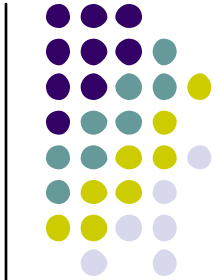
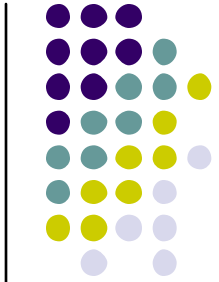
An Environmental Intervention Program for Indoor Air Pollutants and the Onset of Respiratory System Illnesses in Pediatric Asthma

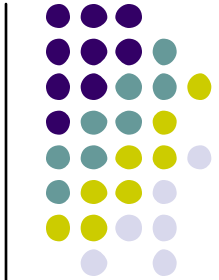


Problem in Missouri



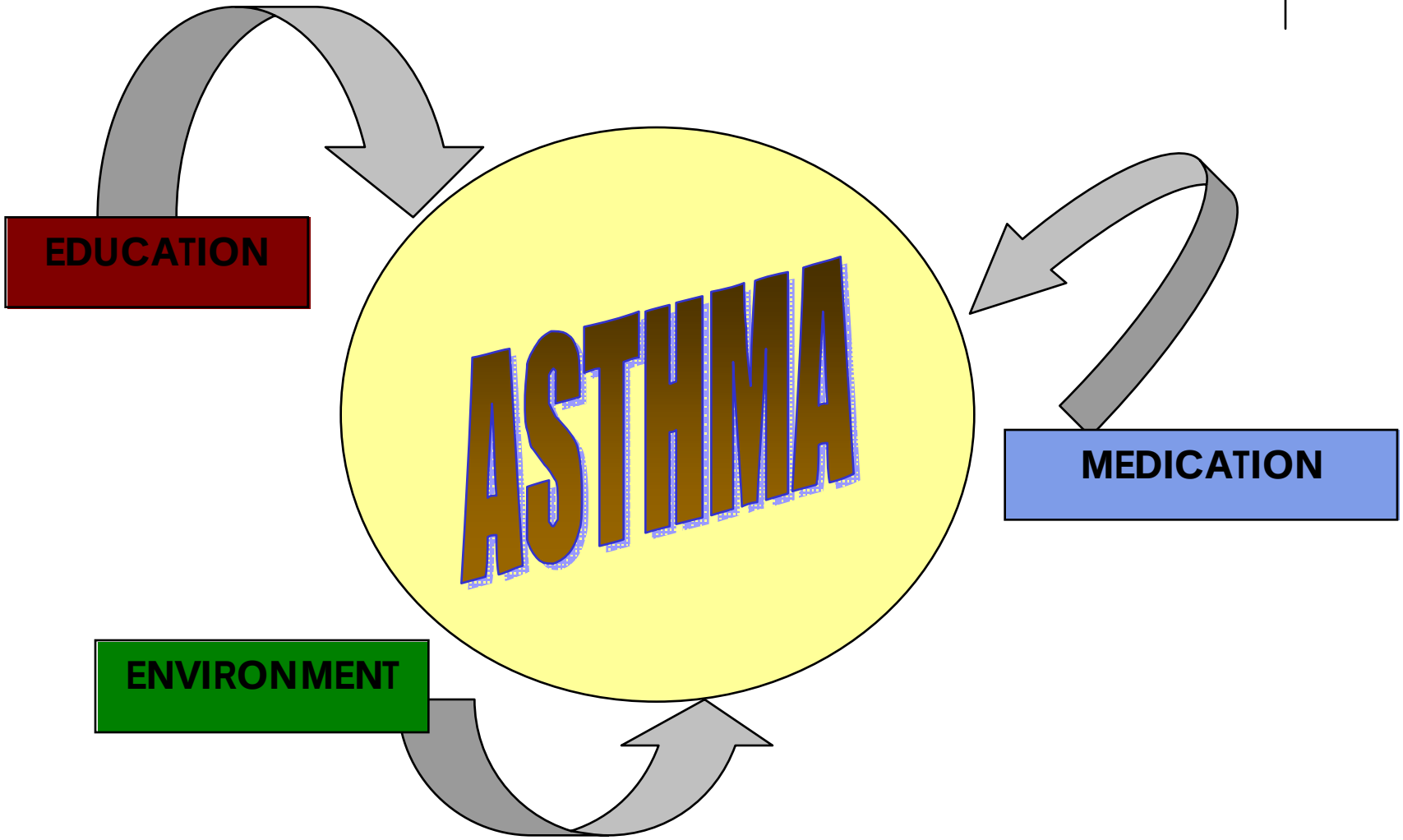
- An estimated 6.7% of Missouri adults live in households with at least one child who has asthma.
- Southeast Missouri ER rates were 3x higher than the state average.
- Missouri direct costs due to asthma: $277 million
  - 32% Medicaid Patients
- Indirect costs: $206 million

Why an Increase in Asthma?

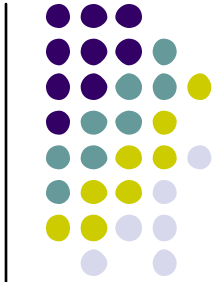


- Better home construction
- Increased number of persons in lower socioeconomic populations in cities and rural settings that occupy substandard housing.
- Health care costs and accessibility.
- Some choose NOT to manage their disease.
  - Lack of education
  - No plan of action
  - Culture-based decisions

What is a Global Asthma Intervention Program?



Environmental Effects on Asthma



- Environmental pollutants may affect asthma severity by:
  - Acting as a trigger and leading to an asthma attack in an individual with hyperresponsive airways.
  - Exacerbating preexisting airway inflammation, leading to increased airway hyper-responsiveness, which may persist after cessation of exposure.
  - Augmenting or modifying immune response to inhaled allergens or intensify the impact or other pollutants in the respiratory tract.

Indoor Air Pollutants

- Exposure to indoor air pollutants is an important contributor to the onset of respiratory system illnesses.
- Environmental triggers contained in indoor air play a key role in the exacerbation of pediatric asthma.

Clearing the Air

Indoor Air Exposures and Asthma Exacerbation

Biological Agents

- Sufficient evidence of a causal relationship
  - Cat
  - Cockroach
  - House dust mite
- Sufficient evidence of an association
  - Dog
  - Fungi/Molds
  - Rhinovirus

Chemical Agents

- Sufficient evidence of a causal relationship
  - Environmental tobacco smoke (in preschool-aged children)
- Sufficient evidence of an association
  - NO_2, NO_x (high levels)
- Limited or suggestive evidence of an association
  - Environmental tobacco smoke (school-aged, older children and adults)
  - Formaldehyde
  - Fragrances

Environmental Triggers

- Dust Mites
- Pet Dander
- ETS
- Mold/Fungi
- Cockroaches
- Combustion Residues
- Endotoxins

Dust Mites

- Triggers:
  - Body Parts and droppings.
- Where found:
  - Highest levels in mattresses and bedding. Also in carpeting, draperies, upholstered furniture, clothes and stuffed toys.

What Have You Learned About Environmental Triggers in Your Home?

Cockroaches and Rodents

- Triggers:
  - Cockroaches: Body parts, secretions and droppings.
  - Rodents: Hair, skin flakes, urine and saliva.
- Where found:
  - Areas with available food and water (kitchens, bathrooms and basements).

Oriental Cockroach | Brown-banded Cockroach | American Cockroach

Mold

- Triggers:
  - Mold and mold spores on damp or wet surfaces.
  - Fungal glucans, mycotoxins.
- Where found:
  - Throughout the homes, especially in areas that are damp and temperate.

Environmental Tobacco Smoke

- Trigger:
  - Children of all ages who live in homes with smokers are 63% more likely to have asthma.
  - Children of teenage mothers have a three fold to five-fold increased risk of developing childhood asthma.
- Where found:
  - Cars or homes where allowed.

Particulates

- A complex mixture of extremely small particles and liquid droplets.
- The size of particles is may be linked to their potential for causing health problems.

Sources:

- Chemicals
- Fields
- Smokestacks/fires
- Automobiles
- SO_x
- NO_x

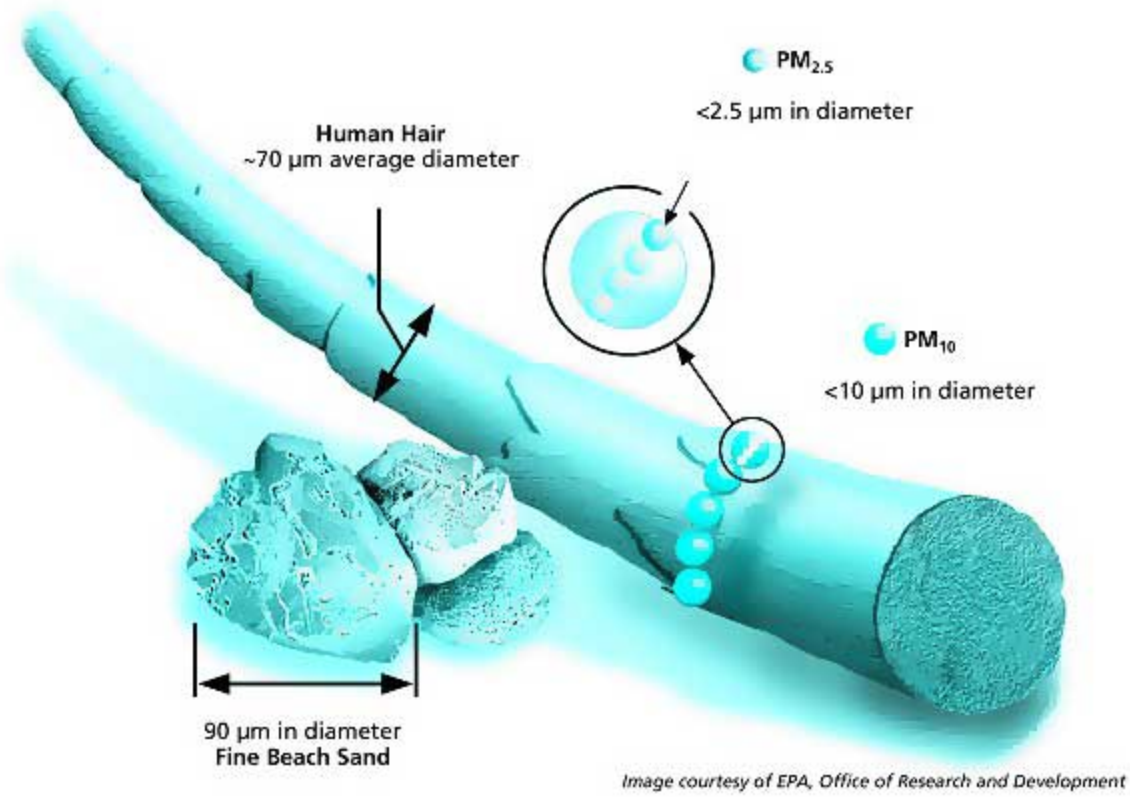
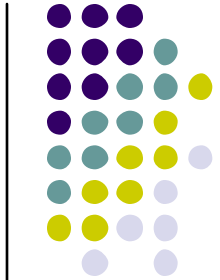


Image courtesy of EPA, Office of Research and Development

Combustion Devices



- Trigger:
  - CO, NO_2, PM and CO_2
  - Irritant to mucous membranes.
- Where found:
  - Gas ranges
  - Improperly vented fireplaces
  - Wood or coal stoves
  - Kerosene or gas space heaters.

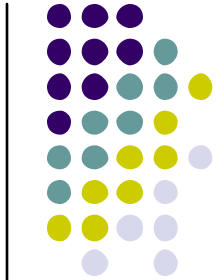
Other Sources of Irritants/Triggers

- Aerosol products
- Air fresheners
- Building materials and home furnishings
- Carpet/padding (new)
- Cleaning agents
- Detergent
- Hair products
- Moth repellents
- Pesticides
- Potpourri

Project Goals

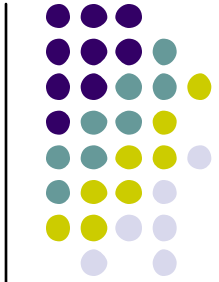
- Show a **decreased** number of ER visits/admissions or physician visits.
- Educate patient/patients families about indoor environmental asthma triggers and how to identify them in their home.
- Show an **increased** health care provider knowledge of indoor environmental asthma triggers and case management.

Methods of Research



- Health Care Provider Training
- Patient /Family Education
  - Educate patients about behavior changes that will minimize symptom severity and/or return
  - Informational Packets:
    - Asthma and symptomology;
    - Environmental triggers;
    - Home environmental checklist;
    - Exposure reduction plan.

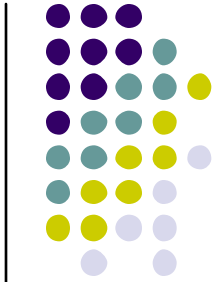
Methods of Our Program



- In-Home Assessment
  - Administer Questionnaire;
  - IAQ measurement;
  - Walk through assessment;
  - Reassessments were done on a quarterly basis.

Why Participate in This Program?

Home Visit Program



- Provide an opportunity to:
  - Educate patients about the importance of staying with the prescribed patient treatment regimen.
  - Educate patients about methods of identifying and mitigating environmental asthma triggers found in and around the home.
  - Educate patient about behavior changes that will minimize symptom severity and/or return.
  - Provide an opportunity to assess indoor air quality.
  - Development of a home asthma action plan.
  - Provide positive reinforcement to participants during Reassessment visits.

Indoor Air Quality

- Monitoring of indoor air provides an opportunity to identify conditions that may exacerbate asthma symptoms or aid in the development or support of indoor conditions that allow environmental asthma triggers to flourish.

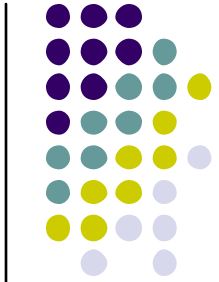
IAQ Survey

- Typical indoor air contaminants that indicate the potential for airway irritation or other concerns:
  - Carbon monoxide
  - Carbon dioxide
  - Oxygen
  - RH
  - Temperature.

IAQ Variables

- CO and CO_2 are indicators of faulty heating devices, poor ventilation, ETS and potential irritation to airways.
- RH indication of growth potential for molds, presence of dust mites and biological allergens.

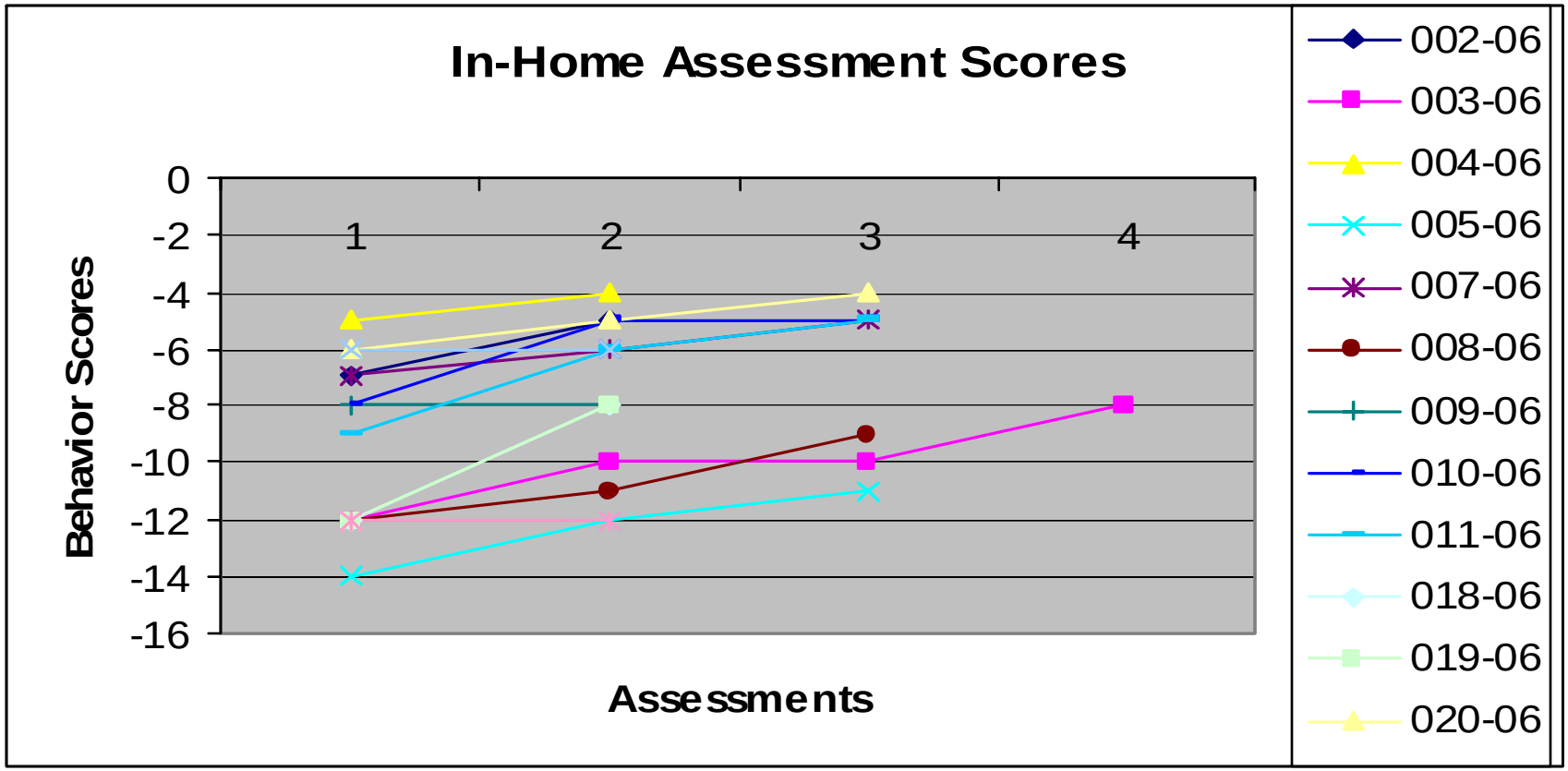
Preliminary Results on Health Care Provider Training



- 152 Health care providers participated in the training program
- Improved knowledge on post tests
- Statistics show significant increase in knowledge ($p<0.0001$)
- Even more training data to come

Results From In-Home Exposure Reduction Plan

- Most patients behavior scores improved (30-50% decrease).

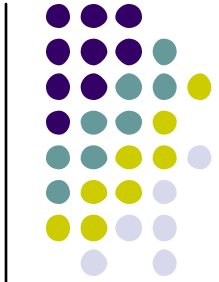


What Actions Have You Taken?

Preliminary Data

	Asthma Patients n=100	Control Group n=246
ER Visits	6 (14.2)	196 (79.6)
Sick Visits (Doctor)	8 (19)	103 (41.8)

Economic Savings



- The first year of this study demonstrated a projected economic savings in excess of $500,000.00 for insured patients.
  - Based on total direct medical costs from:
  - Colice et. al. (2006). Healthcare and workloss costs associated with patients with persistent asthma in privately insured population. Journal of Occupational and Environmental Medicine. 8: 794-802.

Outcomes

- There was significant difference between the control group verses the patients that receive the in-home assessments.

- Our first year of study showed that education and in-home assessments play a key role in the reduction of environmental asthma triggers inside the home.

How Has the Program Benefited Your Family?

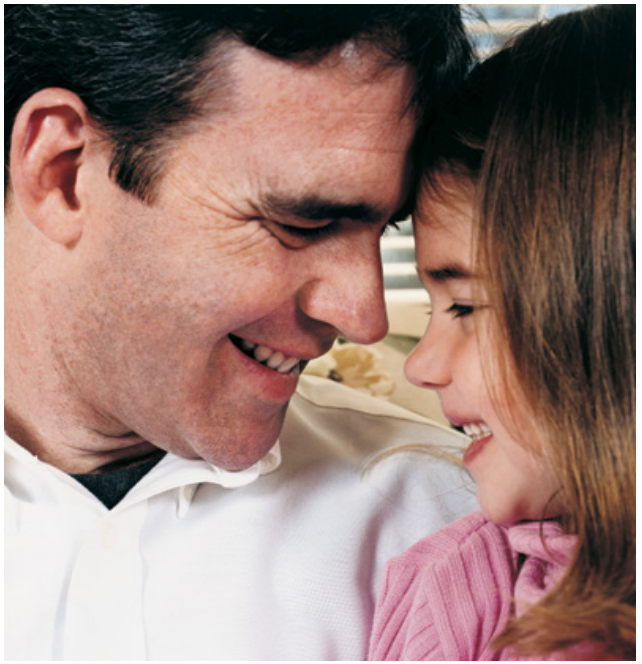
A Public Health Response to Asthma: INTERVENTIONS

- The public needs to know about other resources available.
- Medical
- Environment
- Schools
- Child Care Centers

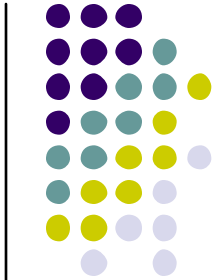
A Public Health Response to Asthma:

EDUCATION

- Education programs can be targeted to—
- People with asthma
- Parents of children with asthma
- Medical care providers
- School personnel
- General public



A Public Health Response to Asthma: HOME INTERVENTIONS



- Improving environmental living conditions.
- Clearer understanding of health care interventions.
- Improve living conditions by improving behaviors (i.e. no smoking in the home).

- “Evidence suggests that poor indoor air quality may be a more likely trigger of childhood asthma than outdoor pollution,” said Dr. Ian Greaves, environmental medical specialist and consultant to the American Lung Association Health House program.

- A healthy home lets us live healthy lives.

Asthma Patient Economic Impact of This Program

Questions?

- Study Funded by EPA Region 7