Indoor Air Quality and Health

Peter A. Breysse Memorial lecture

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University of Washington
3/9/12

Peter A. Breysse

- Bachelor's degree in Civil Engineering University of Idaho - 1952
- Masters degree in Sanitary Engineering from Washington State University - 1954
- Masters of Public Health in Industrial Hygiene from University of Pittsburgh – 1957
  - Studied under Ted Hatch
- A founding faculty member of the Department of Environmental and Occupational Health at the University of Washington - 1957

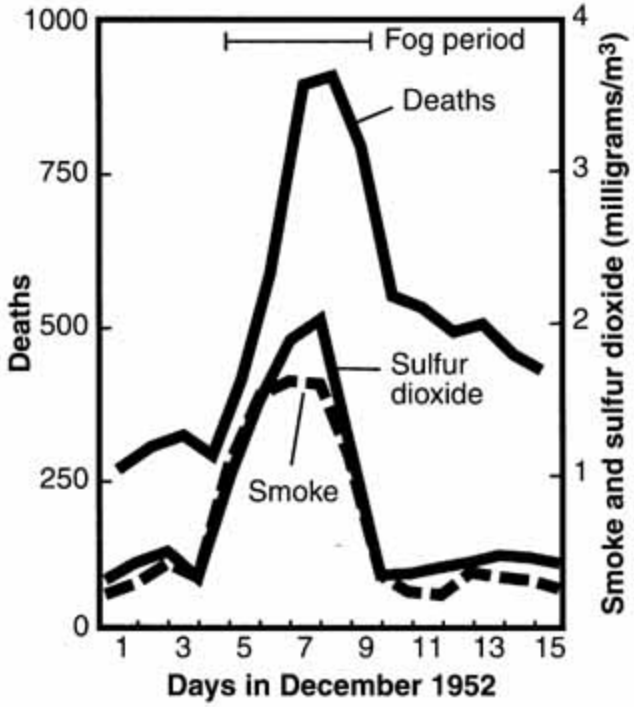
Career Highlights

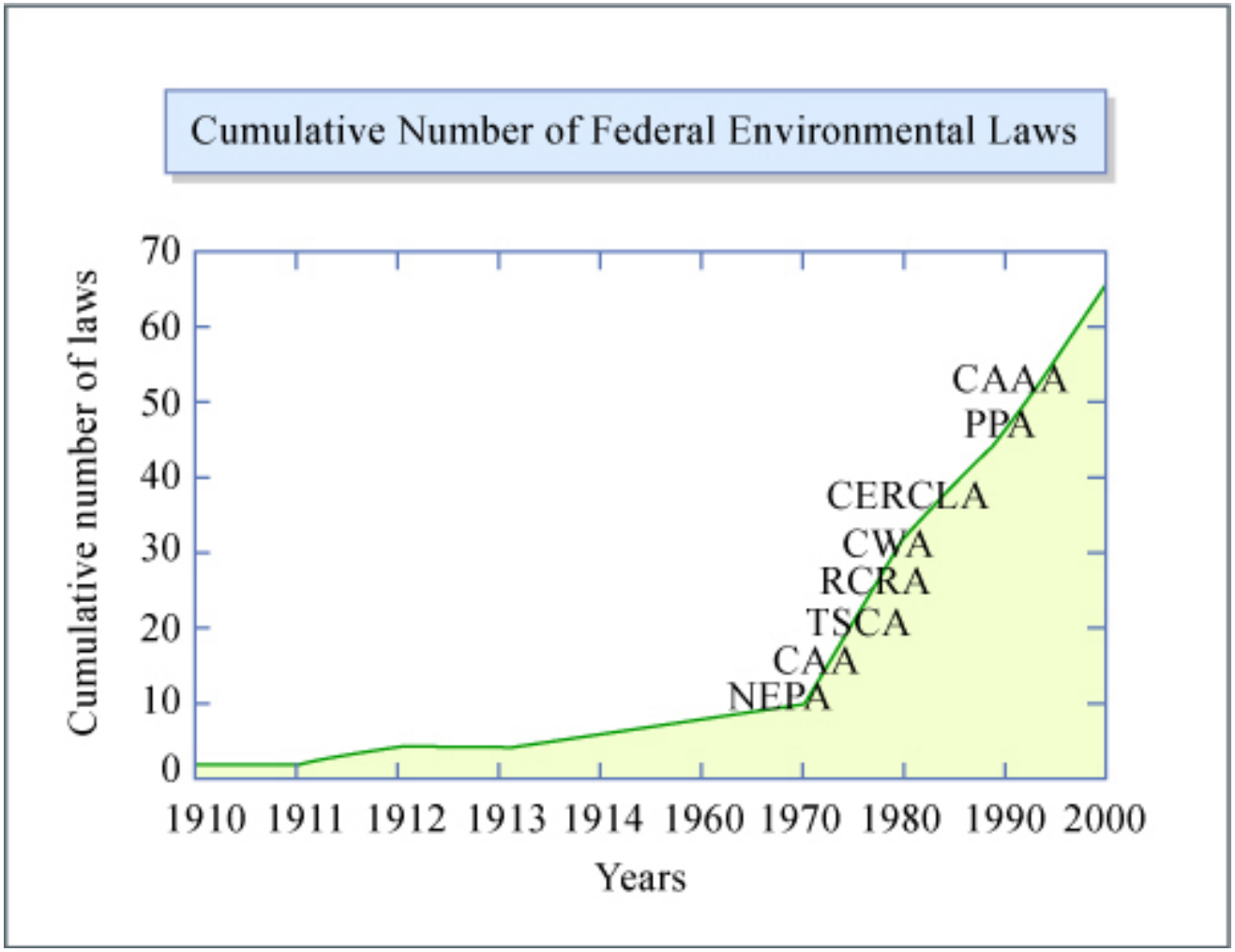
- 1950's – 1970's Served on various state and local air pollution air advisory committees
- Served on American Board of Industrial Hygiene (1977- 1983)
- Served as the Chair of the ACGIH Board of Directors (1988-1992)
- Retired as an Emeritus Associate Professor
  - Served as Head of Industrial Hygiene Program
  - Co-director of the Occupational Health Education and Research Center

London Smog, 1952

London Smog Disaster of 1952

- Four days between the 4 and 8 December 1952
  - Measurements taken at the National Gallery in London suggest that the PM_{10} concentration reached 14 mg/m^3
    - 56 times the level normally experienced at the time
  - sulfur dioxide in the air increased by 7 fold peaking at around 700ppb.

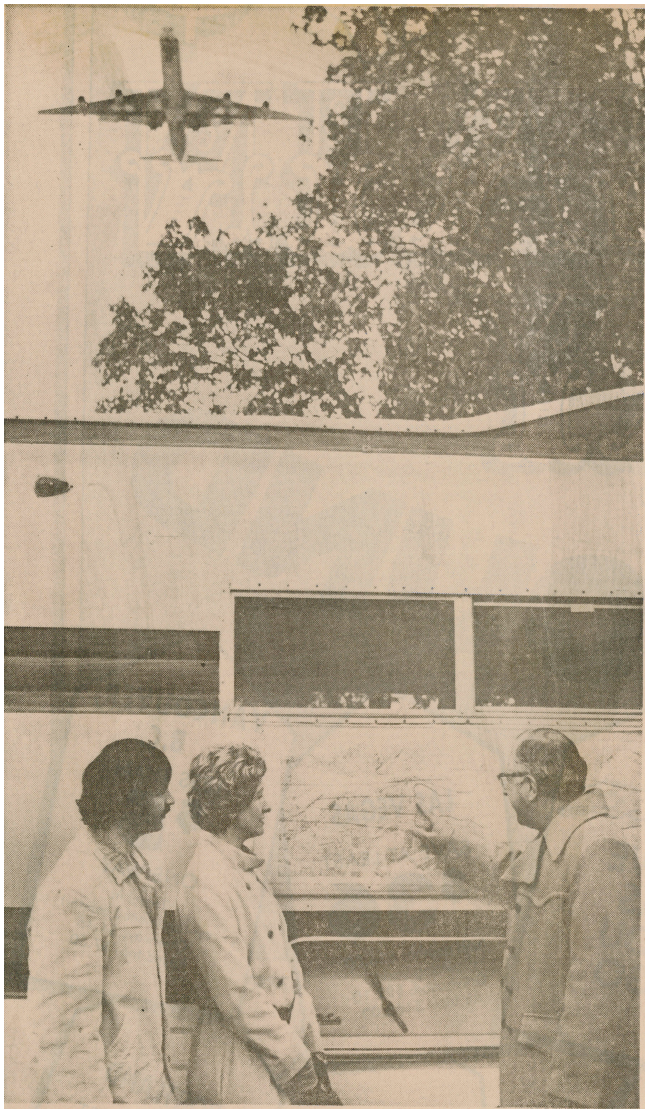




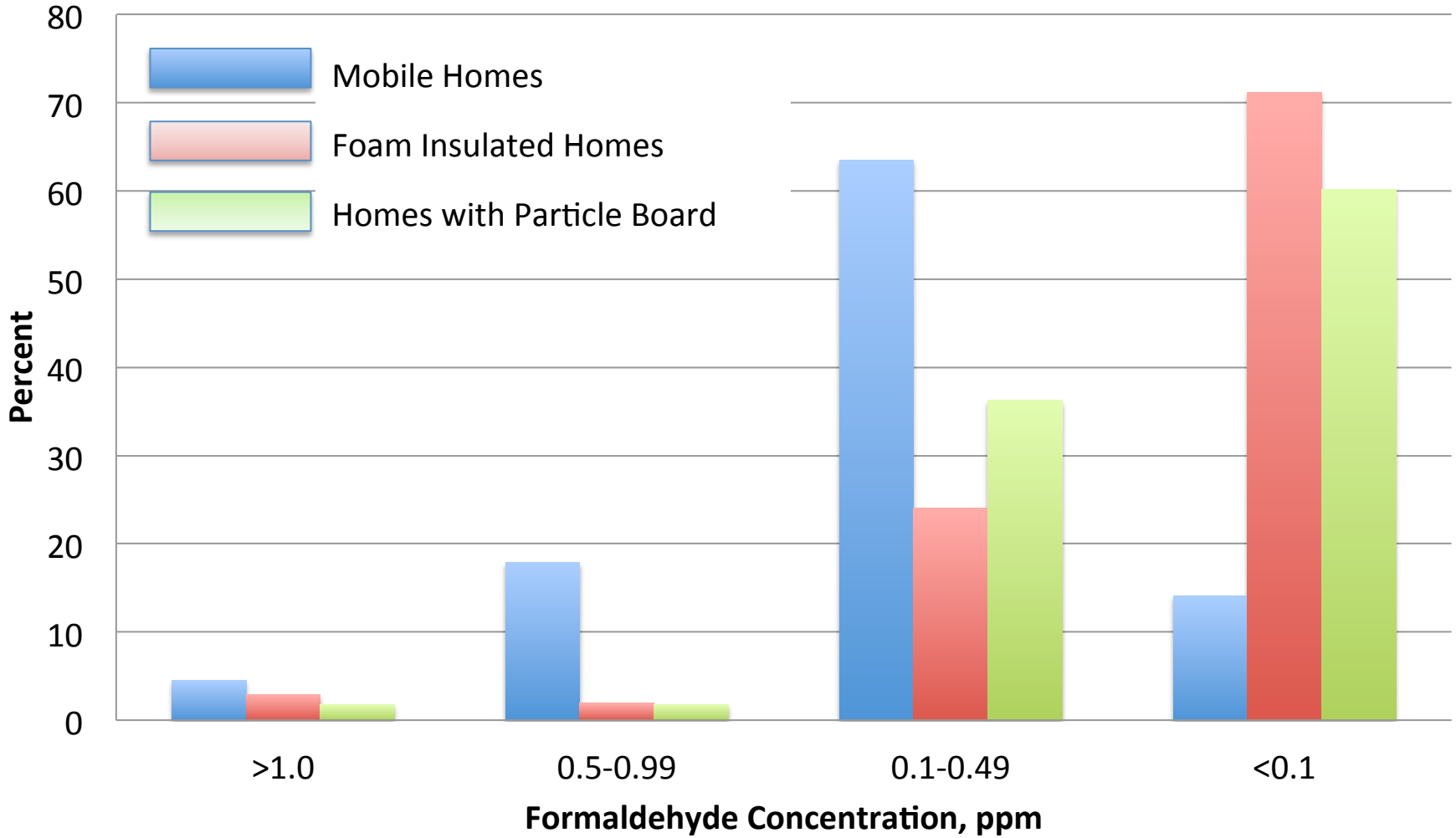
MIT Opencourse ware
http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2004/

Commitment to Public Health Practice

- Early career
  - Mercury vapor in dental offices
  - Noise exposures around airports
  - Carbon monoxide exposure to toll both workers
  - Helped to create the field of "Indoor Air Research"



Formaldehyde in Homes
Conference Proceedings on Indoor Air Quality
Stockholm Sweden - 1984



Residential Symptoms Associated with Formaldehyde Exposure

Symptom	Homes with Foam Insulation		Mobile Homes		Homes/Apartments with Particle Board	
	Adults %(N)	Children %(N)	Adults %(N)	Children %(N)	Adults %(N)	Children %(N)
Throat Irritation	53 (149)	50 (62)	63 (351)	56 (68)	47 (33)	43 (9)
Eye Irritation	49 (136)	29 (40)	63 (353	40 (41)	36 (25)	5 (1)
Headache	32 (90)	19 (27)	24 (131)	19 (23)	39 (27)	5 (1)
Skin Rash	9 (26)	6 (8)	4 (23)	1 (1)	4 (3)	5 (1)
Memory Lapse	26 (74)	17 (23)	29 (160)	7 (9)	20 (14)	10 (2)

Breysse PA. Immediate and long-term effects of formaldehyde, Comments Toxicology 3(2):135-153 (1988).

Energy Crisis late -1970's Early 1980's

- Health Costs of Tight Homes-JAMA(1981)
  - "Now is the time to call a temporary halt to our home energy conservation programs until all aspects of "building tightening" can be reviewed"

Pete - isms

"Risk Assessment is quantifying ignorance"

Center for Childhood Asthma in the Urban Environment (CCAUE)

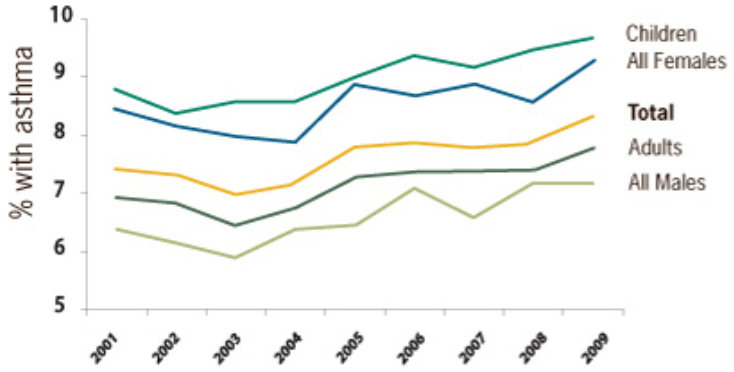
- Funded as a Children's Center Grant in 1998
  - Joint funding by EPA and NIEHS
- Disease Investigation through Specialized Clinically-Oriented Ventures in Environmental Research (DISCOVER)
  - Funded by NIEHS in 2008

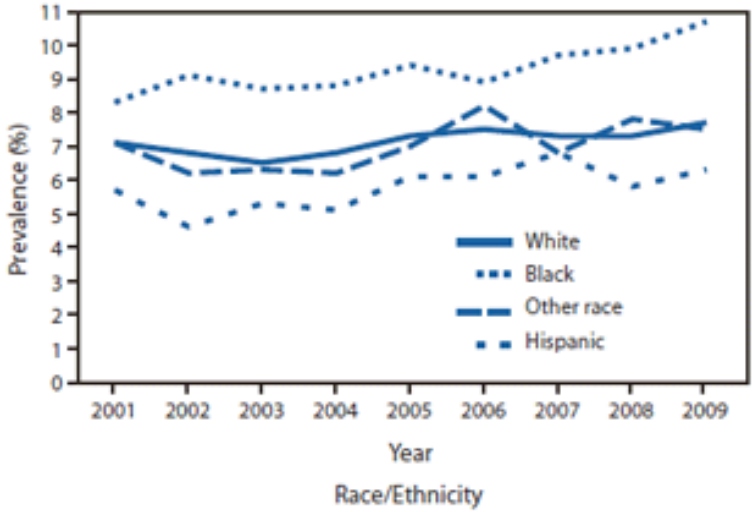
Indoor Air Pollution

- Large literature linking ambient air pollution and disease
- Less is known about the impact of indoor air pollution on morbidity and mortality
  - Particularly true for key microenvironments like homes and schools
- Children, the elderly, and women are the most vulnerable to effects of indoor air pollution
  - Spend as much as 90% of their time in the home environment

Vital Signs: Asthma Prevalence, Disease Characteristics, and Self-Management Education --- United States, 2001—2009*

- Number of people with asthma continues to grow
  - One in 12 people (8% of the population) in 2009
  - One in 14 (7% of the population) in 2001
- Age differences - 2009
  - 1 in 10 children (10%) had asthma
  - 1 in 12 adults (8%) had asthma
- Sex differences - 2009
  - Women were more likely than men
  - Boys more likely than girls to have asthma.
- Racial differences – 2009
  - One in 9 (11%) non-Hispanic blacks had asthma
  - One in 6 (17%) of non-Hispanic black children had asthma
  - The greatest rise in asthma rates was among black children (almost a 50% increase)





* Taken from the National Health Interview Survey

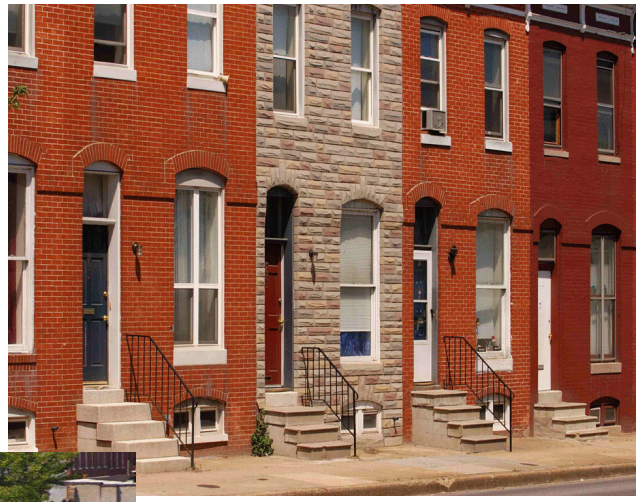
CDC Report – Vital Signs
Asthma Economic and Social Costs

- Asthma cost the US about $3,300 per person with asthma each year from 2002 to 2007 in medical expenses, missed school and work days, and early deaths.
- Medical expenses associated with asthma increased from $48.6 billion in 2002 to $50.1 billion in 2007
- More than half (59%) of children and one-third (33%) of adults who had an asthma attack missed school or work because of asthma in 2008
- On average, in 2008 children missed 4 days of school and adults missed 5 days of work because of asthma

Asthma Morbidity Studies

Baltimore City, Maryland

- Indoor Particulate Matter
- Indoor NO_2
- Mouse Allergen



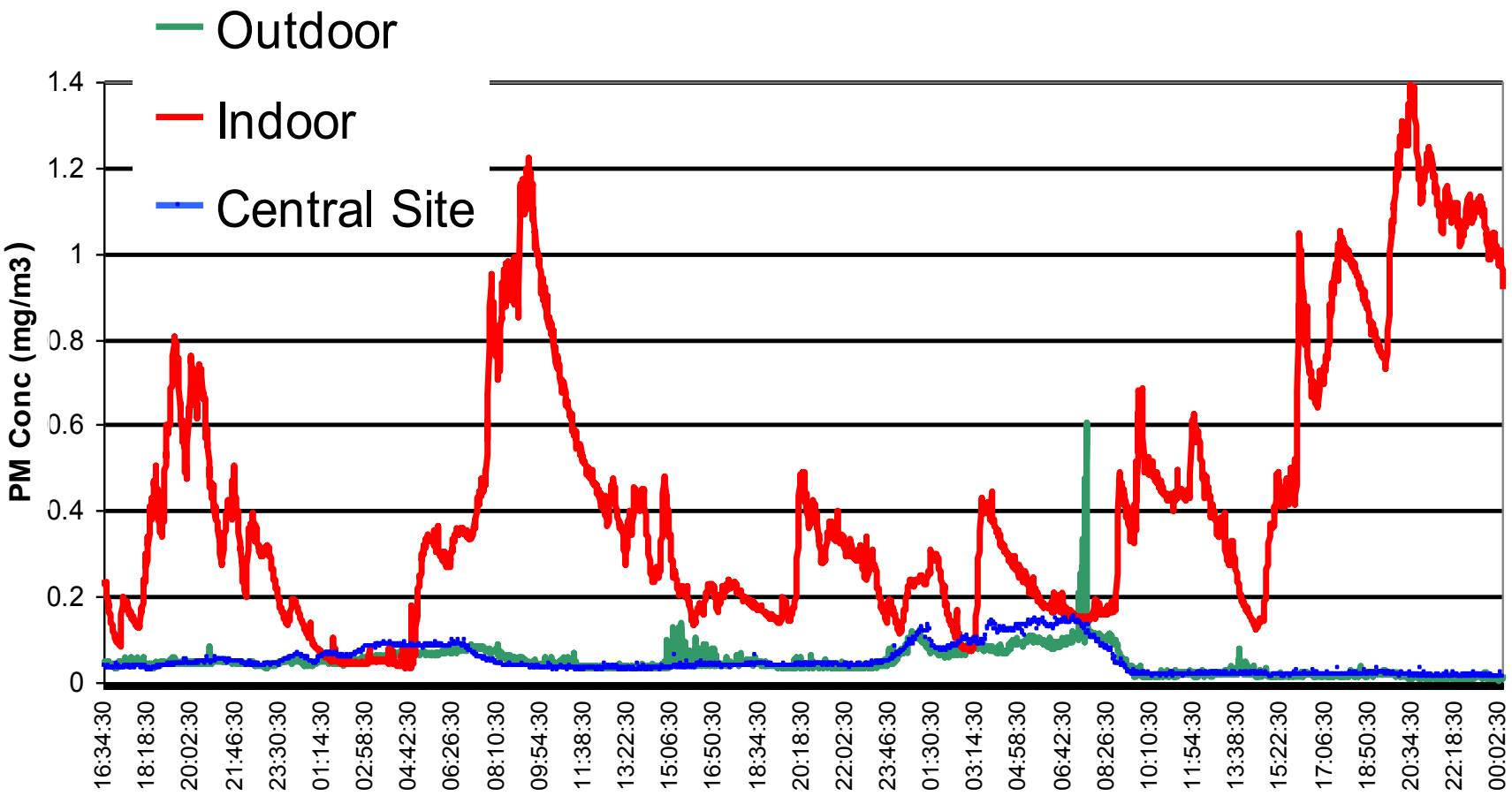
The Baltimore Indoor Environmental Study of Asthma in Kids (BIESAK)

- 150 children from Baltimore, Maryland
- Evaluated at baseline, 3, and 6 months
- Predominant participant characteristics
  - Between ages 2 and 6 years
  - African-American (91%)
  - From households of low socioeconomic status
  - Spent 14 out of 24 hours (on average) in their homes and half of this time in the room being monitored

In Home Environmental Sampling

- PM_{10}
- $PM_{2.5}$
- Inhalable dust
- Real time PM
  - Light scattering device
- O_3
- NO_2
- Nicotine
- Endotoxin
- Allergens in surface dust

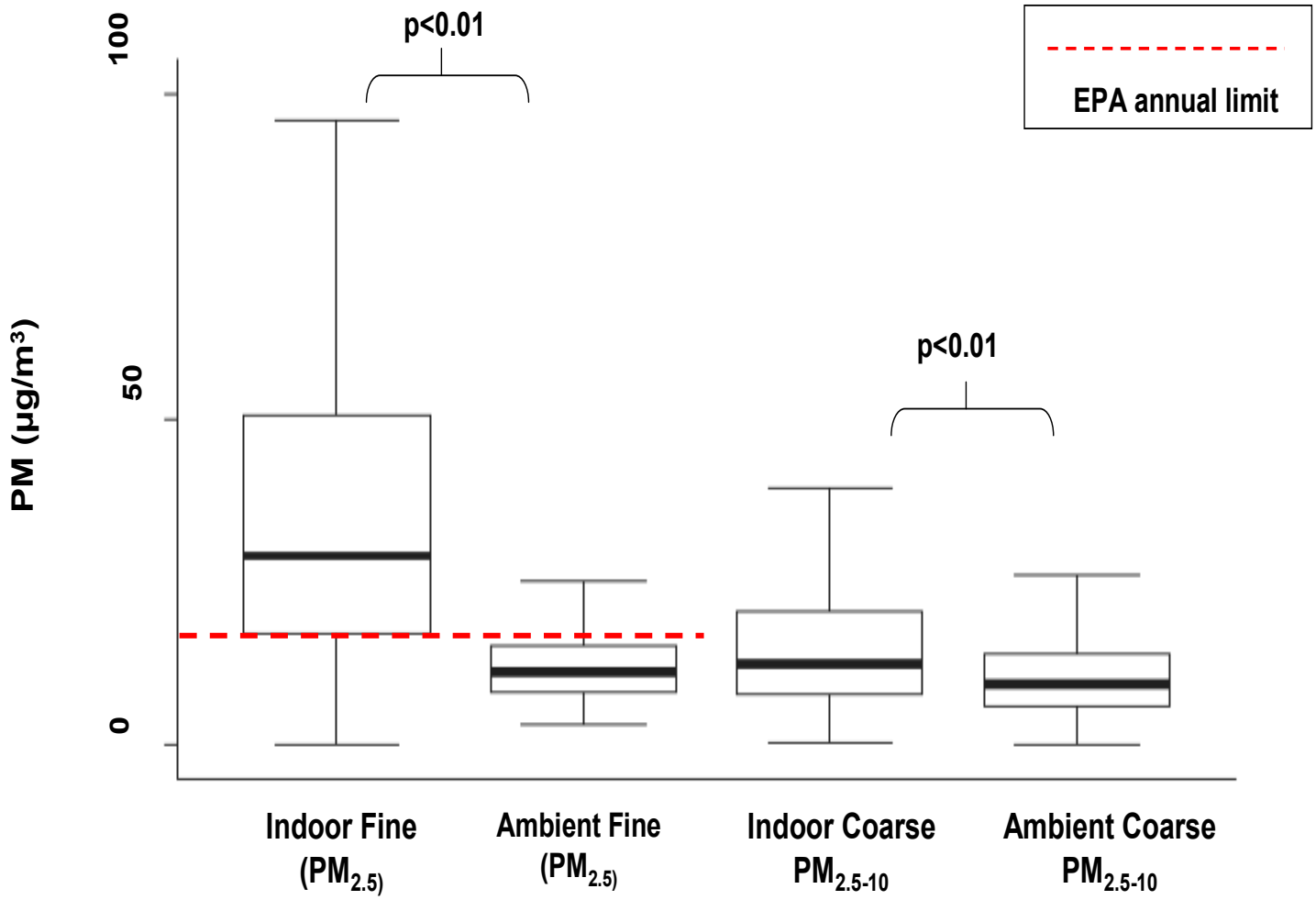
Indoor Versus Outdoor Particulate Matter



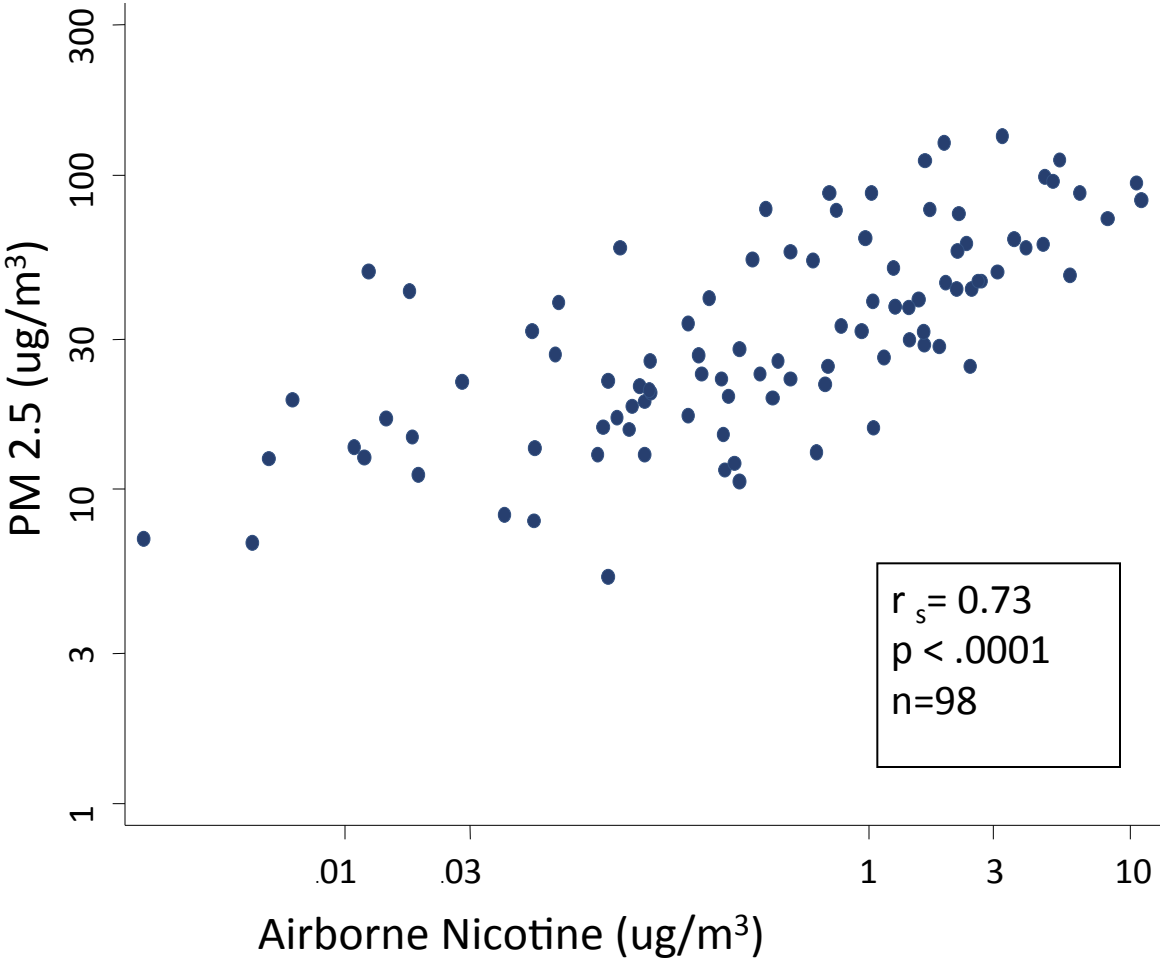
Clinical Assessments

- Skin prick testing
  - Allergen sensitivity
- Pulmonary function testing
- Asthma symptoms
- Health care utilization
- Medication Use

Distributions of indoor PM in the child's bedroom



PM, Smoking, and Airborne Nicotine



- ~60% report having a smoker in the home
- PM2.5 concentrations in homes with smokers is twice as high as homes with non smokers

Indoor PM Concentrations, Asthma Symptoms, and Rescue Medication Use

Outcomes	Coarse PM (per 10 µg/m3)		Fine PM (per 10 µg/m3)	
	IRR	P-value	IRR	P-value
Cough/wheeze/ chest tightness	1.06	0.03	1.03	0.18
Slow/stop activities	1.08	0.01	1.04	0.06
Limited speech from wheeze	1.11	<0.01	1.07	0.04
Nocturnal Symptoms	1.08	0.02	1.06	0.01
Symptoms with running	1.00	0.81	1.07	<0.01
Beta agonist use	1.06	0.01	1.04	0.05

Adjusted for age, sex, race, parent education level, season, indoor PM, ambient PM

NO_2 and Asthma Symptoms

Risk of Asthma Symptoms Per 20-ppb Increase in NO_2 Exposure

Symptom	IRR (95% CI)*
Cough, wheezing, chest tightness	1.04 (0.97-1.12)
Slow down of activity due to symptoms	1.08 (0.94-1.15)
Limited speech	1.17 (1.08-1.27)
Symptoms with running	1.09 (1.01-1.17)
Coughing without a cold	1.15 (1.07-1.23)
Nocturnal symptoms	1.12 (1.04-1.19)

IRR, incidence rate ratio

*adjusted for PM; second hand smoke; distance from the curb; type of street in front of house; season of sampling; age, sex, and race of child; and mothers education level.

Mouse Allergen and Asthma Symptoms

Mouse Allergen and Asthma Morbidity In Mouse Sensitized and Highly Exposed

Outcome/Symptom	Adjusted OR or IRR (95% CI)*
Healthcare use	
Unscheduled visit	3.1 (1.5-6.5)
ED visit	2.1 (1.0-4.3)
Hospitalization	69.9 (5.8-838.9)
Asthma symptoms	
Days of symptoms	1.5 (1.1-2.0)
Days of slowed activity	1.5 (1.1-2.2)
Days of exercise-induced symptoms	1.6 (1.1-2.2)
Days of cough	1.6 (1.1-2.4)
Nights of wakening	1.3 (0.9-1.9)
Days of β-agonist use	1.8 (1.3-2.5)

*Adjusted for age, sex, atopy, cockroach sensitization and exposure, public health insurance and study visit

Working with Communities
Core Values

- Cultural competence and inclusiveness
- First do no harm
- Honesty
- Confidentiality
- Productive use of resources
- Effective communication
- Confidentiality
- **Commitment to advocacy**
- Education/co-learning
- Sound science

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"You can do more with a good jury award than all the research in the world"

Commitment to Advocacy

- Investigators and community should use their information and energy to advocate for community/work place improvement
- Research Translation
  - Education and Outreach
  - Policy change
  - Behavior Change

Commitment to Advocacy

- Frequently served as an expert witness
- Testified at the U.S. House of Representatives on Formaldehyde in mobile homes
  - "the industry has known that [their wood products] give off formaldehyde for years"
  - Recommend banning particle board for home construction.
- Seattle Times dubbed him the "Ralph Nader of the pacific Northwest"

Results

- Urea-formaldehyde foam insulation is now rarely used.
- Low emission particle board is now the norm
  - One manufacture now claims HCOH emissions are 80-90% lower than in the 80's
  - American National Standards Institute has HCOH product testing protocol
- Housing and Urban Development -1985
  - Formaldehyde emission controls standard for wood products for manufactured homes

Commitment to Advocacy

- Formaldehyde on trial: the politics of health in a chemical society

  By - Lloyd Tataryn
- Toxic deception: How the chemical industry manipulates science, bends the law, and endangers your health

  By - Dan Fagin, Marianne Lavelle, Center for Public Integrity

Science Under Attack

Dan Fagin, Marianne Lavelle

- “If academic researchers become too independent, they are attacked. Peter Breysse, a professor of environmental health at the University of Washington gathered evidence that people were being harmed by exposure to formalde-hyde in mobile homes and elsewhere. The Formaldehyde Institute hired a consultant to visit Breysse's superiors at the University to criticize and discredit his work.”

NIOSH Diesel Study

- Washington Post
  - Diesel report's publication delayed as industry demands to see documents first

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“Teach your students how to communicate health risks to lay audience”

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"Oh hell we did that thirty years ago"

Formaldehyde Update

- 2004 the International Agency for Research on Cancer listed Formaldehyde as a “known human carcinogen”
- 2007 the California Air Resources Board (CARB) promulgated restrictive formaldehyde emission standards for wood products
- On July 7, 2010, President Obama signed the Formaldehyde Standards for Composite Wood Products Act into law
  - Establishes limits for formaldehyde emissions from composite wood products
  - Prompted in part by concerns raised over excessive formaldehyde emissions within trailers supplied by the FEMA to Katrina-displaced residents

Formaldehyde Update

- US Green Building Council's LEED rating system began awarding a credit for use of composite wood products with no added urea formaldehyde

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“Ties are why women live longer than men”

Baseball!

Minors Pitching

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Year	Age	Tm	Lg	Lev	Aff	W	L	W-L%	ERA	G	GS	GF	CG	SHO	SV	IP	H	R	ER	HR	BB	IBB	SO	HBP	BK	WP	BF	WHIP
1947	24	Bloomingdale	NATL	D	BSN	3	4	.429	4.83	19						95.0	118	68	51		43							1.695
1 Season						3	4	.429	4.83	19						95.0	118	68	51		43							1.695

A 7890 value in the totals indicates career mark is incomplete.

Minors Batting

Glossary · SHARE · Embed · CSV · PRE · LINK · ?

Year	Age	Tm	Lg	Lev	Aff	G	PA	AB	R	H	2B	3B	HR	RBI	SB	CS	BB	SO	BA	OBP	SLG	OPS	TB	GDP	HBP	SH	SF	IBB
1947	24	Bloomingdale	NATL	D	BSN	19		35		1	0	0	0						.029		.029		1					
1 Season						19	35	35		1	0	0	0						.029	.029	.029	.057	1					

HELENA IN LEAGUE DEBUT THIS YEAR—The Helena Wranglers made their Copper League debut this season. Left to right the Wranglers are, front row: George Snyder, Bud Morris, Ed McEvoy, Bob Richeson, Charles Russell, Whitey Krechmer, Pete Breysse. Back row: John McHugh, Jerry McPherson, George Haegele, Ben Smith, Tom Cisar, Vince Weggenman and Manager Bob Kelly. The bat boy seated in front of the squad, is Ronnie McKnight.

Professor Breysse

- He helped to create a profession
- He helped create a field
- He helped create a department
- He helped to inspire a generation of industrial hygienists

- He helped to create 7 children
  - 3 are teachers
  - 3 are involved in health and safety work

Acknowledgements

- Gregory Diette
- Elizabeth Matsui
- Arlene Butz
- Peyton Eggleston
- Meredith McCormack
- Nadia Hansel
- Timothy Buckley
- D'Ann Williams
- Timothy Green
- Craig Lewis
- Jie Juan
- Jean Curtin-Brosnan
- Study partners

Thank You

Questions?