



# National Center for Healthy Housing

## **Housing Interventions and Health: A Systematic Review of the Evidence**

In December 2007, a panel of experts met in Atlanta, Georgia through a cooperative agreement between the Centers for Disease Control and Prevention (CDC) National Center for Environmental Health / Agency for Toxic Substances and Disease Registry and the National Center for Healthy Housing (NCHH). The panel conducted an exhaustive review of healthy housing intervention research. The panel of experts found sufficient evidence to determine that following interventions were effective. See [www.nchh.org/Housing\\_Interventions\\_and\\_Health.pdf](http://www.nchh.org/Housing_Interventions_and_Health.pdf) for more details.

### **A. Controlling Asthma Symptoms and Reducing Asthma Morbidity:**

Multi-faceted in-home interventions for asthma tailored to the individual that include:

1. Home environmental assessment;
2. Education;
3. Use of mattress and pillow covers;
4. Use of HEPA vacuums and HEPA air filters;
5. Smoking cessation and reduction in environmental tobacco smoke exposure;
6. Cockroach and rodent management;
7. Minor repairs; and
8. Intensive household cleaning.

#### **But the following were found to be ineffective:**

Bedding encasement, sheet washing and upholstery cleaning each by themselves in isolation from other interventions.

### **B. Reducing Asthma Triggers and Exposure to Asthma Triggers**

When implemented together, eliminating moisture intrusion and leaks and removal of moldy items.

### **C. Reducing Exposure to Pests and Pesticides:**

Cockroach control through Integrated Pest Management (IPM). IPM includes:

1. Household cleaning and tool dispensing;
2. Professional cleaning;
3. Education of residents,
4. Baits;
5. Structural repairs; and
6. When necessary, intensive application of low-toxicity, non-spray pesticides.

### **D. Reducing Exposure to Pesticide Residues:**

Integrated pest management (IPM) which includes:

1. Professional cleaning;
2. Sealing of pest entry points;
3. Application of low-toxicity pesticides; and
4. Education.

**E. Reducing Exposure to Radon in Air to Less than 4 pCi/L:**  
Active sub-slab depressurization systems in high-risk areas.

**F. Reducing Exposure to Environmental Tobacco Smoke**  
Elimination of environmental tobacco smoke.

**But the following were found to be ineffective:**

Portable air cleaning filtration systems are ineffective in controlling exposures to environmental tobacco smoke and also formaldehyde, although it is possible that there may be some modest decline in exposure.

**G. Reducing Children’s Blood Lead Levels, Deteriorated Lead-Based Paint and Dust Lead**  
Residential lead hazard control.

**But the following were found to be ineffective:**

Single professional cleaning regimens have been shown to be ineffective in controlling long-term exposures to lead contaminated dust

**H. Reducing Death and Injuries from Residential Fires:**  
Installed, working smoke alarms.

**But the following were found to be less effective:**

Community programs that give away smoke alarms without taking steps to make sure they are actually installed are less effective than programs that actually install alarms, and have not been proven to reduce injuries

**I. Preventing Drowning:**  
Isolation 4-sided pool fencing

**But the following were found to be ineffective:**

Use of three-sided pool fences instead of complete four-sided pool fencing is not effective and may actually increase risk because care-givers may believe the incomplete fencing is adequate.

**J. Reducing Scald Burns:**  
Pre-set safe temperature hot water heaters

**The following were also found to be ineffective:**

- Portable air cleaning filtration systems are ineffective in controlling exposures to environmental tobacco smoke and also formaldehyde, although it is possible that there may be some modest decline in exposure.
- “Air cleaners” that produce large amounts of ozone should not be used, because they result in increased exposure to ozone, which mimics the health effects of radiation exposure and is a known respiratory toxicant.

## Summary Table Evidence of Housing Intervention Effectiveness on Health

	<b>Sufficient Evidence</b>	<b>Needs More Field Evaluation</b>	<b>Needs Formative Research</b>	<b>No Evidence or Ineffective</b>
<b>Interior Biological Agents (Toxins)</b>	<ul style="list-style-type: none"> <li>• Multi-faceted tailored asthma interventions</li> <li>• Integrated Pest Management (allergen reduction)</li> <li>• Moisture intrusion elimination</li> </ul>	<ul style="list-style-type: none"> <li>• Dehumidification</li> <li>• General &amp; local exhaust ventilation (kitchens &amp; baths)</li> <li>• Air cleaners (to reduce asthma)</li> <li>• Dry steam cleaning</li> <li>• Vacuuming</li> </ul>	<ul style="list-style-type: none"> <li>• Carpet treatments</li> <li>• Education only</li> <li>• One-time professional cleaning</li> <li>• Acaracides</li> </ul>	<ul style="list-style-type: none"> <li>• Bedding encasement alone</li> <li>• Sheet washing alone</li> <li>• Upholstery cleaning alone</li> <li>• Air cleaners releasing ozone</li> </ul>
<b>Interior Chemical Agents (Toxics)</b>	<ul style="list-style-type: none"> <li>• Radon air mitigation through active subslab depressurization</li> <li>• Integrated Pest Management (pesticide reduction)</li> <li>• Smoking bans</li> <li>• Lead hazard control</li> </ul>	<ul style="list-style-type: none"> <li>• Radon mitigation in drinking water</li> <li>• Portable HEPA air cleaners to reduce particulate</li> <li>• Attached garage sealing to limit VOC intrusion</li> <li>• Particulate control by envelope sealing</li> </ul>	<ul style="list-style-type: none"> <li>• Radon air mitigation using passive systems</li> <li>• Occupant compliance with residential smoking bans</li> <li>• Improved residential ventilation</li> <li>• VOC avoidance</li> </ul>	<ul style="list-style-type: none"> <li>• Portable HEPA air cleaners to reduce environmental tobacco smoke</li> <li>• Air cleaners using or releasing ozone</li> </ul>
<b>External Exposures (Drinking water &amp; waste treatment)</b>	<ul style="list-style-type: none"> <li>• Voluntary drinking &amp; wastewater treatment standards for small systems &amp; private wells</li> <li>• Training for small system personnel</li> <li>• Guidelines for immuno-compromised individuals</li> </ul>	<ul style="list-style-type: none"> <li>• UV and other filtration point of use systems</li> <li>• DNA to track pathogen sources</li> <li>• Location of privies and failed drinking water and wastewater systems</li> </ul>	<ul style="list-style-type: none"> <li>• Training for planners and zoning officials</li> <li>• Control of pharmaceuticals and endocrine disruptors into drinking and wastewater</li> <li>• Radon mitigation in drinking water</li> </ul>	<ul style="list-style-type: none"> <li>• UV/point of filtration research for systems that already comply with standards</li> </ul>
<b>Structural Deficiencies (Injury)</b>	<ul style="list-style-type: none"> <li>• Installation of working smoke alarms</li> <li>• Isolation 4-sided pool fencing</li> <li>• Pre-set safe temperature hot water heaters</li> <li>• Air condition during heat waves</li> </ul>	<ul style="list-style-type: none"> <li>• Home safety education on stair gates, window locks and window guards, and match &amp; lighter storage with cabinet locks</li> <li>• Fall prevention by handrails, grab bars, and improved lighting</li> </ul>	<ul style="list-style-type: none"> <li>• Ignition source controls (GCFI)</li> <li>• Escape exit signage</li> <li>• Temperature-controlled water faucets</li> <li>• Improved smoke alarm design</li> <li>• Behavior modification to escape fires</li> </ul>	<ul style="list-style-type: none"> <li>• Advise to elderly on fall prevention</li> <li>• Give away smoke alarm programs</li> <li>• 3-sided pool fencing</li> </ul>

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	Sufficient Evidence	Needs More Field Evaluation	Needs Formative Research	No Evidence or Ineffective
<b>Structural Deficiencies (Injury)</b> <i>continued</i>			<ul style="list-style-type: none"> <li>• Automatic fire sprinkler systems for housing</li> <li>• Pool covers and alarms</li> <li>• Bathtub design to reduce falls</li> <li>• Stove control design to prevent burns</li> <li>• Carbon monoxide exposure prevention through design and engineering</li> <li>• Improved enforcement of building and housing codes</li> <li>• Noise reduction</li> </ul>	

*Source: NCHH/CDC Healthy Homes Expert Panel, December 2007.*