Management of Allergy

- Environmental control
- Pharmacotherapy
- Desensitization
- Surgery
- "Alternative" therapies

Environmental Control Works

- Sensitization to Alternaria and other indoor allergens is a major asthma risk factor.\(^2\)
- Strong link between cockroach sensitivity and the development of asthma in inner-city kids.
- There is a relationship between the severity of asthma and the level of allergen exposure.
- Successful environmental control has been found to reverse asthma symptoms, improve pulmonary function and reduce airway inflammation.\(^3\)

Allergic Load

- Total Allergic Load = The sum of allergens and immune stimulators which an individual is exposed to at a given time.
- Patients with a high allergic load are constantly contacting large amounts of allergens, resulting in high levels of circulating allergic inflammatory mediators.
- Small challenges in these patients will result in worsening symptoms.

Goals of Environmental Control

- Remove all the sources of the allergens, or as much as possible.
- Remove allergens which have already accumulated.
- Prevent allergens from returning into the living environment.

History of Environmental Control

In the 16\(^{th}\) century, Gerolamo Cardano, a physician, successfully treated the Scottish Archbishop, John Hamilton, for asthma by eliminating his feather bedding.\(^1\)
Allergic Load Contributors

■ Direct
  - Inhalants
  - Ingestants (food, drugs, additives)
  - Contactants
  - Environmental chemicals and pollution

■ Indirect
  - Illness
  - Stress
  - GI permeability, IgA deficiency

Allergic Load

■ The body is represented by an empty bucket with a small drain in the bottom.
■ Constant load of inflammatory and infectious insults keep a steady state of water in the bucket.
■ When a person is exposed to something they are allergic to, it begins to drip water into that bucket faster than it can drain out.
■ When the bucket reaches its capacity, it begins to overflow and this translates into symptoms for the patient.
■ When the bucket is full, the slightest drip from any source will cause further overflow.

Allergic Load

■ Environmental control slows down the drip
■ Pharmacotherapy makes the drops smaller
■ Desensitization makes your bucket bigger
■ Increasing the empty space in the bucket means that unexpected drips from any source may go unnoticed!

Antigens – The Hidden Enemies

■ Outdoor
  - Pollen from trees, grass and weeds
  - Mold
■ Indoor
  - Dust mite
  - Mold
  - Animals (dog, cat, feather, cockroach)
■ Foods

Outdoor Allergens

“Doc, just put me in the bubble!”

Pollen

■ The male reproductive cells of most plants
■ Lightweight proteins which can travel for miles on the wind
■ Size ranges from 15-50 µm, which does not easily penetrate the lower airway
■ Over 20 grains/m³ can produce symptoms
Pollen

- Trees – February through May in the North. Three consecutive days over 65°F will allow for pollination
- Grasses – June through July
- Weeds – August until the first frost.
- Seasons are longer the further south you travel.

Misconceptions

- “Rose fever” has been a term used to describe spring allergies when flowers bloom, but the pollen from brightly colored flowers is spread primarily by insects and is not allergenic. Odors from the flowers may act as an irritant.
- “Hay fever” is a term used for fall allergies as the hay was being harvested. The offender was not hay, but ragweed.
- That yellow powder you see on your car in spring is not causing your symptoms.

Pollen Count Variables

- Pollen counts are highest in the morning from about 5-10 AM.
- Pollen counts are highest on hot, dry, windy days.
- Pollen counts decrease during a period of rain, but promptly rise again after the rain has passed, even higher than before.

Oak Tree
**Pollen Avoidance Strategies**
- If possible, shift AM activities to PM
- Keep doors and windows closed and AC going as much as possible. This applies for house, apartment and car. Use the air recirculation feature of your car as well.
- Keep pets from going into the bedroom
- Limit yard work and use a mask when working outside.
- Shower when returning home
- Separate indoor and outdoor clothing

**Mold**
- Both an indoor and outdoor allergen, but outdoor counts are twice as high.
- Spores are present in the air throughout the year, unless the ground is covered with snow.
- Spores can survive freezing and boiling
- Generally range between 5-50 μm
- Both the spores and fragments of mycelia are allergenic
- Mold requires warmth, moisture and organic debris to grow.
- How much of the Earth’s bio mass??

**Environmental Prevalence of Mold**
- Damp, shady areas
- Decaying vegetation
- Homes with water leaks
- Spore counts peak after the sun sets.
- Perennial allergen with seasonal spikes
  - Spring thaw in the North
  - May through July
  - September through November

**Indoor Sources of Mold**
- Spores that were released outside entering home through windows, doors, crawl spaces, unsealed parts of the foundation
- Bathrooms, laundry rooms (particularly unvented)
- Kitchen (water leaks, spoiled food)
- Basements, particularly those with an odor
- Indoor plants
- Old books, furniture, piles of newspapers.
Penicillium

Mold Avoidance - Indoors
- Perform regular house survey looking for evidence of mold growth or water damage
- Minimize indoor sources of mold such as plants, old books, newspapers and firewood
- Clean obvious mold with 1:10 bleach solution
- Fix indoor water problems and keep a dehumidifier in damp areas
- Ventilate attic, kitchen, laundry, bathrooms and basement with vents and exhaust fans

Mold Avoidance - Outdoors
- Thin out dense vegetation close to the house or lying on the house.
- Remove any dead or decaying trees and bushes near the house and rake leaves from around the foundation.
- Divert water away from the house and fill any low-lying areas.
- Use professionals to get the job done right

Environmental Control Strategies II
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Indoor Allergens
It is estimated that a person born in the 1990's in the U.S. will spend more than 90% of his/her life indoors.

Dust mites
- Microscopic members of the Arachnid family
- They are blind and unable to drink. They must absorb water from the air
- They feed off of organic debris such as hair and dead skin cells.
- They enjoy high humidity (>50%), low altitudes (<3500 ft) and temperatures between 65-84° F
- The allergenic component Der P 1 is present in the fecal balls produced by the dust mites.
- Each dust mite produces 10-20 fecal balls per day which are 10-20 µm in diameter.

* National Human Activity Pattern Survey Database USEPA, 1995
Dust mites and the Airway

- The most common allergen in children and young adults with asthma.
- Dust mite allergy is a predictor of future allergic sensitizations.
- Dust mites are a significant allergen in patients with isolated allergic rhinitis.

Dust mite Habitats

- Bed sheets
- Mattresses
- Pillows
- Carpets (especially wool)
- Furniture stuffing
- Stuffed animals
- Real animals

Dust mite

Dust Avoidance Strategies

- DUST IS NOT DIRT!
- Focus efforts in the bedroom (“Safe Haven”)
- Keep surfaces free from clutter
- Bare floors are better than carpets
- Vacuum twice per week with HEPA bags
- Wash sheets and pillowcases weekly in hot water (>130° F)
- Put stuffed animals in dryer on “High”
- Keep real animals out of the bedroom
- Purchase barriers for pillows and mattress

Epidermal Allergy

- Dander is a protein that comes from the animals pelt, urine, sweat and saliva
- In the Western world, 60-70% of all households have at least one pet.
- Pet antigen is found in high amounts in carpets, but also on furniture and even on smooth floors.

Cat Dander
Cat Dander
- Approximately 28% of homes in the U.S. have a cat, but 70% of homes have measurable cat dander and significant levels are found in schools, offices, public places, theaters and airplanes.
- The majority of the allergen, Fel D 1, comes from the pelt of the animal.
- Particles are less than 5 µm in diameter
- Particles are very “sticky” and accumulate in high amounts in carpeting (500µg / g dust)

Cat Dander Avoidance
- Eliminating the pet from the household is the most effective strategy, but almost always not well-received. Benefits may take up to 6 months to notice.
- Eliminating carpeting
- Keeping the cat out of the bedroom
- Wash hands after playing with the cat, don’t touch eyes!
- Air purifiers with HEPA filters
- Washing the cat
  - Removes allergen from the cat
  - Decreases the amount of airborne allergen
  - Benefits only found to last 2-3 days

Don’t Try This At Home!

Dog Dander
- More breed to breed variability than with cat dander.
- Antigen not as “sticky” as cat dander and usually present in smaller amounts.
- Overall, avoidance strategies similar to those for cat allergy.
- Many people who claim to be allergic to a dog are actually allergic to other allergens on the dog besides dander, such as pollen, mold and dust mites.

Dog Dander

Feather Allergy
Feather Allergy

- Available extracts usually consist of mixtures of chicken, duck and goose dander.
- There is a direct relationship between the amount of feather dust produced and the size of the bird.
- Other household sources of feathers include comforters, pillows, mattress pads and jackets.
- Many people who feel that they are allergic to their bird are actually sensitive to the mold from droppings at the bottom of the cage.

Cockroach Allergy

- Populations are highest in urban settings.
- They tend to cluster around food and water sources.
- Cockroach sensitivity is a major risk factor for early childhood asthma and rhinitis.
- The allergy is not to the living roach, but the desiccated body parts that become airborne.
- 20% of homes with no visual evidence of cockroach infestation have significant levels of allergen present.

Cockroach Avoidance

- #1 - CLEAN UP FOOD DEBRIS!
- Commercially available insecticides
  - Boric acid (may be made into a paste with milk, flour and onions) is very effective
- Caulking every crack in the house – helpful but very hard to do
- “Roach motels” - don’t waste your money
- Don’t hesitate to call an exterminator

Irritant Sources

- Tobacco smoke
  - Up to 75% of children in the U.S. live in homes with at least one smoker.
  - Exposure to maternal tobacco smoke during pregnancy and during infancy is highly associated with asthma prevalence.
  - Second hand exposure has an adjuvant effect on allergen sensitization during the first 3 years of life.
- Chemicals
  - Cleaning products (alcohols, aldehydes, benzenes)
  - Products of un-vented combustion and respiration
  - mycotoxins

Irritant Avoidance

- Institute a no smoking policy. This includes the porch and the garage.
- Make sure all units that use a flame are adequately vented
  - Furnace
  - Stove
  - Fireplace
- Install fans for fresh air ventilation and make sure air handler is adequate.
School / Workplace Avoidance

“Safe Haven” more difficult to create
- Large amounts of antigen present, particularly in older structures.
- Unknown sources of irritants such as cleaning chemicals and construction.
- Personal air purifier with HEPA filter is helpful.
- Talk with other employees to see if others are having problems.
- Meet with teachers to discuss allergic needs of the child.

The Prevention of Allergy

Case history: Mrs. Lopez is 3 months pregnant and comes to your office with a question. She has a history of allergic rhinitis and her husband has allergies as well as exercise-induced asthma. She took allergy shots when she was younger. She is wondering if there is anything she can do to minimize the chances that her child will have allergies as well.

What do you do?

- Lindfors et al. 1999, studied 189 asthmatic children prospectively:
  - 9% rate of sensitization with no cat present
  - Rate increased proportionally to exposure
  - Dramatic rise to 80% when dampness and tobacco smoke present in the household.
- Ownby et al. 2002, studied 474 children prospectively:
  - Children with 2 or more pets in the home were 77% less likely to have positive allergy skin tests by age 7
  - The likely mechanism is higher levels of endotoxin

The Prevention of Allergy

What do you do?

- Maintain a smoke free household.
- Keep the humidity between 40-50%.
- Survey the house, indoors and outdoors, for any mold or water issues. Remedy any problems identified.
- Check the kitchen for any signs of roach infestation.
- Pull carpets and initiate dust avoidance strategies.
- Consider breastfeeding for at least 6 months.

Survey the house, indoors and outdoors, for any mold or water issues. Remedy any problems identified.
- Check the kitchen for any signs of roach infestation.
- Pull carpets and initiate dust avoidance strategies.
- Consider breastfeeding for at least 6 months.
Who do you do it for?

- Overall risk of a child developing allergies is 25%
- If one parent is allergic, the risk increases to 35%
- If both parents are allergic, the risk increases to 65%
- I only recommend prophylactic environmental control when both parents have a history of allergies.
- There are no risks to initiating these strategies!

When do you start doing it?

- As early as 22 weeks gestation, fetuses of atopic mothers are capable of mounting a proliferative response to dust mite allergen, directed by maternal IgG.\(^{17}\)
- Currently, there are no evidence-based recommendations available to guide physicians and parents when to start these strategies and how long to maintain them, but studies are currently underway.

Does it really work?

- Hide et al., 1994
  - Randomized, controlled trial on high-risk children
  - Strict dust avoidance strategies were implemented for the first 12 months of life
  - Allergic rhinitis was significantly lower at 12 and 24 months, compared to the control group
  - Significant reduction in positive skin prick reactions compared to the control group

Products - Filters

- Fiberglass
  - Used in forced air heating systems
  - Inexpensive, inefficient, use as a prefilter
- Polyester resin
- HEPA (High-Efficiency Particulate Air) filter
  - Originally developed by the Atomic Energy Commission to clean radioactive dust.
  - Must remove 99.97% of particles > 0.3 µm
  - Lasts approximately 2-5 years with prefilter

Products - Air Purifiers

- Over $350 million was spent in 1999 in the U.S. on air purifiers, triple the amount spent in the early 1990's
- Air purifier with HEPA filtration system
- Electronic precipitators
- UV / catalyst
  - New on the market
  - Destroys organic material, but furnishings and occupants are unharmed

Products - Air Purifiers

- HePA Filtration Systems
  - Filters out pollen grains, dust particles, mold spores and animal dander
  - Low maintenance
  - Central and room size
  - Carbon filters remove odors
  - Better if used without carpeting
### Electronic Precipitators
- Charged particles are passed between magnetic plates
- Require more maintenance to clean plates – charged particles may cause greasy, dark deposit
- Small amounts of ozone are generated

### Electronic Precipitators
- “Around the neck” versions have been found to be ineffective
- The Federal Trade Commission determined that they produce 5x the acceptable ozone levels permitted by the U.S. FDA

### Products – Vacuum Cleaners
- Introduced in 1935
- Dust will pass through standard single-layer bags
- Use 2-3 layer microfiltration bags or HEPA filtration bags
- True HEPA vacuum cleaners are available for $100 - $1000

### Products – Dust Barriers
- Originally developed from material used to make typewriter ribbons.
- The same material used to make surgical gowns.
- Variable pore size
- Partial or total is just as effective.

### Products – Acaricides
- Tannic acid – used to tan leather, present in tea. Denatures dust antigen, but does not kill dust mites. Needs frequent reapplication and may stain fabric.
- Benzyl benzoate – a powder which kills dust mites, does not denature the antigen.
During follow-up visits, have the patient report on which strategies are being done. Give the patient the plan in written form. Focus on "reducing" rather than "eliminating". Don’t give the patient a large "to do" list –– prioritize them for the patient. Choose a few key strategies at each visit and stress the importance of these strategies and that even small steps can produce big changes. In order to achieve success, THERE IS NO AVOIDING AVOIDANCE!

References