National Institute for Health and Care Excellence

Guideline version (Draft)

# Indoor air quality at home

## [3.2] Evidence review for occupant behaviour interventions

*NICE guideline <number>*

*Evidence review*

*June 2019*

*Draft for consultation*

*These evidence reviews were developed by the Public Health Internal Guideline Development team*

**Disclaimer**

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

NICE guidelines cover health and care in England. Decisions on how they apply in other UK countries are made by ministers in the Welsh Government, Scottish Government, and Northern Ireland Executive. All NICE guidance is subject to regular review and may be updated or withdrawn.



ISBN:

## Contents

# Occupant behaviour interventions to prevent or reduce the health impacts of poor indoor air quality at home

## Review question

What are the effective occupant behaviour interventions to reduce or prevent the health impacts of poor indoor air quality at home?

### Introduction

People spend up to 90% of their lives indoors and 60% of that time at home. Exposure to indoor air pollutants including nitrogen dioxide (NO2), carbon monoxide (CO), particulate matter (PM), biological agents and volatile organic compounds (VOCs) is widespread. These pollutants are associated with respiratory and other diseases and premature death.

**Table 1: PICO**

| Field | Content |
|---|---|
| Population | People in all dwellings |
| Interventions | Interventions involving change in occupant behaviour to reduce exposure to poor indoor air quality. For example:<br>• Reduce time spent close to heating or fires (for example wood stoves, fire places)<br>• Using home products with very low VOC emissions for example, solvents, paints, glues<br>• Not using stoves, cooker, ovens as heaters<br>• Using these products under adequate ventilated conditions:<br>  ○ household cleaning products,<br>  ○ hygiene products (such as deodorants),<br>  ○ indoor pesticides and<br>  ○ odourisation products (such as plug-in air fresheners and candles)<br>• Reduce moisture producing activities for example internal clothes drying<br>• Using cooker hoods, kitchen extractors, opening windows or doors while cooking<br>• Improve maintenance of all combustion appliances<br>• Improve maintenance of all filtration systems<br>• Behavioural interventions to reduce house dust mite |
| Comparator(s)/control | Interventions compared to alternative or do nothing |
| Outcomes | • Respiratory health effects<br>  ○ Changes in pulmonary function measured as a reduction in e.g. FEV1, PEF<br>  ○ Respiratory symptoms for example cough, wheeze, phlegm, sore throat, nasal congestion, runny nose, sneezing<br>  ○ Respiratory infection for example Pneumonia, alveolitis, bronchitis<br>• COPD |

| Field | Content |
|---|---|
| | • Asthma<br>• Allergic diseases for example<br>  ○ Allergic asthma<br>  ○ Allergic alveolitis<br>  ○ Allergic rhinoconjuctivitis<br>  ○ Allergic rhinitis<br>  ○ Allergic dermatitis<br>• Pregnancy related health effects for example<br>  ○ Low birthweight, perinatal mortality (still births and deaths in the first week of life)<br>• Cardiovascular health effects. For example<br>  ○ Ischaemic heart disease, stroke<br>• Health related quality of life (HRQOL) |

## Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in Appendix A:

Respiratory conditions were reported differently within and across studies. Due to the myriad of respiratory conditions reported, the committee agreed that:

- Where 2 or more respiratory conditions are reported, to use the most sensitive outcome. For example, using Forced expiratory volume - 1 second (FEV1) over peak expiratory flow (PEF) or
- Where 2 or more respiratory conditions are reported, to use the one reported as the primary outcome for which the trial was powered. For example, reporting wheeze powered for study over cough.

Declarations of interest were recorded according to NICE's 2018 conflicts of interest policy.

## Public health evidence

10,773 references were identified from literature searches outlined in Appendix B. An additional 15 references were identified from published systematic reviews, 8 from another review question, and 1,000 from the re-run of the literature search. 103 papers were ordered and retrieved in full-text. 23 RCTs (reported in 29 papers) met the inclusion criteria outlined in the review protocol. 74 studies were excluded.

## Included studies

We included 23 randomised controlled trials (RCTs) for this review. We identified 14 RCTs from priority screening; 1 from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma' (Lea *et al.* 2018). The committee agreed that the 8 studies originally considered for the structural and material interventions review were behavioural interventions and are relevant to this review. For the studies identified from the AHRQ we retrieved and assessed full-text publications.

Ten studies were conducted in US, 7 in the UK, 3 in the Netherlands, 1 in European countries including the UK, 1 in Canada, and 1 in Australia. Most included studies (15 studies) contributed information on children with two also including infants. Six studies contributed information on adults only and 2 studies on mixed populations of children and adults. Most studies included people with asthma or infants at risk of asthma. One study included people with atopic diseases including asthma, eczema, and hay fever. One study included people who were at risk of allergies. One study included people with rhinitis. No study of the effectiveness of these interventions in people without pre-existing health condition were identified. 22 studies reported on exposure to household dust mite, pests, or pet dander. Of these, 5 studies also included second-hand smoke exposure. One study reported on second-hand smoke exposure only. Eight studies reported on a single intervention (mattress, duvet and pillow encasing with impermeable covers). Fifteen studies reported on multicomponent interventions with at least one behavioural component. We identified over 20 individual intervention components such as mattress or mattress and pillow (impermeable) cover, pest control (used in 8 studies), carpet removal, cleaning and washing instructions of bedding and soft toys. Authors used at least 2 and over 10 intervention components within their study design. The most common intervention components were mattress or mattress and pillow (impermeable) cover (used in 11 studies), pest control (used in 8 studies), carpet removal (used in 5 studies) and linen washing (used in 6 studies). Other interventions included provision of cleaning products (both chemicals and mechanical), cleaning strategies and advice on cleaning strategies, air cleaner or purifier, among others. See Appendix D: for more details.

## Excluded studies

We excluded 74 studies from this review (See Appendix K: for full list of studies excluded with the reasons for exclusion).

**Table 2: Summary of public health studies included in the evidence review**

| Study | Population | Intervention | Comparator | Outcomes used | Risk of bias |
|---|---|---|---|---|---|
| **Aeroallergens** | | | | | |
| *Impermeable mattress, duvet, or pillow covers* | | | | | |
| de Vries 2007 (Netherlands) | Adults with asthma | Impermeable mattress, duvet and pillow covers | Placebo covers | Asthma | Low |
| Dharmage 2006 (Australia) | Adults with asthma | Impermeable mattress, duvet and pillow covers | Placebo covers | Asthma<br>Respiratory health | Low |
| Gehring 2012 (Netherlands) | Infants at risk of asthma | Impermeable mattress covers | Placebo covers | Asthma<br>Allergic rhinitis<br>Atopic eczema | Low |
| Luczynska 2003 (UK) | Adults with asthma | Impermeable mattress, duvet and pillow covers | Placebo covers | Respiratory health<br>Quality of life | Low |
| Murray 2017 (UK) | Children with asthma | Impermeable mattress, duvet and pillow covers | Placebo covers | Asthma<br>Quality of life | Low |
| Sheikh 2002 (UK) | Children with asthma | Impermeable mattress, duvet and pillow covers | Placebo covers | Asthma<br>Respiratory health<br>Allergic rhinitis | Low |
| Terreehorst 2003 (Netherlands) | Adults and children with rhinitis | Impermeable mattress, duvet and pillow covers | Placebo covers | Allergic rhinitis | Low |
| Woodcock 2003 (UK) | Adults with asthma | Impermeable mattress, duvet and pillow covers | Placebo covers | Respiratory health<br>Quality of life | Low |
| *Multicomponent interventions* | | | | | |
| Arshad 2012 (Greece, Lithuania, UK) | Children | Allergen-impermeable mattress cover, verbal advice and recommendations | Standard care | Asthma | High (Inadequate randomisation, unequal attrition rate, lack of participant blinding) |
| Barnes 2008 (US) | Children with asthma | Cleaning products<br>Instructions for fungal control | Standard products and cleaning advice | Asthma | High (Lack of participant blinding and inadequate outcome reporting) |

| Study | Population | Intervention | Comparator | Outcomes used | Risk of bias |
|---|---|---|---|---|---|
| Bryant-Stephens 2008 (US) | Children with asthma | Symptom diary,<br>Roach and mice bait,<br>Dusters, mattress and pillow covers,<br>Sponge and buckets,<br>Trash bags, shades and shade brackets | Information about asthma self-management classes in the community | Asthma | Low |
| Carswell 1996 (UK) | Children with asthma | Mattresses, pillows, duvets, and upholstered furniture vacuumed, then treated with Acarosan foam (benzyl benzoate 2.6%)<br>Cotton covers coated with polyurethane on mattresses, pillows, duvets<br>Bed linen washed at 60° C<br>Carpet vacuumed, treated with Acarosan powder (benzyl benzoate 5%)<br>Soft toys removed or washed | Mattresses et al. treated with water spray<br>Mattresses et al. covered with cotton placebos<br>Bed linen washed at 40° C<br>Carpet treated with chalk dust | Respiratory health | Low |
| Dorward 1988 (UK) | Adults sensitive to house dust mites | Cleaning instructions for house dust mite control,<br>Treatment of mattress and bedroom carpet with liquid nitrogen<br>Weekly vacuum cleaning of bed (seams, buttons, and box springs)<br>Cleaning of blankets, pillows, and duvets at the beginning of the trial<br>Weekly wash of sheets and pillow cases<br>Daily airing of mattress by back folding blankets and upper sheets or duvets<br>Weekly damp dusting of hard surfaces<br>Removal of plants, soft toys, cushions, and upholstered furniture from room | Usual cleaning activities | Respiratory health | High (lack of blinding, low number of participants) |
| Hayden 1997 (US) | Children with asthma | Impermeable covers (Allergy Control Products) on mattresses, pillows, box springs<br>Carpet in bedroom replaced with hardwood or vinyl flooring | Placebo cotton covers on mattresses, pillows, box springs<br>Carpet treated with water spray | Respiratory health | Low |

| Study | Population | Intervention | Comparator | Outcomes used | Risk of bias |
|---|---|---|---|---|---|
| | | Carpet in living room or family room treated with 3% tannic acid spray every 3 months<br>Instruction to wash bedding weekly in hot water | Instruction to wash bedding in cold water | | |
| Matsui 2017 (US) | Children with asthma | Professional pest control<br>Impermeable mattress covers<br>Air purifier<br>Education on pest control strategies (e.g., use of traps, sealing of entry points, house cleaning) | Education on pest control strategies | Respiratory health<br>Adverse events | High (lack of blinding) |
| Walshaw 1986 (UK) | Adults with asthma | Plastic covers on mattresses, pillows<br>Feather duvets, quilts and woollen blankets replaced with other materials<br>Bedroom carpet either replaced with linoleum or vacuumed regularly | No intervention | Respiratory health | High (lack of blinding, selective reporting) |
| **Aeroallergens and second-hand smoke** | | | | | |
| Becker 2004 (Canada) | Infants at risk of asthma | Vapour-impermeable mattress covers<br>Benzyl benzoate powder and foam<br>Partially hydrolysed whey formula where applicable<br>Instruction on hot wash of beddings, pillows and bedding<br>Treatment of carpets and upholstery<br>Recommendation on smoke and pet free house<br>Encouragement of breastfeeding for at least 4 months and up to 12 months<br>Advice on diet for the last trimester of pregnancy | Usual care | Asthma<br>Atopy | Low |
| DiMango 2016 (US) | Adults and children with asthma | Impermeable covers on mattresses, vacuum, HEPA air purifier, Mops, Cleaning products, Education and instruction about allergen reduction strategies given by 'intervention counsellors | Education unrelated to allergen reduction given by 'intervention counsellors' | Asthma<br>Respiratory health<br>Health related quality of life | High (lack of blinding) |

| Study | Population | Intervention | Comparator | Outcomes used | Risk of bias |
|---|---|---|---|---|---|
| Eggleston 2005 (US) | Children with asthma | Impermeable mattress and pillow covers (Mission: Allergy) on child's bed<br>HEPA filter in child bedroom<br>Fipronil bait gel for cockroach in kitchen and bathroom<br>Bromadialone bait traps for mouse | No intervention | Asthma<br>Respiratory health<br>Health related quality of life | High (lack of blinding) |
| Evans 1999 (US) | Children with asthma | Impermeable covers on mattresses, pillows<br>Professional application of abamectin insecticide in homes of people with positive Bla g skin test<br>Monthly contact with social workers to discuss allergen control, symptom management, access to medical care | No intervention | Asthma | Low |
| Morgan 2004 (US) | Children with asthma | Impermeable covers on mattresses, pillows, box springs<br>HEPA filtered vacuum<br>HEPA air purifier for people exposed to pets, mould, or tobacco smoke<br>Professional pest control | No intervention | Asthma<br>Respiratory health | Low |
| Parker 2008 (US) | Children with asthma | Impermeable covers on mattresses, pillows<br>HEPA filtered vacuum<br>Household cleaning supplies provided<br>Integrated pest management<br>Education and instruction about allergen reduction strategies given by community health workers | No intervention | Respiratory health | High (lack of blinding and unequal attrition) |
| **Second-hand smoke** | | | | | |
| Butz 2011 (US) | Children with asthma | Asthma education, high-efficiency particle air (HEPA) cleaners, health coach | Asthma education alone | Asthma | High (lack of blinding, lack of allocation concealment and concerns over block randomisation) |

See Appendix D: for full evidence tables.

## Economic evidence

For the review of published cost effectiveness evidence see Evidence reviews for indoor air quality at home:

## Economic model

For the results of the economic analysis see Indoor Air Quality at Home Economic Model Report and Community Health Worker Appendix.

For the economic model see xxx

## Evidence statements

### Aeroallergens

***Impermeable covers*** **(see GRADE profile F.1.1)**

**Children and adults with asthma**

- High quality evidence from 4 RCTs children and adults with asthma followed up for up to 2 years showed no difference in asthma control with the use of impermeable covers on mattress, duvet, and pillows to prevent/reduce house dust mite compared to the control group (n=421; pooled SMD -0.02 95% CI -0.3 to 0.26).
- Moderate quality evidence from 1 RCT on children at risk of allergies followed up in the first 8 years of life showed no difference in asthma with the use of mite-impermeable polyester-cotton mattress and pillow covers for parental bed(s) and the child's bed to prevent/reduce house dust mite compared to the control group (n=810; RR 0.87 95% CI 0.60 to 1.28); number of events not reported).

**Respiratory health in children and adults**

- High quality evidence from 4 RCTs on children and adults with asthma with a follow up of up to 2 years showed no difference in respiratory health effect with the use of impermeable mattress, duvet, and pillow covers to prevent/reduce house dust mite compared to the control group (n=1,252; pooled SMD -0.03 95% CI -0.14 to 0.08).

**Children and adults with allergies**

- Low quality evidence from 1 RCT on children at risk of allergies followed up for 8 years showed no difference in allergic rhinitis with the use of impermeable polyester-cotton mattress and pillow covers for parental bed's and the child's bed to prevent/reduce house dust mite compared to the control group (n=810; RR 0.88 95% CI 0.52 to 1.47; number of events not reported).
- High quality evidence from 1 RCT on children and adults with rhinitis followed up for 12 months showed no difference in allergic rhinitis (using rhinitis specific visual analogue scale) with the use of impermeable bed covers to prevent/reduce house dust mite compared to the control group (n=232; MD 1.03 95% CI -6.91 to 8.97).
- Moderate quality evidence from 1 RCT on children with asthma followed up for 12 months showed no difference in allergic rhinitis (symptoms score) with the use of impermeable mattress, duvet, and pillow covers to prevent/reduce house dust mite compared to the control group (n=43; MD -8.47 95% CI -28.34 to 11.40).

- Moderate quality evidence from 1 RCT on children at risk of allergies followed up for 8 years showed no difference in dermatitis/atopic eczema with the use of impermeable polyester-cotton mattress and pillow covers to prevent/reduce house dust mite compared to the control group (n=810; RR 1.05 95% CI 0.86 to 1.29; number of events not reported).
- High quality evidence from 2 RCTs on children and adults with asthma followed up for 12 months showed no difference quality of life with the use of impermeable mattress, duvet and pillow covers to prevent/reduce house dust mite compared to the control group (n=339; pooled SMD -0.05 95% CI -0.26 to 0.17).
- Low quality evidence from 1 RCT on adults with asthma followed up for 12 months showed no difference in quality of life with the use of impermeable mattress, duvet, and pillow covers to prevent/reduce house dust mite compared to the control group (n=990; OR 0.98 95% CI 0.75 to 1.30; 4 fewer per 1,000 from 62 fewer to 50 more).

**Multicomponent interventions (see GRADE profile F.1.2)**

**Asthma in children**

- Low quality evidence from 1 RCT on children with atopic conditions with a follow up of 12 months showed no difference in asthma with the use of a multicomponent intervention with more than 10 components to prevent/reduce aeroallergen exposure compared to the control group (n=53; OR 0.32 95% CI 0.09 to 1.08; 247 fewer per 1,000 from 538 fewer to 13 more).
- Moderate quality evidence from 2 RCTs on children with asthma with a follow up of up to 12 months showed a reduction in asthma severity (reported using a severity scale or length of hospital stay) with the use of multicomponent intervention with up to 7 components to prevent/reduce aeroallergen exposure compared to the control group (n=940; SMD -0.14, 95% CI -0.27 to -0.01).

**Respiratory health in children and adults**

- Moderate quality evidence from 5 RCTs on children and adults with asthma with a follow up of up to 12 months showed no difference in respiratory health with the use of multicomponent intervention with up to 7 components to prevent/reduce aeroallergen exposure compared to the control group (n=323; SMD 0.14, 95% CI -0.08 to 0.36).

**Adverse events in children**

- Low quality evidence from 1 RCT with a follow up of 12 months showed no difference in the number of people with at least one adverse event with the use of a multicomponent intervention with 3 components to prevent/reduce aeroallergen exposure compared to the control group (n=350; OR 0.81 95% CI 0.49 to 1.33; 37 fewer per 1,000 from 143 more to 44 more).

**Aeroallergens and second-hand smoke (see GRADE profile F.2)**

**Asthma in children and adults**

- Moderate quality evidence from 3 RCTs on children and adults with asthma with a follow up of up to 2 years showed no difference in asthma with the use of multicomponent intervention with up to 4 components to prevent/reduce

aeroallergen exposure and second-hand smoke exposure compared to the control group (n=2,160; SMD -0.13 95% CI -0.26 to 0.01).

**Asthma in children**

- Low quality evidence from 1 RCT on children with asthma with a follow up of 12 months showed no difference in asthma with the use of a multicomponent intervention with 2 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=100; OR 0.38 95% CI 0.07 to 2.03; 59 fewer per 1,000 from 92 fewer to 84 more).
- Moderate quality evidence from 1 RCT on children with risk of asthma with a follow up of 2 years showed no difference in asthma with the use of a multicomponent intervention with 9 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=476; OR 0.65 95% CI 0.41 to 1.02; 68 fewer per 1,000 from 121 fewer to 4 more).
- Moderate quality evidence from 1 RCT on children at risk of asthma with a follow up of 7 years showed a significant reduction in asthma with the use of a multicomponent intervention with 9 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=380; OR 0.58 95% CI 0.35 to 0.98; 82 fewer per 1,000 from 4 fewer to 136 fewer).

**Atopy in children**

- Low quality evidence from 1 RCT on children with asthma with a follow up of 24 months showed no difference in occurrence of atopy with the use of a multicomponent intervention with 9 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=476; OR 1.17 95% CI 0.7 to 1.96; 19 more per 1,000 from 36 fewer to 99 more).
- Moderate quality evidence from 1 RCT on children with asthma with a follow up of 7 years showed no difference in occurrence of atopy with the use of a multicomponent intervention with 9 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=380; OR 1.31 95% CI 0.87 to 1.96; 66 more per 1,000 from 33 fewer to 167 more).

**Health related quality of life in children and adults**

- High quality evidence from 2 RCT children and adults with asthma with a follow up of up to 12 months showed no difference in health related quality of life with the use of a multicomponent intervention with up to 3 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=347; MD -0.15 95% CI -0.37 to 0.06).

**Respiratory health in children and adults**

- Moderate quality evidence from 4 RCTs on children and adults with asthma with a follow up of up to 1 year showed no difference in respiratory health with the use of a multicomponent intervention with up to 4 components to prevent/reduce aeroallergen exposure and second-hand smoke exposure compared to the control group (n=1,539; SMD -0.13 95% CI -0.27 to 0.01).

**Second-hand smoke (see GRADE profile F.3)**

**Asthma in children**

- Low quality evidence from 1 RCT on children with asthma with a follow up of 6 months showed a significant increase in symptom-free days (reduction in asthma) with the use of a multicomponent intervention with 2 components to prevent/reduce second-hand smoke exposure compared to the control group (n=85; MD 1.87 95% CI 0.15 to 3.59).

## Recommendations

## Rationale and impact

Link to be added

## The committee's discussion of the evidence

### Interpreting the evidence

***The outcomes that matter most***

The committee considered all outcomes to be of equal importance. Various pollutants can affect indoor air quality at home. Pollutants such as gases (for example $NO^2$, carbon monoxide), volatile organic compounds (VOCs), particulate matter (PM) from for example open, solid-fuel fires, and cooking, polycyclic aromatic hydrocarbons (PAHs) for example, naphthalene and benzo[a]pyrene) and biological agents such as mould and pet dander. The committee acknowledged the evidence showing that exposure to these different pollutants can lead to negative health outcomes especially in vulnerable groups such as people with pre-existing conditions, the very young and elderly people. In people with asthma, poor indoor air quality might exacerbate health effects such as wheezing and cough. Additionally, the very young and elderly people are likely to spend more time indoor at home than the general population. These people therefore can experience a higher exposure to poor indoor air quality at home leading to poor health outcomes.

The committee agreed with the approach of pooling outcomes for respiratory health as well as for asthma. The committee agreed that all reported asthma outcomes such as number of symptom days per 2 weeks and hospitalisation due to asthma are proxies for asthma worsening or exacerbation.

***The quality of the evidence***

The committee noted the lack of evidence on people with low income as well as older people, people with disabilities and pregnant women. There was also limited evidence on children and young people while the majority of studies included people with asthma.

The committee acknowledged the uncertainty in the evidence base. They noted that this might be due to differences in populations, in terms of different ages, and the myriad of ways of reporting on the same outcome as well as the variability of methods to measure exposure.

The committee recognised some methodological limitations as regards to study design and conduct. One such limitation is the lack of blinding reported in included

studies. The committee acknowledged that blinding, particularly of participants, might be impractical for these types of behaviour intervention studies. People in the included studies were aware of their intervention regimen as interventions relied on active participation of the people. Many studies show high risk of bias concerning the lack of blinding of participants. The committee accepted that the included studies were conducted in people's homes and were constrained by the practical considerations of what measures are to be undertaken. They appreciated that it is difficult or impossible to achieve blinding in such studies. Therefore, for practical and pragmatic reasons the committee accepted the existence of this form of bias.

Another limitation the committee considered was the use of subjective measures (for example using self-reported questionnaires) rather than objective measure for outcomes. Self-reporting is often limited by recall and subjectivity which can lead to both an under- or overestimation of health outcomes. People at risk might be used to their condition and therefore underestimate the health outcome. Conversely, they might overestimate health outcomes to emphasise their condition. The committee agreed that this should be reflected in the quality assessment of the evidence.

The committee also had concerns about prescheduled home visits. Most studies include self-reported outcomes or measurement of pollutant level recorded at scheduled home visits. Both control and intervention group were aware of the home visits and their frequency. Such study design could lead to a placebo effect as people in the control group might prepare for home visits.

Many studies included children with asthma either diagnosed by a healthcare professional or indicated by caregiver through screening questionnaire. The committee agreed that asthma management might influence health outcome measures. People with adequate asthma management might show better health outcomes than people with poor asthma management. The committee noted the accepted associated between poor asthma control and lower socio-economic status and the impact that this would have on outcomes. The committee noted that treatment and management of asthma symptoms during studies on people with asthma can be an ethical and methodological issue.

The committee highlighted that all studies included at risk populations; people who are either at risk of developing asthma (new-borns and infants) or people with asthma (children and adults). The committee agreed that there is an evidence gap for 'healthy people' (people without pre-existing health conditions) and suggested that it is unlikely that interventional studies on poor indoor air quality were or will be conducted on healthy populations, due to researchers conducting studies mainly on at risk populations to ease poor health outcomes caused by poor indoor air quality at home in these populations. The committee then considered drafting research recommendations focussing on people without pre-existing health conditions.

The committee discussed and agreed that results might be generalizable as interventions that show desirable effects in at risk populations are likely also to be protective of the general population.

The committee noted that many included studies used multicomponent behaviour interventions. This is because identified studies included people with asthma and/or atopies and focused on the prevention or management of these conditions using a holistic approach reducing more than one trigger. Additionally, there was no RCT evidence for long-term outcomes such as COPD or cardiovascular health effects. Several factors might play a role. Firstly, follow up was short in most studies between 2 months and 2 years. Such short follow ups are unlikely to capture cardiovascular health effects that develop over greater time periods. Short follow ups would only

capture biomarkers for subsequent cardiovascular disease. Secondly, most studies included children up to the age of 17 rather than adults limiting the opportunity to examine the overall risk of long-term health outcomes that develop over a longer time period. Thirdly, most studies included people with asthma and/or atopies and focused on short-term outcomes directly related to the condition of interest such as cough and wheeze.

There were few RCTs with single intervention all studying the effectiveness of allergen barriers for example impermeable mattress, duvet or pillow covers as a strategy to reduce asthma or allergies. Evidence suggests that these barriers can protect people with allergies against house dust mites. The committee noted that there has been advances in technology for mattress, pillow and duvet impermeable covers with recent advances including the use of micro fine fibre which are able to reduce exposure to house dust mite and allergens. The committee acknowledged that many of the included studies predated these and so the committee was not able to generalise the evidence to current best practice. The committee also noted that pillow covers were of most use as these only reduce exposure around the face.

There was no evidence for some occupant behavioural interventions such as

- reduced time spent close to heating or fires (for example wood stoves, fire places),
- Using home products with very low VOC emissions for example, solvents, paints, glues
- not using stoves, cooker, ovens as heaters,
- reducing moisture-producing activities for example internal clothes drying.
- Using these products under adequate ventilated conditions: (household cleaning products, hygiene products (such as deodorants), indoor pesticides and odourisation products (such as plug-in air fresheners and candles)
- Using cooker hoods, kitchen extractors, opening windows or doors while cooking
- Improve maintenance of all combustion appliances
- Improve maintenance of all filtration systems

The committee agreed that in reality it is impractical to conduct studies on such interventions. The committee agreed that, it is logical that these interventions would be effective in reducing exposure but compliance with these interventions is difficult and makes it difficult to evaluate these in real life. Studies on for example indoor clothes drying are unlikely. It is generally accepted that indoor clothes drying should be avoided as it increases humidity in the home.

The committee noted the evidence in other reviews on exposure and noted that the evidence in those reviews supported their views. For example, drying clothes outside the house was associated with a decrease in house dust mite allergen levels. Evidence in these reviews also showed that infrequent use of an extractor fan when cooking was associated with an increase in NO2 levels.

There is a relative lack of UK studies looking at the effectiveness of multicomponent interventions. The committee were unsure of the generalisability of results from non-UK studies because of different climatic conditions and population characteristics that may influence the findings. However, the committee noted that many of the non-UK studies included populations from low social economic classes or disadvantaged status. This was directly generalizable to the UK where people in these groups are the most affected by poor indoor air quality at home.

***Benefits and harms***

The committee noted that there was a degree of disconnect between the expected reduction of pollutant level using multicomponent behaviour intervention and impact on health outcomes. But they acknowledged that the evidence reviews focused on health outcomes only. The committee agreed that it is difficult to study indoor air quality as there are many parameters to consider. These include location of problem within the home, interval of measure, population size within a study, and mixed housing stock.

Overall, the committee could not distinguish between multicomponent behaviour interventions and control, or impermeable covers for mattress, pillow and duvet and control. However, the committee noted that this was because of the imprecision of the results. The committee emphasized that most point estimates favoured multicomponent interventions versus control. This was consistent across most outcomes.

The committee discussed the potential of interventions early during infancy. This was based on results from one prevention study suggesting that early interventions might be beneficial during later life in at risk populations.

***Cost effectiveness and resource use***

The committee noted the body of health economic evidence on occupant behaviour was sparse, of low quality and only partially applicable. In addition, although the evidence suggests that home modification and education interventions could be cost effective the committee also noted that the outcomes measured – number of days symptom free from asthma and urgent use of healthcare services – were indirect. Nevertheless, the economic model also suggested that interventions to reduce exposure to indoor air pollution could be cost saving. Of particular note was the finding that the main driver of the cost savings was the excess risk profile of dwellings which comprises a combination of both the physical (building) risk and personal baseline risk. A key limitation of the model is that there were no data on the explicit link between indoor air quality and health outcomes in general, and specifically for any of the interventions of interest to the committee. Some identified benefits could not be quantified for example, the benefits that an intervention may bring to someone with comorbidities, suggesting that the overall benefits are likely to have been underestimated. So, the committee concluded that interventions could offer good value for money in certain scenarios.

***Other factors the committee took into account***

Best practice includes regular maintenance of heating and cooking appliances and this is also a legal requirement for rental properties. Best practise also includes ensuring effective ventilation so residents can easily get rid of pollutants. This includes ensuring that installed heating or ventilation systems meet required performance requirements as laid out in Building Bulletin BB 101: Ventilation, thermal comfort and indoor air quality 2018.

# Appendices

# Appendix A: Review protocols

## Review protocol for occupant behaviour interventions

| Field | Content |
|---|---|
| Review question | What are the effective occupant behaviour interventions to reduce or prevent the health impacts of poor indoor air quality at home? |
| Type of review question | Intervention and qualitative |
| Objective of the review | To identify effective occupant behaviour interventions to reduce or prevent the health impact of poor indoor air quality at home |
| Eligibility criteria – population/disease/condition/issue/domain | People in all dwellings |
| Eligibility criteria – interventions | Interventions involving change in occupant behaviour to reduce exposure to poor indoor air quality. For example:<br>• Reduce time spent close to heating or fires (for example wood stoves, fire places)<br>• Using home products with very low VOC emissions for example, solvents, paints, glues<br>• Not using stoves, cooker, ovens as heaters<br>• Using these products under adequate ventilated conditions:<br>  ○ household cleaning products,<br>  ○ hygiene products (such as deodorants),<br>  ○ indoor pesticides and<br>  ○ odourisation products (such as plug-in air fresheners and candles)<br>• Reduce moisture producing activities for example internal clothes drying<br>• Using cooker hoods, kitchen extractors, opening windows or doors while cooking<br>• Improve maintenance of all combustion appliances<br>• Improve maintenance of all filtration systems<br>• Behavioural interventions to reduce house dust mite |
| Eligibility criteria – comparator(s)/control or reference (gold) standard | Interventions compared to alternative or do nothing |
| Outcomes and prioritisation | Respiratory health effects<br>• Changes in pulmonary function measured as a reduction in e.g. FEV1, PEF<br>• Respiratory symptoms for example cough, wheeze, phlegm, sore throat, nasal congestion, runny nose, sneezing<br>• Respiratory infection for example Pneumonia, alveolitis, bronchitis<br>• COPD |

| Field | Content |
|---|---|
| | • Asthma<br>• Allergic diseases for example<br>  ○ Allergic asthma<br>  ○ Allergic alveolitis<br>  ○ Allergic rhinoconjuctivitis<br>  ○ Allergic rhinitis<br>  ○ Allergic dermatitis<br>• Pregnancy related health effects for example<br>• Low birthweight, perinatal mortality (still births and deaths in the first week of life)<br>• Cardiovascular health effects. For example ischaemic heart disease, stroke<br>• HRQOL |
| Eligibility criteria – study design | Inclusion:<br>• RCTs<br>• Cluster RCTs<br>• UK based qualitative studies<br>• Economic studies:<br>• Cost-utility (cost per QALY)<br>• Cost benefit (i.e. net benefit)<br>• Cost-effectiveness (Cost per unit of effect)<br>• Cost minimization<br>• Cost-consequence<br>Exclusion:<br>• Systematic reviews of observational studies will not be included but may be used as a source of primary studies |
| Other inclusion exclusion criteria | Inclusion:<br>• English language only<br>• Published peer-reviewed studies only<br>• Studies conducted in developed economies similar to the UK<br>• Studies conducted from 1970 onwards<br>Exclusion:<br>• Conference abstract, letter, opinion piece, review articles |
| Proposed sensitivity/sub-group analysis, or meta-regression | Where evidence allows, pre-specified sub-group analysis will be conducted to include those at increased risk of poor indoor air quality:<br>Subgroup<br>• People on low income<br>• Older people<br>• Ethnicity<br>• People with disabilities<br>• Pregnant women<br>• Children and young people<br>• People with conditions associated with or exacerbated by indoor air pollution, such as stroke, heart disease, allergic disease and asthma |

| Field | Content |
|---|---|
| Selection process – duplicate screening/selection/analysis | A 10% random sample of abstracts will be duplicate screened as a reliability check. Any disagreement will be resolved by discussion, or if necessary, a third independent reviewer. If the initial level of agreement is below 90%, a second round of screening will be considered.<br><br>A 10% random sample of data extraction and critical appraisal will be checked by a second reviewer. Any disagreements will be resolved by the two reviewers,and escalated to a third reviewer if agreement cannot be reached.<br><br>Only 10% of the search results will be checked as this is an intervention and qualitative review and there is confidence that RCTs, controlled studies or related qualitative studies are unlikely to be missed at the sifting stage. The inclusion list will be double checked with PHAC to ensure no studies are excluded inappropriately |
| Information sources – databases | A systematic search of relevant databases will be carried out to identify relevant studies and evidence.<br>Appropriate limits will be applied. Database functionality will be used, where available, to exclude:<br>Non-English language papers<br>Animal studies<br>Editorials, letters, news items and commentaries<br>Conference abstracts and posters<br>Theses and dissertations<br>Duplicates<br><br>Websites will be browsed or searched to focus on relevant evidence. The bibliographies of relevant reports and findings may also be used to capture evidence.<br><br>The following databases will be searched:<br>• MEDLINE and MEDLINE in Process (OVID)<br>• Embase (OVID)<br>• Health Management Information Consortium (HMIC) (OVID)<br>• Social Policy and Practice (OVID)<br>• CENTRAL (Wiley)<br>• Cochrane Database of Systematic Reviews (Wiley)<br>• DARE (Wiley)<br>• Greenfile (EBSCO)<br>• NHS EED (legacy database) (Wiley)<br>• EconLit (OVID)<br>• OpenGrey<br>• Web of Science<br><br>The following websites will be searched:<br>Google and Google scholar (with appropriate limits and looking specifically for reports or evaluations of interventions related to indoor air quality) |

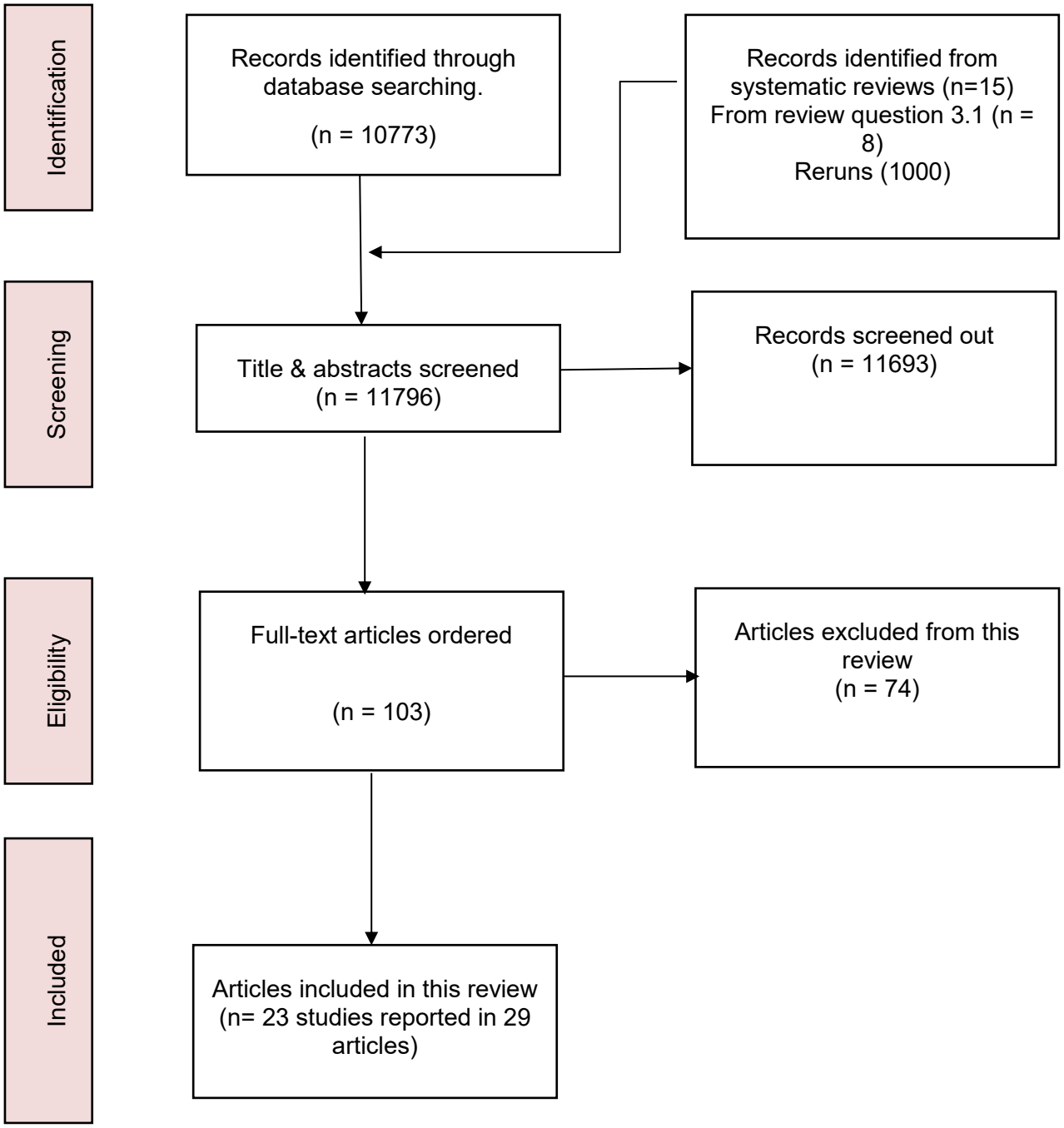
| Field | Content |
|---|---|
| Data management (software) | Where feasible data management will be undertaken using EPPI-reviewer software. Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5).<br><br>Where appropriate qualitative data will be summarised using an appropriate qualitative synthesis approach, for example, narrative synthesis. |
| Methods for assessing bias at outcome/study level | Standard study checklists will be used to critically appraise individual studies. For details please see section 6.2 of Developing NICE guidelines: the manual<br><br>For intervention studies the Cochrane Risk of Bias 2.0 tool will be used and for qualitative studies, the Cochrane qualitative checklist will be used.<br><br>The Grading of Recommendations Assessment, Development and Evaluation (short GRADE) developed by the GRADE working group http://www.gradeworkinggroup.org/ will be used to assess the quality of evidence across outcomes.<br>Where necessary, GRADE will be modified to meet the needs of the review question.<br><br>GRADE-CERQUAL will be used for qualitative findings. |
| Criteria for quantitative synthesis | Data from eligible studies will be extracted for inclusion in evidence tables. For details please see section 6.4 of Developing NICE guidelines: the manual |
| Methods of quantitative analysis – combining studies and exploring (in)consistency | Data from eligible studies will be meta-analysed (combined) if studies are judged to be similar enough in terms of population, interventions, outcomes, study design or risk of bias.<br>Where appropriate, inconsistency will be explored by conducting subgroup analyses.<br>Where appropriate, inconsistency will be incorporated by performing random-effect analyses<br>If the studies are found to be too heterogeneous to be pooled statistically, a narrative synthesis will be conducted. |
| Meta-bias assessment – publication bias, selective reporting bias | For details please see section 6.2 of Developing NICE guidelines: the manual. |
| Confidence in cumulative evidence | For details please see sections 6.4 and 9.1 of Developing NICE guidelines: the manual |

1

# Appendix B: Literature search strategies

Please see search strategies here

# Appendix C: Public health evidence study selection



# Appendix D: Public health evidence tables

## D.1 Reduction/prevention of aeroallergens using impermeable covers for mattress, bedding, or pillow

de Vries *et al.* 2007

| **Bibliographic reference** | **de Vries MP, van den Bemt L, Aretz K, et al. House dust mite allergen avoidance and self-management in allergic patients with asthma: randomised controlled trial. Br J Gen Pract. 2007 Mar;57(536):184-90. PMID: 17359604** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | People were recruited between September 1999 and December 2001. The last patient was studied in July 2004. | | |
| Objective | To investigate whether house dust mite allergen avoidance using bed coverings impermeable to house dust mites improves outcomes when combined with self-management plans. | | |
| Country/ Setting | Netherland/setting not reported | | |
| Number of participants | 126 | | |
| Participants characteristics | Demographic characteristics of home | Non-polyurethane impermeable covers (Cara C'air) on mattresses, pillows, duvets | Placebo covers |
| | Age in years , mean(SD) | 39.8 (13.2) | 43.9 (11.7) |
| | Gender – reported as male/female | 32/31 | 41/22 |
| | Ethnicity | Not reported | |
| | Geographic environment: | Not reported | |
| | Clinical factors (baseline) | | |
| | HDM sensitization (serum IgE): | 100% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Not reported, but people were excluded from study if allergic to cat or dog while keeping pet | |
| | Smoker in home: | 7% of people were current smokers | |
| Exposure | House dust mite | | |
| Inclusion criteria | • aged between 16 and 60 years,<br>• GP-based diagnosis of asthma, allergy to house dust mites, and requiring ICS | | |
| Exclusion criteria | • serious disease other than asthma with a low survival rate;<br>• other diseases that influence bronchial symptoms and/or lung function (for example, congestive heart failure or respiratory diseases other than asthma);<br>• an exacerbation 1 month before the start of the study; | | |

| Bibliographic reference | **de Vries MP, van den Bemt L, Aretz K, et al. House dust mite allergen avoidance and self-management in allergic patients with asthma: randomised controlled trial. Br J Gen Pract. 2007 Mar;57(536):184-90. PMID: 17359604** | | |
|---|---|---|---|
| | • the use of oral steroids or inhaled cromoglycates;<br>• already using house dust mite impermeable mattress and bedding covers;<br>• allergy to cats or dogs while still keeping these pets. | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Non-polyurethane impermeable covers (Cara C'air) on mattresses, pillows, duvets |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | TIDieR Checklist criteria | Paper/Location | Details |
| | Brief Name | – | Placebo covers |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 2 years | | |
| Study Methods | Method of randomisation | Random number list | |

| Bibliographic reference | de Vries MP, van den Bemt L, Aretz K, et al. House dust mite allergen avoidance and self-management in allergic patients with asthma: randomised controlled trial. Br J Gen Pract. 2007 Mar;57(536):184-90. PMID: 17359604 | | |
|---|---|---|---|
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Differences in people characteristics between the two selection methods (GPs or open) or instruction groups (GPs or nurses) were tested with Student's t-test or $\chi 2$ test depending on the type of variable. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 17% attrition | |
| Outcomes measures and effect size. | | Non-polyurethane impermeable covers on mattresses, pillows, duvets | Placebo covers |
| | Asthma, ACQ, mean: | Mattress cover versus placebo: p=0.27 | |
| | Baseline | 1.13 | 1.05 |
| | Follow-up | 1.03 (no SD reported) n=56 | 1.71 (no SD reported) n=49 |

| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
|---|---|---|---|
| | Random sequence generation | Low | Radom number list generated before trial started |
| | Allocation concealment | Unclear | Not reported |
| | Blinding of participants and personnel | Low | people blinded and most outcomes patient-reported |
| | Blinding of outcome assessment | Low | people blinded and most outcomes patient-reported |
| | Incomplete outcome data | Unclear | moderate attrition rate of 17% but intent-to-treat analysis used |
| | Selective reporting | Low | pre-specified outcomes reported |
| | Other sources of bias | Low | study funded in part by pharmaceutical manufacturers |

| | |
|---|---|
| Overall ROB | Low |
| Source of funding | Netherlands Organisation for Scientific Research (grant no. 904-58-091),<br>the Netherlands Asthma Foundation (project no.98.55),<br>AstraZeneca B.V<br>Boehringer Ingelheim |
| Comments | Data extracted as reported in Lea *et al.* 2018 |
| Additional references | van den Bemt L, de Vries MP, Cloosterman S, et al. (2007) Influence of house dust mite impermeable covers on health-related quality of life of adult patients with asthma: Results of a randomized clinical trial. J Asthma. 44(10):843-8. |

Dharmage *et al.* 2006

| **Bibliographic reference** | **Dharmage S, Walters EH, Thien F, et al. Encasement of bedding does not improve asthma in atopic adult asthmatics. Int Arch Allergy Immunol. 2006 Jan;139(2):132-8.** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | Not reported | | |
| Objective | To assess the impact of HDM-impermeable covers as a single intervention on different clinical asthma outcomes among adult atopic asthmatics attending specialist clinics, whose HDM allergy played a significant role in their asthma. | | |
| Country/ Setting | Australia/setting not reported | | |
| Number of participants | 32 | | |
| Participant characteristics | **Demographic characteristics** | Impermeable covers on mattresses, pillows, doonas (duvet) | Placebo cotton covers |
| | Age, mean | 30 years | 33 years |
| | % Male | 37% | |
| | Race | Not reported | |
| | Geographic environment: | Not reported | |
| | **Clinical factors (baseline)** | | |
| | HDM Sensitization (skin prick test positive) | 100% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | 75% | |
| | Cat/dog in home: | 23% had cats | |
| | Smoker in home: | Not reported but current smokers not eligible for enrolment | |
| Exposure | House dust mite | | |
| Inclusion criteria | People in whom dust exposure was considered a trigger factor for asthma, who have<br>• taken short-acting agonists during the last 2 weeks,<br>• who have a positive MCh challenge test (PD 20 FEV 1 ! 2 mg MCh),<br>• a SPT wheal of 6 5 mm for HDM allergen extract with a positive histamine control and<br>• a negative saline control and have perennial asthma. | | |
| Exclusion criteria | • people on oral steroids,<br>• people on inhaled steroids greater than 2,400 micro g per day,<br>• current smokers<br>• ex-smokers greater than 10 pack years<br>• FEV 1 less than 1.0 litre. | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |

| **Bibliographic reference** | **Dharmage S, Walters EH, Thien F, et al. Encasement of bedding does not improve asthma in atopic adult asthmatics. Int Arch Allergy Immunol. 2006 Jan;139(2):132-8.** | | |
|---|---|---|---|
| | Brief Name | – | Impermeable covers on mattresses, pillows, doonas |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | NA |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 6 months | | |
| Study Methods | Method of randomisation | Stratified randomisation in blocks and then allocated by coin toss | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | The statistical significance of the difference in the baseline characteristics between the two groups was examined using either two-sample parametric or non-parametric tests depending on the distribution of the data | |
| | Unit of allocation | Individual | |

| Bibliographic reference | **Dharmage S, Walters EH, Thien F, et al. Encasement of bedding does not improve asthma in atopic adult asthmatics. Int Arch Allergy Immunol. 2006 Jan;139(2):132-8.** | | |
|---|---|---|---|
| | Unit of analysis | Individual | |
| | Attrition | 6% attrition | |
| Outcomes measures and effect size. | | Impermeable covers on mattresses, pillows, doonas | Placebo cotton covers |
| | Asthma | Not reported | |
| | Exacerbations and healthcare utilisation | | |
| | Puffs per day, mean change (95% CI): | 0.36 (-0.14 to 0.85) | 0.20 (-0.02 to 0.43) |
| | Pulmonary physiology | | |
| | Peak flow variability, mean change (95% CI): | 1.95 (-0.05 to 3.9) | 0.50 (-1.50 to 2.50) |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Low | Coin toss |
| | Allocation concealment | Low | Not reported |
| | Blinding of participants and personnel | Low | participants and assessors blinded; |
| | Blinding of outcome assessment | Low | participants and assessors blinded; |
| | Incomplete outcome data | Low | low attrition; |
| | Selective reporting | Low | pre-specified outcomes reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | Victorian Health Promotion Foundation<br>Department of Human Services | | |
| Comments | Data extracted as reported in Lea *et al.* 2018<br>Risk of bias assessment taken from Lea *et al.* 2018 | | |
| Additional references | | | |

Gehring *et al.* 2012

| Bibliographic reference | **Gehring U, de Jongste J C, Kerkhof M et.al. 2012. "The 8-year follow-up of the PIAMA intervention study assessing the effect of mite-impermeable mattress covers". Allergy 67(2):248-56.** |
|---|---|
| Registration | Not reported |
| Study type | Randomised controlled study |
| Study dates | Between March 1996 and May 1997 |
| Objective | To study the effect of an early intervention with mite-impermeable mattress covers on HDM allergen levels and the development of asthma and mite allergy throughout the first 8 years of life |
| Country/ Setting | Netherlands |

| **Bibliographic reference** | **Gehring U, de Jongste J C, Kerkhof M et.al. 2012. "The 8-year follow-up of the PIAMA intervention study assessing the effect of mite-impermeable mattress covers". Allergy 67(2):248-56.** | | |
|---|---|---|---|
| Number of participants | 810 | | |
| Participant characteristics | **Demographic characteristics** | Placebo cover | Active cover |
| | | n (%) | n (%) |
| | Age (months) Mean (SD) | Not reported | Not reported |
| | Sex (female) | 148/338 (44) | 210/383 (55) |
| | Ethnicity | Not reported | Not reported |
| | Socio-economic status (education) | | |
| | Mother low educational level | 73/332 (22) | 86/371 (23) |
| | Father low educational level | 77/321 (24) | 97/366 (27) |
| | Building characteristics | | |
| | Damp/mould spots | 41/325 (13) | 52/366 (14) |
| | Existing condition | | |
| | Allergic to HDM | 224/332 (67) | 248/378 (66) |
| Exposure | House dust mite (HDM) | | |
| Inclusion criteria | Infants at risk of allergies<br>Mothers were recruited during their second trimester of pregnancy | | |
| Exclusion criteria | Not reported | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P248 | Assessing the effect of mite-impermeable mattress covers |
| | Rationale/theory/Goal | P248 | To study the effect of an early intervention with mite-impermeable mattress covers on HDM allergen levels and the development of asthma and mite allergy throughout the first 8 years of life |
| | Materials used | P249 | Mite-impermeable polyester-cotton mattress and pillow covers |
| | Procedures used | P249 | Impermeable covers applied to parental bed(s) and the child’s bed |

| Bibliographic reference | Gehring U, de Jongste J C, Kerkhof M et.al. 2012. "The 8-year follow-up of the PIAMA intervention study assessing the effect of mite-impermeable mattress covers". Allergy 67(2):248-56. | | |
|---|---|---|---|
| | Provider | P249 | ACb; Allergy Control Products, Saratoga Springs, NY, USA |
| | Method of delivery | – | Not applicable |
| | Location | – | Intervention delivered at home |
| | Duration | P249 | 8 years |
| | Intensity | – | Not applicable |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P248 | Assessing the effect of mite-impermeable mattress covers |
| | Rationale/theory/Goal | P248 | To study the effect of an early intervention with mite-impermeable mattress covers on HDM allergen levels and the development of asthma and mite allergy throughout the first 8 years of life |
| | Materials used | P249 | Cotton placebo covers |
| | Procedures used | P249 | Cotton placebo covers applied to parental bed(s) and the child's bed |
| | Provider | – | Not reported |
| | Method of delivery | – | Not applicable |
| | Location | – | Intervention delivered at home |
| | Duration | P249 | 8 years |
| | Intensity | – | Not applicable |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Follow up | 8 years | | |

| Bibliographic reference | **Gehring U, de Jongste J C, Kerkhof M et.al. 2012. "The 8-year follow-up of the PIAMA intervention study assessing the effect of mite-impermeable mattress covers". Allergy 67(2):248-56.** | | |
|---|---|---|---|
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Linear regression was used to compare allergen levels between study groups.<br>Associations of binary outcomes assessed at the age of 8 years only with study group and HDM allergen levels were analysed by generalized linear models with a log link. Intention-to-treat analysis employed | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of participants completing the study: not reported | Reasons for not completing the study:<br>Not reported |
| Outcomes measures and effect size. | Adjusted risk ratio (RR) between the intervention and health outcomes during the first 8 years of life | | |
| | Health outcome | RR (95% CI) | |
| | Asthma | 0.87 (0.60 to 1.28) | |
| | Dermatitis (atopic eczema) | 1.05 (0.86 to 1.29) | |
| | Allergic rhinitis (hay fever) | 0.88 (0.52 to 1.47) | |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Unclear | Not reported |
| | Allocation concealment | Unclear | Not reported |
| | Blinding of participants and personnel | Low | Participants were blinded to interventions received |
| | Blinding of outcome assessment | High | Not reported |
| | Incomplete outcome data | Unclear | Not reported but intention-to-treat analysis conducted |
| | Selective reporting | Low | Pre-specified outcomes reported |
| | Other sources of bias | None | None |
| Overall ROB | Low | | |
| Source of funding | Study was supported by The Netherlands Organization for Health Research and Development; The Netherlands Organization for Scientific Research; The Netherlands Asthma Fund; The Netherlands Ministry of Spatial Planning, Housing, and the Environment; and The Netherlands Ministry of Health, Welfare, and Sport. | | |
| Comments | | | |
| Additional references | Corver K, Kerkhof M, Brussee J E, Brunekreef B, Van Strien, R T, Vos A P, Smit H A, Gerritsen J, Neijens H J, De Jongste , and J C. 2006. "House dust mite allergen reduction and allergy at 4 yr: Follow up of the PIAMA-study". Pediatric Allergy and Immunology 17(5):329-336. | | |

Luczynska *et al.* 2003

| **Bibliographic reference** | **Luczynska C, Tredwell E, Smeeton N, et al. A randomized controlled trial of mite allergen-impermeable bed covers in adult mite-sensitized asthmatics. Clin Exp Allergy. 2003 Dec; 33(12):1648-53.** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | Not reported | | |
| Objective | To assess whether the use of allergen-impermeable bed covers, as a single intervention, resulted in an improvement in allergic disease outcomes in those people most likely to benefit from allergen avoidance | | |
| Country/ Setting | UK/setting not reported | | |
| Number of participants | 55 | | |
| Participant characteristics | **Demographic characteristics** | Microfiber impermeable covers (Allerguard) on mattresses, pillows, duvets | Placebo covers |
| | Age, mean | 36 years (range 18 to 54 years) | |
| | % of male | 49% (not reported by groups) | |
| | Race | Not reported | |
| | Geographic environment: | Urban | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (serum IgE): | 100% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Not reported, but people were excluded from study if allergic to cat or dog while keeping pet | |
| | Smoker in home: | Not reported | |
| Inclusion criteria | • Diagnosis of asthma<br>• Aged 18 to 54 years<br>• At least one prescription for inhaled steroids in the last 12 months<br>• Provided consent | | |
| Exclusion criteria | • Cat-allergic and living with a cat<br>• Dog-allergic and living with a dog<br>• More than one bed in the bedroom<br>• Pregnant<br>• Planning to move house.<br>• Someone else in household already in the study | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Microfiber impermeable covers |

| Bibliographic reference | Luczynska C, Tredwell E, Smeeton N, et al. A randomized controlled trial of mite allergen-impermeable bed covers in adult mite-sensitized asthmatics. Clin Exp Allergy. 2003 Dec; 33(12):1648-53. | | |
|---|---|---|---|
| | | | (Allerguard) on mattresses, pillows, duvets |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Placebo covers |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | All analyses were adjusted for the age and sex of the participants. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 18% attrition | |

| Bibliographic reference | **Luczynska C, Tredwell E, Smeeton N, et al. A randomized controlled trial of mite allergen-impermeable bed covers in adult mite-sensitized asthmatics. Clin Exp Allergy. 2003 Dec; 33(12):1648-53.** | | |
|---|---|---|---|
| Outcomes measures and effect size. | | Microfiber impermeable covers | Placebo covers |
| | Pulmonary physiology | | |
| | PEFR, mean (95% CI): | | |
| | Follow-up (12 months) | 367 (289 to 445) n=16 | 388 (350 to 428) n=15 |
| | Quality of life (QoL) | | |
| | Marks Asthma Quality of Life Questionnaire, mean decrease in square root of score (95% CI) higher score is worse | 0.44 (-0.25 to 1.14) n=16 | 0.69 (-0.04 to 1.42) n=15 |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | Insufficient description of randomization; |
| | Allocation concealment | Unclear | Insufficient description of randomization; |
| | Blinding of participants and personnel | Low | people blinded and most outcomes patient-reported; |
| | Blinding of outcome assessment | Low | people blinded and most outcomes patient-reported; |
| | Incomplete outcome data | Low | intent-to-treat analysis found similar results |
| | Selective reporting | Low | pre-specified outcomes reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | Department of Health | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |
| Additional references | | | |

Murray *et al.* 2017

| Bibliographic reference | **Murray CS, Foden P, Sumner H, et al. Preventing severe asthma exacerbations in children: a randomised trial of mite impermeable bedcovers. Am J Respir Crit Care Med. 2017** |
|---|---|
| Registration | ISRCTN 69543196 |
| Study type | RCT |
| Study dates | Participants were recruited between November 2011 and May 2013 and were followed for 12 months |
| Objective | To compare the effect of mite-impermeable bedcovers with that of placebo bedcovers in reducing the risk of severe asthma exacerbations in mite-sensitized children |

| Bibliographic reference | **Murray CS, Foden P, Sumner H, et al. Preventing severe asthma exacerbations in children: a randomised trial of mite impermeable bedcovers. Am J Respir Crit Care Med. 2017** | | |
|---|---|---|---|
| Country/ Setting | UK/setting not reported in the study | | |
| Number of participants | 284 | | |
| Participant characteristics | **Demographic characteristics** | Impermeable covers on mattresses, pillows, duvets n=146 | Placebo covers n=138 |
| | Age, mean (SD) | 7.11 (3.49) | 7.45 (3.55) |
| | % male | 66% (not reported by groups) | |
| | Race | | |
| | White | 64% (not reported by groups) | |
| | Asian | 25% (not reported by groups) | |
| | Other | 1% (not reported by groups) | |
| | Homeownership | Not reported in the study | |
| | Geographic environment | Not reported in the study | |
| | Clinical factors | | |
| | HDM Sensitization (skin prick test positive): | 100% | |
| | Asthma severity, % GINA step 1/2/3/4/5: | 6.8% / 45.2% / 33.6% / 14.4% / 0.0% | 3.6% / 48.6% / 34.8% / 12.3% / 0.7% |
| | Comorbidity | | |
| | Hay fever | 35.7% | 30.6% |
| | Eczema | 40.7% | 51.8% |
| | Carpeted bedrooms: | Not reported in the study | |
| | Cat/dog in home and sensitized: | 21.2% | 21.0% |
| | Smoker in home | 45.9% | 41.3% |
| Exposure | House dust mite | | |
| Inclusion criteria | Children<br>• aged 3 to 17 years with physician-diagnosed asthma who had presented to the hospital with an asthma exacerbation.<br>• sensitized (wheal diameter was at least 3 mm greater than the negative control) to HDM (with or without other allergens) | | |
| Exclusion criteria | Children<br>• already using allergen-impermeable bedding, if they had been born prematurely (<36 weeks), or<br>• if they had another respiratory disease. | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |

| Bibliographic reference | **Murray CS, Foden P, Sumner H, et al. Preventing severe asthma exacerbations in children: a randomised trial of mite impermeable bedcovers. Am J Respir Crit Care Med. 2017** | | |
|---|---|---|---|
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Impermeable covers (Astex Pristine) on mattresses, pillows, duvets |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Placebo covers |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Computer based minimisation | |

| Bibliographic reference | **Murray CS, Foden P, Sumner H, et al. Preventing severe asthma exacerbations in children: a randomised trial of mite impermeable bedcovers. Am J Respir Crit Care Med. 2017** | | |
|---|---|---|---|
| | Method of allocation concealment | Identical information provided | |
| | Statistical method(s) used to analyse data | Baseline characteristics were compared between groups using t tests, the Mann-Whitney U test, and chi-square tests as appropriate.<br>Efficacy analysis was performed according to the intention-to-treat principles | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 15% | |
| Outcomes measures and effect size | | Impermeable covers on mattresses, pillows, duvets<br>n=123 | Placebo covers<br>n=118 |
| | Asthma, ACQ, mean difference (95% CI) | -0.56 (-0.18 to -0.93) | -0.25 (-0.61 to 0.11) |
| | Quality of life, PACQLQ, mean difference (95% CI) lower values are better | 0.50 (0.14 to 0.80) | 0.57 (0.12 to 1.02) |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Low | computer-based minimization procedure |
| | Allocation concealment | Low | All participants received identical printed washing instructions |
| | Blinding of participants and personnel | Low | Participant blinded |
| | Blinding of outcome assessment | Low | Assessors blinded to participant allocation |
| | Incomplete outcome data | Low | intent-to-treat analysis |
| | Selective reporting | Low | pre-specified outcomes reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | J. P. Moulton Charitable Foundation | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |
| Additional references | | | |

Sheikh *et al.* 2002

| **Bibliographic reference** | **Sheikh A, Hurwitz B, Sibbald B, et al. House dust mite barrier bedding for childhood asthma: randomised placebo-controlled trial in primary care [ISRCTN63308372]. BMC Fam Pract. 2002 Jun 18;1-6. PMID: 12079502** | | |
|---|---|---|---|
| Registration | ISRCTN63308372 | | |
| Study type | RCT | | |
| Study dates | Study was conducted between 1998 and 1999 | | |
| Objective | To evaluate the effectiveness of semipermeable house dust mite barrier bedding in children sensitised to the dust mite | | |
| Country/ Setting | UK/setting not reported | | |
| Number of participants | 47 | | |
| Participant characteristics | **Demographic characteristics** | Impermeable covers on mattresses, pillows, duvets (n=26) | Placebo covers (n=21) |
| | Age, mean | 11 year, range of eligible people 5 to 14 | |
| | % of male | 62% (not reported by groups) | |
| | Race | Not reported | |
| | Geographic environment: | Not reported | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (skin prick test positive) | 100% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Pet owners were excluded from study | |
| | Smoker in home: | Not reported | |
| Exposure | House dust mite | | |
| Inclusion criteria | Children<br>• aged 5 to 14 years with a recorded diagnosis of asthma and who had been prescribed one or more asthma treatments in the preceding six months,<br>• with a clinical history suggestive of house dust mite allergy, as judged by a positive response to the question 'has your child's asthma ever got worse when the bed is made or when the vacuuming or dusting is done?' and a positive response to Der p1 was defined as a weal of at least five millimetres greater than that induced by the negative control. | | |
| Exclusion criteria | • dermographism (because of the difficulty in interpreting skin prick test results),<br>• children who did not use a duvet,<br>• children already using allergy control bedding, and cat or dog ownership. | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Impermeable covers (Allerayde) on |

| Bibliographic reference | Sheikh A, Hurwitz B, Sibbald B, et al. House dust mite barrier bedding for childhood asthma: randomised placebo-controlled trial in primary care [ISRCTN63308372]. BMC Fam Pract. 2002 Jun 18;1-6. PMID: 12079502 | | |
|---|---|---|---|
| | | | mattresses, pillows, duvets |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Placebo covers |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Random numbers table | |
| | Method of allocation concealment | All people were given identical advice and written instructions | |
| | Statistical method(s) used to analyse data | Normally distributed data were analysed using student t-test and mean values and standard deviations calculated; the Mann Whitney test was used for non-parametric data and medians and inter-quartile ranges calculated. | |

| Bibliographic reference | **Sheikh A, Hurwitz B, Sibbald B, et al. House dust mite barrier bedding for childhood asthma: randomised placebo-controlled trial in primary care [ISRCTN63308372]. BMC Fam Pract. 2002 Jun 18;1-6. PMID: 12079502** | | |
|---|---|---|---|
| | | Categorical data were analysed using Chi-square test or Fisher's exact test in the event of small numbers | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 8% attrition | |
| Outcomes measures and effect size. | PEF, self-reported symptoms scores for asthma (cough, wheeze, shortness of breath and chest tightness) and rhinitis (sneeze, runny nose, blocked nose) symptoms on a four-point Likert scale (0 to 3), healthcare utilization | | |
| | | Impermeable covers on mattresses, pillows, duvets (n=23) | Placebo covers (n=20) |
| | Pulmonary physiology | | |
| | PEFR, mean change litres/min (SD): | 16.38 (25.62) n=23 | 13.68 (43.14) n=20 |
| | Symptoms, patient diaries | | |
| | Asthma symptoms score, mean change (SD): (cough, wheeze, shortness of breath, chest tightness) | -3.40 (29.50) n=23 | -18.10 (27.80) n=20 |
| | Rhinitis symptoms score, mean change (SD): | -31.14 (35.79) n=23 | -22.67 (30.70) n=20 |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Low | Random numbers table |
| | Allocation concealment | Low | Identical information provided to both groups |
| | Blinding of participants and personnel | Low | participants and assessors blinded |
| | Blinding of outcome assessment | Low | participants and assessors blinded; |
| | Incomplete outcome data | Low | low attrition; |
| | Selective reporting | Low | pre-specified outcomes reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | National Respiratory Training Centre, | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |
| Additional references | | | |

Terreehorst *et al.* 2003

| **Bibliographic reference** | **Terreehorst I, Hak E, Oosting AJ et.al. 2003. "Evaluation of impermeable covers for bedding in patients with allergic rhinitis". The New England journal of medicine 349(3):237-46.** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | Randomised controlled study | | |
| Study dates | Not reported | | |
| Objective | To determine the effects of impermeable bedding covers in the bedrooms on the signs and symptoms of disease in people with rhinitis who were sensitized to house-dust mites | | |
| Country/ Setting | Netherlands | | |
| Number of participants | 297 | | |
| Participant characteristics | **Demographic characteristics** | Impermeable-Cover Group (n=114) | Control Group (n=118) |
| | | n (%) | n (%) |
| | Age Mean (SD) | 25.7±1.1 | 26.9±1.1 |
| | Sex (male) | 44 (38.6) | 50 (42.4) |
| | Ethnicity | Not reported | Not reported |
| | Socio-economic status (education) | Not reported | Not reported |
| | Building characteristics | Not reported | Not reported |
| | Existing condition (atopy) | | |
| | Dermatitis | 30 (26.3) | 28 (23.7) |
| | Asthma | 53 (46.5) | 57 (48.3) |
| Exposure | House dust mite | | |
| Inclusion criteria | • An age of 8 to 50 years<br>• People not pregnant or lactating<br>• No bedding covers in place or people willing to remove them for the duration of the study<br>• Clinical history of allergic rhinitis and a positive nasal allergen-provocation test with house-dust-mite allergen<br>• RAST class ≥2, skin-test index ≥0.7 for house-dust mite, or both<br>• ≥0.2 microgram of Der p1 or Der f1 per gram of dust in sample from mattress | | |
| Exclusion criteria | Pets at home and a positive skin test (index ≥0.7), RAST class ≥2, or both for the pet allergen<br>Daily use of inhaled corticosteroids ≥1600 microgram/day (in adults) or ≥800 microgram/day (in children)<br>Daily use of oral corticosteroids<br>Daily use of cyclosporine<br>Regular use of antibiotics for upper or lower airway infection<br>Regular use of oral corticosteroids for exacerbations of asthma | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Terreehorst I, Hak E, Oosting AJ et.al. 2003. "Evaluation of impermeable covers for bedding in patients with allergic rhinitis". The New England journal of medicine 349(3):237-46.** | | |
| | Brief Name | P237 | Effect of impermeable mattress covers on allergic rhinitis |
| | Rationale/theory/Goal | P237 | To determine the effects of impermeable bed covers in the bedrooms on the signs and symptoms of disease in people with rhinitis who were sensitized to house-dust mites |
| | Materials used | P238 | Impermeable bedding covers |
| | Procedures used | P239 | Covers were put on pillows, duvets, and mattresses after base-line dust collection |
| | Provider | – | Not applicable |
| | Method of delivery | – | Not applicable |
| | Location | P239 | Intervention delivered at home |
| | Duration | P237 | 12 months |
| | Intensity | – | Not applicable |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P237 | Effect of impermeable mattress covers on allergic rhinitis |
| | Rationale/theory/Goal | P237 | To determine the effects of impermeable bed covers in the bedrooms on the signs and symptoms of disease in people with rhinitis who were sensitized to house-dust mites |
| | Materials used | P238 | Non impermeable bedding to covers |
| | Procedures used | P239 | Covers were put on pillows, duvets, and mattresses after base-line dust collection |
| | Provider | – | Not applicable |
| | Method of delivery | – | Not applicable |

| Bibliographic reference | Terreehorst I, Hak E, Oosting AJ et.al. 2003. "Evaluation of impermeable covers for bedding in patients with allergic rhinitis". The New England journal of medicine 349(3):237-46. | | |
|---|---|---|---|
| | Location | P239 | Intervention delivered at home |
| | Duration | P237 | 12 months |
| | Intensity | – | Not applicable |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Central computerized randomization schedule | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Effectiveness was estimated with the use of unpaired t-tests to assess the mean difference between groups (or the mean ratio, for log-transformed variables) in changes from baseline in the scores on the visual-analogue scale and in the secondary end-points and their corresponding 95 percent confidence intervals. Intention-to-treat analysis was performed with the use of data on all 232 people | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of participants completing the study: 232 | Reasons for not completing the study:<br>Moved house<br>Study too stressful<br>Study took much time<br>Pregnancy<br>Matrass encasing too hot<br>Use of topical steroids |
| Outcomes measures and effect size | | Impermeable-cover Group (n=114) | Control group (n=118) |
| | Allergic rhinitis severity as measured by the Rhinitis-specific visual analogue scale at 12 months | | |
| | Base-line score Mean (SD) | 52.18 (2.89) | 49.82 (2.76) |
| | 12 month score Mean (SD) | 42.35 (2.79) | 38.96 (2.68) |
| | Mean change (95% CI) | -9.83 (-15.28 to -4.39) | -10.86 (-16.64 to -5.09) |
| | **Outcome** | **Judgement** | **Comments** |

| Bibliographic reference | Terreehorst I, Hak E, Oosting AJ et.al. 2003. "Evaluation of impermeable covers for bedding in patients with allergic rhinitis". The New England journal of medicine 349(3):237-46. | | |
|---|---|---|---|
| Risk of bias (ROB) | Random sequence generation | Low | Central computerised randomisation schedule |
| | Allocation concealment | High | Not reported |
| | Blinding of participants and personnel | Low | Participants blinded to intervention and control measures |
| | Blinding of outcome assessment | Low | Dust sampling was performed by trained students blinded to clinical measurements |
| | Incomplete outcome data | Unclear | 22% total loss to follow up in total. Data analysed by intention-to-treat |
| | Selective reporting | Low | Pre-specified outcomes reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | Supported by the Netherlands Organization for Health Research and Development. | | |
| Comments | None | | |

Woodcock *et al.* 2003

| Bibliographic reference | Woodcock A, Forster L, Matthews E, et al. Control of exposure to mite allergen and allergen-impermeable bed covers for adults with asthma. N Engl J Med. 2003 Jul 17; 349(3):225-36. | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | Published 2003 | | |
| Objective | To determine if allergen-impermeable bed covers improve asthma control. | | |
| Country/ Setting | UK/setting not reported | | |
| Number of participants | 1,122 | | |
| Participant characteristics | **Demographic characteristics** | Impermeable covers (Allergy Control Products) on mattresses, pillows, quilt covers | Placebo polyester-cotton covers |
| | Age, mean | 37 years (range 18 to 50 years) | |
| | % of male | 36% (not reported by groups) | |
| | Race | 98% White | |
| | Geographic environment: | Not reported | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (serum IgE): | 65% | |
| | Asthma severity: | Not reported | |

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Woodcock A, Forster L, Matthews E, et al. Control of exposure to mite allergen and allergen-impermeable bed covers for adults with asthma. N Engl J Med. 2003 Jul 17; 349(3):225-36.** | | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | not reported | |
| | Cat/dog in home: | 55% | |
| | Smoker in home: | 23% | |
| Inclusion criteria | People 18 to 50 years of age with physician-diagnosed asthma who were regularly taking inhaled corticosteroids | | |
| Exclusion criteria | People already using allergen-impermeable bed covers or using less than 100 microgram of albuterol per day or the equivalent | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Impermeable covers (Allergy Control Products) on mattresses, pillows, quilt covers |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Placebo polyester-cotton covers |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |

| Bibliographic reference | **Woodcock A, Forster L, Matthews E, et al. Control of exposure to mite allergen and allergen-impermeable bed covers for adults with asthma. N Engl J Med. 2003 Jul 17; 349(3):225-36.** | | |
|---|---|---|---|
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 6 months | | |
| Study Methods | Method of randomisation | Not reported in the review | |
| | Method of allocation concealment | Not reported in the review | |
| | Statistical method(s) used to analyse data | Not reported in the review | |
| | Unit of allocation | Not reported in the review | |
| | Unit of analysis | Not reported in the review | |
| | Attrition | 16% attrition | |
| Outcomes measures and effect size. | | Impermeable covers (Allergy Control Products) on mattresses, pillows, quilt covers (n=480) | Placebo polyester-cotton covers (n=485) |
| | Peak flow, mean litres/minute: | Mattress cover versus placebo: adjusted difference (95% CI): -1.6 (-5.9 to 2.7), p=0.46 | |
| | Baseline | 410.7 | 417.8 |
| | Follow-up | 419.1 | 427.4 |
| | Quality of life | | |
| | George's Respiratory Questionnaire, number (%) of people reporting that their quality of life had improved: | 351/492 (71.3) | 357/498 (71.7) |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Low | Method not reported |
| | Allocation concealment | Low | Method not reported |
| | Blinding of participants and personnel | Low | reported as double-blind but no further details provided |
| | Blinding of outcome assessment | Low | reported as double-blind but no further details provided |
| | Incomplete outcome data | Low | 16% attrition |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | National Health Service Research and Development Programme | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |

| | |
|---|---|
| **Bibliographic reference** | **Woodcock A, Forster L, Matthews E, et al. Control of exposure to mite allergen and allergen-impermeable bed covers for adults with asthma. N Engl J Med. 2003 Jul 17; 349(3):225-36.** |
| Additional references | |

## D.3 Reduction/prevention of aeroallergens using multicomponent behavioural interventions

Arshad *et al.* 2002

| **Bibliographic reference** | **Arshad S H, Bojarskas J, Tsitoura S, Matthews S, Mealy B, Dean T, Karmaus W, Frischer T, Kuehr J, Forster J, and group Space study (2002) Prevention of sensitization to house dust mite by allergen avoidance in school age children: a randomized controlled study. Clinical and experimental allergy: Journal of the British Society for Allergy and Clinical Immunology 32(6), 843-9** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | Randomised controlled study | | |
| Study dates | June 1997 to June 1998 | | |
| Objective | To prevent development of sensitization to house dust mite in atopic school age children, who are not house dust mite sensitive at enrolment | | |
| Country/ Setting | UK, Greece, Lithuania | | |
| Number of participants | 242 children aged 5 to 7 years<br>Control group (n=115), intervention group (n=127), | | |
| Participant characteristics | **Demographic characteristics** | Control<br>% (n/total n) | Intervention<br>% (n/total n) |
| | Age Mean (95% confidence interval) | 6.61 (6.36-6.82) | 6.72 (6.56-6.88) |
| | Sex (male) | 59.1 (68/115) | 60.6 (77/127) |
| | Ethnicity | Not reported | Not reported |
| | Socio-economic status (education) | | |
| | University education mother | 41.6 (47/113) | 34.7 (43/124) |
| | University education father | 45.9 (50/109) | 34.1 (42/123) |
| | Existing condition (family atopy) | | |
| | Maternal asthma | 10.9 (12/110) | 7.1 (9/126) |
| | Paternal asthma (n/total n; %) | 7.4 (8/108) | 5.6 (7/127) |
| | Sibling asthma | 14.5 (16/110) | 14.5 (17/117) |
| | Existing conditions | | |
| | Ever (asthma, eczema or hayfever, at least one) | 51.3 (59/115) calculated by NICE | 52 (66127) calculated by NICE |
| | Wheezing | 23/115 (20) | 30/127 (23.62) |
| | Smoking in the house | 38.3 (44/115) | 39.7 (50/126) |
| | Pets (cat and/or dog) | 29.8 (34/114) | 37.6 (50/126) |
| Inclusion criteria | • Children aged 5 to 7 years<br>• Positive family history of atopy (asthma, eczema and hayfever) established by questionnaire | | |

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Arshad S H, Bojarskas J, Tsitoura S, Matthews S, Mealy B, Dean T, Karmaus W, Frischer T, Kuehr J, Forster J, and group Space study (2002) Prevention of sensitization to house dust mite by allergen avoidance in school age children: a randomized controlled study. Clinical and experimental allergy: Journal of the British Society for Allergy and Clinical Immunology 32(6), 843-9** | | |
| | • Sensitization to one or more common aeroallergens on skin prick test, in absence of sensitization to house dust mite | | |
| Exclusion criteria | Not specified | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P844 | Multicomponent programme of reduced aeroallergen exposure |
| | Rationale/theory/Goal | P844 | To control for house dust mite and contact allergen exposure |
| | Materials used | P844 | Allergen-impermeable mattress cover (ACb®, DR Beckmann GmbH)<br>Verbal advice and recommendations |
| | Procedures used | P844-845 | Mattress on the child's bed and on any other bed in the same room was encased<br>Children were discouraged from sleeping in, or playing on, beds that were not covered, and to avoid sleeping in bottom bed of bunk bed<br>Advice on carpet removal, type of curtains (hot wash)<br>Advice on hot wash of soft toys, beddings, pillows and bedding<br>Advice on ventilation of child's bedroom<br>Advice on damp cloth for dusting, weekly vacuum cleaning in absence of child<br>Recommendation on toy storage<br>Recommendation on smoke and pet free house |
| | Provider | P845 | Health professionals |
| | Method of delivery | P845 | Face to face |
| | Location | P845 | Intervention delivered at home |
| | Duration | P845 | 6 months |
| | Intensity | – | – |
| | Tailoring/adaptation | P845 | Tailored to home |
| | Modifications | – | Not reported |

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Arshad S H, Bojarskas J, Tsitoura S, Matthews S, Mealy B, Dean T, Karmaus W, Frischer T, Kuehr J, Forster J, and group Space study (2002) Prevention of sensitization to house dust mite by allergen avoidance in school age children: a randomized controlled study. Clinical and experimental allergy: Journal of the British Society for Allergy and Clinical Immunology 32(6), 843-9** | | |
| | Planned treatment fidelity | P845 | Compliance was reinforced and checked during visits |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | None |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P845 | Standard care |
| | Rationale/theory/Goal | P845 | To control for house dust mite and contact allergen exposure |
| | Materials used | P845 | Information booklet on general information on allergy and allergic disorder and routine advice on avoidance of exposure to pet in child's bedroom, ventilation, and avoidance of smoking in child's presence |
| | Procedures used | – | Not applicable |
| | Provider | P845 | Health professionals |
| | Method of delivery | P845 | Booklet |
| | Location | – | No applicable |
| | Duration | P845 | 6 months |
| | Intensity | – | Not applicable |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Randomisation based on first day of contact, block randomisation of a 2-week period | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Proportional data were cross-tabulated and compared using chi-square test for two-sided significance | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of participants completing the study: control group (n=96), | Reasons for not completing the study: Lost to follow up (control group n=19, intervention group n=10), refused follow up (control group n=13, |

| Bibliographic reference | **Arshad S H, Bojarskas J, Tsitoura S, Matthews S, Mealy B, Dean T, Karmaus W, Frischer T, Kuehr J, Forster J, and group Space study (2002) Prevention of sensitization to house dust mite by allergen avoidance in school age children: a randomized controlled study. Clinical and experimental allergy: Journal of the British Society for Allergy and Clinical Immunology 32(6), 843-9** | | |
|---|---|---|---|
| | | intervention group (n=117) | intervention group n=8), moved from the area (control group n=3, intervention group n=1), could not be contacted (control group n=3, intervention group n=1) |
| Outcomes measures and effect size. | | Control<br>% (n/total n) | Intervention<br>% (n/total n) |
| | Number of children with wheeze at baseline | 20 (23/115) | 23.62 (30/127) |
| | Number of children with wheeze at follow up | 25.22 (29/115) | 22.05 (28/127) |
| | Number of children with wheeze at baseline who stopped wheezing at follow up | 21.7 (5/23) | 46.66 (14/30) |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | High | Randomisation based on first day of contact, block randomisation of a 2-week period |
| | Allocation concealment | Unknown | Not reported |
| | Blinding of participants and personnel | High | Participant not blinded as no placebo cover sent |
| | Blinding of outcome assessment | Low | Assessor blinded to study allocation |
| | Incomplete outcome data | High | Attrition in control group was 17% in intervention group it was 8%, reason for attrition was similar |
| | Selective reporting | Low | All outcomes are reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | European Commission | | |
| Comments | | | |
| Additional references | | | |

Barnes *et al.* 2008

| Bibliographic reference | **Barnes Charles S, Kennedy Kevin, Gard Luke, Forrest Erika, Johnson Linda, Pacheco Freddy, Hu Frank, Amado Mercedes, and Portnoy Jay M (2008) The impact of home cleaning on quality of life for homes with asthmatic children. Allergy and asthma proceedings 29(2), 197-204** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | Randomised controlled study | | |
| Study dates | Not reported | | |
| Objective | To test the ability of regular cleaning using a combination of products, many containing dilute hypochlorite, to produce an improvement in the quality of life (QOL) of asthmatic children and their parents | | |
| Country/ Setting | US | | |
| Number of participants | 193 families with children aged 2 to 17 years<br>Families with children with asthma (n=97), Families with children with asthma (n=96) | | |
| Participant characteristics | **Demographic characteristics of home** | Not reported | |
| | Age | Not reported | |
| | Sex | Not reported | |
| | Ethnicity | Not reported | |
| | Socio-economic status | Not reported | |
| | Existing conditions | Not reported | |
| Inclusion criteria | • Homes that housed at least three persons with at least one person between 2 and 17 years of age<br>• Homes in people with asthma included at least one child with persistent asthma as defined by National Heart, Lung, and Blood Institute guidelines or one child with other chronic respiratory symptoms including rhinitis or bronchitis<br>• The family must have lived in the same home, either rental or self-owned, for at least 2 months. | | |
| Exclusion criteria | • Home where an occupant stated they were allergic or sensitive to bleach-based products<br>• Home that was grossly contaminated with fungi, was mechanically unsound, or was generally unsafe | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P198 | Cleaning products and instructions for fungal control |
| | Rationale/theory/Goal | P198 | To improve QOL of children with asthma and their parents using regular cleaning with combination of cleaning products |
| | Materials used | P198 | Ultra Clorox Bleach, Clorox Clean Up, Clorox Disinfecting |

| Bibliographic reference | Barnes Charles S, Kennedy Kevin, Gard Luke, Forrest Erika, Johnson Linda, Pacheco Freddy, Hu Frank, Amado Mercedes, and Portnoy Jay M (2008) The impact of home cleaning on quality of life for homes with asthmatic children. Allergy and asthma proceedings 29(2), 197-204 | | |
|---|---|---|---|
| | | | Wipes, Ready Mop, Clorox Toilet Bowl Cleaner, Clorox Disinfecting Spray, and Clorox Toilet Bowl Automatic Cleaning Tablets |
| | Procedures used | P198 | Usage charts, cleaning protocols describing how to use the products, and diaries for their respective sets of products |
| | Provider | – | Not reported |
| | Method of delivery | P198 | Face to face and phone |
| | Location | P198 | Intervention at home |
| | Duration | P198 | 8 weeks |
| | Intensity | P198 | Questionnaire filled every 2 weeks<br>Home visited every 4 weeks |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P198 | Control |
| | Rationale/theory/Goal | P198 | To improve QOL of children with asthma and their parents using regular cleaning with combination of cleaning products |
| | Materials used | P198 | None specified |
| | Procedures used | P198 | Cleaning diary |
| | Provider | – | Not reported |
| | Method of delivery | – | Face to face and phone |
| | Location | P198 | Intervention at home |

| Bibliographic reference | **Barnes Charles S, Kennedy Kevin, Gard Luke, Forrest Erika, Johnson Linda, Pacheco Freddy, Hu Frank, Amado Mercedes, and Portnoy Jay M (2008) The impact of home cleaning on quality of life for homes with asthmatic children. Allergy and asthma proceedings 29(2), 197-204** | | |
|---|---|---|---|
| | Duration | P198 | 8 weeks |
| | Intensity | P198 | Questionnaire filled every 2 weeks<br>Home visited every 4 weeks |
| | Tailoring/adaptation | – | Not applicable |
| | Modifications | – | Not applicable |
| | Planned treatment fidelity | – | Not applicable |
| | Actual treatment fidelity | – | Not applicable |
| | Other details | – | None |
| Follow up | 10 weeks | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Not reported | |
| | Unit of allocation | Home | |
| | Unit of analysis | Home and individual | |
| | Attrition | Number of homes completing the study: 181; Families with children with asthma (n=91), Families with children with asthma (n=90) | Reasons for not completing the study: loss of interest by the family, failure to have qualifying child in the home |
| Outcomes measures and effect size. | Asthma symptom severity on a 7-point Likert scale (people with asthma only) | | |
| | | Control<br>Mean (SD) n=376 | Intervention<br>Mean (SD) n=283 |
| | Wheeze in AM at follow up | 2.10 (2.90) | 1.67 (2.59) |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | Probably cluster randomisation |
| | Allocation concealment | Unclear | Not described |
| | Blinding of participants and personnel | High | Control group did not receive products during study period |
| | Blinding of outcome assessment | High | Lack of blinding |
| | Incomplete outcome data | Low | Attrition was low |
| | Selective reporting | High | Authors do not report all data; unclear which time point of follow up is reported |

| Bibliographic reference | **Barnes Charles S, Kennedy Kevin, Gard Luke, Forrest Erika, Johnson Linda, Pacheco Freddy, Hu Frank, Amado Mercedes, and Portnoy Jay M (2008) The impact of home cleaning on quality of life for homes with asthmatic children. Allergy and asthma proceedings 29(2), 197-204** | | |
|---|---|---|---|
| | Other sources of bias | High | Data analysis is unclear, n numbers are not explained<br>Products by Clorox |
| Overall ROB | High | | |
| Source of funding | Not reported | | |
| Comments | | | |
| Additional references | | | |

Bryant-Stephens *et al.* 2008

| Bibliographic reference | **Bryant-Stephens T, and Li Y (2008) Outcomes of a home-based environmental remediation for urban children with asthma. Journal of the national medical association 100(3), 306-316** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | Randomized controlled trial | | |
| Study dates | 1999 to 2002 | | |
| Objective | To study the effectiveness of a low-cost approach to improve control of asthma symptoms in an urban population through lay educators who promote a generalized approach to asthma trigger avoidance in the bedrooms of children with asthma | | |
| Country/ Setting | US<br>Urban area | | |
| Number of participants | 280 children aged 2 to 16 years<br>Control group n=128, intervention group n=153 | | |
| Participant characteristics | **Demographic characteristics of children at baseline** | Control group n (%) | Intervention group n (%) |
| | Age Mean (SD) | 5.6 (3.5) | 6.1 (3.9) |
| | Sex (male) | 82 (66) | 88 (60) |
| | Ethnicity | | |
| | African American | 124 (100) | 145 (99) |
| | Latino | 0 | 0 |
| | Other | 0 | 1 (1) |
| | Socio-economic status (education) | | |
| | Caretaker completed high school | 77 (68) | 108 (76) |
| | Existing condition (family atopy) | Not reported | |
| Inclusion criteria | • Children 2 to 16 years of age<br>• 1 or more hospitalization due to asthma or 2 or more asthma-related emergency visits one year before the time of enrolment | | |

| Bibliographic reference | **Bryant-Stephens T, and Li Y (2008) Outcomes of a home-based environmental remediation for urban children with asthma. Journal of the national medical association 100(3), 306-316** | | |
|---|---|---|---|
| Exclusion criteria | Not specified | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P307 | Multicomponent programme of reduced allergen exposure |
| | Rationale/theory/Goal | P306 | To avoid asthma triggers using low-cost intervention |
| | Materials used | P307 | Symptom diary<br>Roach and mice bait<br>Dusters, mattress and pillow covers<br>Sponge and buckets<br>Trash bags, shades and shade brackets |
| | Procedures used | P307 | Instruction given on bait use<br>Demonstration given on use of dusters, mattress and pillow covers<br>Removal of carpet or supply of vacuum bags<br>Demonstration of proper floor washing method<br>Cockroach and pet dander avoidance technique |
| | Provider | P306 | Trained home visitors, women who live in same targeted community |
| | Method of delivery | P306 | Face to face |
| | Location | P306 | Intervention delivered at home |
| | Duration | P306 | 12 months |
| | Intensity | P306 | Initially weekly for 5 weeks followed by monthly |
| | Tailoring/adaptation | – | – |
| | Modifications | – | – |
| | Planned treatment fidelity | – | – |
| | Actual treatment fidelity | – | – |

| Bibliographic reference | **Bryant-Stephens T, and Li Y (2008) Outcomes of a home-based environmental remediation for urban children with asthma. Journal of the national medical association 100(3), 306-316** | | |
|---|---|---|---|
| | Other details | – | – |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P308 | Control |
| | Rationale/theory/Goal | P306 | To avoid asthma triggers using low-cost intervention |
| | Materials used | P308 | Symptom diary |
| | Procedures used | P308 | Information about asthma self-management classes in the community |
| | Provider | P306 | Trained home visitors, women who live in same targeted community |
| | Method of delivery | P308 | Face to face |
| | Location | P308 | Intervention was delivered at home |
| | Duration | P306 | 12 month |
| | Intensity | P308 | Monthly |
| | Tailoring/adaptation | – | – |
| | Modifications | – | – |
| | Planned treatment fidelity | – | – |
| | Actual treatment fidelity | – | – |
| | Other details | – | – |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | No detail provided | |
| | Method of allocation concealment | No detail provided | |
| | Statistical method(s) used to analyse data | No detail provided | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of people completing the study: 137, control group 128, intervention group 109 | Reasons for not completing the study: intervention not completed or it took longer than 2 months to complete intervention |
| Outcomes measures and effect size. | | Control group Mean (SD) | Intervention group Mean (SD) |
| | Inpatient visit (length of stay in days) before | 0.56 (0.75) | 0.66 (0.84) |

| Bibliographic reference | **Bryant-Stephens T, and Li Y (2008) Outcomes of a home-based environmental remediation for urban children with asthma. Journal of the national medical association 100(3), 306-316** | | |
|---|---|---|---|
| | Inpatient visit (length of stay in days) after | 0.32 (0.65) | 0.35 (0.78) |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | Probably done but no details provided |
| | Allocation concealment | Unclear | No details provided |
| | Blinding of participants and personnel | Unclear | Unlikely to blind control group |
| | Blinding of outcome assessment | Low | Chart record used for primary outcome |
| | Incomplete outcome data | Unclear | High attrition but unlikely to affect outcomes |
| | Selective reporting | Low | All outcomes are reported |
| | Other sources of bias | High | Investigators provided incentives after each visit worth up to $10<br>Investigators provided cleaning products and mattress and pillow covers |
| Overall ROB | Low | | |
| Source of funding | Office of Minority Health, The U.S. Department of Health and Human Services (#US2MP97AO1-02-2)<br>U.S. Environmental Protection Agency (#IHA-IED-024) | | |
| Comments | | | |
| Additional references | | | |

Carswell *et al.* 1996

| Bibliographic reference | **Carswell F, Birmingham K, Oliver J, et al. The respiratory effects of reduction of mite allergen in the bedrooms of asthmatic children - a double-blind controlled trial. Clin Exp Allergy. 1996;26(4):386-96.** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | Published 1996 | | |
| Objective | To determine n mite allergen removal is an effective therapeutic procedure in children sensitive to mite | | |
| Country/ Setting | UK/home | | |
| Number of participants | 70 | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention: | Multi-component intervention: |

| Bibliographic reference | **Carswell F, Birmingham K, Oliver J, et al. The respiratory effects of reduction of mite allergen in the bedrooms of asthmatic children - a double-blind controlled trial. Clin Exp Allergy. 1996;26(4):386-96.** | | |
|---|---|---|---|
| | Age, mean | 10 years, range 7 to 10 | |
| | % of male | 63% | |
| | Race | Not reported | |
| | Homeownership: | Not reported | |
| | Geographic environment: | Not reported | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (skin prick test positive) | 100% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | 10% | |
| | Smoker in home: | Not reported | |
| Inclusion criteria | Children with a diagnosis of asthma based on symptoms | | |
| Exclusion criteria | Children were excluded from the trial if there was no telephone in the household (to permit telephone appointments), if they did not sleep in a single bed, or did not use a duvet, or if there were more than two beds or heating by ducted hot air in | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | 388 | Multi-component intervention:<br>• Mattresses, pillows, duvets, and upholstered furniture vacuumed, then treated with Acarosan foam (benzyl benzoate 2.6%)<br>• Cotton covers coated with polyurethane on mattresses, pillows, duvets<br>• Bed linen washed at 60° C<br>• Carpet vacuumed, treated with Acarosan powder (benzyl benzoate 5%)<br>• Soft toys removed or washed |

| Bibliographic reference | Carswell F, Birmingham K, Oliver J, et al. The respiratory effects of reduction of mite allergen in the bedrooms of asthmatic children - a double-blind controlled trial. Clin Exp Allergy. 1996;26(4):386-96. | | |
|---|---|---|---|
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | Home |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Multi-component intervention:<br>• Mattresses et al. treated with water spray<br>• Mattresses et al. covered with cotton placebos<br>• Bed linen washed at 40° C<br>• Carpet treated with chalk dust |
| | Rationale/theory/Goal | 388 | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 24 weeks | | |
| Study Methods | Method of randomisation | Not reported | |

| Bibliographic reference | **Carswell F, Birmingham K, Oliver J, et al. The respiratory effects of reduction of mite allergen in the bedrooms of asthmatic children - a double-blind controlled trial. Clin Exp Allergy. 1996;26(4):386-96.** | | |
|---|---|---|---|
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Mann-Whitney tests were used for between group comparisons and Wilcoxon matched pairs signed rank tests for within group comparisons. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 13% attrition | |
| Outcomes measures and effect size. | | Multicomponent intervention | Comparator |
| | Pulmonary physiology | | |
| | FEV1: % predicted | | |
| | Baseline | 102.7 % (5.8) n=23 | 101.8% (11.8) n=23 |
| | Follow-up | 105.0% (10.2) n=23 | 98.6% (15.3) n=23 |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | Insufficient description of randomization; |
| | Allocation concealment | Unclear | Insufficient description of randomization; |
| | Blinding of participants and personnel | Low | “The treatments were carried out with the parents, sample collectors and assessors successfully blinded to the children's therapeutic groups“ |
| | Blinding of outcome assessment | Low | “The treatments were carried out with the parents, sample collectors and assessors successfully blinded to the children's therapeutic groups-“ |
| | Incomplete outcome data | Low | 13% attrition |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | Wellcome Trust | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |

| Bibliographic reference | **Carswell F, Birmingham K, Oliver J, et al. The respiratory effects of reduction of mite allergen in the bedrooms of asthmatic children - a double-blind controlled trial. Clin Exp Allergy. 1996;26(4):386-96.** |
|---|---|
| Additional references | Access available: http://dx.doi.org/10.1111/j.1365-2222.1996.tb00554.x. |

Dorward *et al.* 1988

| Bibliographic reference | **Dorward AJ, Colloff MJ, MacKay NS, McSharry C, and Thomson NC (1988) Effect of house dust mite avoidance measures on adult atopic asthma. Thorax 43(2), 98-102** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | Randomised controlled trial | | |
| Study dates | January to April 1984 | | |
| Objective | To examine the effect of eight weeks of house dust mite avoidance measures on non-specific airway responsiveness in adults sensitive to the house dust mite. | | |
| Country/ Setting | Scotland | | |
| Number of participants | 21 adults<br>Control group n=10, intervention group n=11 | | |
| Participant characteristics | **Demographic characteristics** | Control (n=9)<br>n (%) | Intervention (n=9)<br>n (%) |
| | Age Mean (range) | 24.8 (13 to 48) | 25.6 (14 to 53) |
| | Sex (male) | 5 | 3 |
| | Ethnicity | | |
| | Socio-economic status (education) | | |
| | Existing condition (family atopy) | | |
| | Existing conditions | | |
| Inclusion criteria | • Positive skin prick test (weal diameter of at least 3 mm greater than control)<br>• Forced expiratory volume in one second (FEV1) of more than 60% of their predicted value | | |
| Exclusion criteria | People who required oral steroids, theophylline, or sodium cromoglycate or who had a cat or dog at home | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P99 | Cleaning instructions for house dust mite control |
| | Rationale/theory/Goal | P99 | To avoid exposure to house dust mite allergens |
| | Materials used | P99 | Liquid nitrogen |
| | Procedures used | P99 | Treatment of mattress and bedroom carpet with liquid nitrogen |

| Bibliographic reference | Dorward AJ, Colloff MJ, MacKay NS, McSharry C, and Thomson NC (1988) Effect of house dust mite avoidance measures on adult atopic asthma. Thorax 43(2), 98-102 | | |
|---|---|---|---|
| | | | Weekly vacuum cleaning of bed (seams, buttons, and box springs)<br>Cleaning of blankets, pillows, and duvets at the beginning of the trial<br>Weekly wash of sheets and pillow cases<br>Daily airing of mattress by back folding blankets and upper sheets or duvets<br>Weekly damp dusting of hard surfaces<br>Removal of plants, soft toys, cushions, and upholstered furniture from room |
| | Provider | P99 | Investigator<br>Spouse or parent |
| | Method of delivery | P99 | Face to face |
| | Location | P99 | Intervention delivered at home |
| | Duration | P98 | 8 weeks |
| | Intensity | P99 | weekly |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P99 | Normal cleaning |
| | Rationale/theory/Goal | P99 | To avoid exposure to house dust mite allergens |
| | Materials used | – | Not reported |
| | Procedures used | – | Not reported |

| Bibliographic reference | **Dorward AJ, Colloff MJ, MacKay NS, McSharry C, and Thomson NC (1988) Effect of house dust mite avoidance measures on adult atopic asthma. Thorax 43(2), 98-102** | | |
|---|---|---|---|
| | Provider | – | Not reported |
| | Method of delivery | – | Not reported |
| | Location | P99 | Intervention delivered at home |
| | Duration | P99 | 8 weeks |
| | Intensity | – | Not reported |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Follow up | 8 weeks | | |
| Study Methods | Method of randomisation | Not described | |
| | Method of allocation concealment | Not described | |
| | Statistical method(s) used to analyse data | Wilcoxon's rank sum test (signed rank test for paired data, two sample test for unpaired data) used for symptom scores were analysed by using the<br>Two way analysis of variance (ANOVA) for other data | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of adults completing the study: | Reasons for not completing the study: change of residence, refusal to cooperate, wheezing because of new pet, loss of diary |
| Outcomes measures and effect size. | FEV1 | Control<br>Mean (SD) | Intervention<br>Mean (SD) |
| | FEV1 (baseline) | 2.78 (0.59) | 2.84 (0.84) |
| | FEV1 (8 weeks) | 2.61 (0.51) | 2.74 (0.81) |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Low | Probably done |
| | Allocation concealment | Unclear | Not reported |
| | Blinding of participants and personnel | High | Because of the nature of intervention blinding is unlikely |
| | Blinding of outcome assessment | Unclear | Not reported but assessor might |

| Bibliographic reference | Dorward AJ, Colloff MJ, MacKay NS, McSharry C, and Thomson NC (1988) Effect of house dust mite avoidance measures on adult atopic asthma. Thorax 43(2), 98-102 | | |
|---|---|---|---|
| | | | have been blinded |
| | Incomplete outcome data | Low | Attrition was low |
| | Selective reporting | Low | All outcomes reported |
| | Other sources of bias | High | Few people participated |
| Overall ROB | High | | |
| Source of funding | Not reported | | |
| Comments | | | |
| Additional references | | | |

Hayden *et al.* 1997

| Bibliographic reference | Hayden ML, Perzanowski M, Matheson L, et al. Dust mite allergen avoidance in the treatment of hospitalized children with asthma. Ann Allergy Asthma Immunol. 1997;79(5):437-42. PMID: 9396978. | | |
|---|---|---|---|
| Registration | Not reported in the review | | |
| Study type | RCT | | |
| Study dates | January 1, 1993 and April 30, for recruitment1994 | | |
| Objective | To evaluate the practicality and effect of modifying homes of children admitted to hospital with asthma. | | |
| Country/ Setting | USA/home | | |
| Number of participants | 23 children | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention: | Multi-component intervention: |
| | Age, mean | 9 years, range 5 to 16 years | |
| | % of male | 61% | |
| | Race | | |
| | White | 52% | |
| | African American | 48% | |
| | Homeownership: | 87% | |
| | Geographic environment: | Suburban | |
| | Clinical factors (baseline) | | |
| | Sensitization: (serum IgE) | | |
| | HDM | 65% | |
| | Bla g | 9% | |
| | Fel d | 13% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |

| **Bibliographic reference** | **Hayden ML, Perzanowski M, Matheson L, et al. Dust mite allergen avoidance in the treatment of hospitalized children with asthma. Ann Allergy Asthma Immunol. 1997;79(5):437-42. PMID: 9396978.** | | |
|---|---|---|---|
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | 30% indoor pet | |
| | Smoker in home: | 22% | |
| Inclusion criteria | Children aged between 5 and 18 years with asthma | | |
| Exclusion criteria | Not reported | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | 438 | Multi-component intervention:<br>• Impermeable covers (Allergy Control Products) on mattresses, pillows, box springs<br>• Carpet in bedroom replaced with hardwood or vinyl flooring<br>• Carpet in living room or family room treated with 3% tannic acid spray every 3 months<br>• Instruction to wash bedding weekly in hot water |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |

| Bibliographic reference | Hayden ML, Perzanowski M, Matheson L, et al. Dust mite allergen avoidance in the treatment of hospitalized children with asthma. Ann Allergy Asthma Immunol. 1997;79(5):437-42. PMID: 9396978. | | |
|---|---|---|---|
| | Brief Name | 438 | Multi-component intervention:<br>• Placebo cotton covers on mattresses, pillows, box springs<br>• Carpet treated with water spray<br>• Instruction to wash bedding in cold water |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 6 months | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Paired t test were to compare mean percentage improvement in PEFR. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 8% attrition | |
| Outcomes measures and effect size. | | Multicomponent intervention | Comparator |
| | Pulmonary physiology | | |
| | PEFR % increase | 15.1 | 4.4 |
| | PEFR L/min, mean (SD) | 328 (62) n=11 | 266 (102) n=9 |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | Insufficient description of randomization; |

| Bibliographic reference | **Hayden ML, Perzanowski M, Matheson L, et al. Dust mite allergen avoidance in the treatment of hospitalized children with asthma. Ann Allergy Asthma Immunol. 1997;79(5):437-42. PMID: 9396978.** | | |
|---|---|---|---|
| | Allocation concealment | Unclear | Insufficient description of randomization; placebo used; 8% attrition |
| | Blinding of participants and personnel | Unclear | Not reported |
| | Blinding of outcome assessment | Unclear | Not reported |
| | Incomplete outcome data | Low | 8% attrition |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low risk | | |
| Source of funding | NIH | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |
| Additional references | - | | |

Matsui *et al.* 2017

| Bibliographic reference | **Matsui EC, Perzanowski M, Peng RD, et al. Effect of an integrated pest management intervention on asthma symptoms among mouse-sensitized children and adolescents with asthma: a randomized clinical trial. JAMA. 2017 Mar 14;317(10):1027-36** | | |
|---|---|---|---|
| Registration | NCT01251224 | | |
| Study type | RCT | | |
| Study dates | May 2010 and August 2014 (enrolment)<br>September 2015 last data point collection | | |
| Objective | To determine if an intensive, professionally delivered, integrated pest management (IPM) home intervention that included education about pest management would result in improvements in asthma symptoms | | |
| Country/ Setting | USA/home | | |
| Number of participants | 361 children | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention: | Education on pest control strategies |
| | Age, mean | 10. (3.2) years, range 5 to 17 | |
| | % of male | 62% | |
| | Race | | |
| | Black | 79% | |
| | Hispanic | 21% | |
| | White | 11 | |

| Bibliographic reference | **Matsui EC, Perzanowski M, Peng RD, et al. Effect of an integrated pest management intervention on asthma symptoms among mouse-sensitized children and adolescents with asthma: a randomized clinical trial. JAMA. 2017 Mar 14;317(10):1027-36** | | |
|---|---|---|---|
| | Homeownership | 71% in houses, 29% in apartments | |
| | Geographic environment: | Urban | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (skin prick test positive): | | |
| | HDM: | 44% | |
| | Cockroach: | 55% | |
| | Cat | 54% | |
| | Dog | 23% | |
| | Mold | 34% | |
| | Mouse (skin prick test or IgE): | 100% | |
| | Asthma severity: | 12% step 1<br>19% step 2<br>15% step 3<br>5% step 4<br>49% step 5 | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Not reported | |
| | Smoker in home: | Not reported | |
| Inclusion criteria | Children and adolescents<br>• aged 5 to 17 years with persistent asthma and an exacerbation in the previous year were eligible for the clinic screening visit<br>• with mouse sensitization, which was defined as either a positive skin test to mouse epithelial extract (defined as an orthogonal wheal diameter ≥3 mm larger than the negative control) or a mouse urine-specific IgE of 0.10 kU/L or greater, were eligible for a home visit to assess mouse allergen levels<br>• had a bed dust mouse allergen concentration of 0.4 microgram/g or greater or a bedroom floor dust mouse allergen concentration of 0.5 microgram/g or greater spend at least 4 nights per week in the primary home | | |
| Exclusion criteria | Not reported | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | 4 | IPM intervention<br>• Professional pest control<br>• Impermeable mattress covers<br>• Air purifier<br>• Education on pest control strategies (e.g., use of traps, |

| Bibliographic reference | Matsui EC, Perzanowski M, Peng RD, et al. Effect of an integrated pest management intervention on asthma symptoms among mouse-sensitized children and adolescents with asthma: a randomized clinical trial. JAMA. 2017 Mar 14;317(10):1027-36 | | |
|---|---|---|---|
| | | | sealing of entry points, house cleaning) |
| | Rationale/theory/Goal | | Not reported |
| | Materials used | 4 | Written material |
| | Procedures used | 4 | Demonstrations |
| | Provider | | Not reported |
| | Method of delivery | 4 | Face to face |
| | Location | 4 | Home |
| | Duration | 4 | 2 session |
| | Intensity | 4 | 1 2.5 hour session followed by 1 hour booster session |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Education on pest control strategies |
| | Rationale/theory/Goal | – | Not reported |
| | Materials used | – | Not reported |
| | Procedures used | – | Not reported |
| | Provider | – | Not reported |
| | Method of delivery | – | Not reported |
| | Location | – | Not reported |
| | Duration | – | Not reported |
| | Intensity | – | Not reported |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Estimates of the expected change in maximal symptom days and other outcomes for pre-specified reductions of 50%, 75%, and 90% in | |

| Bibliographic reference | **Matsui EC, Perzanowski M, Peng RD, et al. Effect of an integrated pest management intervention on asthma symptoms among mouse-sensitized children and adolescents with asthma: a randomized clinical trial. JAMA. 2017 Mar 14;317(10):1027-36** | | |
|---|---|---|---|
| | | bedroom floor mouse allergen were calculated using the coefficients from the random-effects models | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 7% attrition | |
| Outcomes measures and effect size | | Multi-component intervention | Education on pest control strategies |
| | Pulmonary physiology | | |
| | FEV1 % predicted, mean (SD): | Arm 1 versus Arm 2: Beta coefficient (95% CI): 2.29 (-1.63 to 6.22) | |
| | Baseline | 89.2 (13.9) | 86.4 (19.0) |
| | 12 months | 87.9 (14.0) n=94 | 85.9 (14.2) n=103 |
| | Adverse effects N (%) with at least 1 AE | 132 (75%) | 137 (79%) |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | No details provided |
| | Allocation concealment | Unclear | No details provided |
| | Blinding of participants and personnel | High | No blinding |
| | Blinding of outcome assessment | High | No blinding |
| | Incomplete outcome data | Low | No concerns |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | Not reported in the review | | |
| Comments | No | | |
| Additional references | Access available: http://dx.doi.org/10.1001/jama.2016.21048. | | |

Walshaw *et al.* 1986

| Bibliographic reference | **Walshaw MJ, Evans CC. Allergen avoidance in house dust mite sensitive adult asthma. QJM. 1986;58(226):199-215. PMID: 3520626.** |
|---|---|
| Registration | Not reported |
| Study type | RCT |
| Study dates | Published 1986 |
| Objective | To assess the effectiveness of dust avoidance techniques in adult mite sensitive asthma |
| Country/ Setting | UK/home |

| **Bibliographic reference** | **Walshaw MJ, Evans CC. Allergen avoidance in house dust mite sensitive adult asthma. QJM. 1986;58(226):199-215. PMID: 3520626.** | | |
|---|---|---|---|
| Number of participants | 50 adults | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention: | No interventions |
| | Age, mean | 33 years | |
| | % of male | 44% | |
| | Race | Not reported | |
| | Homeownership: | Not reported | |
| | Geographic environment: | Not reported | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (serum IgE) | 100% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Not reported | |
| | Smoker in home: | Not reported | |
| Inclusion criteria | • Adults with asthma and a strongly positive skin-prick (wheal 5mm diameter or more) to house dust mite<br>• A documented history of asthma and<br>• No other chest disease | | |
| Exclusion criteria | Not reported | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Multi-component intervention:<br>• Plastic covers on mattresses, pillows<br>• Feather duvets, quilts and woollen blankets replaced with other materials<br>• Bedroom carpet either replaced with linoleum or vacuumed regularly |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |

| Bibliographic reference | Walshaw MJ, Evans CC. Allergen avoidance in house dust mite sensitive adult asthma. QJM. 1986;58(226):199-215. PMID: 3520626. | | |
|---|---|---|---|
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | No interventions |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Not reported | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 16% attrition | |
| Outcomes measures and effect size. | | Multicomponent intervention | No interventions |
| | Pulmonary physiology | | |
| | FEV1/FVC %, mean (SEM): (no between-arm analysis provided) | | |
| | Baseline | | |
| | Follow-up | 77.4 (0.57) n=22 | 74.65 (6.84) n=20 |

| Bibliographic reference | Walshaw MJ, Evans CC. Allergen avoidance in house dust mite sensitive adult asthma. QJM. 1986;58(226):199-215. PMID: 3520626. | | |
|---|---|---|---|
| | Pre-post p value | | |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | Insufficient description of randomization; |
| | Allocation concealment | Unclear | Insufficient description of randomization; |
| | Blinding of participants and personnel | High | no blinding of people; |
| | Blinding of outcome assessment | Unclear | unclear in outcome assessors were blinded |
| | Incomplete outcome data | Low | No concerns |
| | Selective reporting | High | some data or between-group comparisons not reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | Not reported | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |
| Additional references | - | | |

## D.4 Reduction/prevention of aeroallergens including second-hand smoke exposure

Becker *et al.* 2004

| Bibliographic reference | Becker Allan, Watson Wade, Ferguson Alexander, Dimich-Ward Helen, and Chan-Yeung Moira (2005) The Canadian asthma primary prevention study: outcomes at 2 years of age. The Journal of allergy and clinical immunology 113(4), 650-6 |
|---|---|
| Registration | Not reported |
| Study type | Randomised controlled trial |
| Study dates | Infants born between October 1994 and August 1996<br>Follow up was up to 7 years |
| Objective | To determine the effectiveness of a multifaceted intervention program in primary prevention of asthma in high-risk infants. |
| Country/ Setting | Canada |
| Number of participants | 549 infants (545 mothers were randomised; control group n=266, intervention group 279, 2 twin births in each group) |

| Bibliographic reference | **Becker Allan, Watson Wade, Ferguson Alexander, Dimich-Ward Helen, and Chan-Yeung Moira (2005) The Canadian asthma primary prevention study: outcomes at 2 years of age. The Journal of allergy and clinical immunology 113(4), 650-6** | | |
|---|---|---|---|
| Participant characteristics | **Demographic characteristics of children at baseline** | Control (n=242) n (%) | Intervention (n=251) n (%) |
| | Age | Not applicable | Not applicable |
| | Sex (male) | 120 (49.6) | 138 (55.0) |
| | Ethnicity | | |
| | White | 194 (80.2) | 201 (80.0) |
| | Asian | 18 (7.4) | 23 (9.2) |
| | Other | 30 (12.4) | 27 (10.8) |
| | Socio-economic status (education) | | |
| | Mothers with postsecondary education | 199 (82.2) | 182 (72.5) |
| | Existing condition (family atopy) | | |
| | Maternal asthma | 96 (39.7) | 115 (45.8) |
| | Paternal asthma | 95 (40.5) | 82 (33.6) |
| | Smokers (any – mother, father or others) | 57 (23.6) | 57 (22.7) |
| | Pet owners (any – cat, dog) | 84 (34.7) | 96 (38.2) |
| Inclusion criteria | High-risk infants, at least 1 first-degree relative with asthma or 2 first-degree relative with other IgE-mediated allergic diseases | | |
| Exclusion criteria | • Infant born before time of contact<br>• Premature delivery of infant<br>• Change in residence<br>• Language issues | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P658/659 | Multicomponent programme of house dust mite control, pet avoidance, smoke-free environment and breastfeeding |
| | Rationale/theory/Goal | P658 | To control allergen exposure |
| | Materials used | P658/659 | Vapour-impermeable mattress covers<br>Benzyl benzoate powder and foam<br>Partially hydrolysed whey formula where applicable |
| | Procedures used | P658/659 | Mattress on the child's and parents bed was encased |

| Bibliographic reference | Becker Allan, Watson Wade, Ferguson Alexander, Dimich-Ward Helen, and Chan-Yeung Moira (2005) The Canadian asthma primary prevention study: outcomes at 2 years of age. The Journal of allergy and clinical immunology 113(4), 650-6 | | |
|---|---|---|---|
| | | | Instruction on hot wash of beddings, pillows and bedding<br>Treatment of carpets and upholstery<br>Recommendation on smoke and pet free house<br>Encouragement of breastfeeding for at least 4 months and up to 12 months<br>Advice on diet for the last trimester of pregnancy |
| | Provider | – | Not reported |
| | Method of delivery | P658 | Face to face |
| | Location | P658/659 | Intervention delivered at home |
| | Duration | – | Not reported |
| | Intensity | P658 | Every 4 months for first 12 months, 24 months |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P658 | Control |
| | Rationale/theory/Goal | P658 | To control allergen exposure |
| | Materials used | P658 | Not applicable |
| | Procedures used | P658 | Usual care |
| | Provider | P658 | Primary care physician |
| | Method of delivery | P658 | Face to face |
| | Location | P658 | Practice |
| | Duration | – | Not reported |
| | Intensity | – | Not reported |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |

| Bibliographic reference | **Becker Allan, Watson Wade, Ferguson Alexander, Dimich-Ward Helen, and Chan-Yeung Moira (2005) The Canadian asthma primary prevention study: outcomes at 2 years of age. The Journal of allergy and clinical immunology 113(4), 650-6** | | |
|---|---|---|---|
| Follow up | Up to 7 years | | |
| Study Methods | Method of randomisation | Computer-generated list of random numbers | |
| | Method of allocation concealment | Sealed envelope | |
| | Statistical method(s) used to analyse data | Cumulative incidence (percentage)<br>1-sided test of significance for hypothesis testing<br>The CATMOD procedure for modelling repeated-measurements data with a dichotomous outcome was used. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of families (children) assessed at 12 months: control group n=240 (242), intervention group n=249 (251)*<br>Number of children assessed at 24 months: control group n=230, intervention group n=246<br>Number of children assessed at 7 years: control group n=178, intervention group n=202 | Reasons for not completing: poor health of infant |
| Outcomes measures and effect size. | Combined possible or probable asthma (events) | | |
| | | Control group<br>n (%) | Intervention group<br>n (%) |
| | At 12 months | Not extracted as infants could have been breast fed for up to 12 months | |
| | At 24 months | 53 (23.0) | 40 (16.3) |
| | At 7 years (diagnosis by paediatric allergist) | 41 (23.0) | 30 (14.9) |
| | Atopy (positive skin test reaction to one or more common inhalant or ingestant allergen) | | |
| | | Control group<br>n (%) | Intervention group<br>n (%) |
| | At 12 months | Not extracted as infants could have been breast fed for up to 12 months | |
| | At 24 months | 31 (13.7) | 38 (15.6) |
| | At 7 years | 72 (41.6) | 95 (49.0) |
| | Outcome | Judgement | Comments |

| Bibliographic reference | Becker Allan, Watson Wade, Ferguson Alexander, Dimich-Ward Helen, and Chan-Yeung Moira (2005) The Canadian asthma primary prevention study: outcomes at 2 years of age. The Journal of allergy and clinical immunology 113(4), 650-6 | | |
|---|---|---|---|
| Risk of bias (ROB) | Random sequence generation | Low | Computer-generated list of random numbers |
| | Allocation concealment | Low | Sealed envelope |
| | Blinding of participants and personnel | Unclear | Unclear whether control group was blind |
| | Blinding of outcome assessment | Unclear | Paediatric allergist was blinded, but nurse who performed skin prick test was not |
| | Incomplete outcome data | Unclear | High attrition at 7-year follow up but reasons not reported |
| | Selective reporting | Low | For primary outcome |
| | Other sources of bias | Unclear | Reporting is inconsistent across the publications |
| Overall ROB | Low | | |
| Source of funding | Respiratory Health Network of Centres of Excellence | | |
| Comments | Study details and baseline data extracted from Chan-Yeung et al. 2000 | | |
| Additional references | Chan-Yeung Moira, Ferguson Alexander, Watson Wade, Dimich-Ward Helen, Rousseau Roxanne, Lilley Marilyn, Dybuncio Anne, and Becker Allan (2005) The Canadian Childhood Asthma Primary Prevention Study: outcomes at 7 years of age. The Journal of allergy and clinical immunology 116(1), 49-55<br>Chan-Yeung M, Manfreda J, Dimich-Ward H, Ferguson A, Watson W, and Becker A (2000) A randomized controlled study on the effectiveness of a multifaceted intervention program in the primary prevention of asthma in high-risk infants. Archives of pediatrics & adolescent medicine 154(7), 657-63 | | |

DiMango *et al.* 2016

| Bibliographic reference | DiMango E, Serebrisky D, Narula S, et al. Individualized household allergen intervention lowers allergen level but not asthma medication use: a randomized controlled trial. J Allergy Clin Immunol Pract. 2016 Jul-Aug;4(4):671-679.e4 |
|---|---|
| Registration | NCT01593111 |
| Study type | Randomized controlled trial |
| Study dates | March 2011 and July 2012. |
| Objective | To assess the effect of multi-faceted indoor allergen avoidance measures on the ability to step down asthma therapy in adults and children with mild to severe persistent asthma who were both sensitized and exposed to specific indoor allergens. |
| Country/ Setting | US |
| Number of participants | 247 children and adults<br>Control group n=125, intervention group n=122 |

| Bibliographic reference | **DiMango E, Serebrisky D, Narula S, et al. Individualized household allergen intervention lowers allergen level but not asthma medication use: a randomized controlled trial. J Allergy Clin Immunol Pract. 2016 Jul-Aug;4(4):671-679.e4** | | |
|---|---|---|---|
| Participant characteristics | Demographic characteristics | Multi-component intervention | Education unrelated to allergen reduction |
| | Age, n (%)<br>Age 6 to 17 years<br>Age 18 to 69 years | <br>56 (44.8%)<br>69 (55.2%) | <br>54 (44.3%)<br>68 (55.7%) |
| | Gender, n (%)<br>Female<br>Male | <br>73 (58.4%)<br>52 (41.6%) | <br>64 (52.5%)<br>58 (47.5%) |
| | Race, n (%) | | |
| | Black (no-Hispanic)<br>Hispanic<br>White (non-Hispanic) | 47 (38.8%)<br>67 (55.4%)<br>7 (5.79%) | 45 (38.1%)<br>72 (61.0%)<br>1 (0.85%) |
| | Homeownership: | Not reported | |
| | Geographic environment: | urban | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (skin prick test positive) | 100% of participants sensitized to at least 1 allergen | |
| | Asthma severity: | 67% step 4 to 6<br>33% step 1 to 3 | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Not reported | |
| | Smoker in home: | 31% | |
| Inclusion criteria | • Individuals on controller therapy or who had symptoms consistent with persistent asthma if not receiving therapy<br>• Forced Expiratory Volume in 1 second (FEV1) ≥ 40% predicted and asthma confirmed by bronchodilator reversibility defined as having a 12% or greater increase in FEV1 15 minutes after administration of 2 puffs of albuterol or PC20 methacholine ≤ 8mg/ml if not using inhaled corticosteroids (ICS) or ≤16mg/ml if using ICS.<br>• Sleep overnight at the same address at least 5 times per week,<br>• have a positive skin test (or ImmunoCAP if FEV1 < 60% precluded skin testing) to protein extracts of at least one common indoor allergen including dust mite German cockroach , mouse, Aspergillus mix, cat and dog | | |
| Exclusion criteria | Not reported | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | 4 to 5 | Multi-component intervention:<br>• Impermeable covers (brand NR) on mattresses |

| Bibliographic reference | DiMango E, Serebrisky D, Narula S, et al. Individualized household allergen intervention lowers allergen level but not asthma medication use: a randomized controlled trial. J Allergy Clin Immunol Pract. 2016 Jul-Aug;4(4):671-679.e4 | | |
|---|---|---|---|
| | | | • Vacuum (Electrolux; not specified if HEPA-filtered)<br>• HEPA air purifier (Orek)<br>• Mops (Swiffer WetJet)<br>• Cleaning products (not specified)<br>• Education and instruction about allergen reduction strategies given by 'intervention counsellors |
| | Rationale/theory/Goal | – | Not reported |
| | Materials used | 4 to 5 | Individualised home-based education based on Morgan et al 2004 |
| | Procedures used | – | Education and provision of cleaning products |
| | Provider | 4 to 5 | Intervention counsellors |
| | Method of delivery | 4 to 5 | Face to face |
| | Location | 4 to 5 | Individuals home |
| | Duration | | Not reported |
| | Intensity | 4 to 5 | 3 sessions |
| | Tailoring/adaptation | 4 to 5 | Individualised |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | No |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | Education unrelated to allergen reduction given by 'intervention counsellors' |
| | Rationale/theory/Goal | – | Not reported |
| | Materials used | – | Not reported |
| | Procedures used | – | Not reported |
| | Provider | – | Not reported |
| | Method of delivery | – | Not reported |

| Bibliographic reference | DiMango E, Serebrisky D, Narula S, et al. Individualized household allergen intervention lowers allergen level but not asthma medication use: a randomized controlled trial. J Allergy Clin Immunol Pract. 2016 Jul-Aug;4(4):671-679.e4 | | |
|---|---|---|---|
| | Location | – | Not reported |
| | Duration | – | Not reported |
| | Intensity | – | Not reported |
| | Tailoring/adaptation | – | Not reported |
| | Modifications | – | Not reported |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Follow up | 40 weeks | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | The mean post randomization outcome variables for each group and group differences were analysed with linear mixed-effects models with visit and group as fixed effects. For variables with skewed distribution, log transformation was performed and ratio was reported. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 16% attrition | |
| Outcomes measures and effect size. | Reduction in asthma step therapy between baseline and week 40 | | |
| | | Multi-component intervention | Education unrelated to allergen reduction given by 'intervention counsellors' |
| | Treatment step final mean (SE) | 3.5 (0.16) | 3.43 (0.17) |
| | Pulmonary physiology | | |
| | FEV1, mean (SD) baseline | 85.4 (18.6) | 84.9 (18.1) |
| | FEV1, mean (SE) endpoint | 83.8 (1.45) n=125 | 82.8 (1.51) n=122 |
| | | Arm 1 versus Arm 2: p=0.79 | |
| | Quality of life | | |
| | Juniper Mini-AQLQ, mean (SE) | 5.41 (0.13) n=125 | 5.63 (0.14) n=122 |
| | | Arm 1 versus Arm 2: p=0.26 | |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Unclear | Insufficient description of randomization; |
| | Allocation concealment | Unclear | Insufficient description of randomization; |

| Bibliographic reference | DiMango E, Serebrisky D, Narula S, et al. Individualized household allergen intervention lowers allergen level but not asthma medication use: a randomized controlled trial. J Allergy Clin Immunol Pract. 2016 Jul-Aug;4(4):671-679.e4 | | |
|---|---|---|---|
| | Blinding of participants and personnel | High | No blinding |
| | Blinding of outcome assessment | High | No blinding |
| | Incomplete outcome data | Low | Attrition 16% but intent-to-treat analysis; |
| | Selective reporting | Low | Pre-specified outcomes and subgroup analyses |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | Not reported | | |
| Comments | No | | |
| Additional references | | | |

Eggleston *et al.* 2005

| Bibliographic reference | Eggleston PA, Butz A, Rand C, et al. Home environmental intervention in inner-city asthma: a randomized controlled clinical trial. Ann Allergy Asthma Immunol. 2005 Dec; 95(6):518-24. PMID: 16400889. | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | Not reported | | |
| Objective | To test the efficacy of a home-based intervention in reducing allergen and particulate exposure in a randomized controlled clinical trial<br>Authors hypothesized that the successful reduction of levels of particulates, allergens, or both could improve the health of asthmatic children living in the home | | |
| Country/ Setting | US<br>Home | | |
| Number of participants | 100 children aged 6 to 12 years, median age 8 years | | |
| Participant characteristics | **Demographic characteristics** | Control group (n=50) | Intervention group (n=50) |
| | Age (years mean (SD) | 8.3 (1.4) | 8.5 (1.5) |
| | Sex (female %) | 60 | 48 |
| | Ethnicity | | |
| | African American | 98 | 100 |
| | Socio-economic status (education) | Not reported | |
| | Homeownership | Not reported | |
| | Geographic environment | Urban | |

| Bibliographic reference | **Eggleston PA, Butz A, Rand C, et al. Home environmental intervention in inner-city asthma: a randomized controlled clinical trial. Ann Allergy Asthma Immunol. 2005 Dec; 95(6):518-24. PMID: 16400889.** | | |
|---|---|---|---|
| | Existing condition (family atopy) | Not reported | |
| | Maternal asthma | | |
| | Paternal asthma | | |
| | Existing conditions | | |
| | Asthma (moderate to severe) | 20 | 28 |
| Inclusion criteria | Children aged 6 to 12 years, physician-diagnosed asthma, current asthma symptoms, and no other chronic lung disease | | |
| Exclusion criteria | Not reported in review | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Multicomponent programme of house dust mite and pest control |
| | Rationale/theory/Goal | – | To reduce allergen and particulate exposure |
| | Materials used | – | Impermeable mattress and pillow covers (Mission: Allergy) on child's bed<br>HEPA filter in child bedroom<br>fipronil bait gel for cockroach in kitchen and bathroom<br>Bromadialone bait traps for mouse |
| | Procedures used | – | Impermeable covers (Mission: Allergy) on mattresses, pillows<br>HEPA filter in bedroom<br>Integrated pest management (including fipronil bait gel for cockroach and bromadialone bait traps for mouse)<br>Education and instruction about allergen reduction strategies given |

| Bibliographic reference | Eggleston PA, Butz A, Rand C, et al. Home environmental intervention in inner-city asthma: a randomized controlled clinical trial. Ann Allergy Asthma Immunol. 2005 Dec; 95(6):518-24. PMID: 16400889. | | |
|---|---|---|---|
| | Provider | – | Trained environmental educator |
| | Method of delivery | – | Face to face and via telephone |
| | Location | – | Home and telephone |
| | Duration | – | 12 months |
| | Intensity | – | 3 home visits |
| | Tailoring/adaptation | – | None |
| | Modifications | – | None |
| | Planned treatment fidelity | – | Not reported |
| | Actual treatment fidelity | – | Not reported |
| | Other details | – | Not reported |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | No intervention (received the intervention at the end of the study) |
| | Rationale/theory/Goal | – | To reduce allergen and particulate exposure |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 12 months | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Overall differences during follow-up between groups were also compared using generalized estimating equations to account for possible correlations between repeated measurements | |

| Bibliographic reference | **Eggleston PA, Butz A, Rand C, et al. Home environmental intervention in inner-city asthma: a randomized controlled clinical trial. Ann Allergy Asthma Immunol. 2005 Dec; 95(6):518-24. PMID: 16400889.** | | |
|---|---|---|---|
| | | within participants and the presence of symptoms at baseline<br>Forced expiratory volume in 1 second (FEV1) and quality-of-life scores between groups at baseline and 12 months were compared using t tests. Statistical significance was assumed at p smaller than 0.05 | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 16 failed scheduled visit before randomisation<br>3 dropped out of study after randomisation | |
| Outcomes measures and effect size. | | Control (n=50) | Intervention (n=50) |
| | Quality of life, mean (SD) | | |
| | Baseline | 3.69 (1.28) | 4.70 (1.22) |
| | 12 month follow up | 4.01 (1.29) | 5.00 (1.39) |
| | Daytime symptoms 2 weeks (% of children reporting) | | |
| | Baseline | 50 | 58 |
| | 12 month follow up | 59 | 55 |
| | p-value | Smaller than 0.05 | |
| | OR (95% CI), p-value at 12 month follow up | 0.62 (0.36 to 1.05), p=0.07 | |
| | FEV1 | | |
| | Baseline, % (SD) | 100 (21) | 101 (20) |
| | 12 month follow up | 101 (20) | 94 (21) |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Unclear | Insufficient description of randomization |
| | Allocation concealment | Unclear | No details provided |
| | Blinding of participants and personnel | High | No blinding |
| | Blinding of outcome assessment | High | No blinding |
| | Incomplete outcome data | Low | 9 attrition |
| | Selective reporting | Unclear | Some data not shown and quality of life scales not described |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | Grant R82672401 from the US Environmental Protection Agency, grant ES09606 from the National Institute of Environmental Health Sciences, grant HL058942 from the National Heart, Lung, and Blood Institute, and a grant from the US Environmental Protection Agency's Science to Achieve Results (STAR) program | | |

| Bibliographic reference | **Eggleston PA, Butz A, Rand C, et al. Home environmental intervention in inner-city asthma: a randomized controlled clinical trial. Ann Allergy Asthma Immunol. 2005 Dec; 95(6):518-24. PMID: 16400889.** |
|---|---|
| Comments | Data extracted as reported in Lea *et al.* 2018 |
| Additional references | Swartz L J, Callahan K A, Butz A M, Rand C S, Kanchanaraksa S, Diette G B, Krishnan J A, Breysse P N, Buckley T J, Mosley A M, and Eggleston P A (2004) Methods and issues in conducting a community-based environmental randomized trial. Environmental Research 95(2), 156-165 |

Evans *et al.* 1999

| Bibliographic reference | **Evans R III, Gergen PJ, Mitchell H, et al. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. J Pediatr. 1999 Sep;135(3):332-8. PMID: 10484799** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | Randomised controlled trial | | |
| Study dates | Published 1999 | | |
| Objective | To reduce asthma symptoms to improve the quality of life for inner-city children with asthma | | |
| Country/ Setting | US/home | | |
| Number of participants | 1,033 | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention (n=515) | No interventions (n=518) |
| | Age, mean | 8 years, range 5 to 11 | |
| | % of male | 64% | |
| | Race | | |
| | Black | 75% | |
| | Hispanic | 17% | |
| | Homeownership: | Not reported | |
| | Geographic environment: | Urban | |
| | Clinical factors (baseline) | | |
| | HDM Sensitization (skin prick test positive) | 86% sensitized to at least one allergen | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | Not reported | |
| | Smoker in home: | 42% | |
| Inclusion criteria | Children with asthma | | |
| Exclusion criteria | Not reported | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |

| Bibliographic reference | **Evans R III, Gergen PJ, Mitchell H, et al. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. J Pediatr. 1999 Sep;135(3):332-8. PMID: 10484799** | | |
|---|---|---|---|
| | Study details extracted from the Agency for Healthcare Research and Quality (AHRQ) comparative effectiveness review on 'Indoor Allergen Reduction in Management of Asthma 2018' | | |
| | Brief Name | – | Multi-component intervention:<br>• Impermeable covers (brand NR) on mattresses, pillows<br>• Professional application of abamectin insecticide in homes of people with positive Bla g skin test<br>• Monthly contact with social workers to discuss allergen control, symptom management, access to medical care |
| | Rationale/theory/Goal | – | – |
| | Materials used | – | – |
| | Procedures used | – | – |
| | Provider | – | Masters level social workers |
| | Method of delivery | – | Group + individual |
| | Location | – | – |
| | Duration | – | 2 months |
| | Intensity | – | 2 group + 1 individual session |
| | Tailoring/adaptation | – | – |
| | Modifications | – | – |
| | Planned treatment fidelity | – | – |
| | Actual treatment fidelity | – | – |
| | Other details | – | – |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | No interventions |
| | Rationale/theory/Goal | – | – |
| | Materials used | – | – |
| | Procedures used | – | – |
| | Provider | – | – |

| Bibliographic reference | **Evans R III, Gergen PJ, Mitchell H, et al. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. J Pediatr. 1999 Sep;135(3):332-8. PMID: 10484799** | | |
|---|---|---|---|
| | Method of delivery | – | – |
| | Location | – | – |
| | Duration | – | – |
| | Intensity | – | – |
| | Tailoring/adaptation | – | – |
| | Modifications | – | – |
| | Planned treatment fidelity | – | – |
| | Actual treatment fidelity | – | – |
| | Other details | – | – |
| Follow up | 2 years | | |
| Study Methods | Method of randomisation | Not reported in the review | |
| | Method of allocation concealment | Not reported in the review | |
| | Statistical method(s) used to analyse data | Not reported in the review | |
| | Unit of allocation | Not reported in the review | |
| | Unit of analysis | Not reported in the review | |
| | Attrition | 7% attrition at 1 year, and 14% at 2 years | |
| Outcomes measures and effect size. | | Multicomponent intervention (n=515) | No inventions (n=518) |
| | Maximum number of symptom days/2 weeks, mean (SD where available) | | |
| | Baseline | 5.1 (4.5) | 5.1 (4.6) |
| | 12 months | 3.51 (SD not reported) | 4.06 (SD not reported) |
| | | Statistically significant, p=0.004<br>difference and 95% CI between the groups – 0.55 (-0.92 to -0.18) | |
| | 2 years | 2.64 (SD not reported) | 3.16 (SD not reported) |
| | | Statistically significant, p=0.7<br>Difference and 95% CI between groups -0.51 (-0.89 to -0.13) | |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Low | Block randomisation, stratification by asthma study unit |
| | Allocation concealment | Unclear | No description of allocation |

| Bibliographic reference | **Evans R III, Gergen PJ, Mitchell H, et al. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. J Pediatr. 1999 Sep;135(3):332-8. PMID: 10484799** | | |
|---|---|---|---|
| | Blinding of participants and personnel | High | outcomes assessors blinded but people were not; |
| | Blinding of outcome assessment | Low | outcomes assessors blinded but people were not; |
| | Incomplete outcome data | Low | Low attrition |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | National Institute of Allergy and Infectious Disease | | |
| Comments | Data extracted as reported in Lea *et al.* 2018 | | |
| Additional references | - | | |

Morgan *et al.* 2004

| Bibliographic reference | **Morgan WJ, Crain EF, Gruchalla RS, et al. Results of a home-based environmental intervention among urban children with asthma. N Engl J Med. 2004 Sep 9;351(11):1068-80.** | | |
|---|---|---|---|
| Registration | Not reported | | |
| Study type | RCT | | |
| Study dates | Not reported | | |
| Objective | To determine whether an intervention tailored to each child's sensitization and environmental risk profile could improve the symptoms of asthma and decrease the use of health care services. | | |
| Country/ Setting | USA/home | | |
| Number of participants | 937 children | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention: | No interventions |
| | Age, mean | 8 years | |
| | % of male | 63% | |
| | Race | | |
| | Black | 40% | |
| | Hispanic | 40% | |
| | Homeownership: | Not reported | |
| | Geographic environment: | Urban | |
| | Clinical factors (baseline) | | |
| | Sensitization: | | |

| Bibliographic reference | **Morgan WJ, Crain EF, Gruchalla RS, et al. Results of a home-based environmental intervention among urban children with asthma. N Engl J Med. 2004 Sep 9;351(11):1068-80.** | | |
|---|---|---|---|
| | (skin prick test positive:): | | |
| | HDM | 63% | |
| | Bla g | 69% | |
| | Fel d | 44% | |
| | Can f | 22% | |
| | Mus m | 33% | |
| | Mould | 50% | |
| | Asthma severity: | Not reported | |
| | Comorbidity: | Not reported | |
| | Carpeted bedrooms: | Not reported | |
| | Cat/dog in home: | 22% dog, 18% cat | |
| | Smoker in home: | 48% | |
| Inclusion criteria | At least, one asthma-related hospitalization or two unscheduled, asthma-related visits to the clinic or emergency department during the previous six months and a positive skin test in response to at least 1 of 11 indoor allergens | | |
| Exclusion criteria | Within three weeks of an asthma-related hospitalization or visit to the emergency department and could not have any other serious chronic illness | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | 1069 | Multi-component intervention:<br>• Impermeable covers (Allergy Control Products) on mattresses, pillows, box springs<br>• HEPA filtered vacuum (Miele)<br>• HEPA air purifier (Holmes Products) for people exposed to pets, mould, or tobacco smoke<br>• Professional pest control (Terminix) |
| | Rationale/theory/Goal | 1069 | To provide the child's caretaker with the knowledge, skills, motivation, equipment, and supplies necessary to perform comprehensive environmental remediation.<br>Interventions based on social learning theory |
| | Materials used | – | Not clear |

| **Bibliographic reference** | **Morgan WJ, Crain EF, Gruchalla RS, et al. Results of a home-based environmental intervention among urban children with asthma. N Engl J Med. 2004 Sep 9;351(11):1068-80.** | | |
|---|---|---|---|
| | Procedures used | 1089 | Activities |
| | Provider | – | Not clear |
| | Method of delivery | 1069 | Face to face |
| | Location | 1069 | Home |
| | Duration | 1069 | 12 months |
| | Intensity | 1069 | 6 sessions |
| | Tailoring/adaptation | 1069 | Individualised |
| | Modifications | – | Not clear |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | 1068-9 | No interventions |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | 1068-9 | 6-months evaluation visit only |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 2 years | | |
| Study Methods | Method of randomisation | Not reported | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Differences in pulmonary function between the groups were analysed with the use of analysis of variance, with adjustment for baseline measurement and site. | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | 12% attrition | |

| Bibliographic reference | **Morgan WJ, Crain EF, Gruchalla RS, et al. Results of a home-based environmental intervention among urban children with asthma. N Engl J Med. 2004 Sep 9;351(11):1068-80.** | | |
|---|---|---|---|
| Outcomes measures and effect size. | | Multicomponent intervention | No interventions |
| | Symptoms, patient questionnaires | | |
| | Maximal number of days with symptoms/2 weeks, mean (SE) | | |
| | Baseline | 6 (0.23) n=469 | 6 (0.24) n=468 |
| | 12 months | 3.39 (0.12) n=444 | 4.20 (0.12) n=425 |
| | 2 years | 2.62 (0.12) n=407 | 3.21 (0.13) n=414 |
| | Pulmonary physiology | | |
| | FEV1 (% predicted value), mean (SE): | | |
| | Baseline | 88.3 (8.3) n=469 | 87.3 (0.82) n=468 |
| | 12 months | 87.0 (0.77) n=444 | 87.4 (0.78) n=425 |
| | 2 years | not reported | not reported |
| Risk of bias (ROB) | **Outcome** | **Judgement** | **Comments** |
| | Random sequence generation | Unclear | No detail provided |
| | Allocation concealment | Unclear | No description of allocation; |
| | Blinding of participants and personnel | High | People not blinded, but study evaluators blinded; |
| | Blinding of outcome assessment | Low | People not blinded, but study evaluators blinded; |
| | Incomplete outcome data | Low | 12% attrition |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | Low | | |
| Source of funding | This study was supported by from the National Institute of Allergy and Infectious Diseases and the National Institute of Environmental Health Sciences, National Institutes of Health, and by the National Center for Research Resources, National Institutes of Health. | | |
| Comments | No | | |
| Additional references | Pongracic Ja, Visness Cm, Gruchalla Rs, Evans R, and Mitchell He (2008) Effect of mouse allergen and rodent environmental intervention on asthma in inner-city children. Annals of allergy, and asthma & immunology 101(1), 35-41 | | |

Parker *et al.* 2008

| Bibliographic reference | **Parker EA, Israel BA, Robins TG, et al. Evaluation of community action against asthma: a community health worker intervention to improve children's asthma-related health by reducing household environmental triggers for asthma. Health Educ Behav. 2008 Jun;35(3):376-95.** |
|---|---|
| Registration | Not reported |

| **Bibliographic reference** | **Parker EA, Israel BA, Robins TG, et al. Evaluation of community action against asthma: a community health worker intervention to improve children's asthma-related health by reducing household environmental triggers for asthma. Health Educ Behav. 2008 Jun;35(3):376-95.** | | |
|---|---|---|---|
| Study type | RCT | | |
| Study dates | Published 2008 | | |
| Objective | To improve children's asthma-related health by reducing household environmental triggers for asthma | | |
| Country/ Setting | USA/home | | |
| Number of participants | 298 | | |
| Participant characteristics | **Demographic characteristics** | Multi-component intervention (n=150) | No interventions (n=148) |
| | Age, mean | 9 years, range 7 to 11 | |
| | % of male | 58% | |
| | Race | | |
| | African American | 81% | |
| | Latino | 10% | |
| | Caucasian | 4% | |
| | Homeownership | 36% | |
| | Geographic environment | Urban | |
| | Clinical factors (baseline) | | |
| | Sensitization (skin prick test positive) | | |
| | HDM | 38% | |
| | Bla g | 21% | |
| | Fel d | 23% | |
| | Can f | 8% | |
| | Mus m | 13% | |
| | Asthma severity | 48% moderate-severe 28% mild persistent 20% mild intermittent | |
| | Comorbidity | Not reported | |
| | Carpeted bedrooms | Not reported | |
| | Cat/dog in home | Not reported | |
| | Smoker in home | 38% | |
| Inclusion criteria | Not reported in the review | | |
| Exclusion criteria | Not reported in the review | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | 4 | Multi-component intervention:<br>• Impermeable covers (brand NR) |

| Bibliographic reference | Parker EA, Israel BA, Robins TG, et al. Evaluation of community action against asthma: a community health worker intervention to improve children's asthma-related health by reducing household environmental triggers for asthma. Health Educ Behav. 2008 Jun;35(3):376-95. | | |
|---|---|---|---|
| | | | on mattresses, pillows<br>• HEPA filtered vacuum (Eureka SmartVac)<br>• Household cleaning supplies provided<br>• Integrated pest management<br>• Education and instruction about allergen reduction strategies given by community health workers |
| | Rationale/theory/Goal | 4 | Empowerment and social cognitive theory |
| | Materials used | 4 | Not reported |
| | Procedures used | 4 | Plan of action was agreed with caregiver |
| | Provider | 5 | Community environment specialists |
| | Method of delivery | 5 | Face to face |
| | Location | 5 | Home |
| | Duration | 5 | 1 year |
| | Intensity | 5 | 9 visits |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | – | No interventions |
| | Rationale/theory/Goal | – | NA |
| | Materials used | – | NA |
| | Procedures used | – | NA |
| | Provider | – | NA |
| | Method of delivery | – | NA |
| | Location | – | NA |
| | Duration | – | NA |

| Bibliographic reference | **Parker EA, Israel BA, Robins TG, et al. Evaluation of community action against asthma: a community health worker intervention to improve children's asthma-related health by reducing household environmental triggers for asthma. Health Educ Behav. 2008 Jun;35(3):376-95.** | | |
|---|---|---|---|
| | Intensity | – | NA |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 3 months | | |
| Study Methods | Method of randomisation | Not reported in the review | |
| | Method of allocation concealment | Not reported in the review | |
| | Statistical method(s) used to analyse data | Not reported in the review | |
| | Unit of allocation | Not reported in the review | |
| | Unit of analysis | Not reported in the review | |
| | Attrition | 24% attrition | |
| Outcomes measures and effect size. | | Multicomponent intervention | No interventions |
| | Pulmonary physiology | | |
| | FEV1 intraday variability % mean (SD) baseline | 15.1 (12.2) | 14.2 (12.0) |
| | FEV1 intraday variability % mean (SD) endpoint | 14.4 (12.1) | 17.1 (13.7) |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Low | Random number generation, stratified by household location |
| | Allocation concealment | Unclear | No description of allocation; |
| | Blinding of participants and personnel | High | No blinding |
| | Blinding of outcome assessment | High | No blinding |
| | Incomplete outcome data | High | 24% attrition and dropouts differed from completers on homeownership |
| | Selective reporting | Low | No concerns |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | National Institute of Environmental Health Sciences and the U.S. Environmental Protection Agency | | |
| Comments | No | | |

| | |
|---|---|
| **Bibliographic reference** | **Parker EA, Israel BA, Robins TG, et al. Evaluation of community action against asthma: a community health worker intervention to improve children's asthma-related health by reducing household environmental triggers for asthma. Health Educ Behav. 2008 Jun;35(3):376-95.** |
| Additional references | |

## D.5 Reduction/prevention of second-hand smoke exposure

Butz *et al.* 2011

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Butz Arlene M, Matsui Elizabeth C, Breysse Patrick, Curtin-Brosnan Jean, Eggleston Peyton, Diette Gregory, Williams D'Ann, Yuan Jie, Bernert John T, and Rand Cynthia (2011) A randomized trial of air cleaners and a health coach to improve indoor air quality for inner-city children with asthma and secondhand smoke exposure. Archives of pediatrics & adolescent medicine 165(8), 741-8** | | |
| Registration | NCT00466024 | | |
| Study type | Randomized controlled trial (3 arm) | | |
| Study dates | October 2006 to December 2008, identification of eligible children | | |
| Objective | To test an air cleaner and health coach intervention to reduce second-hand smoke exposure in children with asthma residing with smoker | | |
| Country/ Setting | US | | |
| Number of participants | 126 children aged 6 to 12 years<br>Control group n=44, intervention group n=41 | | |
| Participant characteristics | **Demographic characteristics** | Control<br>n (%) | Intervention<br>n (%) |
| | Age Mean (SD) | 9.2 (2.2 | 8.9 (1.5) |
| | Sex (male) | 22 (50) | 23 (56) |
| | Ethnicity | | |
| | African-American race | 41 (93) | 40 (98) |
| | Socio-economic status (education) | | |
| | High school graduate | 20 (45) | 22 (55) |
| | Existing condition (asthma severity) | | |
| | Intermittent | 11 (25) | 7 (17) |
| | Mild persistent | 7 (16) | 6 (15) |
| | Moderate persistent | 12 (27) | 15 (37) |
| | Severe persistent | 14 (32) | 13 (32) |
| Inclusion criteria | • Children age of 6 to 12 years;<br>• Physician-diagnosed asthma<br>• Persistent asthma signified by symptom frequency, and/or controller medication<br>• A smoker in the home who smoked more than 5 cigarettes per day and resided in the home at least 4 days per week<br>• Residence in the Baltimore metropolitan area | | |

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Butz Arlene M, Matsui Elizabeth C, Breysse Patrick, Curtin-Brosnan Jean, Eggleston Peyton, Diette Gregory, Williams D'Ann, Yuan Jie, Bernert John T, and Rand Cynthia (2011) A randomized trial of air cleaners and a health coach to improve indoor air quality for inner-city children with asthma and secondhand smoke exposure. Archives of pediatrics & adolescent medicine 165(8), 741-8** | | |
| Exclusion criteria | From trial registry<br>Children will be excluded is they have other respiratory morbidity such as cystic fibrosis or bronchopulmonary dysplasia, if they smoke cigarettes, if they do not have asthma symptoms or medication use in the month before randomization<br>Families living in a shelter or transitional housing will be excluded | | |
| Intervention | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P741 | Smoke exposure reduction education |
| | Rationale/theory/Goal | P741 | To reduce second-hand smoke exposure |
| | Materials used | P742 | Asthma education<br>High-efficiency particle air (HEPA) cleaners<br>Health coach |
| | Procedures used | P742 | Identification of the child's second-hand smoke exposure risk<br>Assessment of the caregiver's motivation and readiness for behaviour change<br>Set a home smoking ban goal with the caregiver for which the caregiver signs a contingency contract for established behaviour change<br>Encourage and monitor the use of air cleaners<br>Teach the child second-hand smoke avoidance techniques |
| | Provider | P742 | Nurse health coach with ongoing weekly supervision |
| | Method of delivery | P472 | Face to face |
| | Location | P472 | Intervention delivered at home |
| | Duration | P472 | 2 months |
| | Intensity | P472 | 4 visits (30 to 45 minutes) |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |

| | | | |
|---|---|---|---|
| **Bibliographic reference** | **Butz Arlene M, Matsui Elizabeth C, Breysse Patrick, Curtin-Brosnan Jean, Eggleston Peyton, Diette Gregory, Williams D'Ann, Yuan Jie, Bernert John T, and Rand Cynthia (2011) A randomized trial of air cleaners and a health coach to improve indoor air quality for inner-city children with asthma and secondhand smoke exposure. Archives of pediatrics & adolescent medicine 165(8), 741-8** | | |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Comparison | **TIDieR Checklist criteria** | **Paper/Location** | **Details** |
| | Brief Name | P742 | Control |
| | Rationale/theory/Goal | P742 | To reduce second-hand smoke exposure |
| | Materials used | P742 | Asthma education |
| | Procedures used | – | – |
| | Provider | P742 | Nurse |
| | Method of delivery | P742 | Face to face |
| | Location | P742 | Delivery at home |
| | Duration | P742 | 2 months |
| | Intensity | P742 | 4 visits |
| | Tailoring/adaptation | – | NA |
| | Modifications | – | NA |
| | Planned treatment fidelity | – | NA |
| | Actual treatment fidelity | – | NA |
| | Other details | – | NA |
| Follow up | 6 months | | |
| Study Methods | Method of randomisation | Randomization function embedded in the study database, block randomization | |
| | Method of allocation concealment | Not reported | |
| | Statistical method(s) used to analyse data | Baseline characteristics were compared across the groups using Chi-square tests for categorical variables, the Kruskal-Wallis test for nonnormally<br>distributed continuous variables, and analysis of variance for age<br>Differences in exposure outcomes from baseline to 6 months were calculated and compared across the 3 treatment groups using the Kruskal-Wallis test | |
| | Unit of allocation | Individual | |
| | Unit of analysis | Individual | |
| | Attrition | Number of children completing the study: 115, control group (n=42), intervention group (n=38) | Reasons for not completing the study: Not reported |

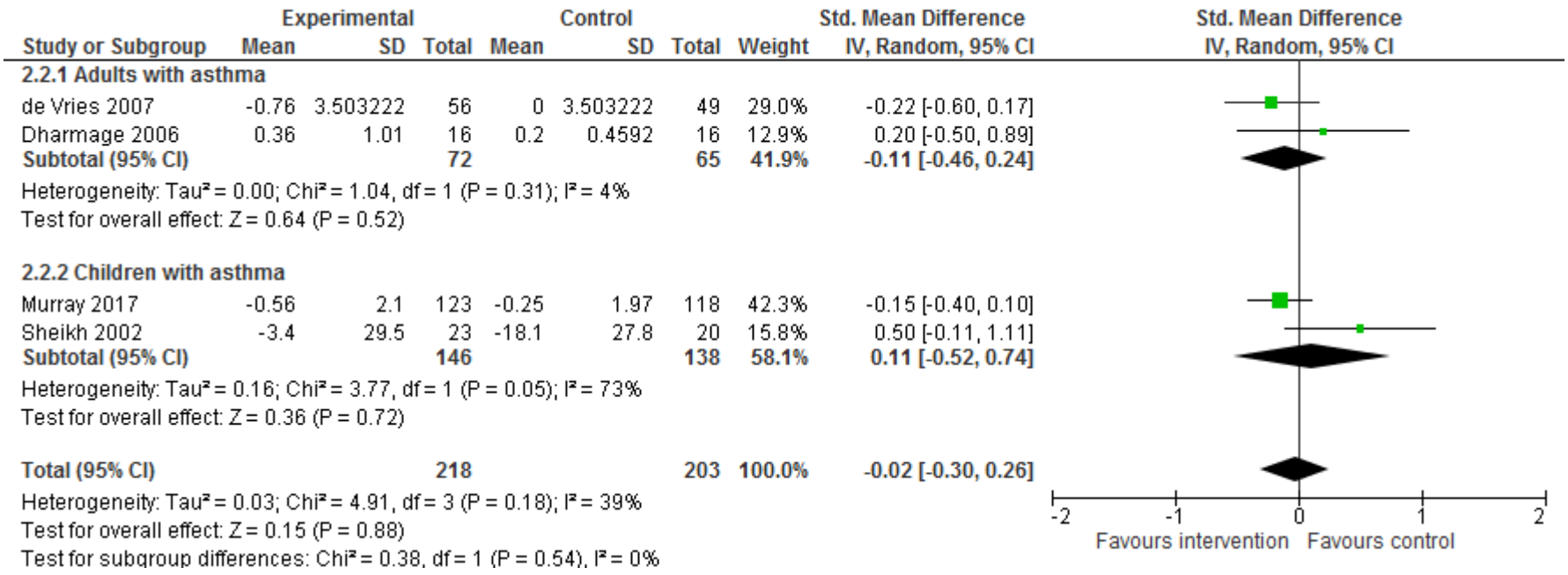
| Bibliographic reference | **Butz Arlene M, Matsui Elizabeth C, Breysse Patrick, Curtin-Brosnan Jean, Eggleston Peyton, Diette Gregory, Williams D'Ann, Yuan Jie, Bernert John T, and Rand Cynthia (2011) A randomized trial of air cleaners and a health coach to improve indoor air quality for inner-city children with asthma and secondhand smoke exposure. Archives of pediatrics & adolescent medicine 165(8), 741-8** | | |
|---|---|---|---|
| Outcomes measures and effect size. | | Control<br>Mean (SD) | Intervention<br>Mean (SD) |
| | Differences in symptom-free days during past 14 days from baseline to 6 months | -0.24 (3.0) | 1.63 (4.8) |
| Risk of bias (ROB) | Outcome | Judgement | Comments |
| | Random sequence generation | Low | Randomization function embedded in the study database, block randomization |
| | Allocation concealment | High | Not reported, as block randomization is use group allocation might be guessed |
| | Blinding of participants and personnel | High | Participants in control group did not receive any products |
| | Blinding of outcome assessment | Low | Outcome assessors were blinded |
| | Incomplete outcome data | Low | Attrition was low |
| | Selective reporting | Low | All outcomes reported |
| | Other sources of bias | Low | No concerns |
| Overall ROB | High | | |
| Source of funding | The National Institute of Environmental Health Science, National Institutes of Health (E09606)<br>The Environmental Protection Agency (P01 R-826724)<br>The Johns Hopkins Center for Childhood Asthma in the Urban Environment. | | |
| Comments | | | |
| Additional references | | | |

# Appendix E: Forest plots

## E.1 Aeroallergens – mattress, duvet, and pillow cover

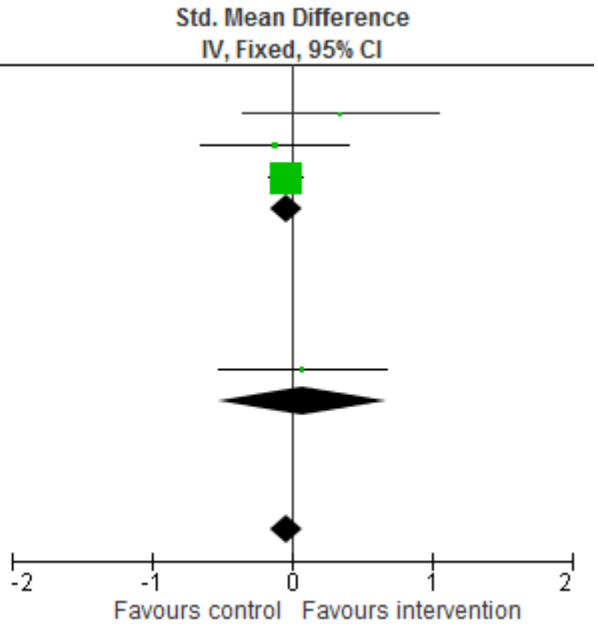
### E.1.1 Asthma in children and adults with asthma

**Asthma (asthma control questionnaire, puffs per day)**



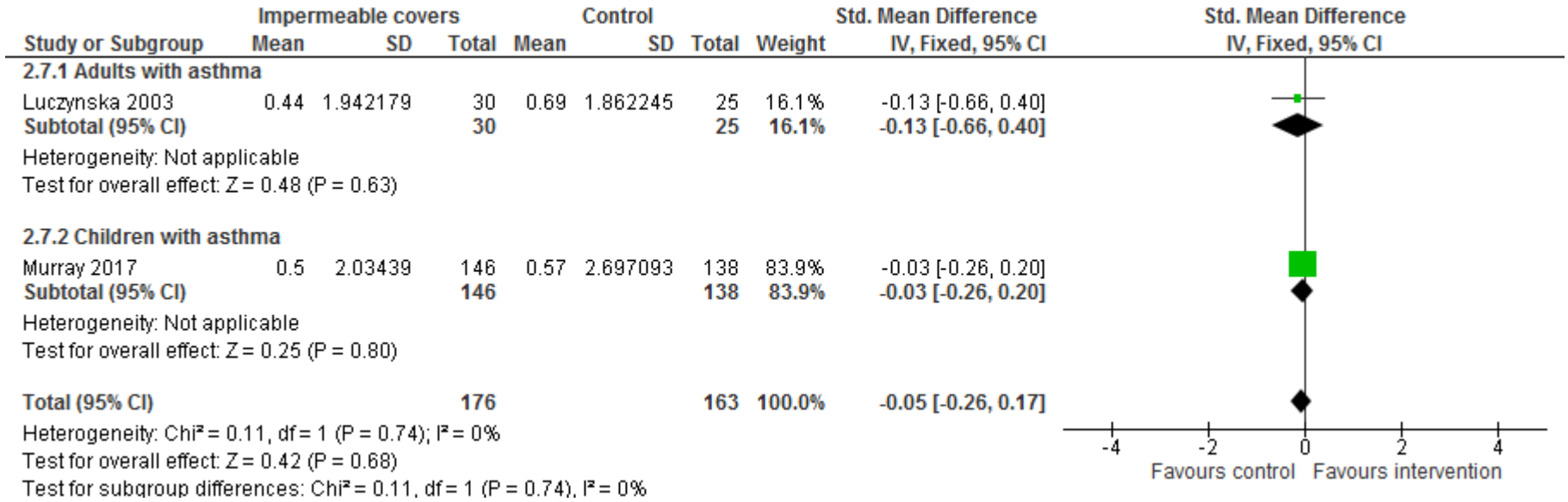
### E.1.2 Respiratory health (measured by peak flow) in children and adults with asthma

| Study or Subgroup | Impermeable covers Mean | SD | Total | Control Mean | SD | Total | Weight | Std. Mean Difference IV, Fixed, 95% CI |
|---|---|---|---|---|---|---|---|---|
| **2.1.1 Adults with asthma** | | | | | | | | |
| Dharmage 2006 | 1.95 | 4.030612 | 16 | 0.5 | 4.081633 | 16 | 2.5% | 0.35 [-0.35, 1.05] |
| Luczynska 2003 | 367 | 217.9712 | 30 | 388 | 99.4898 | 25 | 4.4% | -0.12 [-0.65, 0.41] |
| Woodcock 2003 | -1.6 | 36.7433 | 560 | 0 | 36.7433 | 562 | 89.7% | -0.04 [-0.16, 0.07] |
| **Subtotal (95% CI)** | | | **606** | | | **603** | **96.6%** | **-0.04 [-0.15, 0.08]** |
| Heterogeneity: Chi² = 1.27, df = 2 (P = 0.53); I² = 0% | | | | | | | | |
| Test for overall effect: Z = 0.64 (P = 0.52) | | | | | | | | |
| **2.1.2 Children with asthma** | | | | | | | | |
| Sheikh 2002 | 16.38 | 25.62 | 23 | 13.68 | 43.14 | 20 | 3.4% | 0.08 [-0.52, 0.68] |
| **Subtotal (95% CI)** | | | **23** | | | **20** | **3.4%** | **0.08 [-0.52, 0.68]** |
| Heterogeneity: Not applicable | | | | | | | | |
| Test for overall effect: Z = 0.25 (P = 0.80) | | | | | | | | |
| **Total (95% CI)** | | | **629** | | | **623** | **100.0%** | **-0.03 [-0.14, 0.08]** |
| Heterogeneity: Chi² = 1.40, df = 3 (P = 0.71); I² = 0% | | | | | | | | |
| Test for overall effect: Z = 0.58 (P = 0.56) | | | | | | | | |
| Test for subgroup differences: Chi² = 0.13, df = 1 (P = 0.72), I² = 0% | | | | | | | | |



### E.1.3 Quality of life in children and adults with asthma

**Quality of life (Marks Asthma Quality of Life Questionnaire, asthma control questionnaire)**



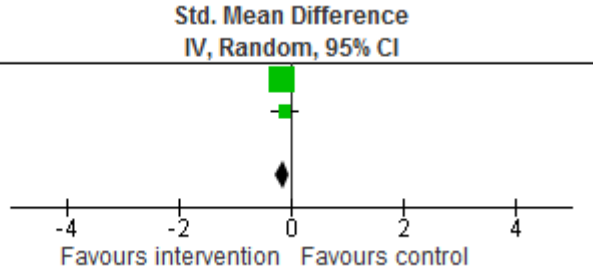
# E.2 Aeroallergens – multicomponent intervention

## E.2.1 Asthma in children with asthma

### E.2.1.1 Asthma – wheeze (7-point Likert scale) or asthma-related inpatient visit (days)

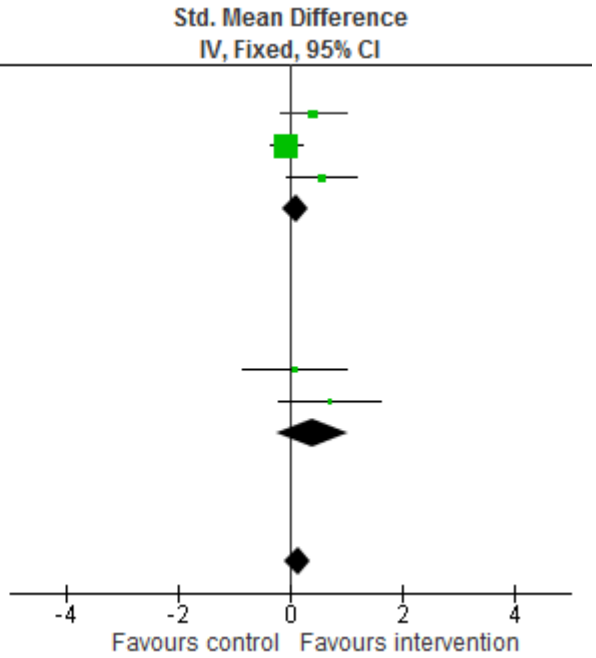
| | Experimental | | | Control | | | | Std. Mean Difference |
|---|---|---|---|---|---|---|---|---|
| Study or Subgroup | Mean | SD | Total | Mean | SD | Total | Weight | IV, Random, 95% CI |
| Barnes 2008 | 1.67 | 2.6 | 283 | 2.1 | 2.9 | 376 | 69.8% | -0.15 [-0.31, -0.00] |
| Bryant-Stephens 2008 | -0.31 | 0.78 | 153 | -0.24 | 0.65 | 128 | 30.2% | -0.10 [-0.33, 0.14] |
| **Total (95% CI)** | | | **436** | | | **504** | **100.0%** | **-0.14 [-0.27, -0.01]** |

Heterogeneity: Tau² = 0.00; Chi² = 0.17, df = 1 (P = 0.68); I² = 0%
Test for overall effect: Z = 2.08 (P = 0.04)



### E.2.2 Respiratory health (measured by FEV1 and PEF) in children and adults with asthma,

| Study or Subgroup | Experimental Mean | SD | Total | Control Mean | SD | Total | Weight | Std. Mean Difference IV, Fixed, 95% CI |
|---|---|---|---|---|---|---|---|---|
| **1.6.1 Mattress cover included** | | | | | | | | |
| Carswell 1996 | 2.3 | 10.2 | 23 | -3.2 | 15.3 | 23 | 14.1% | 0.42 [-0.17, 1.00] |
| Matsui 2017 | -1.3 | 14 | 94 | -0.5 | 14.2 | 103 | 61.8% | -0.06 [-0.34, 0.22] |
| Walshaw 1986 | 77.4 | 0.6 | 22 | 74.65 | 6.8 | 20 | 12.6% | 0.57 [-0.05, 1.19] |
| **Subtotal (95% CI)** | | | **139** | | | **146** | **88.6%** | **0.11 [-0.13, 0.34]** |
| Heterogeneity: Chi² = 4.56, df = 2 (P = 0.10); I² = 56% | | | | | | | | |
| Test for overall effect: Z = 0.91 (P = 0.36) | | | | | | | | |
| **1.6.2 Mattress cover not included** | | | | | | | | |
| Dorward 1988 | -0.1 | 0.81 | 9 | -0.17 | 0.51 | 9 | 5.7% | 0.10 [-0.83, 1.02] |
| Hayden 1997 | 328 | 62 | 11 | 266 | 102 | 9 | 5.8% | 0.72 [-0.19, 1.64] |
| **Subtotal (95% CI)** | | | **20** | | | **18** | **11.4%** | **0.41 [-0.24, 1.06]** |
| Heterogeneity: Chi² = 0.88, df = 1 (P = 0.35); I² = 0% | | | | | | | | |
| Test for overall effect: Z = 1.25 (P = 0.21) | | | | | | | | |
| **Total (95% CI)** | | | **159** | | | **164** | **100.0%** | **0.14 [-0.08, 0.36]** |
| Heterogeneity: Chi² = 6.19, df = 4 (P = 0.19); I² = 35% | | | | | | | | |
| Test for overall effect: Z = 1.28 (P = 0.20) | | | | | | | | |
| Test for subgroup differences: Chi² = 0.75, df = 1 (P = 0.39), I² = 0% | | | | | | | | |



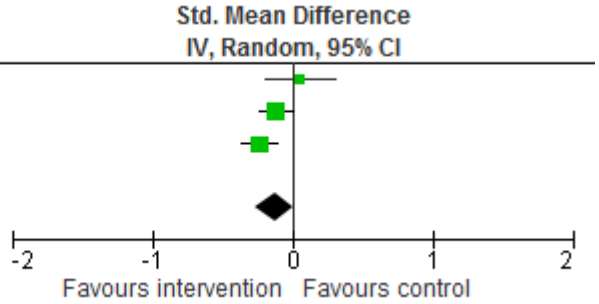
# E.3 Aeroallergens and second-hand smoke

## E.3.1 Asthma

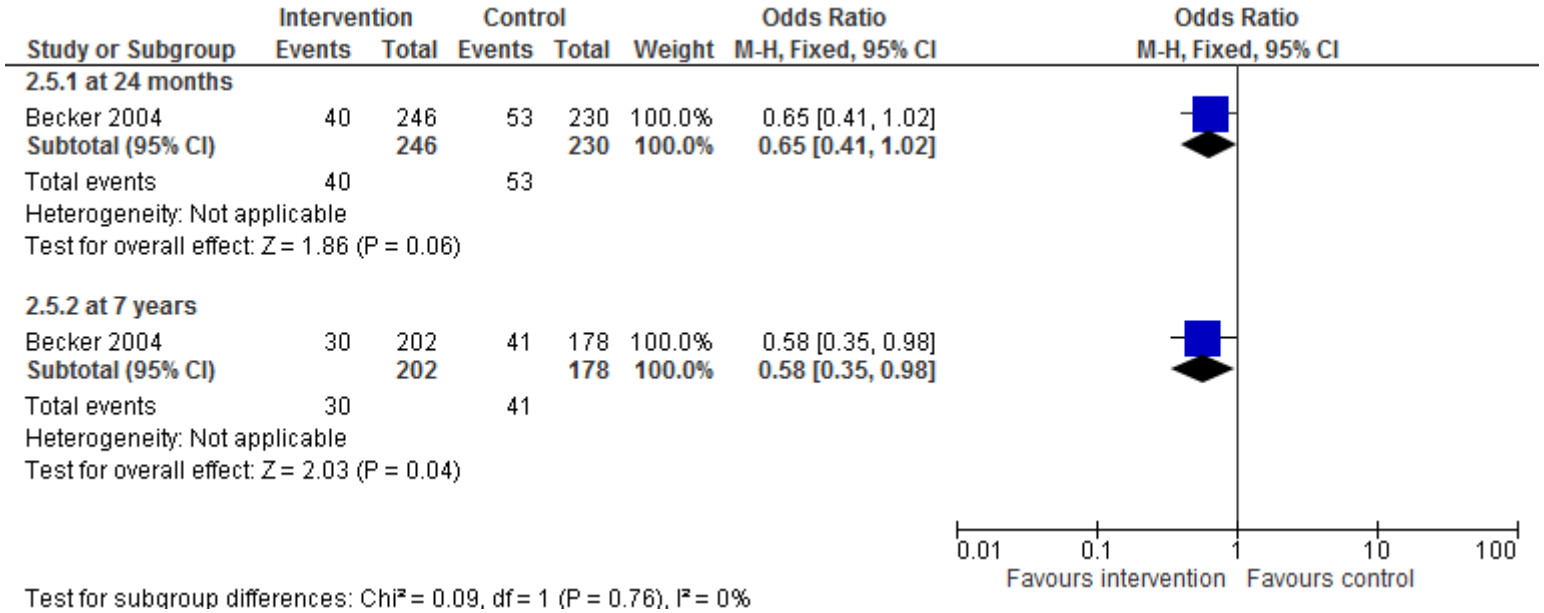
### E.3.1.1 Asthma in children and adults – symptom days/2 weeks, treatment steps

| | Intervention | | | Control | | | | Std. Mean Difference |
|---|---|---|---|---|---|---|---|---|
| Study or Subgroup | Mean | SD | Total | Mean | SD | Total | Weight | IV, Random, 95% CI |
| DiMango 2016 | 3.5 | 0.19 | 125 | 3.43 | 1.88 | 122 | 19.7% | 0.05 [-0.20, 0.30] |
| Evans 1999 | -2.46 | 4.5 | 515 | -1.94 | 4.6 | 515 | 41.3% | -0.11 [-0.24, 0.01] |
| Morgan 2004 | -3.38 | 2.42 | 469 | -2.79 | 2.65 | 414 | 38.9% | -0.23 [-0.37, -0.10] |
| **Total (95% CI)** | | | **1109** | | | **1051** | **100.0%** | **-0.13 [-0.26, 0.01]** |

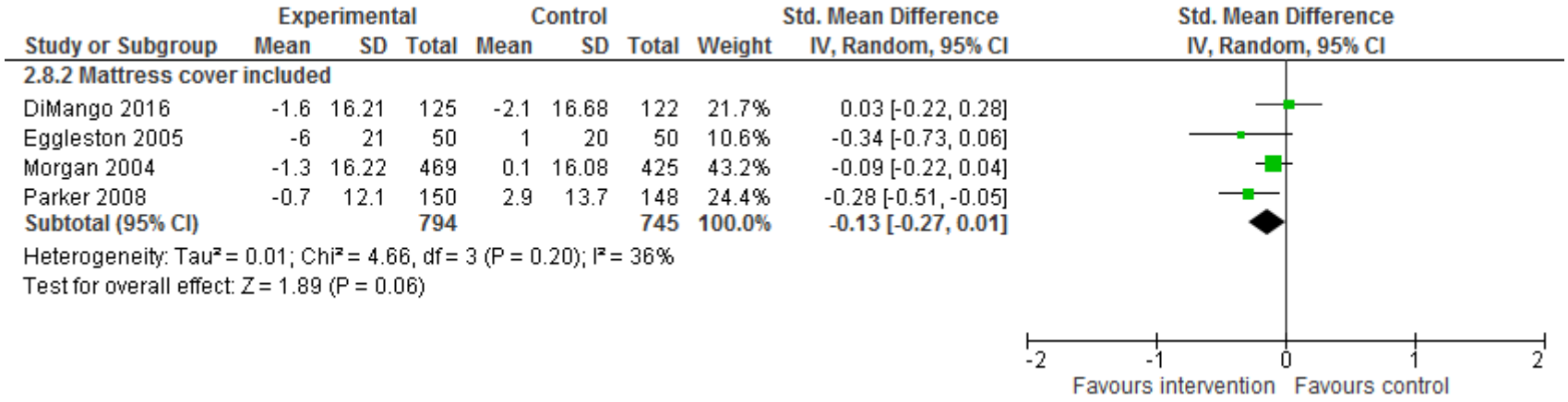
Heterogeneity: Tau² = 0.01; Chi² = 4.34, df = 2 (P = 0.11); I² = 54%
Test for overall effect: Z = 1.87 (P = 0.06)



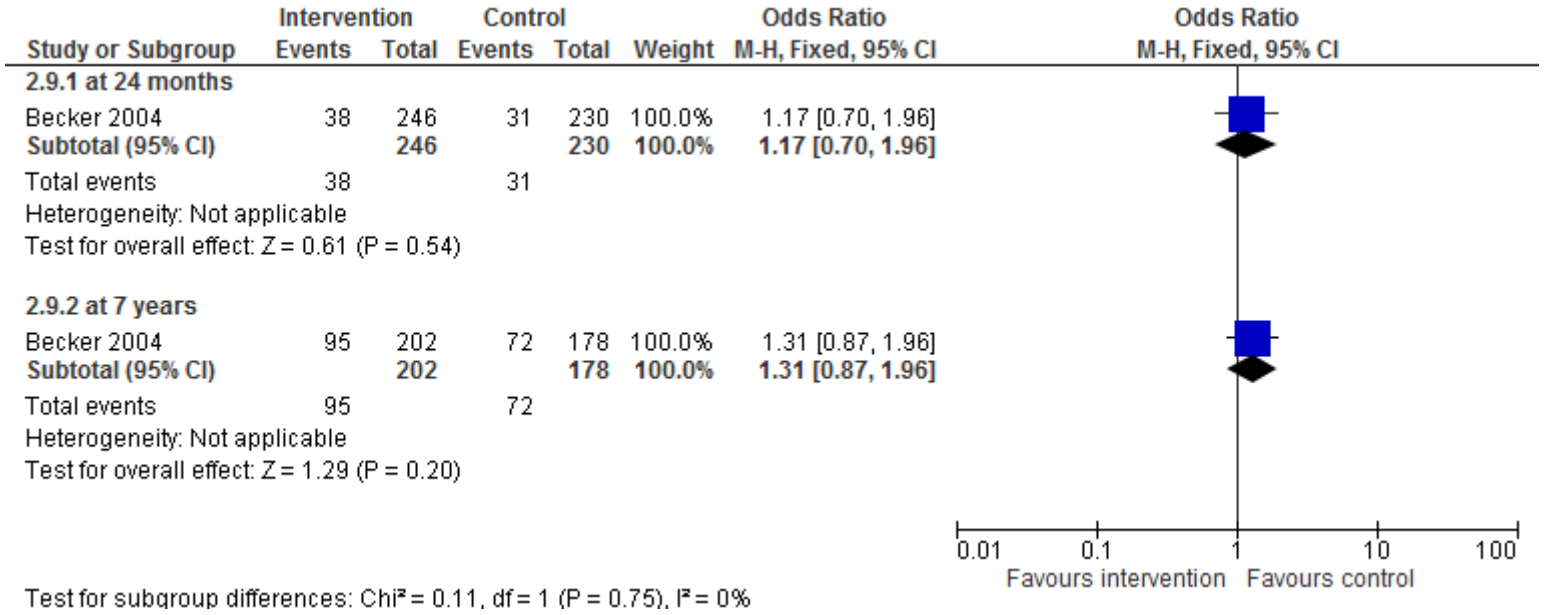
### E.3.1.2 Asthma in children – number of people diagnosed at 2 and 7 years



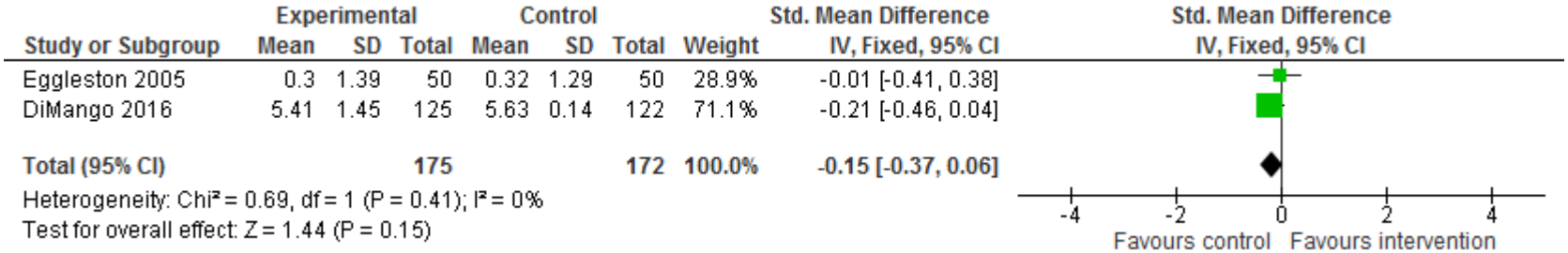
### E.3.2 Respiratory health in children and adults



### E.3.3 Atopy




### E.3.4 Health related quality of life



# Appendix F:GRADE profiles

## F.1 Aeroallergens

### F.1.1 Impermeable bed covers

| Quality assessment | | | | | | | No of participants | | Effect | | Quality | Importance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No of studies | Design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Aeroallergen mattress cover | Control | Relative (95% CI) | Absolute | | |
| **Asthma (ACQ mean, puffs per day) (follow-up up to 2 years; Better indicated by lower values)** | | | | | | | | | | | | |
| de Vries 2007, Dharmage 2006, Murray 2017, Sheikh 2002 | randomised trials | no serious risk of bias[1] | no serious inconsistency[2] | no serious indirectness[3] | no serious imprecision[4] | none | 218 | 203 | - | SMD 0.02 lower (0.30 lower to 0.26 higher) | HIGH | |
| **Asthma (RR) (follow-up for 8 years)** | | | | | | | | | | | | |
| Gehring 2012 | randomised trial | no serious risk of bias[1] | no serious inconsistency[5] | no serious indirectness[3] | serious[6] | none | Not reported | Not reported | RR 0.87 (0.60 to 1.28) | - | MODERATE | |
| **Respiratory health effect (follow-up up to 2 years; Better indicated by higher values)** | | | | | | | | | | | | |
| Dharmage 2006, Luczynska 2003, Sheikh 2002, Woodcock 2003 | randomised trials | no serious risk of bias[1] | no serious inconsistency[2] | no serious indirectness[3] | no serious imprecision[4] | none | 629 | 623 | - | SMD 0.03 lower (0.14 lower to 0.08 higher) | HIGH | |
| **Allergic rhinitis (RR) (follow-up 8 years)** | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gehring 2012 | randomised trial | no serious risk of bias[1] | no serious inconsistency[5] | no serious indirectness[3] | very serious[7] | none | Not reported | Not reported | RR 0.88 (0.52 to 1.47) | - | LOW | |
| **Allergic rhinitis (continuous) - Children and adults with rhinitis (follow-up 12 months; Better indicated by lower values)** | | | | | | | | | | | | |
| Terreehorst 2003 | randomised trial | no serious risk of bias[1] | no serious inconsistency[5] | no serious indirectness[3] | no serious imprecision[4] | none | 114 | 118 | - | MD 1.03 higher (6.91 lower to 8.97 higher) | HIGH | |
| **Allergic rhinitis (continuous) - Children with asthma (follow-up 12 months; Better indicated by lower values)** | | | | | | | | | | | | |
| Sheikh 2002 | randomised trial | no serious risk of bias[1] | no serious inconsistency[5] | no serious indirectness[3] | serious[8] | none | 23 | 20 | - | MD 8.47 lower (28.34 lower to 11.4 higher) | MODERATE | |
| **Dermatitis/atopic eczema (RR) - Infants at risk (follow-up 12 months)** | | | | | | | | | | | | |
| Gehring 2012 | randomised trials | no serious risk of bias[1] | no serious inconsistency[5] | no serious indirectness[3] | serious[9] | none | Not reported | Not reported | RR 1.05 (0.86 to 1.29) | - | MODERATE | |
| **Quality of life (continuous) (follow-up 12 months; Better indicated by higher values)** | | | | | | | | | | | | |
| Luczynska 2003, Murray 2017 | randomised trials | no serious risk of bias[1] | no serious inconsistency[2] | no serious indirectness[3] | no serious imprecision[4] | none | 176 | 163 | - | SMD 0.05 lower (0.26 lower to 0.17 higher) | HIGH | |
| **Quality of life (OR) - Adults with asthma (follow-up 12 months)** | | | | | | | | | | | | |
| Woodcock 2003 | randomised trials | no serious risk of bias[1] | no serious inconsistency[5] | no serious indirectness[3] | very serious[7] | none | 351/492 (71.3%) | 357/498 (71.7%) | OR 0.98 (0.75 to 1.3) | 4 fewer per 1000 (from 62 fewer to 50 more) | LOW | |

[1] Not downgraded - study/ies judged to be of low risk of bias
[2] Not downgraded - no evidence of heterogeneity: I squared smaller than 50%
[3] Not downgraded as study/ies met eligibility criteria as per protocol
[4] Not downgraded as confidence interval precise (minimal important difference for SMD is 0.5 either side of point estimate; for MD is 0.5 the SD of control either side of the point estimate)
[5] Not applicable as single study
[6] Downgraded once as confidence interval includes appreciable benefit (0.8; default minimal important difference for risk ratios)
[7] Downgraded twice as confidence interval includes both appreciable benefit and harm (0.8 and 1.25 respectively; default minimal important difference for risk ratios)

[8] Downgraded once as the lower confidence interval includes calculated MID for this outcome measure -15.35 (calculated from 0.5 SD of the control group)
[9] Downgraded once as confidence interval includes appreciable harm (1.25; default minimal important difference for risk ratios)

## F.1.2 Multicomponent intervention including behavioural component

| Quality assessment | | | | | | | No of participants | | Effect | | Quality |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No of studies | Design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Aeroallergen multicomponent behavioural intervention versus control | Control | Relative (95% CI) | Absolute | |
| **Asthma in children with atopic condition - number of children with wheeze at baseline continue with wheeze (follow-up 12 months)** | | | | | | | | | | | |
| Arshad 2002 | randomised trials | serious[1] | no serious inconsistency[2] | no serious indirectness[3] | serious[4] | none | 16/30 (53.3%) | 18/23 (78.3%) | OR 0.32 (0.09 to 1.08) | 247 fewer per 1000 (from 538 fewer to 13 more) | LOW |
| **Asthma in children with asthma- wheeze (7-point likert scale), length of hospital stay (days) (follow-up up to 12 months; Better indicated by lower values)** | | | | | | | | | | | |
| Barnes 2008, Bryant-Stephens 2008 | randomised trials | serious[5] | no serious inconsistency[6] | no serious indirectness[3] | no serious imprecision[7] | none | 436 | 504 | - | SMD 0.14 lower (0.27 to 0.01 lower) | MODERATE |
| **Respiratory health in children and adults- FEV1, PEF (follow-up 8 to 52 weeks; Better indicated by higher values)** | | | | | | | | | | | |
| Carswell 1996, Dorward 1988, Hayden 1997, Matsui 2017, Walshaw 1986 | randomised trials | serious[8] | no serious inconsistency[6] | no serious indirectness[3] | no serious imprecision[7] | none | 159 | 164 | - | SMD 0.14 higher (0.08 lower to 0.36 higher) | MODERATE |
| **Adverse events in children (follow-up 12 months)** | | | | | | | | | | | |
| Matsui 2017 | randomised trials | no serious risk of bias[9] | no serious inconsistency[2] | no serious indirectness[3] | very serious[10] | none | 132/176 (75%) | 137/174 (78.7%) | OR 0.81 (0.49 to 1.33) | 37 fewer per 1000 (from 143 fewer to 44 more) | LOW |

[1] Downgraded once – study/ies judged high risk of bias (lack of randomisation, blinding of participants, and imbalance in attrition)
[2] Not applicable - single study
[3] Not downgraded - study met eligibility criteria as per protocol
[4] Downgraded once - confidence interval includes appreciable benefit (0.8; default minimal important difference for odds ratios) and low number of participants contributing to the outcome

[5] Downgraded once – study/ies judged high risk of bias (lack of blinding, risk of selective reporting, approach of data analysis is unclear, products are provided by Clorox)
[6] Not downgraded - evidence of heterogeneity: I squared smaller than 50%
[7] Not downgraded - confidence interval precise (minimal important difference for SMD is 0.5 either side of point estimate)
[8] Downgraded once - most studies are judged high risk of bias (lack of blinding, selective reporting, low participation)
[9] Not downgraded - although study judged high risk of bias (lack of blinding) committee accept that blinding might be difficult for behaviour interventions
[10] Downgraded twice - confidence interval includes both appreciable benefit and harm (0.8 and 1.25 respectively; default minimal important difference for odds ratios)

# F.2 Aeroallergens and second-hand smoke

| Quality assessment | | | | | | | No of participants | | Effect | | Quality | Importance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No of studies | Design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Aeroallergens including second hand smoke behavioural intervention versus control | Control | Relative (95% CI) | Absolute | | |
| **Asthma - symptom days/2 weeks, treatment steps (follow-up 40 weeks to 2 years; Better indicated by lower values)** | | | | | | | | | | | | |
| DiMango 2016, Evans 1999, Morgan 2004 | randomised trials | no serious risk of bias[1] | serious[2] | no serious indirectness[3] | no serious imprecision[4] | none | 1109 | 1051 | - | SMD 0.13 lower (0.26 lower to 0.01 higher) | MODERATE | |
| **Asthma (people with symptom days/2 weeks (follow-up 12 months)** | | | | | | | | | | | | |
| Eggleston 2005 | randomised trials | no serious risk of bias[5] | no serious inconsistency[6] | no serious indirectness[3] | very serious[7] | none | 2/50 (4%) | 5/50 (10%) | OR 0.38 (0.07 to 2.03) | 59 fewer per 1000 (from 92 fewer to 84 more) | LOW | |
| **Asthma (number of children) - at 24 months (follow-up 24 months)** | | | | | | | | | | | | |
| Becker 2004 | randomised trials | no serious risk of bias[5] | no serious inconsistency[6] | no serious indirectness[3] | serious[8] | none | 40/246 (16.3%) | 53/230 (23%) | OR 0.65 (0.41 to 1.02) | 68 fewer per 1000 (from 121 fewer to 4 more) | MODERATE | |
| **Asthma (number of children) - at 7 years (follow-up 7 years)** | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Becker 2004 | randomised trials | no serious risk of bias[5] | no serious inconsistency[6] | no serious indirectness[3] | serious[8] | none | 30/202 (14.9%) | 41/178 (23%) | OR 0.58 (0.35 to 0.98) | 82 fewer per 1000 (from 4 fewer to 136 fewer) | MODERATE | |
| **Respiratory health -FEV1 - Mattress cover included (follow-up 3 to 12 months; Better indicated by lower values)** | | | | | | | | | | | | |
| DiMango 2016, Eggleston 2005, Morgan 2004, Parker 2008 | randomised trials | serious[9] | no serious inconsistency[10] | no serious indirectness[3] | no serious imprecision[4] | none | 794 | 745 | - | SMD 0.13 lower (0.27 lower to 0.01 higher) | MODERATE | |
| **Atopy (number of children) - at 24 months** | | | | | | | | | | | | |
| Becker 2004 | randomised trials | no serious risk of bias[5] | no serious inconsistency[6] | no serious indirectness[3] | very serious[7] | none | 38/246 (15.4%) | 31/230 (13.5%) | OR 1.17 (0.7 to 1.96) | 19 more per 1000 (from 36 fewer to 99 more) | LOW | |
| **Atopy (number of children) - at 7 years (follow-up 7 years)** | | | | | | | | | | | | |
| Becker 2004 | randomised trials | no serious risk of bias[5] | no serious inconsistency[6] | no serious indirectness[3] | serious[11] | none | 95/202 (47%) | 72/178 (40.4%) | OR 1.31 (0.87 to 1.96) | 66 more per 1000 (from 33 fewer to 167 more) | MODERATE | |
| **HRQoL (follow-up up to 12 months; Better indicated by lower values)** | | | | | | | | | | | | |
| DiMango 2016, Eggleston 2005 | randomised trials | no serious risk of bias[1] | no serious inconsistency[10] | no serious indirectness[3] | no serious imprecision[4] | none | 175 | 172 | - | SMD 0.15 lower (0.37 lower to 0.06 higher) | HIGH | |

[1] Not downgraded - study/ies judged high risk of bias because of lack of blinding, the committee accept that blinding might be difficult for behaviour interventions and therefore agreed not to downgrade
[2] Downgraded once - evidence of heterogeneity: I squared equal or greater than 50% but smaller than 75%
[3] Not downgraded - study/ies met eligibility criteria as per protocol
[4] Not downgraded - the confidence interval is precise - does not cross the effect size of 0.5 in either direction (default minimal important difference for standardised mean difference)
[5] Not downgraded - study judged to be of low risk of bias
[6] Not applicable - a single study
[7] Downgraded twice as confidence interval includes appreciable benefit and harm (0.8 and 1.25 respectively; default minimal important difference for odds ratios)
[8] Downgraded once - confidence interval includes appreciable benefit (0.8; default minimal important difference for odds ratios)
[9] Downgraded once as 2 studies were judged to be high risk of bias (lack of blinding, incomplete outcome data)
[10] Not downgraded - no evidence of heterogeneity: I squared smaller than 50%[11] Downgraded once - confidence interval includes appreciable harm (1.25; default minimal important difference for odds ratios)

# F.3 Second-hand smoke

| Quality assessment | | | | | | | No of participants | | Effect | | Quality |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No of studies | Design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Second-hand smoke behavioural intervention versus control | Control | Relative (95% CI) | Absolute | |
| **Asthma in children with asthma- symptom-free days/2 weeks (follow-up 6 months; Better indicated by higher values)** | | | | | | | | | | | |
| Butz 2011 | randomised trials | serious[1] | no serious inconsistency[2] | no serious indirectness[3] | serious[4] | none | 41 | 44 | - | MD 1.87 higher (0.15 to 3.59 higher) | LOW |

[1] Downgraded once as study was judged to be high risk of bias (lack of allocation concealment and blinding)
[2] Not applicable as a single study
[3] Not downgraded as study met eligibility criteria as per protocol
[4] Downgraded once as the lower confidence interval crosses the effect size of 1.5 (default minimal important difference for mean difference)

# Appendix G: Health economic evidence study selection

Please see health economic report

# Appendix H: Health economic evidence tables

Please see health economic report

# Appendix I: Health economic evidence profiles

Please see health economic report

# Appendix J: Health economic analysis

Please see Health economic report

# Appendix K: Excluded studies

## K.1 Public health studies

| | Bibliography | Reason for exclusion |
|---|---|---|
| 1. | Adgate John L, Ramachandran Gurumurthy, Cho Sook Ja, Ryan Andrew D, and Grengs Jason (2008) Allergen levels in inner city homes: baseline concentrations and evaluation of intervention effectiveness. Journal of exposure science & environmental epidemiology 18(4), 430-40 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 2. | Arbes Samuel J, Jr, Sever Michelle, Archer Janet, Long Elizabeth H, Gore J Chad, Schal Coby, Walter Michelle, Nuebler Betsy, Vaughn Ben, Mitchell Herman, Liu Eric, Collette Nicholas, Adler Peter, Sandel Megan, and Zeldin Darryl C (2003) Abatement of cockroach allergen (Bla g 1) in low-income, urban housing: A randomized controlled trial. The Journal of allergy and clinical immunology 112(2), 339-45 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 3. | Arlian L G, Neal J S, Morgan M S, Vyszenski-Moher D L, Rapp C M, and Alexander A K (2001) Reducing relative humidity is a practical way to control dust mites and their allergens in homes in temperate climates. The Journal of allergy and clinical immunology 107(1), 99-104 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 4. | Arshad S H, Bateman B, and Matthews S M. 2003. Primary prevention of asthma and atopy during childhood by allergen avoidance in infancy: a randomised controlled study. Thorax 58(6):489-93. | Study does not contain any relevant interventions - Multicomponent behaviour intervention also includes breastfeeding and diet (exclusion of dairy products, egg, wheat, nuts, fish and soya) |
| 5. | Breysse Jill, Wendt Jean, Dixon Sherry, Murphy Amy, Wilson Jonathan, Meurer John, Cohn Jennifer, and Jacobs David E (2011) Nurse case management and housing interventions reduce allergen exposures: the Milwaukee randomized controlled trial. Public health reports (Washington, and D.C. : 1974) 126 Suppl 1, 89-99 | Study does not contain any of the outcomes of interest - Reported outcome allergen level |
| 6. | Breysse Jill, Dixon Sherry, Gregory Joel, Philby Miriam, Jacobs David E, and Krieger James (2014) Effect of weatherization combined with community health worker in-home education on asthma control. American journal of public health 104(1), e57-64 | Not a relevant study design - Quasi-experimental |
| 7. | Bryant-Stephens T (2001) Reducing asthma triggers in the asthmatic child's bedroom: a randomized, controlled study using lay home visitors. Annual meeting of the american public health association, philadelphia (october 22, and 2001) , | Conference abstract |
| 8. | Bryant-Stephens Tyra, Kurian Cizely, Guo Rong, and Zhao Hauqing (2009) Impact of a household environmental intervention delivered by lay health workers on asthma | Not a relevant study design - Cross-over study design |

| | Bibliography | Reason for exclusion |
|---|---|---|
| | symptom control in urban, disadvantaged children with asthma. American journal of public health 99 Suppl 3, S657-65 | |
| 9. | Butterfield Patricia G, Hill Wade, Postma Julie, Butterfield Phillip W, and Odom-Maryon Tamara (2011) Effectiveness of a household environmental health intervention delivered by rural public health nurses. American journal of public health 101 Suppl 1, S262-70 | Study does not contain any relevant interventions |
| 10. | Carswell F, Oliver J, and Weeks J (1999) Do mite avoidance measures affect mite and cat airborne allergens?. Clinical and Experimental Allergy 29(2), 193-200 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 11. | Carter MC, Perzanowski MS, Raymond A, and Platts-Mills TA (2001) Home intervention in the treatment of asthma among inner-city children.. The Journal of allergy and clinical immunology 108(5), 732-7 | Data not reported in an extractable format |
| 12. | Chan-Yeung M, Manfreda J, Dimich-Ward H, Ferguson A, Watson W, and Becker A (2000) A randomized controlled study on the effectiveness of a multifaceted intervention program in the primary prevention of asthma in high-risk infants. Archives of pediatrics & adolescent medicine 154(7), 657-63 | Study does not contain any relevant interventions<br>- Multicomponent behavioural program includes breastfeeding for up to 12 months and assessment is at 12 months after birth |
| 13. | Coriolano Maria Wanderleya de Lavor, Lima Marinus de Moraes, Sette Gabriela Cunha Schechtman, Sarinho Emanuel Savio Cavalcanti, and Lima Luciane Soares de (2011) Impact that an educational intervention carried out by community health agents has on environmental conditions in the households of children with asthma. Jornal brasileiro de pneumologia : publicacao oficial da Sociedade Brasileira de Pneumologia e Tisilogia 37(3), 317-25 | Not a relevant study design - Before-after study |
| 14. | Custovic A, Simpson B M, Simpson A, Hallam C, Craven M, Brutsche M, and Woodcock A (2000) Manchester Asthma and Allergy Study: low-allergen environment can be achieved and maintained during pregnancy and in early life. The Journal of allergy and clinical immunology 105(2 Pt 1), 252-8 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 15. | Custovic Adnan, Simpson Bridget M, Murray Clare S, Lowe Lesley, Woodcock Ashley, Asthma N A. C. Manchester, Allergy Study, and Group (2002) The National Asthma Campaign Manchester Asthma and Allergy Study. Pediatric allergy and immunology : official publication of the European Society of Pediatric Allergy and Immunology 13 Suppl 15, 32-7 | Study does not contain any of the outcomes of interest |
| 16. | de Blay , F , Fourgaut G, Hedelin G, Vervloet D, Michel F B, Godard P, Charpin D, Pauli G, Scientific Committee of the, and Miec study (2003) Medical Indoor Environment Counselor (MIEC): role in compliance with advice on mite allergen avoidance and on mite allergen exposure. Allergy 58(1), 27-33 | Comparator in study does not match that specified in protocol<br>- Intervention and comparator very similar |
| 17. | El-Ghitany Em, and Abd El-Salam Mm (2012) Environmental intervention for house dust mite control in childhood bronchial | Country not similar to UK |

| | Bibliography | Reason for exclusion |
|---|---|---|
| | asthma. Environmental health and preventive medicine 17(5), 377-384 | |
| 18. | Endo K, Fukuzumi T, Adachi J, Kojima M, Aoki T, Yoshida M, Morita K, Nari T, and Tsujino M (1997) Effect of vacuum cleaning of room floors and bed clothes of patients on house dust mites counts and clinical scores of atopic dermatitis. A double blind control trial. Arerugi [Allergy] 46(10), 1013-1024 | Study not reported in English |
| 19. | Fang Z, Cai Y, and Wang L (2001) The efficacy of controlling of house dusts in attacks of mite sensitive asthmatics. Zhonghua jie he he hu xi za zhi [Chinese journal of tuberculosis and respiratory diseases] 24(11), 685-689 | Study not reported in English |
| 20. | Finkelstein Jonathan A, Fuhlbrigge Anne, Lozano Paula, Grant Evalyn N, Shulruff Reeva, Arduino Kelly E, and Weiss Kevin B (2002) Parent-reported environmental exposures and environmental control measures for children with asthma. Archives of pediatrics & adolescent medicine 156(3), 258-64 | Not a relevant study design - Epidemiology study prior RCT |
| 21. | Frederick J M, Warner J O, Jessop W J, Enander I, and Warner J A (1997) Effect of a bed covering system in children with asthma and house dust mite hypersensitivity. The European respiratory journal 10(2), 361-6 | Not a relevant study design – Cross-over study design |
| 22. | Geller-Bernstein C, Pibourdin J M, Dornelas A, and Fondarai J (1995) Efficacy of the acaricide: acardust for the prevention of asthma and rhinitis due to dust mite allergy, in children. Allergie et immunologie 27(5), 147-54 | Study does not contain any relevant interventions – Intervention is use of acaricide |
| 23. | Gillies Drn, Littlewood Jm, and Sarsfield Jk (1987) Controlled trial of house dust mite avoidance in children with mild to moderate asthma. Clinical allergy and immunology 17(2), 105-111 | Not a relevant study design – non-RCT |
| 24. | Halmerbauer Gerhard, Gartner Christian, Schierl Michael, Arshad Hassan, Dean Tara, Koller Dieter Y, Karmaus Wilfried, Kuehr Joachim, Forster Johannes, Urbanek Radvan, Frischer Thomas, and Team Space Collaborative Study (2003) Study on the Prevention of Allergy in Children in Europe (SPACE): allergic sensitization at 1 year of age in a controlled trial of allergen avoidance from birth. Pediatric allergy and immunology : official publication of the European Society of Pediatric Allergy and Immunology 14(1), 10-7 | Study does not contain any relevant interventions - Multicomponent educational programme also includes breastfeeding and diet |
| 25. | Harving H, Korsgaard J, and Dahl R (1994a) House-dust mite exposure reduction in specially designed, mechanically ventilated "healthy" homes. Allergy 49(9), 713-8 | Study does not contain any relevant interventions - Mechanical interventions |
| 26. | Harving H, Korsgaard J, and Dahl R (1994b) Clinical efficacy of reduction in house-dust mite exposure in specially designed, mechanically ventilated "healthy" homes. Allergy 49(10), 866-70 | Study does not contain any relevant interventions |
| 27. | Haynes Ak, Sever M, Crockett Pw, Jaramillo R, Zombeck A, Crohn R, and Zeldin D (2010) Dust mite allergen reduction study. Journal of allergy and clinical immunology. 125(2 suppl. 1), Ab30 | Conference abstract |

| | Bibliography | Reason for exclusion |
|---|---|---|
| 28. | Horak Jr, F , Matthews S, Ihorst G, Arshad S H, Frischer T, Kuehr J, Schwieger A, and Forster J (2004) Effect of mite-impermeable mattress encasings and an educational package on the development of allergies in a multinational randomized, controlled birth-cohort study - 24 Months results of the Study of Prevention of Allergy in Children in Europe. Clinical and Experimental Allergy 34(8), 1220-1225 | Study does not contain any relevant interventions<br>- Multicomponent educational programme includes diet |
| 29. | Huang F, and Kim J S (2012) A randomized trial of air cleaners and a health coach to improve indoor air quality for inner-city children with asthma and secondhand smoke exposure. Pediatrics 130(SUPPL.1), S33-S34 | Not a peer-reviewed publication<br>Commentary |
| 30. | Huss K, Salerno M, and Huss Rw (1991) Computer-assisted reinforcement of instruction: effects on adherence in adult atopic asthmatics. Research in nursing & health 14(4), 259-267 | Comparator in study does not match that specified in protocol<br>- Same as intervention but without reinforcement |
| 31. | Huss K, Squire E N, Jr , Carpenter G B, Smith L J, Huss R W, Salata K, Salerno M, Agostinelli D, and Hershey J (1992) Effective education of adults with asthma who are allergic to dust mites. The Journal of allergy and clinical immunology 89(4), 836-43 | Comparator in study does not match that specified in protocol<br>- Same as intervention but without reinforcement |
| 32. | Hyndman S J, Vickers L M, Htut T, Maunder J W, Peock A, and Higenbottam T W (2000) A randomized trial of dehumidification in the control of house dust mite. Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology 30(8), 1172-80 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 33. | Kercsmar Carolyn M, Dearborn Dorr G, Schluchter Mark, Xue Lintong, Kirchner H Lester, Sobolewski John, Greenberg Stuart J, Vesper Stephen J, and Allan Terry (2006) Reduction in asthma morbidity in children as a result of home remediation aimed at moisture sources. Environmental health perspectives 114(10), 1574-80 | Study does not contain any relevant intervention – Intervention is refurbishment by external people |
| 34. | Klinnert Mary D, Liu Andrew H, Pearson Marcella R, Ellison Misoo C, Budhiraja Nisha, and Robinson Joann L (2005) Short-term impact of a randomized multifaceted intervention for wheezing infants in low-income families. Archives of pediatrics & adolescent medicine 159(1), 75-82 | Data not reported in an extractable format |
| 35. | Korsgaard J (1983) Preventive measures in mite asthma. A controlled trial. Allergy 38(2), 93-102 | Data not reported in an extractable format |
| 36. | Krieger J W, Song L, Takaro T K, and Stout J (2000) Asthma and the home environment of low-income urban children: preliminary findings from the Seattle-King County healthy homes project. Journal of urban health : bulletin of the New York Academy of Medicine 77(1), 50-67 | Study does not contain any of the outcomes of interest - Baseline data only reported |
| 37. | Krieger James K, Takaro Tim K, Allen Carol, Song Lin, Weaver Marcia, Chai Sanders, and Dickey Phillip (2002) The Seattle-King County healthy homes project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma. Environmental health perspectives 110 Suppl 2, 311-22 | Study does not contain any of the outcomes of interest - Study description and protocol only |

| | Bibliography | Reason for exclusion |
|---|---|---|
| 38. | Krieger J, Takaro TK, Song L, Beaudet N, and Edwards K (2009) A randomized controlled trial of asthma self-management support comparing clinic-based nurses and in-home community health workers: the Seattle-King County Healthy Homes II Project.. Archives of pediatrics & adolescent medicine 163(2), 141-9 | Study does not contain any of the outcomes of interest - |
| 39. | Krieger JW, Takaro TK, Song L, and Weaver M (2005) The Seattle-King County Healthy Homes Project: a randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers.. American journal of public health 95(4), 652-9 | Comparator in study does not match that specified in protocol – contains behavioural component |
| 40. | Kuiper S, Maas T, Van Schayck , C P, Muris J W. M, Schonberger H J. A. M, Dompeling E, Gijsbers B, Van Weel , C , and Knottnerus J A (2005) The primary prevention of asthma in children study: Design of a multifaceted prevention program. Pediatric Allergy and Immunology 16(4), 321-331 | Not specific to indoor air quality - Multicomponent behavioural programme, includes breast feeding and diet |
| 41. | Lanphear B P, Howard C, Eberly S, Auinger P, Kolassa J, Weitzman M, Schaffer S J, and Alexander K (1999) Primary prevention of childhood lead exposure: A randomized trial of dust control. Pediatrics 103(4 Pt 1), 772-7 | Study does not contain any of the outcomes of interest - Lead blood level |
| 42. | Lee Inn-Sook (2003) Effect of bedding control on amount of house dust mite allergens, asthma symptoms, and peak expiratory flow rate. Yonsei medical journal 44(2), 313-22 | Not a relevant study design – Quasi-experimental study design |
| 43. | Lee Yj, Bang Js, Oh Yj, Lee Jw, Sung Tj, Lee Kh, and Lee Hr (2015) Effect of vacuuming mattresses on allergic rhinitis symptoms in children. Allergy: european journal of allergy and clinical immunology. 70, 301 | Conference abstract |
| 44. | Mankikar Deepa, Campbell Carla, and Greenberg Rachael (2016) Evaluation of a Home-Based Environmental and Educational Intervention to Improve Health in Vulnerable Households: Southeastern Pennsylvania Lead and Healthy Homes Program. International journal of environmental research and public health 13(9), | Not a relevant study design - Before-after study |
| 45. | Marks GB, Tovey ER, Green W, Shearer M, Salome CM, and Woolcock AJ (1994) House dust mite allergen avoidance: a randomized controlled trial of surface chemical treatment and encasement of bedding. Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology 24(11), 1078-83 | Study does not examine an intervention of interest |
| 46. | Marks Gb, Mihrshahi S, Kemp As, Tovey Er, Webb K, Almqvist C, Ampon Rd, Crisafulli D, Belousova Eg, Mellis Cm, Peat Jk, and Leeder Sr (2006) Prevention of asthma during the first 5 years of life: a randomized controlled trial. Journal of allergy and clinical immunology 118(1), 53-61 | Comparator in study does not match that specified in protocol - Comparator also included behavioural components |
| 47. | McConnell Rob, Jones Craig, Milam Joel, Gonzalez Patty, Berhane Kiros, Clement Loran, Richardson Jean, Hanley-Lopez Jean, Kwong Kenneth, Maalouf Najib, Galvan Judith, and Platts-Mills Tom (2003) Cockroach counts and house dust allergen concentrations after professional cockroach control and cleaning. Annals of allergy, asthma & immunology : official | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |

| | Bibliography | Reason for exclusion |
|---|---|---|
| | publication of the American College of Allergy, Asthma, and & Immunology 91(6), 546-52 | |
| 48. | McConnell R, Milam J, Richardson J, Galvan J, Jones C, Thorne P S, and Berhane K (2005) Educational intervention to control cockroach allergen exposure in the homes of hispanic children in Los Angeles: results of the La Casa study. Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology 35(4), 426-33 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 49. | Mihrshahi S, Marks G B, Criss S, Tovey E R, Vanlaar C H, Peat J K, and Team Caps (2003) Effectiveness of an intervention to reduce house dust mite allergen levels in children's beds. Allergy 58(8), 784-9 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 50. | Moira Chan-Yeung, Ferguson Alexander, Dimich-Ward Helen, Watson Wade, Manfreda Jure, and Becker Allan (2002) Effectiveness of and compliance to intervention measures in reducing house dust and cat allergen levels. Annals of allergy, asthma & immunology : official publication of the American College of Allergy, Asthma, and & Immunology 88(1), 52-8 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 51. | Montaudie-Dumas I, Giovannini-Chami L, Debail C, Collomp R, Bailly-Piccini C, Berlioz M, Albertini M, and Bourrier T (2013) Impact of the medical indoor environment counselor on the interior environment of allergic children. Archives de Pediatrie 20(12), 1288-1295 | Not a relevant study design - Before-after study |
| 52. | Nishioka K, Saito A, Akiyama K, and Yasueda H (2006) Effect of home environment control on children with atopic or non-atopic asthma. Allergology International 55(2), 141-148 | Not a relevant study design - Non-randomised study |
| 53. | Moon J S, and Choi S O (1999) Environmental controls in reducing house dust mites and nasal symptoms in patients with allergic rhinitis. Yonsei medical journal 40(3), 238-43 | Data not reported in an extractable format - Mean and range reported |
| 54. | Phipatanakul Wanda, Cronin Beth, Wood Robert A, Eggleston Peyton A, Shih Mei-Chiung, Song Leslie, Tachdjian Raffi, and Oettgen Hans C (2004) Effect of environmental intervention on mouse allergen levels in homes of inner-city Boston children with asthma. Annals of allergy, asthma & immunology : official publication of the American College of Allergy, Asthma, and & Immunology 92(4), 420-5 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 55. | Ramsey Cd, Chan E, Chooniedass R, DyBuncio A, Rousseau R, Becker A, and Chan-Yeung M (2013) The canadian asthma primary prevention study (CAPPS): outcomes at 15 years of age. American journal of respiratory and critical care medicine 187, | Conference abstract |
| 56. | Ricci G, Patrizi A, Specchia F, Menna L, Bottau P, D'Angelo V, and Masi M (2000) Effect of house dust mite avoidance measures in children with atopic dermatitis. The British journal of dermatology 143(2), 379-84 | Data not reported in an extractable format - Only means reported, SDs or SEs not available or possible to calculate from available data |
| 57. | Schonberger H J. A. M, Maas T, Dompeling E, Knottnerus J A, van Weel , C , van Schayck , and C P (2004) Compliance of | Not specific to indoor air quality - Multicomponent |

| | Bibliography | Reason for exclusion |
|---|---|---|
| | asthmatic families with a primary prevention programme of asthma and effectiveness of measures to reduce inhalant allergens--a randomized trial. Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology 34(7), 1024-31 | behavioural programme, includes breast feeding |
| 58. | Shapiro G G, Wighton T G, Chinn T, Zuckrman J, Eliassen A H, Picciano J F, and Platts-Mills T A (1999) House dust mite avoidance for children with asthma in homes of low-income families. The Journal of allergy and clinical immunology 103(6), 1069-74 | Study does not reported the results in a reusable format |
| 59. | Sidenius Kirsten E, Hallas Thorkil E, Poulsen Lars K, and Mosbech Holger (2002) A controlled intervention study concerning the effect of intended temperature rise on house dust mite load. Annals of agricultural and environmental medicine : AAEM 9(2), 163-8 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 60. | Simpson A, Simpson B, Custovic A, Craven M, and Woodcock A (2003) Stringent environmental control in pregnancy and early life: the long-term effects on mite, cat and dog allergen. Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology 33(9), 1183-9 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 61. | Swartz L J, Callahan K A, Butz A M, Rand C S, Kanchanaraksa S, Diette G B, Krishnan J A, Breysse P N, Buckley T J, Mosley A M, and Eggleston P A (2004) Methods and issues in conducting a community-based environmental randomized trial. Environmental Research 95(2), 156-165 | Study does not contain any of the outcomes of interest - Baseline data reported only |
| 62. | Sweet Laura L, Polivka Barbara J, Chaudry Rosemary V, and Bouton Philip (2014) The impact of an urban home-based intervention program on asthma outcomes in children. Public health nursing (Boston, and Mass.) 31(3), 243-52 | Not a relevant study design - Before-after study |
| 63. | Takaro Tim K, Krieger James W, and Song Lin (2004) Effect of environmental interventions to reduce exposure to asthma triggers in homes of low-income children in Seattle. Journal of exposure analysis and environmental epidemiology 14 Suppl 1, S133-43 | Comparator in study does not match that specified in protocol - Comparator also included behavioural component |
| 64. | Takaro Tk, Krieger J, Song L, Sharify D, and Beaudet N (2011) The Breathe-Easy Home: the impact of asthma-friendly home construction on clinical outcomes and trigger exposure. American journal of public health 101(1), 55-62 | Not a relevant study design - Quasi-experimental |
| 65. | Tan Bb, Weald D, Strickland I, and Friedmann Ps (1996) Double-blind controlled trial of effect of housedust-mite allergen avoidance on atopic dermatitis. Lancet (london, and england) 347(8993), 15-18 | Data not reported in an extractable format - Only means reported, SDs or SEs not available or possible to calculate from available data |
| 66. | Turcotte David A, Alker Heather, Chaves Emily, Gore Rebecca, and Woskie Susan (2014) Healthy homes: in-home environmental asthma intervention in a diverse urban community. American journal of public health 104(4), 665-71 | Not a relevant study design - Before-after study |

| | Bibliography | Reason for exclusion |
|---|---|---|
| 67. | Turyk Mary, Banda Elizabeth, Chisum Gay, Weems Dolores Jr, Liu Yangyang, Damitz Maureen, Williams Rhonda, and Persky Victoria (2013) A multifaceted community-based asthma intervention in Chicago: effects of trigger reduction and self-management education on asthma morbidity. The Journal of asthma : official journal of the Association for the Care of Asthma 50(7), 729-36 | Not a relevant study design - Before-after study |
| 68. | Vojta P J, Randels S P, Stout J, Muilenberg M, Burge H A, Lynn H, Mitchell H, O'Connor G T, and Zeldin D C (2001) Effects of physical interventions on house dust mite allergen levels in carpet, bed, and upholstery dust in low-income, urban homes. Environmental health perspectives 109(8), 815-9 | Study does not contain any of the outcomes of interest - Reported outcome is allergen level |
| 69. | Wakefield M, Banham D, McCaul K, Martin J, Ruffin R, Badcock N, and Roberts L (2002) Effect of feedback regarding urinary cotinine and brief tailored advice on home smoking restrictions among low-income parents of children with asthma: A controlled trial. Preventive Medicine 34(1), 58-65 | Study does not contain any relevant interventions – Intervention is smoking ban |
| 70. | Warner J A, Frederick J M, Bryant T N, Weich C, Raw G J, Hunter C, Stephen F R, McIntyre D A, and Warner J O (2000) Mechanical ventilation and high-efficiency vacuum cleaning: A combined strategy of mite and mite allergen reduction in the control of mite-sensitive asthma. The Journal of allergy and clinical immunology 105(1 Pt 1), 75-82 | Study does not contain any relevant interventions<br>- Ventilation systems |
| 71. | Williams Seymour G, Brown Clive M, Falter Kenneth H, Alverson Clinton J, Gotway-Crawford Carol, Homa David, Jones Donna S, Adams E Kathleen, and Redd Stephen C (2006) Does a multifaceted environmental intervention alter the impact of asthma on inner-city children?. Journal of the National Medical Association 98(2), 249-60 | Study does not reported outcomes in a usable format |
| 72. | Williams Megan K, Barr Dana B, Camann David E, Cruz Linda A, Carlton Elizabeth J, Borjas Mejico, Reyes Andria, Evans Dave, Kinney Patrick L, Whitehead Ralph D, Jr , Perera Frederica P, Matsoanne Stephen, and Whyatt Robin M (2006) An intervention to reduce residential insecticide exposure during pregnancy among an inner-city cohort. Environmental health perspectives 114(11), 1684-9 | Not a relevant study design - Before-after study |
| 73. | Winn Amber K, Salo Paivi M, Klein Cynthia, Sever Michelle L, Harris Shawn F, Johndrow David, Crockett Patrick W, Cohn Richard D, and Zeldin Darryl C (2016) Efficacy of an in-home test kit in reducing dust mite allergen levels: results of a randomized controlled pilot study. The Journal of asthma : official journal of the Association for the Care of Asthma 53(2), 133-8 | Study does not contain any relevant interventions<br>- Motivational intervention rather than behavioural intervention |
| 74. | Yu Chang Ho, Yiin Lih-Ming, Tina Fan, Zhi-Hua, and Rhoads George G (2009) Evaluation of HEPA vacuum cleaning and dry steam cleaning in reducing levels of polycyclic aromatic hydrocarbons and house dust mite allergens in carpets. Journal of environmental monitoring : JEM 11(1), 205-11 | Not a relevant study design - Before-after study |

## K.2 Economic studies

Please see health economic report

Use this and any additional appendices only for essential information specific to the guideline (for example, meta-analysis or a bespoke checklist). Do not include the scope, list of committee members, list of guideline centre staff, list of NICE staff, acknowledgements, etc