

# Childhood Asthma and Housing Conditions in Seattle

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# Acknowledgements

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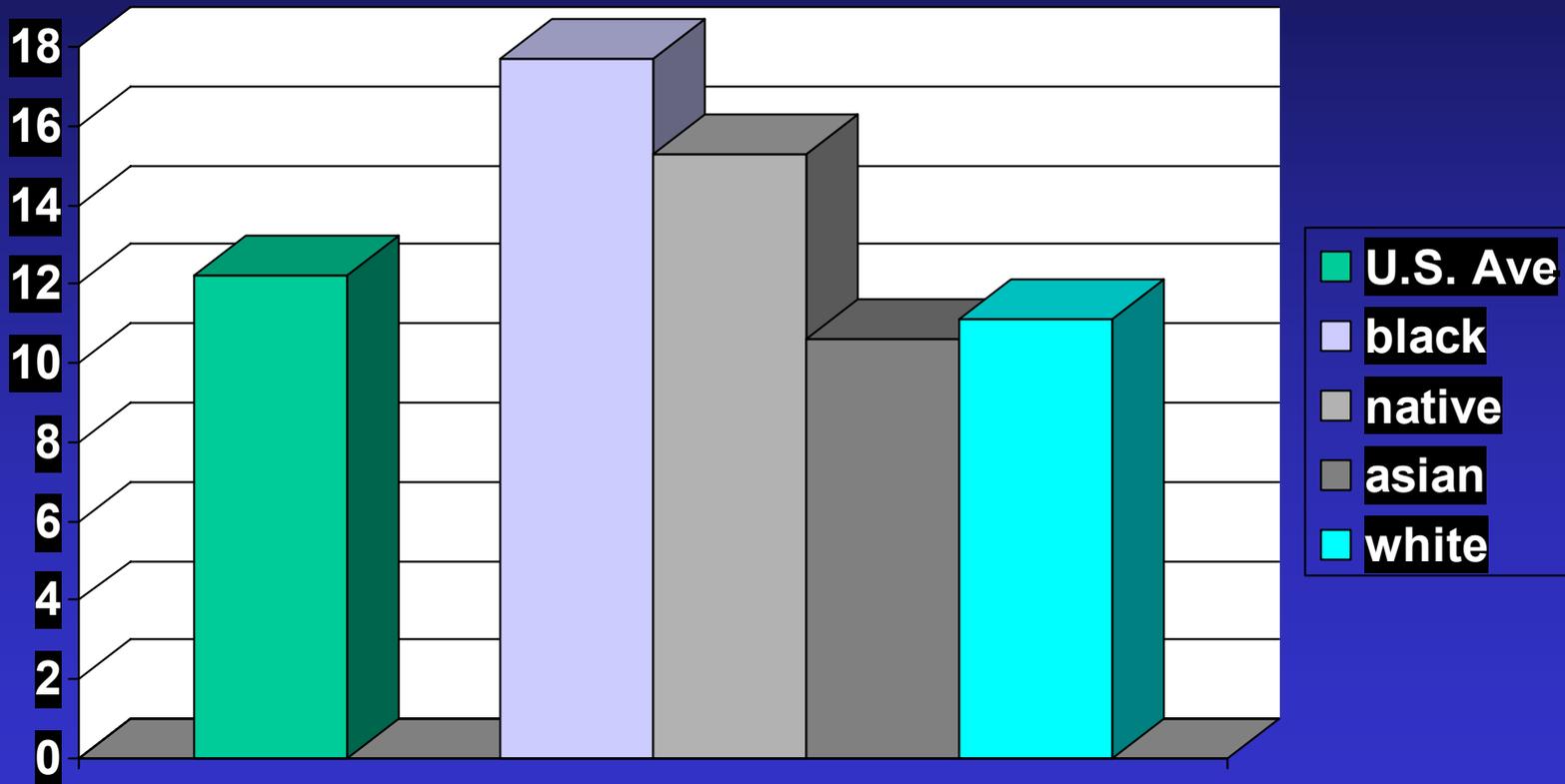
Nancy Beaudet CIH, DEOHS Laboratory Team

# National Childhood Asthma Impact

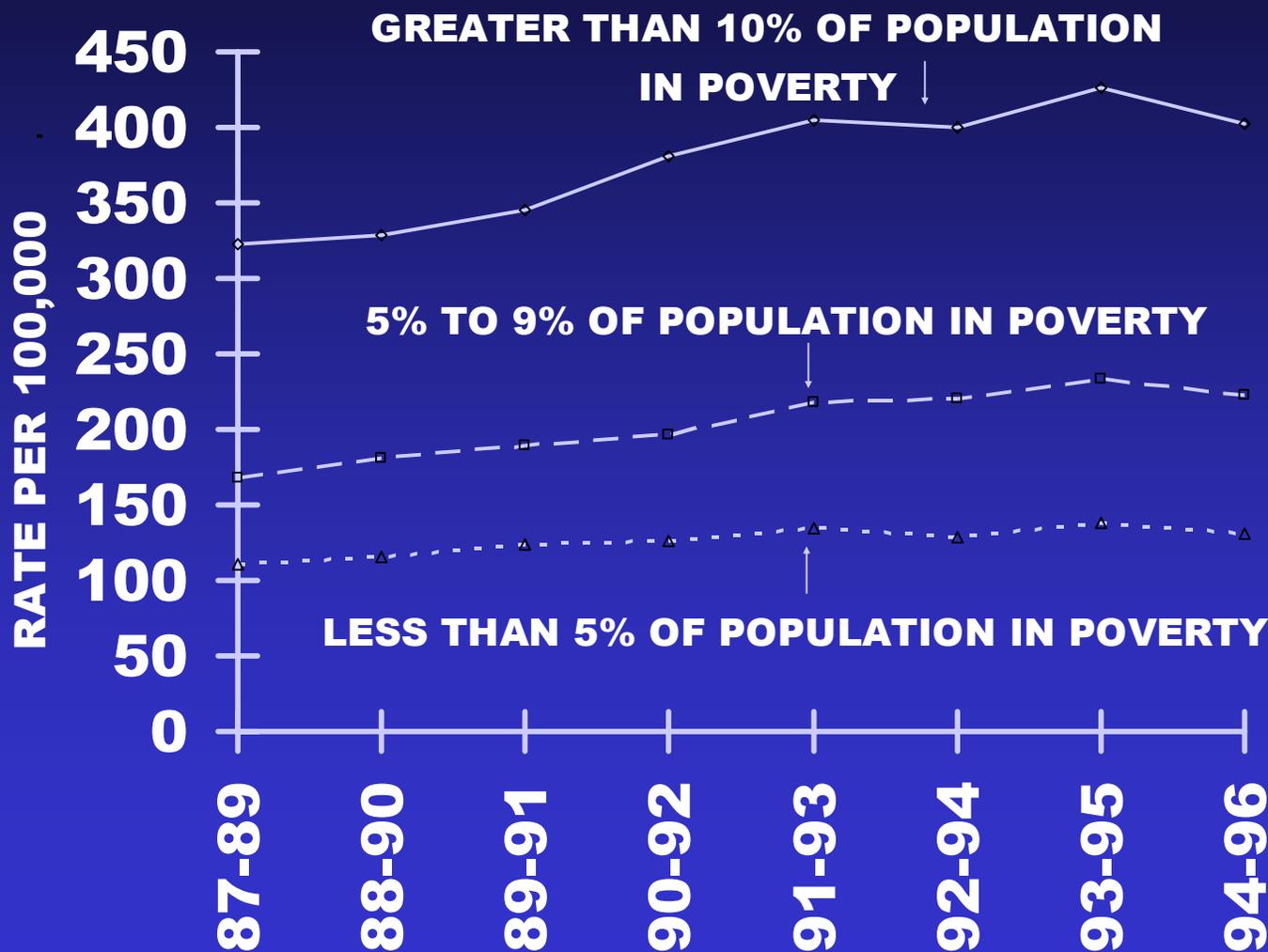
- In 2002 over 4 million US children had asthma.
- In 1999
  - ◆ 650,000 emergency department visits
  - ◆ 190,000 hospitalizations - #1 dz. diagnosis
  - ◆ 176 deaths attributed to asthma – more than doubled since 1980
- Asthma is the most common reason for school absences (14 Million days in 1996).
- Low-income and minority populations experience substantially higher rates of fatalities, hospital admissions, and emergency department visits.
- The combined direct and indirect costs for asthma in United States was approximately \$12.7 billion in 1998

# Asthma in U.S. Children 2002

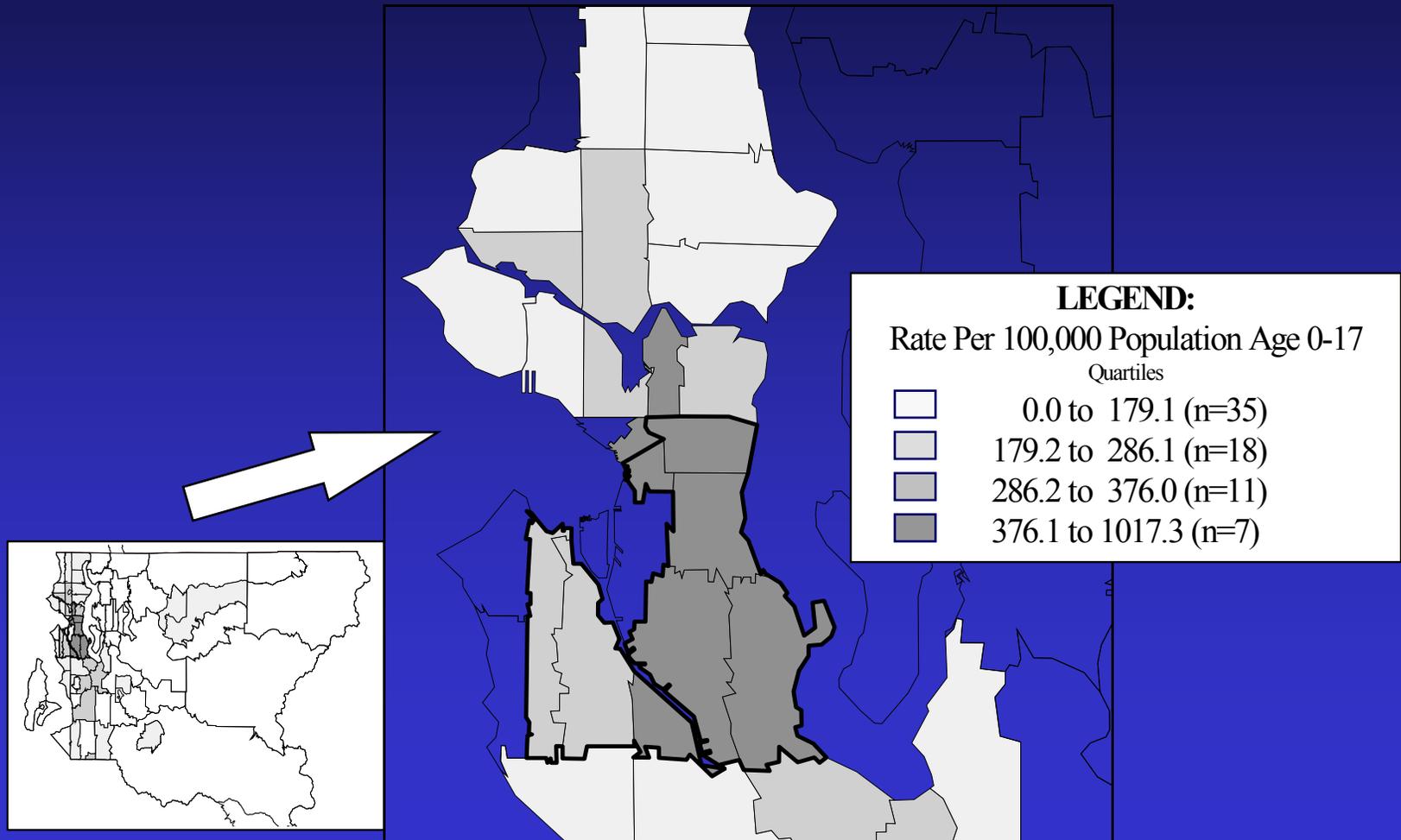
## By Racial Group



# Hospitalization Rates in King Co. Neighborhoods with Highest Poverty



# Hospitalizations for Asthma King County, 1987-1993



# Asthma and Housing

- Exposure to indoor asthma triggers is a major contributor to asthma morbidity.
- Substandard housing is related to increased exposure to asthma triggers
  - ◆ Moisture promotes mites & mold (25 million homes '99 w/ water damage)
  - ◆ Roach specific allergen
  - ◆ Poor ventilation (higher allergen and ETS levels)
  - ◆ CO and/or NO<sub>x</sub> from stoves or heaters
- Low income tenants have few resources to address these exposures.

# Exacerbation of Asthma by Indoor Hazards

- **Cats\***
- **Cockroaches\***
- **Dust mites † \***
- **Environmental Tobacco Smoke\*** (pre-school age)
- **Dogs**
- **Molds**
- **NO<sub>2</sub> , NO<sub>x</sub>**
- **Rhinovirus**
- **Multiple irritants (VOCs)**

IOM, Clearing the Air, 2000

\* adequate evidence for causation. Others show association.

† Sufficient evidence for causation in the development of asthma

Build Healthy New Communities

Build Healthy New Housing

Make Existing Housing Healthier

In-home Education

Seattle-King County



Healthy Homes Project

# **In-Home Intervention Recruitment and Research Design**

- **Community-based participatory research methods**
- **Eligibility**
  - ◆ **household income below 200% poverty**
  - ◆ **child age 4-12 with asthma**
- **Randomized controlled design: participants randomized into high (n=138) and low (n=136) intensity intervention groups.**
  - ◆ **High group: full intervention**
  - ◆ **Low group: one visit, action plan, follow-up call, bedding covers**
  - ◆ **Low group crosses over to high group after one year**

# **In-Home Intervention**

## **Main Outcome Measures**

### **Primary Outcomes**

- ◆ **Child's asthma symptoms**
- ◆ **Caregiver quality of life**
- ◆ **Asthma-related health services utilization**

### **Secondary outcomes**

- ◆ **Behavioral changes**
- ◆ **Evidence for mold, moisture, ETS, pets and pests**
- ◆ **Surface dust loading & antigens in carpet sample**
  - **Dust mite**
  - **Roach**
  - **Cat**
  - **Dog**

# Community Health Worker Home Visits

- Make 5-9 visits over one year (high intensity) or 1 visit (low intensity).
- Assess home environment and develop Action Plan to reduce exposure to moisture, ETS, mites, mold, pets, roaches.
- Offer client education and encourage behaviors to implement plan (e.g. dust control, ventilation, tobacco).
- Review progress in implementing Action Plan at each visit.



Putting on a mattress cover

# Community Health Worker Activities

- CHWs are from participating communities, receive rigorous training, and have personal experience with asthma.

In addition to trigger focused action plan:

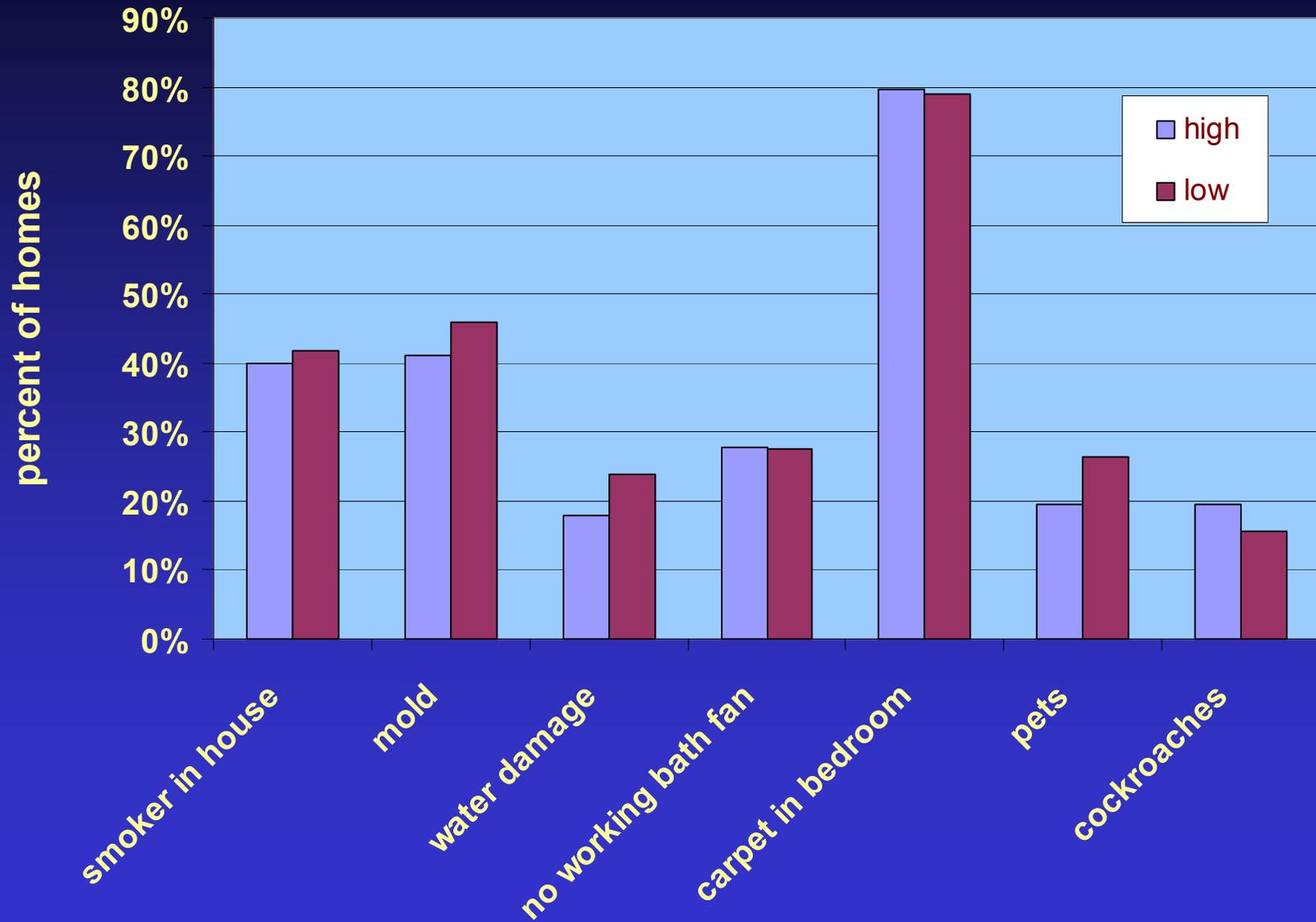
- Counsel about smoking, refer to free telephonic smoking cessation program (Free and Clear™), provide nicotine patches.
- Promote tenant-landlord communication.
- Provide social support.
- Offer advocacy/referral (housing, food, furniture, jobs, etc.).

# Participant Demographics

Baseline Characteristics of Higher and Lower Intensity Groups (%)  
n=274

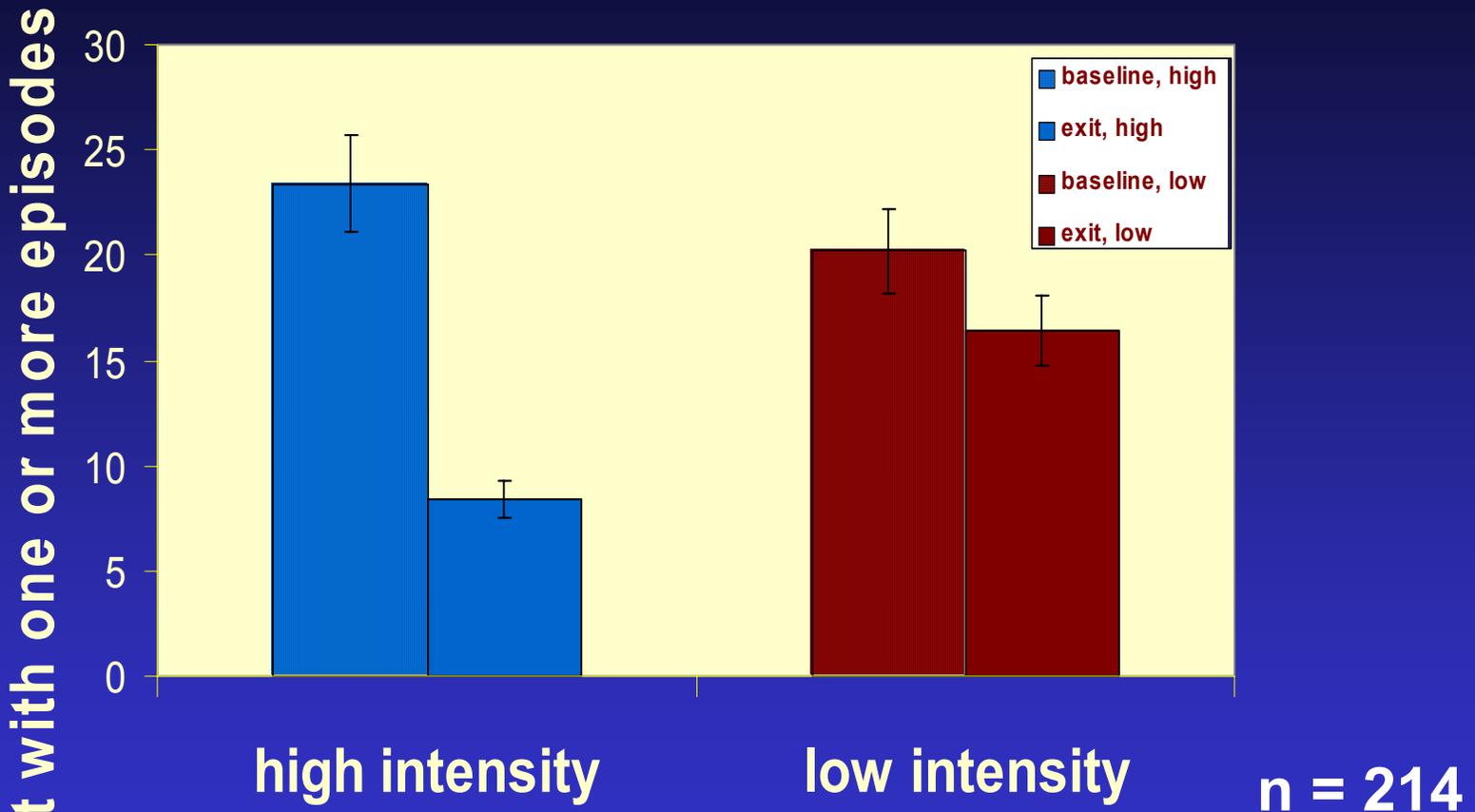
Characteristic	high	low
Number	138	136
Income < 100% poverty	51.9	60.9
Ethnicity		
Asian	34.1	27.3
African American	31.9	27.2
White non-Hispanic	11.6	20.6
Hispanic	17.4	16.9
Other	5.1	8.1
Renter	81.9	83.0
Completed high school	59.1	52.4
Caretaker employed	47.8	57.4

# Extent of Exposures in Seattle



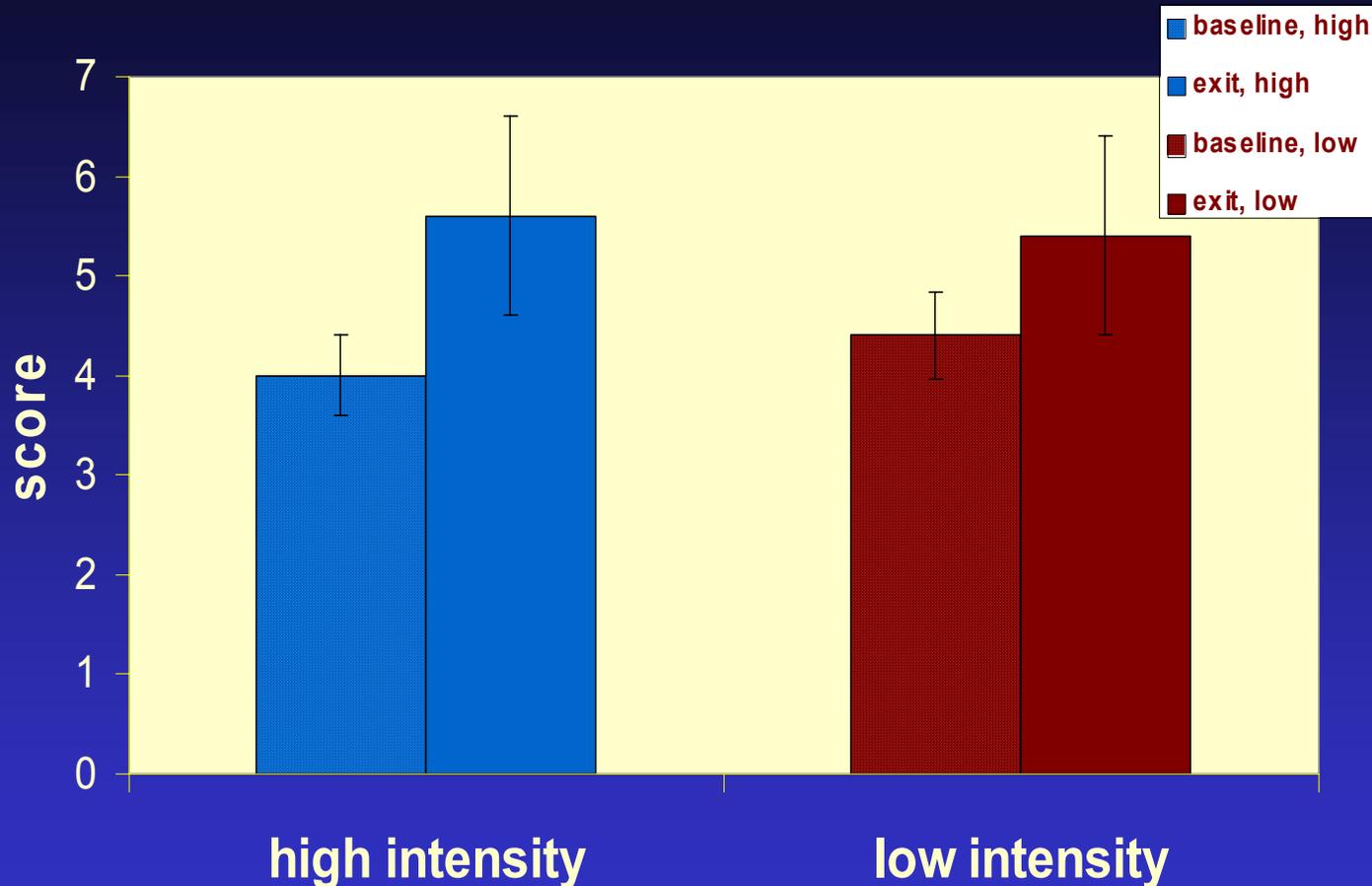
Baseline data from Healthy Homes I, n = 274

# Outcome: Urgent Health Services



p-values:  
0.000 (high intensity, baseline vs. exit, chi-square)  
0.414 (low intensity, baseline vs. exit, chi-square)  
0.041 (exit, low vs. high intensity, regression adjusted for baseline score)

# Outcome: Caregiver Quality of Life



n = 214

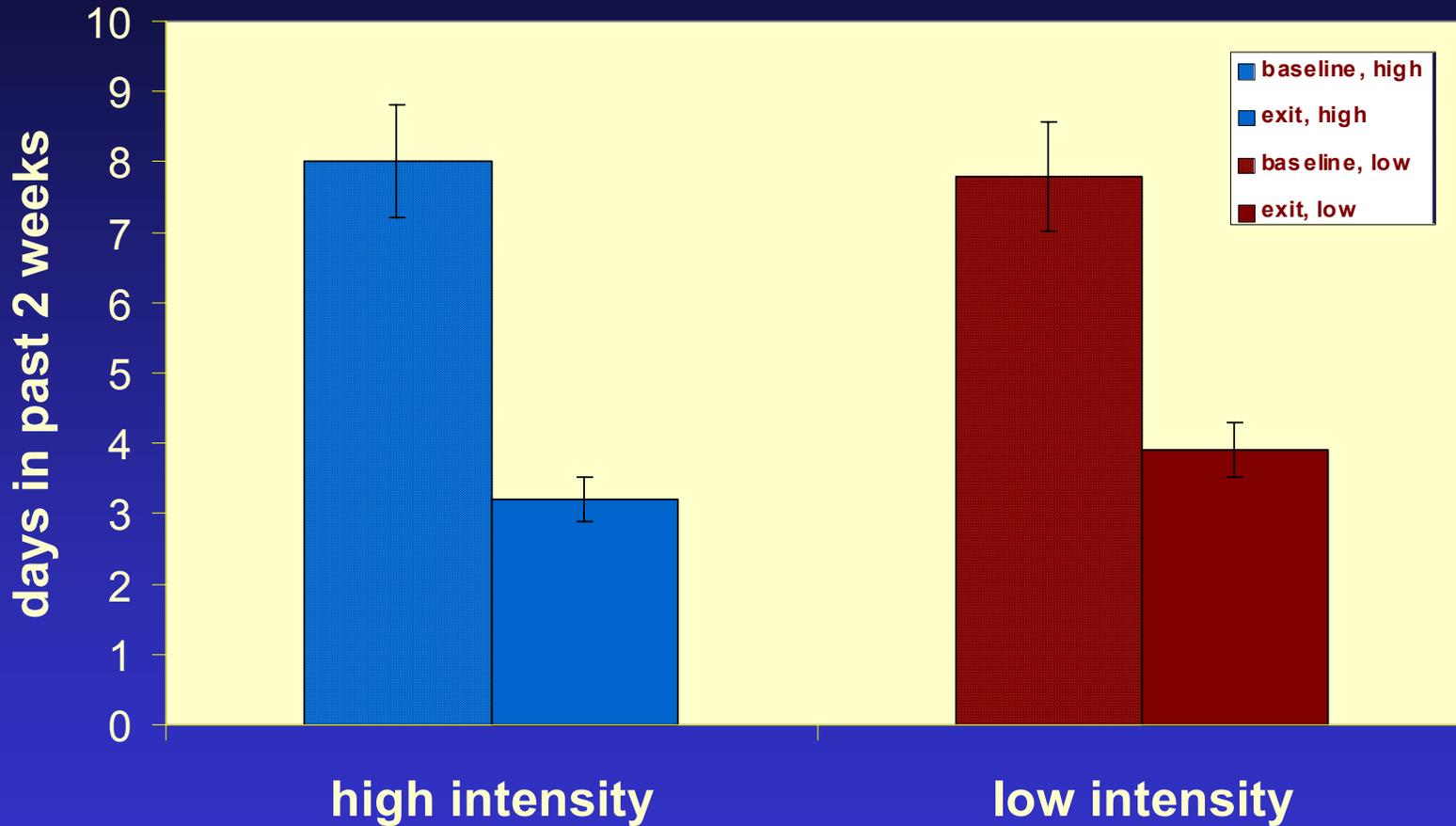
p-values:

0.000 (high intensity, baseline vs. exit, chi-square)

0.006 (low intensity, baseline vs. exit, chi-square)

0.001 (exit, low vs. high intensity, regression adjusted for baseline score)

# Outcome: Symptom Days



n = 214

p-values:  
0.000 (high intensity, baseline vs. exit, chi-square)  
0.000 (low intensity, baseline vs. exit, chi-square)  
0.123 (exit, low vs. high intensity, regression adjusted for baseline score)

# Primary Outcomes

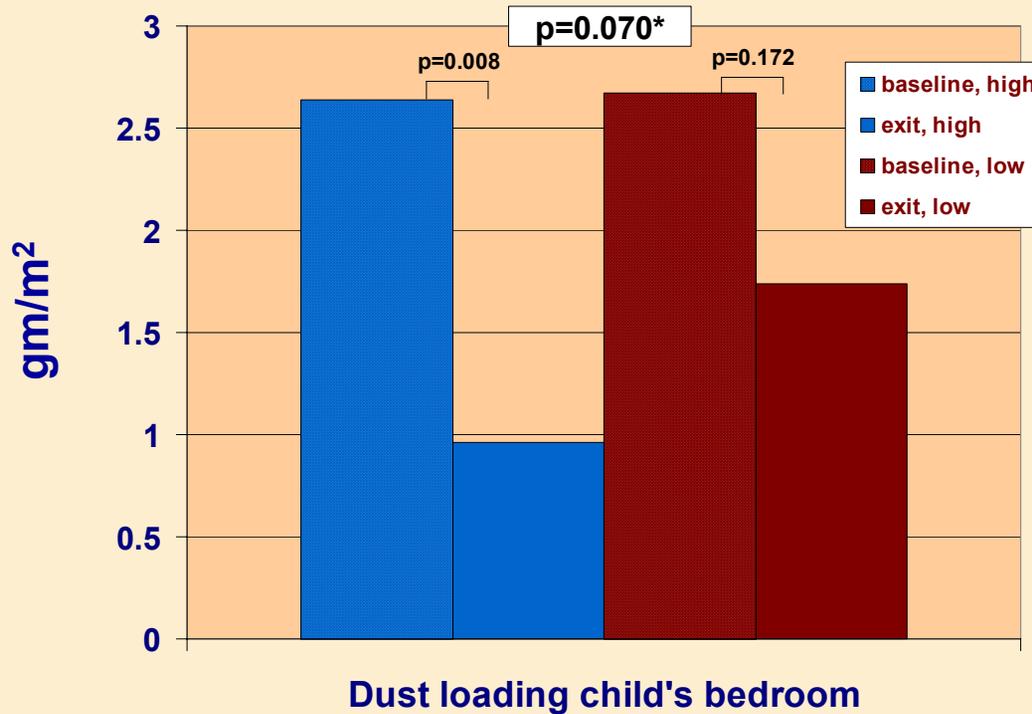
- **Healthy Homes reduced urgent health services utilization and improved caretaker quality of life.**

<b>Outcome</b>	<b>High Intensity</b>	<b>Low Intensity</b>
<b>Symptoms</b>	↓	↓
<b>Quality of Life</b>	↑	↑
<b>Urgent utilization</b>	↓	

- **The degree of improvement in quality of life and utilization was greater with the higher intensity intervention.**

# Outcomes

## Floor Dust Loading



\* p value comparing high vs. low exit values after adjustment for baseline values using linear regression

# Secondary Outcomes Related to Exposure

Outcome	High Intensity	Low Intensity
Behaviors to ↓ Exposure	↑	
Surface Dust Loading	↓	
Der p1 Loading	↓	
Moisture	↓	
Trigger Knowledge	↑	↑
Trigger Score *	↓	

\* Trigger score: 1 point ea. for condensation, mold, roaches, pets, daily ETS

# Conclusions

- A community health worker intervention addressing multiple exposures reduced asthma symptom days, improved caretaker quality of life and reduced urgent health services utilization.
- More exposure measures improved in the high intensity group, e.g. reduced loading of dust and Der p1 antigen, moisture and trigger score.
- The degree of improvement in quality of life, symptoms and medical utilization was greater with the higher intensity intervention.
- The intervention increased caretaker knowledge and actions, in both groups, but more so in the high intensity group.

# Seattle Health Homes Asthma Intervention Spectrum

**Asthma Education**

NIEHS  
1997-2001

**Asthma Education + Community Health Worker I**

NIEHS  
2001-2005

**Clinic Asthma Nurse**

**Clinic Asthma Nurse + Community Health Worker II**

HUD  
2001-2004

**Community Health Worker III**

**Community Health Worker III + Remediation**

**Community Health Worker IV**

HUD/NIEHS  
2003-2007

**Community Health Worker IV+ New Healthy Housing**

# Healthy Homes II



- **Goals**
  - ◆ **Link indoor environmental and clinical approaches for improving asthma control**
  - ◆ **Demonstrate value of in-home interventions to health care payors and others**
- **Combines support for medical aspects of asthma self-management with reduction of indoor triggers**
- **Compares effectiveness of CHW in-home asthma support to clinic-based education & case management**
- **RCT of 380 low-income households with children with asthma funded by NIEHS**



# Better Homes for Asthma

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*Co-Principal Investigator*

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*Systems Analyst*

**Funded primarily by US Dept. of Housing and Urban  
Development**

# **Better Homes for Asthma Project Overview**

- **Compare marginal value of adding remediation to the community health worker intervention**
- **Remediate 70 substandard homes with conditions associated with asthma and other health risks:**
  - **\*improve ventilation**
  - **\*remove old carpet**
  - **\*eliminate water intrusion**
- **Randomized controlled trial of asthmatic children:**
  - **Assess impact of remediation on asthma-related health outcomes, FEV1 & FVC, and exposures to asthma triggers including total fungal loading.**

# Better Homes for Asthma

## Structural Interventions

- Randomly assign households to early vs. late remediation
- Average \$3000/unit, range \$1500-\$9000
- Include units if
  - ◆ Damaged roof, siding, evidence of moisture intrusion
  - ◆ Mold
  - ◆ Plumbing leaks
  - ◆ Carpet moist or poor condition
  - ◆ Pests and structural defects permitting egress
- Exclude units if
  - ◆ none of these conditions
  - ◆ condition so poor that remediation beyond scope

# **Community Health Workers Serve All Participants**

- **Provide services similar to Healthy Homes**
- **Provide resources**
  - ◆ **Allergy control covers for bedding**
  - ◆ **Vacuum and bags**
  - ◆ **Cleaning Kit**
  - ◆ **Door mats**
  - ◆ **Injury prevention**  
(outlet protectors, stair guards, smoke detectors and batteries, locked gun storage boxes, cabinet safety locks, CO detector)

# Healthy Communities/Healthy Homes: High Point

- Redevelop 1600 units
- Included in demonstration project
- Incorporate features to promote health
  - ✦ Network of open spaces and trails
  - ✦ Increase access to transit
  - ✦ Develop spaces for social interaction
  - ✦ Incorporate healthy homes approaches into construction of new units
  - ✦ Low-allergen landscaping
  - ✦ Designate tobacco-free units and zones
  - ✦ Neighborhood market providing healthy, affordable food
  - ✦ Community gardens
- ✦ Promote community organizations



*Map overview of the  
High Point redevelopment.*

# High Point Project Overview

- **Assess impact of community redevelopment**
  - ◆ health
  - ◆ social capital, community power and cohesion
  - ◆ physical activity
  - ◆ physical security and safety
  - ◆ illicit substance availability
- **Assess impact of new housing**
  - ◆ general health status
  - ◆ asthma-related health status
- **Funding: HUD and NIEHS**

# Evaluation for Asthma Families

- **Modified Case-Control**
  - ◆ Cases evaluated over 1 yr. prior to move with CHW intervention.
  - ◆ Cases evaluated over 1 yr. in new units
  - ◆ Controls randomly selected from standard new units
- **Outcome Measures**
  - ◆ changes in asthma-related health outcomes, FEV1 & FVC
  - ◆ changes in home environment
  - ◆ changes in participant behaviors and knowledge

# **High Point**

## **Features of All New Units**

- **Advanced framing with increased energy efficiency**
- **Airtight drywall installation**
- **Energy Star compliant argon-filled windows (U<0.35)**
- **Low VOC finishes**
- **Sealed cabinets to decrease emissions**
- **Cement board exterior siding**

# High Point

## Additional Features Breathe Easy Units

- **Slab: sealed, insulated to keep warm and dry**
- **Blown-in insulation, rain screen**
- **Exterior grade plywood (no OSB)**
- **Cement board siding with house wrap**
- **Airtight drywall with low-emission joint compound**
- **Windows: Argon,  $U < 0.35$ , water-tight flashing**
- **Low emission doors, trim, cabinets, finishes, adhesives**
- **No carpeting**

# High Point

## Additional Features Breathe Easy Units

- Heating and ventilation:
  - ◆ Air handler w/ HEPA filter
  - ◆ Fresh air to bedrooms and living rooms
  - ◆ Continuous fan with constant air regulator (1/3 ACH)
  - ◆ Airtight ducts
  - ◆ Radiant/Hydronic baseboard heat
  - ◆ Humidity-controlled kitchen fan
  - ◆ timed bath fan
- Hard surface floors (linoleum or VCT)

# **Public Health Practice in Housing for Asthma Morbidity Reduction**

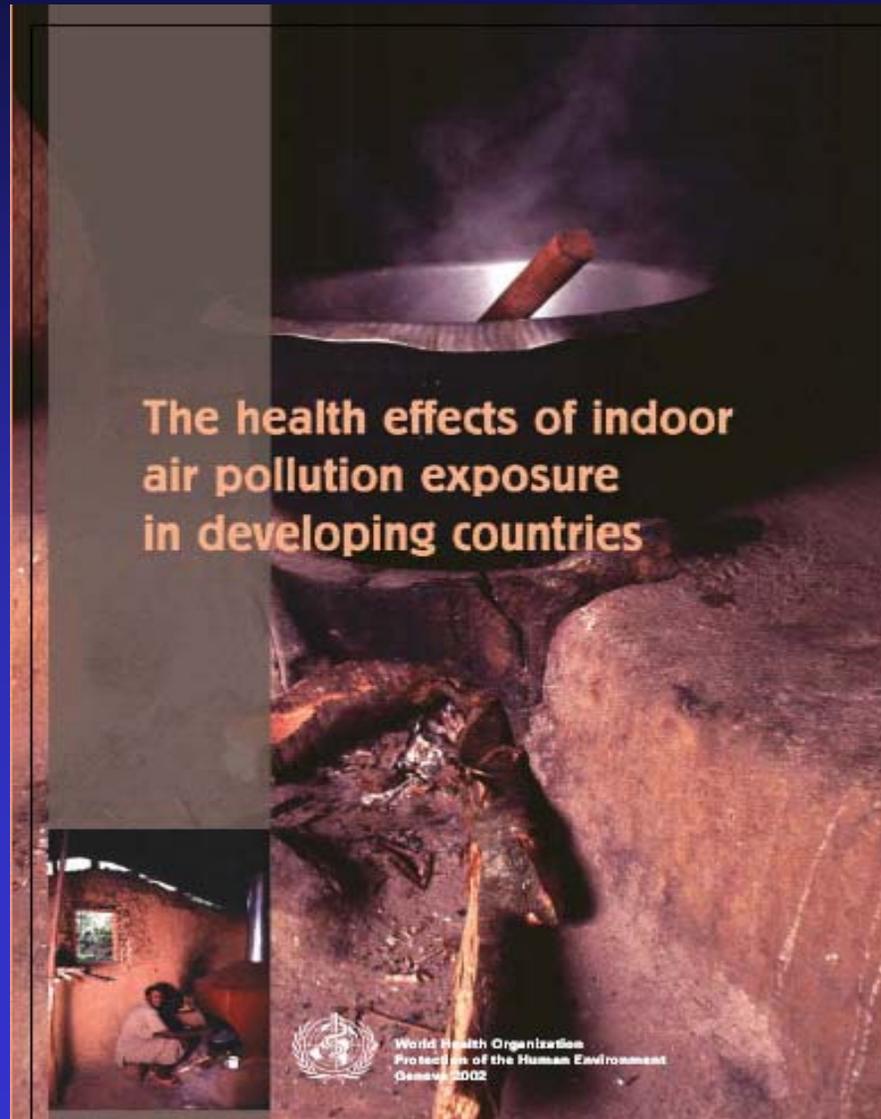
- **Increase availability of healthy housing for low income families**
- **Educate primary care providers on linkage of IEQ efforts to clinical asthma management**
- **Promote Insurance coverage of exposure control resources and Community Health Worker driven interventions**

# **Public Health Practice in Housing for Asthma Morbidity Reduction**

- **Provide evidence for building guidelines for healthy homes construction and renovation**
- **Convene consensus conference to develop such healthy homes guidelines**
- **Review of local housing codes**
  - ◆ **Assess for inclusion of healthy homes specs**
  - ◆ **Develop model language to address gaps**
  - ◆ **Promote adoption of healthy housing codes**
  - ◆ **Train housing inspectors, housing advocates, designers, builders, contractors.**

# International Burden of Asthma

## 3 Billion People Use Biomass



# Healthy Homes Other Partners

- King County Housing Authority
- Youthbuild
- Healthy Buildings, Inc.
- The King County Asthma Forum
- Seattle Partners for Healthy Communities
- Seattle Tenants Union
- Group Health Cooperative of Puget Sound
- Engineering Plus
- Community clinics, hospitals and emergency departments
- Seattle Public School District
- Rental Housing Association of Puget Sound
- Hoover Vacuum Company
- Seattle Solid Waste Utility
- Horn of Africa Services
- International District Housing Authority
- Puget Sound Neighborhood Health Center
- Centers for Disease Control and Nesholm Foundation
- Safe Futures Youth Centers

# Estimate of Costs and Savings

- **Program costs per client**
  - **High Intensity: \$1345**
  - **Low intensity: \$222**
- **Program medical care savings per client (12 months)**
  - **High intensity: \$1205 - 2001**
  - **Low intensity: \$1050 - 1786**
- **High vs. Low Intensity projected over 4 years**
  - **Marginal cost of high: \$1127**
  - **Marginal savings in urgent medical care: \$1316-1849**