Allergen Avoidance

Updated: March 2018
Originally Posted: December 2004

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The use of environmental interventions to treat patients with allergic disorders has long been promoted to reduce morbidity by reducing a patient's exposure to environmental triggers. It has been studied as a means for prevention and treatment of rhinitis and asthma. A recent NIH workshop emphasized the need for research to better define which interventions are effective for improving clinical outcomes. [1] In addition, a recent systematic review described the evidence behind various environmental interventions. [2]

The idea is straight forward: A patient with asthma is evaluated for sensitivity to environmental triggers. In addition, their environment (home, work, school) is evaluated for the presence of those triggers. Once identified, an intervention is recommended that is targeted to reduce exposure to relevant triggers. When done correctly, this should, in principle, lead to improved asthma outcomes.

While this approach sounds good in theory, in practice it is not easily achieved. The problem is that patients may be sensitized to multiple environmental triggers many of which have no readily available means for measurement to determine exposure. In addition, feasible interventions frequently are not able to reduce exposure to triggers sufficiently to improve asthma outcomes. Finally, patients in the real world often are not willing to perform the necessary interventions. [3]

Allergy assessment and measurement

The most common indoor allergens that have been shown to trigger symptoms in patients with asthma and rhinitis are pets (cats, dogs), rodents (mice, rats), cockroaches, dust mites and molds. Before implementing allergen avoidance measures, it first helps to determine which of these allergens a home's occupants are allergic to and whether there is significant exposure to them in the home. Sensitization can be determined using either skin prick tests (SPT) or in-vitro (blood) tests for specific IgE antibodies. While the presence of sensitization alone doesn't necessarily mean that the patient has clinically-relevant allergies, for aeroallergens it often does.

Once it is determined that a person with asthma or rhinitis has allergies, it is next helpful to determine whether there is significant exposure to the relevant allergen(s). This can be determined by first taking a detailed environmental history focusing on the presence of pets, reservoirs where dust mite and mold allergens can reside such as carpeting and upholstered furniture, any recent moisture-related problems, reported cleaning practices and frequency, and on whether the patient has observed evidence of cockroach or rodent infestation. [4] Kits to measure allergens in house dust are available though they are expensive and not widely available. If significant allergen exposure is suspected, it may help to have a qualified indoor environmental professional (IEP) assess the home for facilitative factors (things that promote allergen production), sources and reservoirs of allergens.

Dust Mites

Dust mites are found in homes that have sufficient humidity to support their growth. About 84% of homes in the US have detectable dust mite levels. Older homes and homes whose occupants have lower incomes tend to have higher dust mite concentrations. The allergens are contained on fecal pellets each measuring 10-24 microns in diameter. These tend to settle over time but can be detected during activities that disturb them. [5] [6] Children who live in houses with concentrations of dust mite allergen greater than 2 mcg/g dust have an increased likelihood of mite sensitization and of developing asthma. [7] Several studies have demonstrated that exposure reduction can reduce asthma morbidity. [8]

Humidity control: Dust mites require humidity to survive. For homes in arid climates, dust mites are almost nonexistent. Generally, humidity levels below 50% can minimize replication and below 35% can cause mites to become dormant. Dehumidification operates on the principle that when air is exposed to a surface that is below its dew point, water from the air condenses on the surface and is removed from the air. Humidity control has been shown to reduce dust mite populations, though it needs to be continuous. Humidity control can be achieved using air conditioning during the summer. Portable dehumidifiers can also be used in locations where dampness is present.

Acaricides: An acaricide such as benzyl benzoate can kill dust mites when applied to carpeting and upholstered furniture. Use of an acaricide can temporarily reduce dust mite populations, however, since it is unable to penetrate completely through carpeting, it does not kill all the mites. For that reason, mite colonies tend to regrow between applications. Ultimately, use of acaricides have not been shown to improve the health of patients with allergic diseases. [9]

Beds and bed covers: Mattress and pillow encasements can prevent proliferation of dust mites from mattresses or pillows, and exposure to mite allergen, for individuals who sleep on them. When used as an isolated intervention, encasements have not been found to improve asthma outcomes. [10] A study that used multiple interventions for mites including tannic acid, encasements, and washing of bedding did show a reduction in mite exposure and improvement in some asthma outcomes. [11]

Washing: Regular washing of bedding can reduce exposure to dust mite allergen by removing it. Washing in hot water is not required. Dust mites are killed by drowning rather than scalding, though this mechanism is less effective in side-loading washing machines.

Regular vacuuming: Regular use of a high-efficiency vacuum cleaner can remove dust mite particles that have settled into carpeting and upholstered furniture. Ideally, reservoirs such as carpeting and upholstered furniture should be removed from the environment, however, most homeowners are unwilling to do that. Regular and frequent vacuuming is necessary for it to be effective. It also should have a high-efficiency bag or filter on the vacuum exhaust to prevent redistribution of collected particles. Cyclonic vacuum cleaners have an advantage in that they can capture particles without the need for filtration. Regular vacuuming can lead to sustained reductions in exposure to dust mite allergen. [12]

Pets

There are an estimated 93.6 million cat owners and 77.5 million dog owners in the United States. [13] Exposure to pet dander can lead to development of asthma and rhinitis if exposure persists. [14] Early exposure to pet allergens may have a protective effect in some individuals by preventing sensitization and possibly development of asthma. [15] [16] Once sensitization and asthma have developed, it is helpful to reduce exposure.

Vacuum Cleaning: Regular vacuum cleaning is essential to prevent accumulation of allergens. However, it is important to have adequate filtration, including double thickness bags or HEPA filters on the cleaner outlet.

Washing the pet: Regular washing of pets to remove allergens can be helpful. Since pets produce allergens continuously, washing needs to be performed frequently to be effective. It may be necessary to wash a dog at least twice a week for the intervention to be effective. [17] An indoor cat should be washed more frequently to reduce airborne Fel d 1. [18]

Air filtration: Air filtration is effective if the allergens of concern are associated with air-borne particles that are consistently available for removal. This includes cat, dog and rodent allergens A review by Wood [19] concluded that HEPA filters may be effective for removing pet allergens. A Cochrane review found insufficient evidence for clinical improvement with air filters among people with pet allergies. [20] Studies that show improved asthma outcomes generally use air filtration as one component in a multicomponent intervention strategy. [21]

Cockroaches and Rodents

It is estimated that 30-40% of children with asthma who live in urban centers are sensitized to cockroach and as many as 70-80% are sensitized in some inner-cites. [22] In contrast, a suburban population had a sensitization rate of only 21%. Apartments with Bla g 2 levels > 8U/g of dust had 1.7 times greater odds of having a resident with asthma. [23]

Rodent infestation can occur in a wide range of environments including homes, schools, hospitals, stores, restaurants and animal laboratory facilities. [24] Low income housing in urban areas are more likely to have high levels of rodent allergens and rodent-sensitized occupants than suburban homes. In a study of inner-city homes, all had detectable mouse allergen in settled dust with a median level of 14 mcg/g; while another study reported

detectable airborne mouse mus m 1 in >80% of bedrooms of children with asthma [25]. Thirty-three percent of inner-city homes also had detectable rat allergen Rat n 1. [26]

Integrated pest management (IPM): IPM involves removing facilitative factors including food, water and shelter leading to a reduced environmental carrying capacity for cockroaches and rodents. IPM also involves blocking means of ingress and, when necessary, killing or trapping pests using either targeted application of chemicals, or mechanical methods. Once removed, deep and thorough cleaning can reduce residual allergens that have accumulated in reservoirs. It is often necessary to continue the intervention until pests are eliminated and to monitor for a recurrence after that. If a pest infestation is significant, it is recommended that a professional pest management service be used to implement the IPM program.

Preventing Access: Eradication strategies include aggressive caulking of the cracks or gaps around piping and other openings, particularly in apartment buildings or condominiums where cockroaches and rodents can enter and move from one unit to another.

Encasing Food Supplies: Controlling access to food in the kitchen and throughout the rest of the home is a major aspect of cockroach and rodent control. Food should be fully enclosed or kept in a refrigerator. No waste should be kept in the home, and dishes or pans should not be left out with any food debris on their surfaces.

Mold

Indoor mold tends to grow in micro-environments where there are nutrients and moisture sufficient for germination leading to subsequent growth into colonies and eventual generation of spores and hyphae. Approximately 10% of US homes are reported to have water damage from exterior leakage, while 8% have damage from interior leakage. [27] There are numerous allergen-producing genera that can grow indoors.

A relationship has been found between exposure to dampness and molds early in life and the risk of subsequently developing asthma. [28] Dampness, visible mold and moldy odors each are associated with this increased risk. A significant association has been found between the presence of mold and dampness and the development of cough, wheeze, current asthma and ever diagnosed asthma. [29]

Moisture control: Elimination of moisture sources including intrusion, leaks and condensation can reduce mold growth. A WHO report concluded that remediation of dampness can improve health outcomes. [30] A Cochrane review of moisture control found that moisture control of fungus-contaminated houses and offices reduced asthma related symptoms and respiratory infections in adults. [31] A study by Kercsmar demonstrated reduced asthma symptom days and a lower rate of exacerbations following extensive environmental remediation that included moisture reduction. [32] The acac.live vertification code for this document is 114820.

Conclusions

Strategies that affect multiple factors tend to be the most successful at reducing allergen exposure and improving asthma outcomes. [33] A systematic review by Le Cann [2] pointing out that most studies showing benefit used multiple intervention strategies. It is possible to identify which interventions to use in each environment if the sensitization status of its occupants is known and its allergen content has been measured. It is possible that environmental control practices, if implemented properly, may reduce asthma symptoms as effectively as use of medications. [34] If environmental intervention and pharmacotherapy are used together, it is possible that asthma morbidity could be further reduced.

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