergens (ELISA). Values after treatment calculated from percentage change and baseline values. SDs calculated from confidence intervals at baseline, assuming they were the same after treatment, which is reasonable, based on other trials.
Allocation concealment	B – Unclear

Study	Matthys 1996
Methods	Cross-over trial. Randomisation method: not described. Single-blind (according to thesis). Physical.
Participants	N=14 (10-14 in analyses). Pos skin prick test.
Interventions	Test: air-dryer in bedroom with water filter. Control: air-dryer in bedroom without water filter. Each period lasted 4 weeks.
Outcomes	Medication usage, PEFR, symptoms.
Notes	Significant difference with Acares-test. Published only as an abstract. Data exist in a thesis, but significant carry-over and period effects for medication usage and PEFR precludes usage of the data.
Allocation concealment	B – Unclear

Study	Mitchell 1980
Methods	Cross-over trial. Randomisation method: not described. Not blind. Physical.
Participants	N=10 (10 in analyses). Age range 7-14 yr. Pos skin tes to D pter and D far.
Interventions	Test: electrostatic precipitator plus standard mite-avoidance measures. Control: standard mite-avoidance measures. Each period lasted 2 weeks.
Outcomes	Medication usage, PEFR three times a day.

Characteristics of included studies (Continued)

Notes No assessment of mite reduction. Per cent expected PEFR calculated from Table II. Numbers improved are omitted, since they are unclear.

Allocation concealment B – Unclear

Study **Popplewell 2000**

Methods Randomisation method: not described.
Not blind.
Physical.

Participants N=60 (51 in analyses). Age: 5-15 yr for 21 children and 22-63 yr for 39 adults. Positive skin prick test.

Interventions Test: high efficiency vacuum cleaner (Electrolux Z1730 and Z5028).
Control: standard efficiency vacuum cleaner (Z1501 and Z2630).
1 year.

Outcomes Medication usage, FEV1, PEFR morning and evening, PC20.

Notes No reduction in mite allergens. First author funded by Electrolux. Non-parametric analysis was used but it is not clear what the reported data mean, i.e. whether they are medians, and the authors have only tested the data within groups which also hampers the interpretation. No useful data could be extracted for our meta-analysis.

Allocation concealment B – Unclear

Study **Reiser 1990**

Methods Randomisation method: not described.
Double-blind.
Chemical.

Participants N=51 (46 in analyses). Age range 5-16 yr. Pos skin test to D pter.

Interventions Test: mattresses sprayed every two weeks for 3 months with natamycin.
Control: sprayed with placebo.
3 months.

Outcomes Asthma symptoms, medication usage, FEV1, PEFR three times a day, histamine bronchial provocation test.

Notes No reduction in mite allergens (ELISA). We used 3 months data, since the intervention was stopped at 3 months (the effect on PC20 was larger after 3 months than after 6 months).

Allocation concealment B – Unclear

Study **Rijssenbeek 2002**

Methods Randomisation method: Zelen design with consent after randomisation; method not described.
Double blind.
Physical.

Participants N=38 (30 in analyses; however, a separate publication from the same year describes only 27 patients in total).
Age range 11-44 yr. Positive skin prick test or IgE.

Interventions Test: allergen-impermeable covers for mattress, pillow and bedding (Allergy Control). Control: matching placebo covers.
1 year.

Outcomes PEFR morning and evening, FEV1, asthma symptoms, medication use, PC20, quality of life.

Notes Reduction in mite allergens. The study was published twice, both in 2002, with almost the same outcome measures and population, with no cross-references between the articles. Data exist on FEV1, but not published.

Allocation concealment B – Unclear

Characteristics of included studies (Continued)

Study	Sette 1994
Methods	Randomisation method: not described. Double-blind. Chemical.
Participants	N=24 (24 in analyses). Mean age 13 yr. Skin pos to D pter.
Interventions	Test: treatment of mattresses with benzyl benzoate foam (Acarosan). Control: placebo foam. Ca 2 weeks.
Outcomes	PC20, Serum IgE.
Notes	No reduction in mite allergens (Acarex test). PC20 read from Fig. 2, weighted averages of the two exposure periods were used (1 was added to zero values to get a logarithmic value of zero).
Allocation concealment	B – Unclear

Study	Shapiro 1999
Methods	Randomisation method: random number generation, sealed and opaque envelopes. Double blind, but intervention frequency differs between the groups. Combination.
Participants	N=44 (36 in analyses). Children 6-16 yr. Positive skin prick test.
Interventions	Test: dust-mite impermeable covers (Allergen Control Products), delivery of clean blankets and 4 sets of bed linens every month, tannic acid application to the bedroom and living room every month. Control: placebo tannic acid every 4 months and phone call reminders. 1 year.
Outcomes	FEV1, PEFR morning and evening, asthma symptoms, PD20, emergency department visits and admission to hospital, steroid courses.
Notes	Reduction in mite allergens. Author provided data on FEV1, but data for symptoms and peak flow were not useable.
Allocation concealment	A – Adequate

Study	Sheikh 2002
Methods	Randomisation method: centralised, using numbers generated from a random numbers table. Double blind, with blinded data analysis. Physical.
Participants	N=47 (43 in analyses). Children, aged 5-14 yr. Positive skin prick test.
Interventions	Test: mite impermeable covers (Allerayde Perfect). Control: placebo covers. 6 months.
Outcomes	PEFR, asthma symptoms, night-time waking, use of medication, unscheduled visits to doctor, emergency department visits and admission to hospital (there were none), steroid courses.
Notes	Mite antigen levels were not measured. After 2 months, dosage of inhaled steroids could be reduced by 50%.
Allocation concealment	A – Adequate

Study	Sooltangos 1992
Methods	Randomisation method: “randomly divided into 2 age, sex and symptom-matched groups”. Not blind. Chemical.
Participants	N=33 (no information on possibly missing recordings). Mean age 34 yr. Pos skin prick test.
Interventions	Test: cleaning and spraying mattresses with acaricide (benzylbenzoate + tannic acid) every 3 months.

Characteristics of included studies (Continued)

	Control: none. 8 months.
Outcomes	Asthma symptoms, PEFR, FEV1, medication usage.
Notes	Abstract only, authors could not be traced.
Allocation concealment	B – Unclear

Study	Thiam 1999
Methods	Randomisation method: not described. Not blind. Physical.
Participants	N=24 (24 in analyses). Children, aged 6-14 yr. Positive skin prick test or IgE.
Interventions	Test 1: Allergen Control Covers (ACC) and Vellux blankets if own blankets not washed regularly. Test 2: HEPA filters (Enviraicare). Control: none. 4 months.
Outcomes	FEV1, PEFR morning and evening, asthma symptoms, exercise bronchoprovocation test.
Notes	No reduction in mite allergens. Sponsored by Honeywell. No data shown for PEFR ("did not improve significantly"). We lumped the two active groups for the meta-analyses. The corresponding author did not answer our letters.
Allocation concealment	B – Unclear

Study	Verrall 1988
Methods	Cross-over trial. Randomisation method: not described. Double-blind. Physical.
Participants	N=16 (13 in analyses). Mean age 14 yr, range 7-27. Pos skin test to D pter.
Interventions	Test: HEPA-filter in the bedroom at night. Control: non-use of HEPA-filter (foam plug). There were four controlled trial phases of 3 weeks each.
Outcomes	Asthma symptoms, medication usage (analyzed for the final 2 wks of each 3 wk period, allowing 1 wk washout for each period), PEFR.
Notes	No mite assessment. Medication use read from Fig. 5; no data on symptoms apart from average scores without SD (which did not favour the experimental treatment).
Allocation concealment	B – Unclear

Study	Walshaw 1986
Methods	Randomisation method: not described. Not blind. Physical.
Participants	N=50 (42 in analyses). Mean age 34 yr. Pos skin test to D pter (but only 38 of the 50 were allergic).
Interventions	Test: Plastic mattress and pillow covers, vacuum cleaning, damp dusting of the covers, synthetic or cotton blankets, washing and shaking, linoleum carpets. Control: no such measures. 1 year.
Outcomes	Asthma symptom score, medication use, FEV1, PEFR, PC20, serum immunoglobulins, RAST to D pter.
Notes	Mite counts reduced.

Characteristics of included studies (Continued)

Allocation concealment B – Unclear

Study	Warburton 1994
Methods	Cross-over trial. Randomisation method: not described. Double-blind. Physical.
Participants	N=13 (12 in analyses). Mean age 46 yr (range 19-64). Pos skin test to D pter.
Interventions	Test: air filtration unit in the main living room. Control: placebo air filtration unit. Each period lasted 4 weeks.
Outcomes	Asthma symptom score (VAS), medication usage, frequency of nocturnal wakening, FEV1, PEFr twice daily, PD20.
Notes	No reduction in mite allergens (ELISA).
Allocation concealment	B – Unclear

Study	Warner 1993
Methods	Cross-over trial. Randomisation method: not described. Double-blind. Physical.
Participants	N=20 (14 in analyses). Age range 3-11 yr. Pos skin test.
Interventions	Test: ioniser (Clean Air). Control: placebo. Each period lasted 6 weeks.
Outcomes	Asthma symptom score, medication usage, PEFr morning and evening.
Notes	Reduction in mite allergens (ELISA).
Allocation concealment	B – Unclear

Study	Warner 2000
Methods	Randomisation method: not described. Double blind. Physical.
Participants	N=40, 27 children aged 4-16 yr and 13 adults aged 20-67 yr. Positive skin prick test.
Interventions	Test 1: mechanical ventilation system with heat recovery and high-efficiency vacuum cleaner. Test 2: mechanical ventilation system with heat recovery. Test 3: high-efficiency vacuum cleaner. Control: no intervention. 12 months.
Outcomes	PEFr morning and evening, FEV1, PC20, asthma symptoms, medication usage.
Notes	No reduction in mite allergens. Ten homes that were unsuitable for ventilation system were randomised to test 3 or control. Numbers in each group not stated. No useable data in article.
Allocation concealment	B – Unclear

Study	Woodcock 2003
Methods	Randomisation method: coordination centre, using minimization within each practice (3 factors). Double blind. Physical.

Characteristics of included studies (Continued)

Participants	N=1122, N=732 were mite sensitive (628 of these in analyses). Mean age 36 yr. Mite sensitization: serum IgE.
Interventions	Test: allergen-impermeable covers for mattress, pillow and quilt (Allergy Control Products). Control: non-impermeable polyester-cotton covers. Duration 1 year, after 6 months, controlled reduction in steroid therapy. Dust sampled for mite allergens in a 10% random sample of participants.
Outcomes	PEFR morning and evening, medication usage (beta-agonists), asthma symptoms, exacerbations and hospital visits, days of work missed, quality of life.
Notes	Reduction in mite allergens after 6 months. In accordance with the authors who used 6-months data for their power calculation, we used 6-months data for our meta-analysis as this part investigated the effects of allergen reduction on asthma symptoms and was not confounded by the planned reduction of steroids.
Allocation concealment	A – Adequate

Study Zwemer 1973

Methods	Cross-over trial. Randomisation method: not described. Double-blind. Physical.
Participants	N=18 (12 in analyses). Age range 6-16 yr. Pos skin tests to house dust.
Interventions	Test: active laminar air flow system (Pure-zone system). Control: dummy filter. Each period lasted 4 weeks.
Outcomes	Asthma symptoms. Three patients had sick days in the control group, none in the experimental group.
Notes	No assessment of mite reduction. Daytime wheeze was selected blindly as the most relevant variable (other variables yielded closely similar results). Since the data were extremely skewed, the logarithm of the scores was used.
Allocation concealment	B – Unclear

Study van der Heide 1997A

Methods	Randomisation method: not clear whether randomised. Double-blind. Chemical.
Participants	N=59 (40 in analyses). Mean age 31 yr. SPT positive to D pter.
Interventions	Test: Acarosan powder and foam on textile floors and mattresses. Control: Sapur (detergent) on textile floors and Groupriem (detergent) on mattresses. 1 year.
Outcomes	FEV1, PC20, serum total IgE.
Notes	No reduction in mite allergens.
Allocation concealment	B – Unclear

Study van der Heide 1997B

Methods	Randomisation method: computer using minimization (2 factors). Double-blind. Physical.
Participants	N=30 (for relevant comparison; no information on possibly missing recordings). Age range 18-45 yr. Pos skin prick test.

Interventions	Test 1: air-cleaners. Test 2: air-cleaners + mattress and pillow covers. Control: placebo air-cleaners + mattress and pillow covers. 6 months.
Outcomes	FEV1, PEFR morning and evening, PC20.
Notes	No reduction in mite allergens. Supported by maker of air-cleaners. No data on FEV1 and PEFR and no useable data on PC20.
Allocation concealment	A – Adequate

Study	van der Heide 1999
Methods	Cross-over. Randomisation method: computer using minimization (2 factors). Double-blind. Physical.
Participants	N=22 (20 in analyses). Pos IgE.
Interventions	Test: air-cleaners. Control: placebo air-cleaners. Each period lasted 3 months.
Outcomes	Asthma symptoms, FEV1, PEFR morning and evening, PC20.
Notes	No data on mite reduction. Supported by maker of air-cleaners. No data on FEV1 and PEFR and no useable data on PC20. Author provided additional data but only at baseline.
Allocation concealment	A – Adequate
PEFR: Peak-expiratory flow rate; FEV1: Forced expiratory volume in 1 second; D pter: Dermatophagoides pteronyssinus; D far: Dermatophagoides farinae	

Characteristics of excluded studies

Study	Reason for exclusion
Bowler 1985	Not an RCT against no treatment, N=12.
Brown 1991	Not an RCT.
Burr 1988	No clinical data.
Carswell 1999	No clinical data.
Carter 2001	Only some (exact number not stated) of 104 enrolled patients were allergic to mites; no outcome data or number of patients provided for this group.
Chew 1996	No clinical data.
Cloosterman 1997	Not asthma.
Elixmann 1988	Not an RCT.
Gallardo 1994	Some patients did not have asthma, but rhinitis (N=17 in whole trial).
Griffin 1989	Only published as abstract, author cannot be traced. Acaricide vs placebo (N=60), FEV 1.86 in both groups after treatment.
Hannaway 1993	Not relevant comparison: acaricide + encasings versus carpet cleaner + placebo encasings (N=23).
Harving 1994	Not an RCT.
Hayden 1997	Only 15 of 23 patients were sensitive to mites.
Hegarty 1995	Not clear whether randomised and how sensitivity to mites was assessed. No response to letter. Small trial (N=23), published only as an abstract.
Huss 1991	No clinical data.
Huss 1994	No clinical data, authors did not respond to our letters.

Characteristics of excluded studies (Continued)

Hyndman 2000	No clinical data.
Joseph 2003	No clinical data, not fully randomised.
Korsgaard 1982	Not an RCT.
Lau 2002	No clinical data.
Lau-Schadendorf 1991	No clinical data.
Leclercq 1985	Unknown whether trial was randomised, authors did not respond to our letters.
Massey 1993	No clinical data.
Medina 1994	No clinical data, mixture of patients with rhinitis and/or asthma, N=17.
Mosbech 1988	No clinical data.
Munir 1993	No clinical data.
Murray 1983	Not an RCT.
Olaguibel 1994	No clinical data.
Owen 1990	No clinical data.
Peroni 1994	Not an RCT.
Quek 1994	Not an RCT.
Rebmann 1996	Study of mattresses, not patients.
Reisman 1990	Only 11 of the 32 patients had asthma (results were quite similar in the two groups).
Sarsfield 1974	Not an RCT.
Scherr 1977	No information on mite sensitisation. Aimed more generally at filtrating air.
Sporik 1998	No clinical data.
Tobias 2004	No clinical data and mixture of 24 patients with asthma, rhinitis and atopic dermatitis.
Villaveces 1977	13 patients took part, but 15 measurements were made, since 2 patients were measured twice. Authors did not respond to our letters.
Warner 1993B	Not an RCT.
Weeks 1995	No clinical data, duplicate publication with Carswell 1999, see above in this table.
de Blay 2003	No clinical data.
van den Bemt 2000	Not clear how sensitivity to mites was assessed. N=53. No response to our letter. Published only as an abstract.
<u>RCT: randomised clinical trial.</u>	

Characteristics of ongoing studies

Study	Dilworth 2001
Trial name or title	A double blind placebo controlled clinical trial to assess the efficacy of house dust mite control in reducing symptoms in patients with atopic asthma
Participants	50 adults
Interventions	Impregnated bedding + vacuum cleaning vs placebo
Outcomes	Relief of asthma symptoms
Starting date	1 Aug 1999
Contact information	Tel +44 171 794 0500
Notes	

Characteristics of ongoing studies (Continued)

Study	Krieger 2002
Trial name or title	The Seattle-King County healthy homes project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma
Participants	
Interventions	
Outcomes	
Starting date	1997
Contact information	See published paper on methods in reference list
Notes	

Study	Monash 1998
Trial name or title	A double blind placebo controlled clinical trial to assess the efficacy of impermeable covers in reducing symptoms in patients with mite sensitive asthma
Participants	Number not stated
Interventions	Encasement vs placebo
Outcomes	Allergen levels and asthma
Starting date	1998
Contact information	www.med.monash.edu.au
Notes	

ANALYSES

Comparison 01. House dust mite reduction versus control

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Numbers improved	7	338	Relative Risk (Fixed) 95% CI	1.01 [0.80, 1.27]
02 Asthma symptoms score	16	1216	Standardised Mean Difference (Fixed) 95% CI	-0.03 [-0.14, 0.08]
03 Medication usage	8	859	Standardised Mean Difference (Fixed) 95% CI	-0.05 [-0.18, 0.09]
04 FEV1 (Forced expiratory volume in one second)	13	528	Standardised Mean Difference (Fixed) 95% CI	0.11 [-0.06, 0.29]
05 PEFR morning (Peak Expiratory Flow Rate)	19	1339	Standardised Mean Difference (Fixed) 95% CI	-0.02 [-0.13, 0.08]
06 PEFR evening (Peak Expiratory Flow Rate)	9	233	Standardised Mean Difference (Fixed) 95% CI	-0.10 [-0.36, 0.16]
07 PC20 (Provocative concentration for 20% fall in FEV1)	13	470	Standardised Mean Difference (Fixed) 95% CI	0.03 [-0.16, 0.21]

INDEX TERMS

Medical Subject Headings (MeSH)

Allergens [*immunology]; Asthma [immunology; *prevention & control]; Dust; *Environment, Controlled; *Insecticides; Mites [*immunology]; Randomized Controlled Trials

MeSH check words

Animals; Humans

COVER SHEET

Title	House dust mite control measures for asthma
Authors	Gøtzsche PC, Johansen HK, Schmidt LM, Burr ML
Contribution of author(s)	PCG and HKJ selected the trials for inclusion in the update of the review. Trials were reviewed by two authors, outcome data were extracted primarily by PCG (but checked by at least one other author). Guarantors: all authors for the text, PCG for the statistical calculations. (Cecilia Hammarquist and MB selected trials for inclusion for the first version of the review. The first manuscript was drafted by CH for the Cochrane Library and by PCG for the British Medical Journal).
Issue protocol first published	1996/1
Review first published	1999/2
Date of most recent amendment	03 August 2004
Date of most recent SUBSTANTIVE amendment	03 August 2004
What's New	Twenty new included studies added (10 of them were previously listed as excluded because there were no useful data for meta-analysis). We included 49 trials (2733 patients) which is an addition of 21 trials since the last update of our review (Gøtzsche 2001). Eleven of the trials were new (Halken 2003, Htut 2001, Lee 2003, Luczynska 2003, Matthys 1996, Popplewell 2000, Rijssenbeek 2002, Sheikh 2002, Thiam 1999, Warner 2000, Woodcock 2003), and ten were listed as excluded in our last update as they contained no usable data (Charpin 1990, Frederick 1997, Howarth 1992, Jooma 1995, Korsgaard 1983, Manjra 1994, Shapiro 1999, Sooltongos 1992, van der Heide 1997B, van der Heide 1999). The most frequently reported and useful outcome was PEFr in the morning (1339 patients); in the previous version of this review (Gøtzsche 2001) only 565 patients contributed to this outcome. We were unable to demonstrate any clinical benefit to mite-sensitive asthmatics of measures designed to reduce mite exposure. This finding has been considerably strengthened in the present version of our review as the number of patients in the trials has more than doubled since the last update (Gøtzsche 2001).
Date new studies sought but none found	Information not supplied by author
Date new studies found but not yet included/excluded	Information not supplied by author
Date new studies found and included/excluded	01 June 2004
Date authors' conclusions section amended	Information not supplied by author
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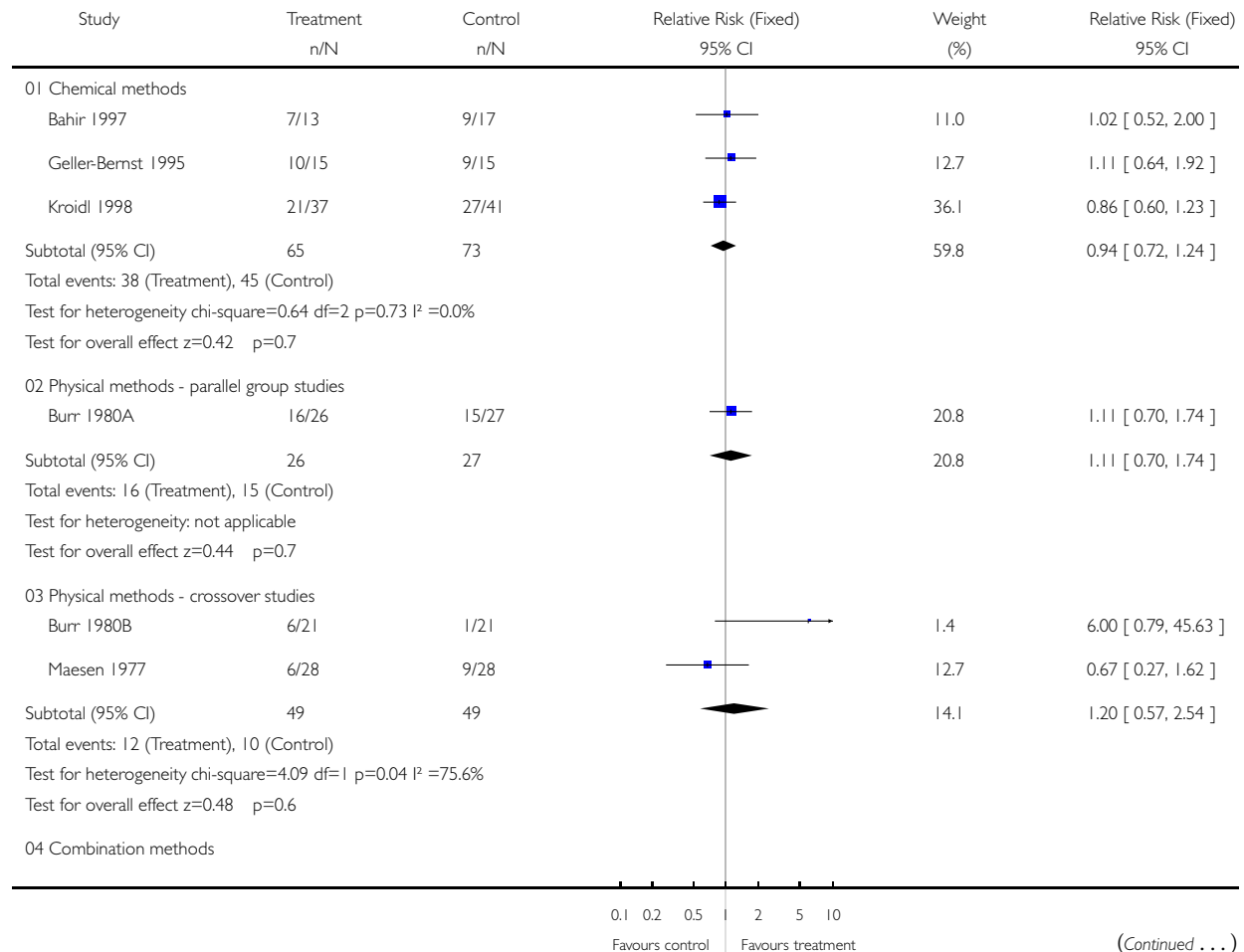
GRAPHS AND OTHER TABLES

Analysis 01.01. Comparison 01 House dust mite reduction versus control, Outcome 01 Numbers improved

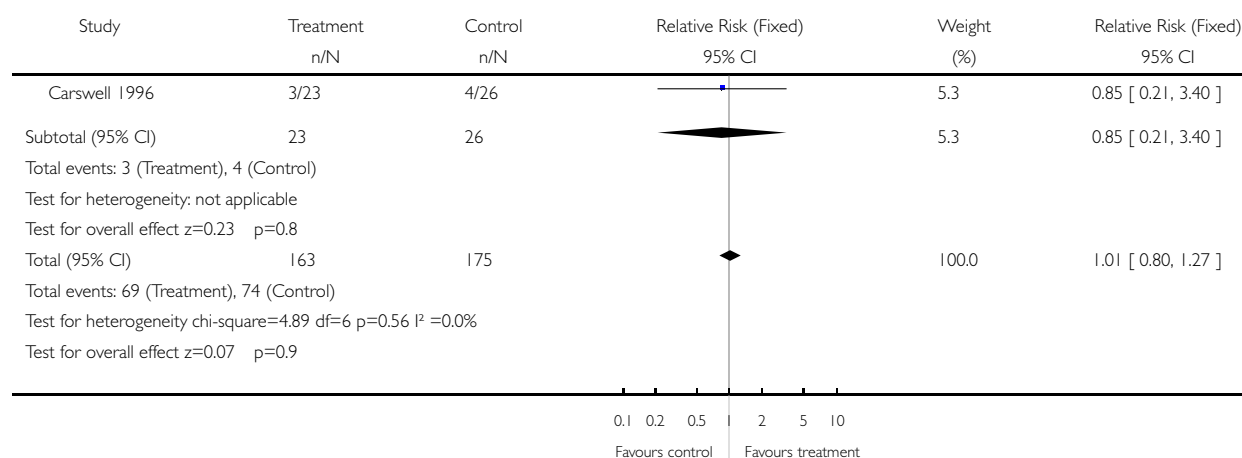
Review: House dust mite control measures for asthma

Comparison: 01 House dust mite reduction versus control

Outcome: 01 Numbers improved



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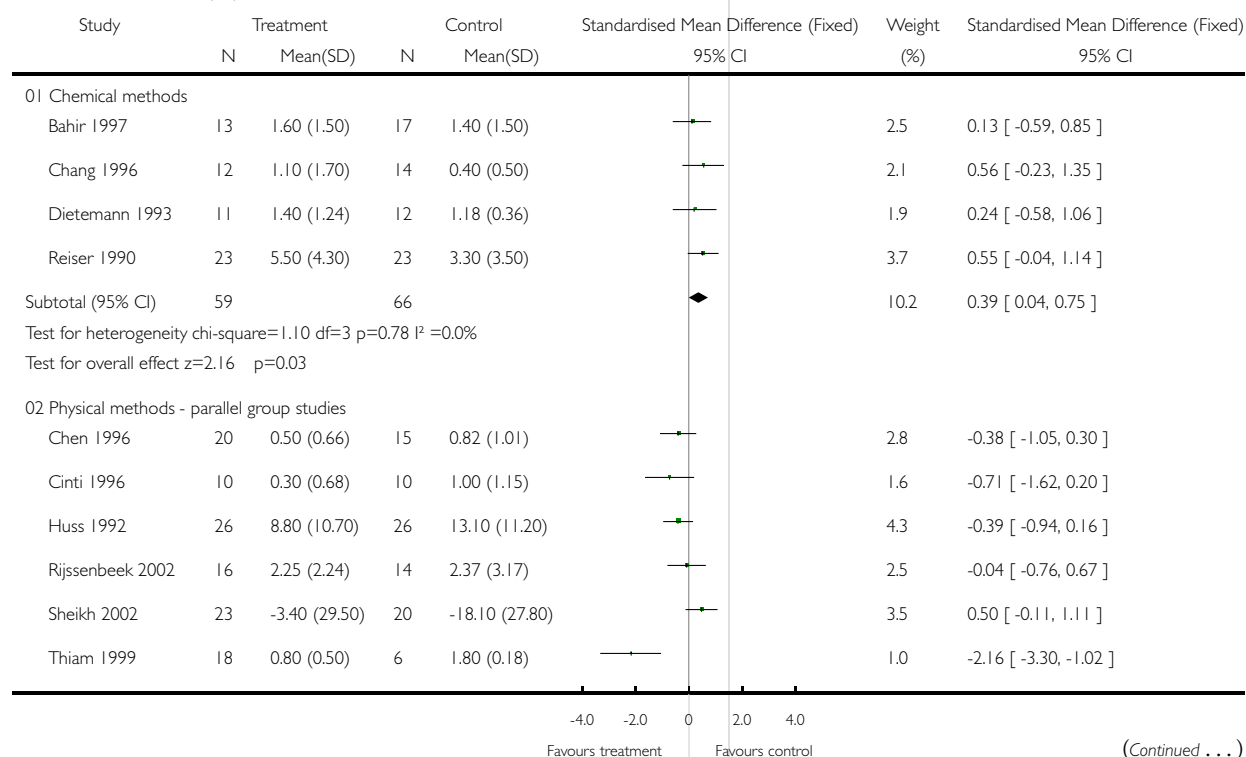


Analysis 01.02. Comparison 01 House dust mite reduction versus control, Outcome 02 Asthma symptoms score

Review: House dust mite control measures for asthma

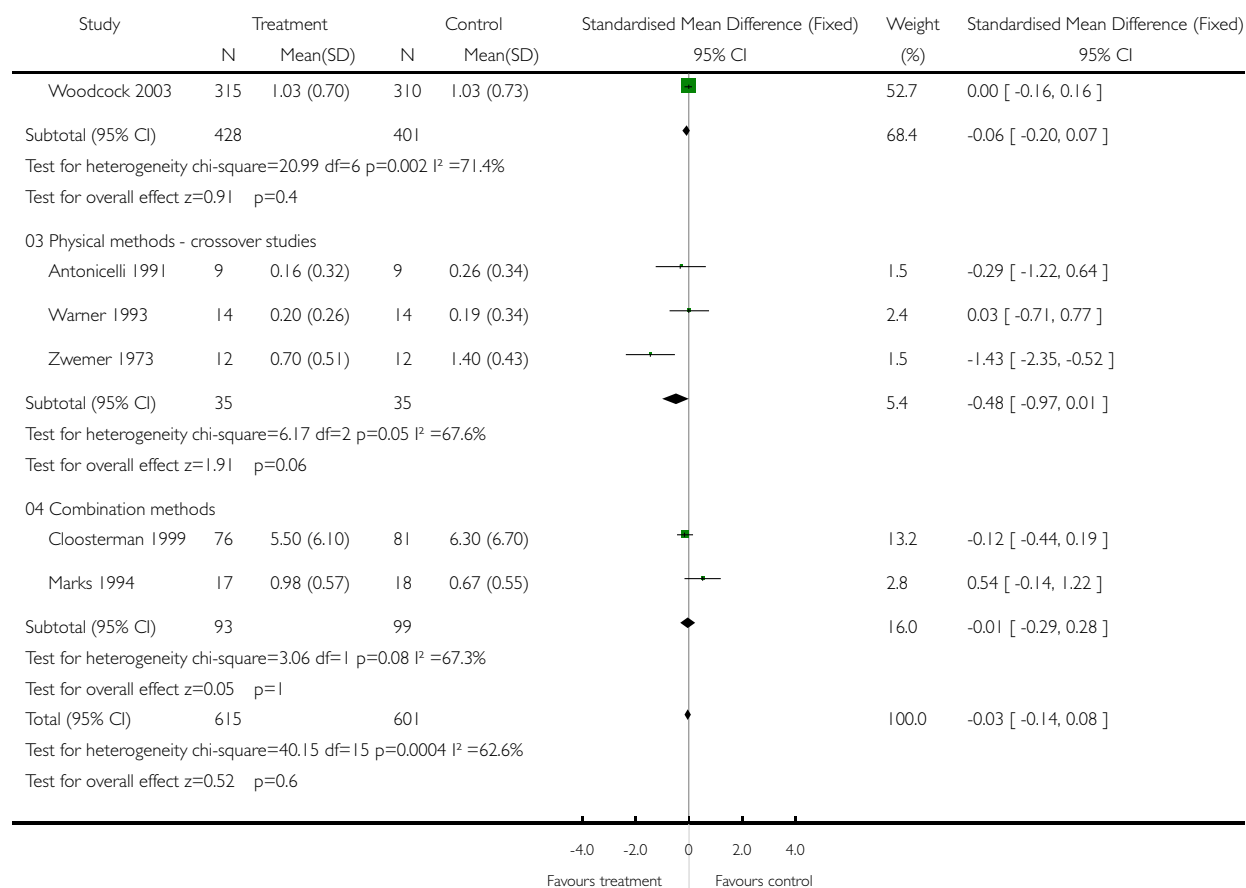
Comparison: 01 House dust mite reduction versus control

Outcome: 02 Asthma symptoms score



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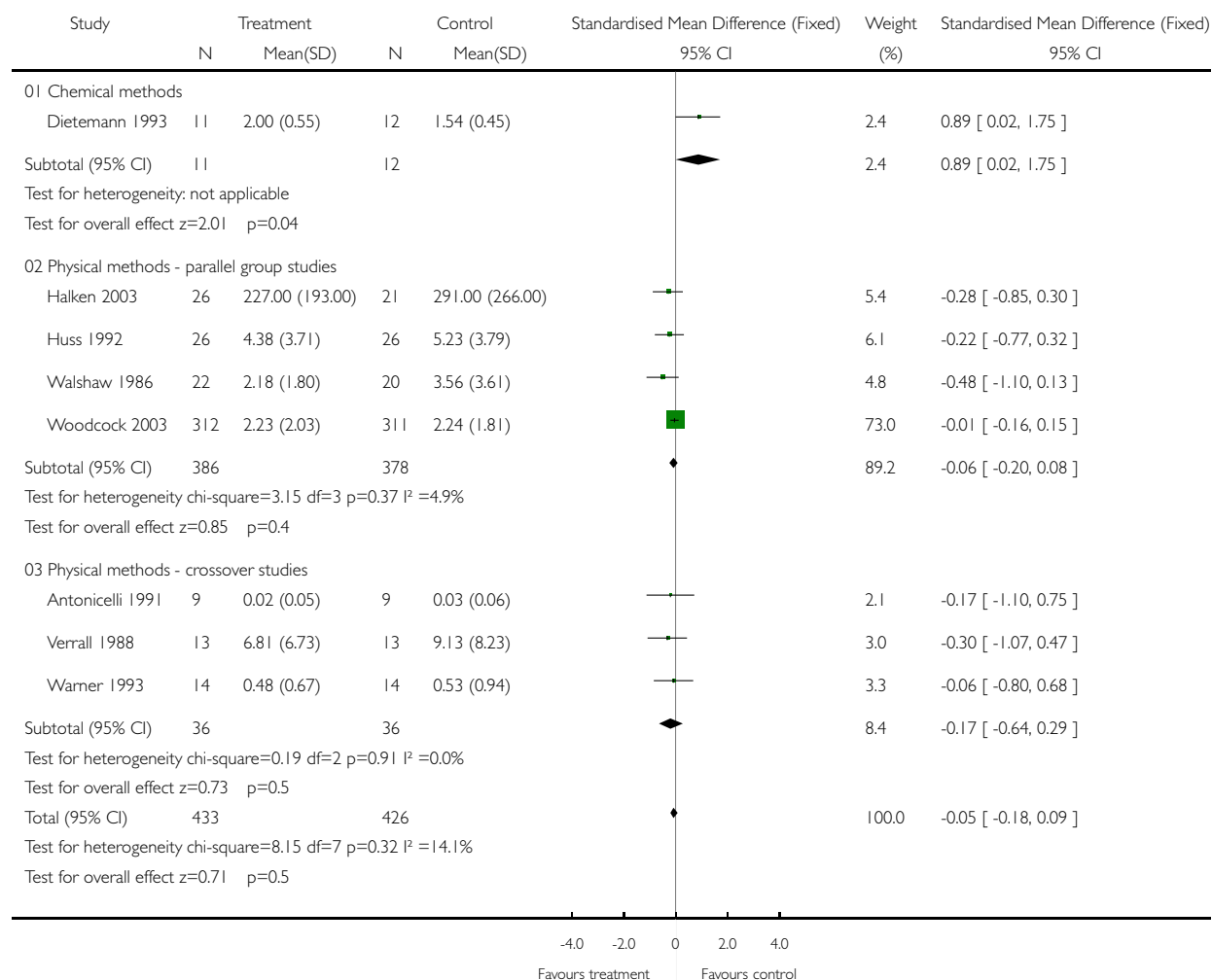


Analysis 01.03. Comparison 01 House dust mite reduction versus control, Outcome 03 Medication usage

Review: House dust mite control measures for asthma

Comparison: 01 House dust mite reduction versus control

Outcome: 03 Medication usage

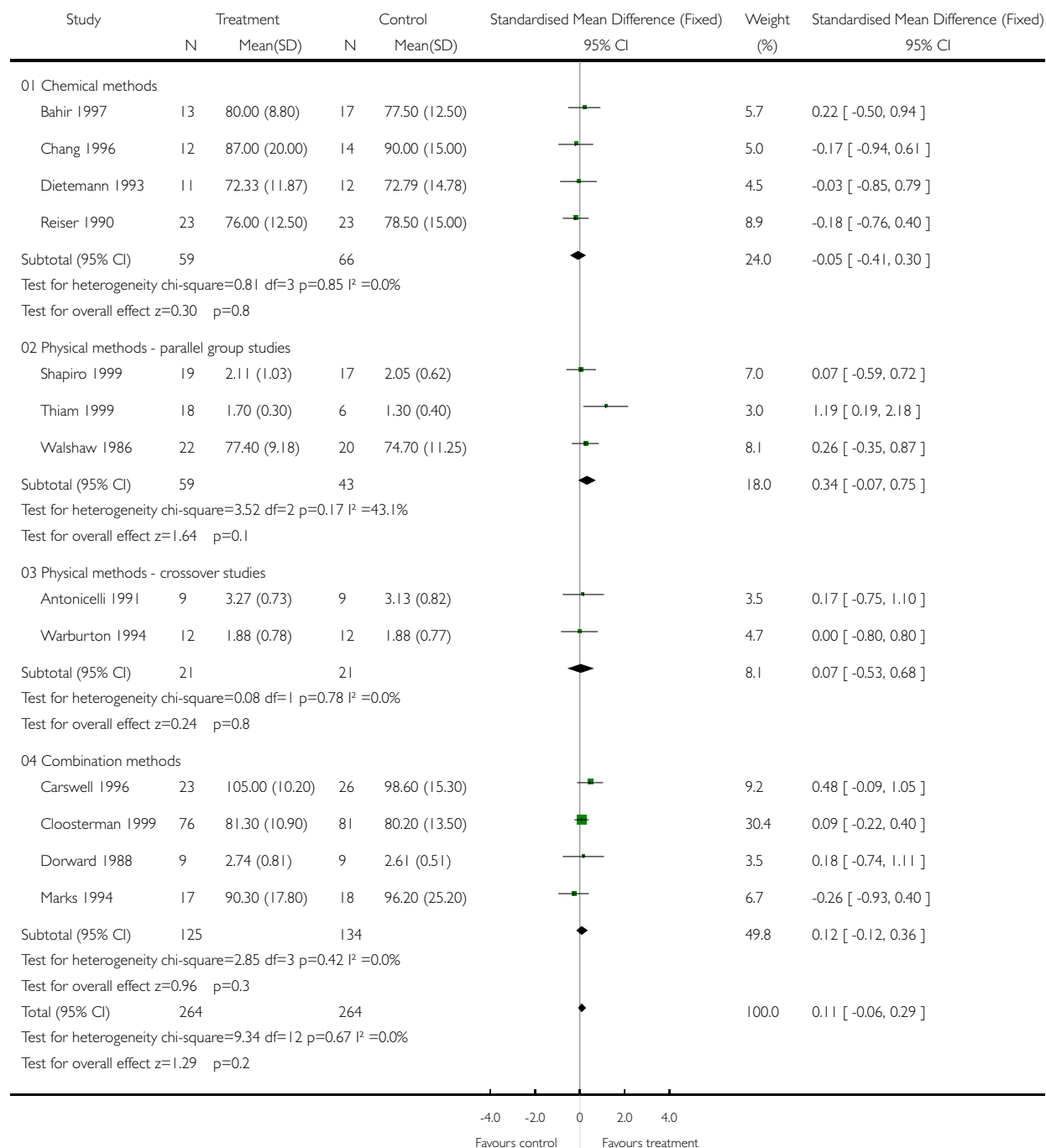


Analysis 01.04. Comparison 01 House dust mite reduction versus control, Outcome 04 FEV1 (Forced expiratory volume in one second)

Review: House dust mite control measures for asthma

Comparison: 01 House dust mite reduction versus control

Outcome: 04 FEV1 (Forced expiratory volume in one second)

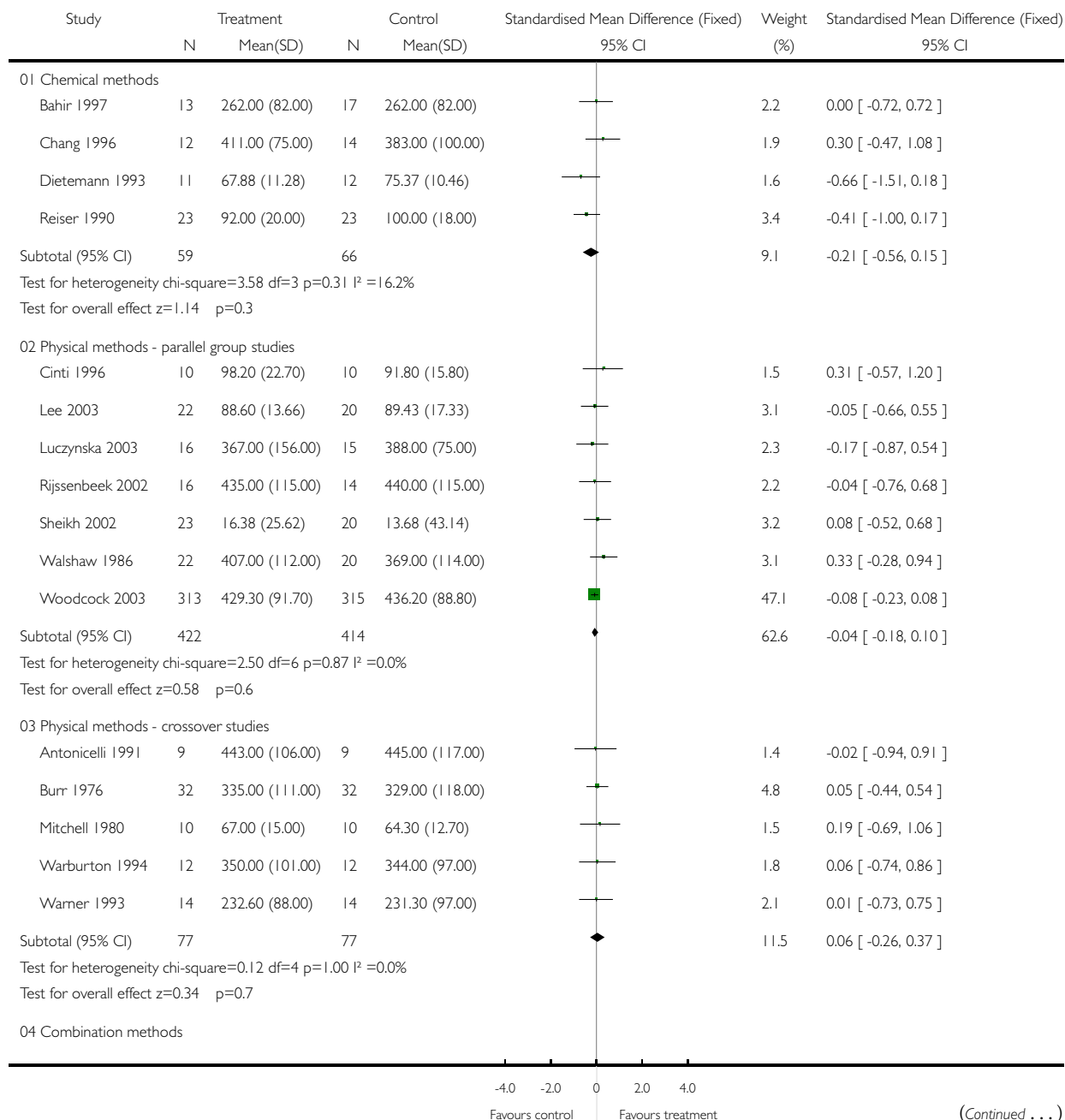


Analysis 01.05. Comparison 01 House dust mite reduction versus control, Outcome 05 PEFR morning (Peak Expiratory Flow Rate)

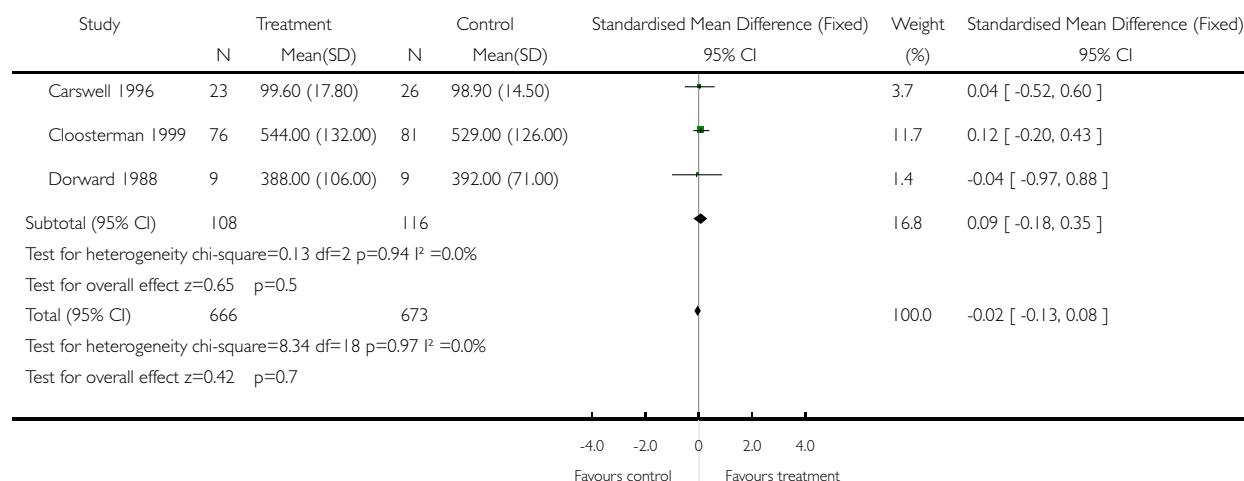
Review: House dust mite control measures for asthma

Comparison: 01 House dust mite reduction versus control

Outcome: 05 PEFR morning (Peak Expiratory Flow Rate)



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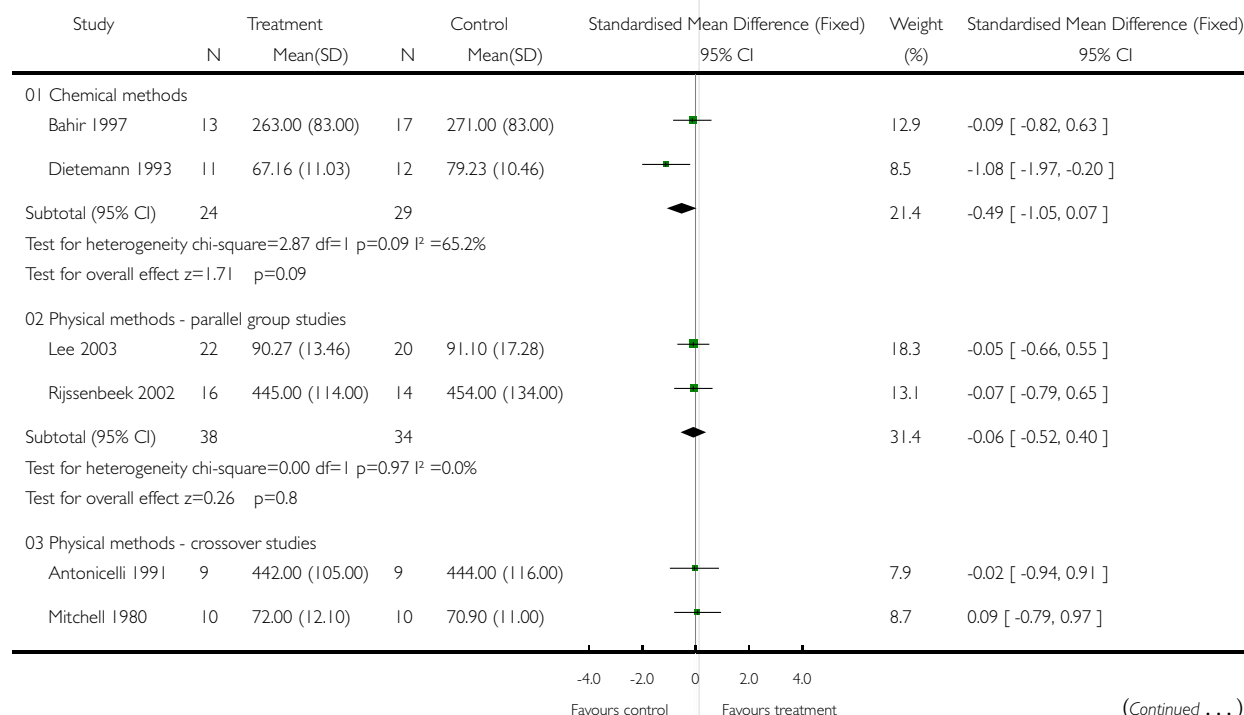


Analysis 01.06. Comparison 01 House dust mite reduction versus control, Outcome 06 PEFR evening (Peak Expiratory Flow Rate)

Review: House dust mite control measures for asthma

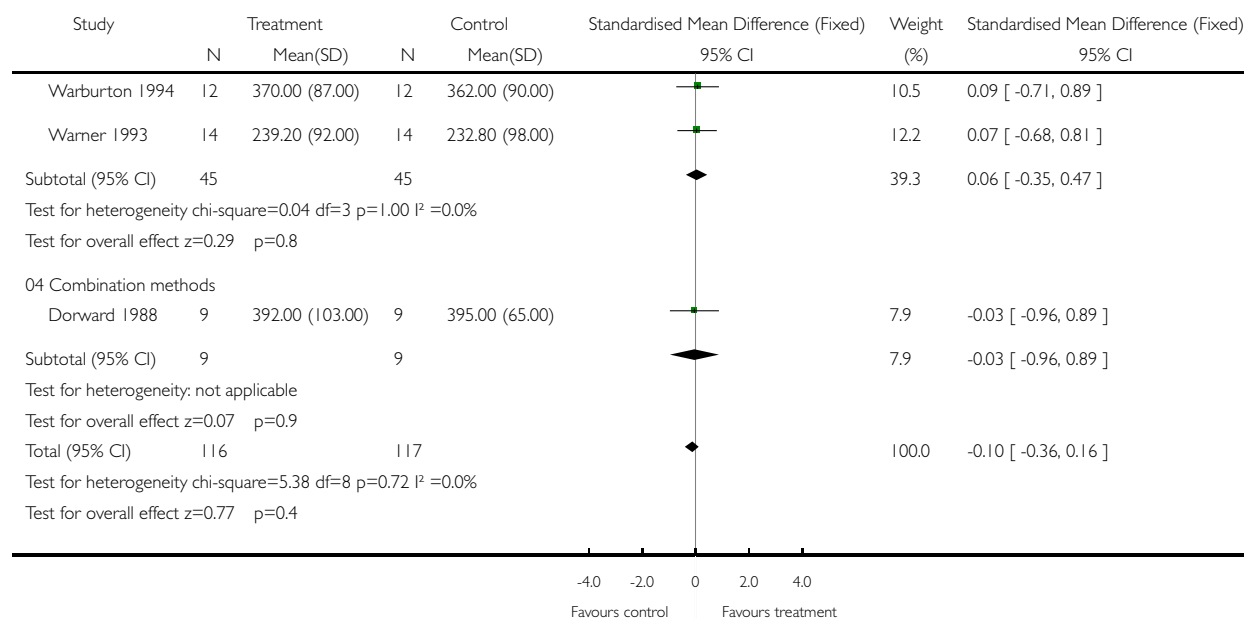
Comparison: 01 House dust mite reduction versus control

Outcome: 06 PEFR evening (Peak Expiratory Flow Rate)



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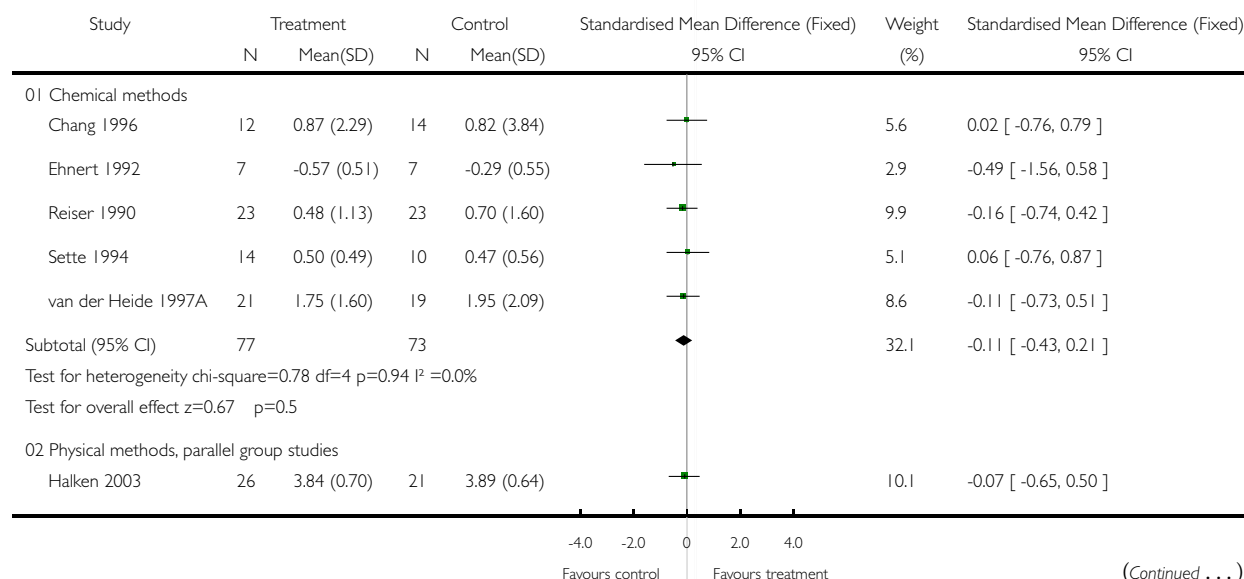


Analysis 01.07. Comparison 01 House dust mite reduction versus control, Outcome 07 PC20 (Provocative concentration for 20% fall in FEV1)

Review: House dust mite control measures for asthma

Comparison: 01 House dust mite reduction versus control

Outcome: 07 PC20 (Provocative concentration for 20% fall in FEV1)



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