A comprehensive assessment of children's health and indoor air quality in child care settings

Margot Brown, ASPH EPA Fellow
Brenda Foos, US EPA
Carrie Knowlton, ASPH EPA Fellow
Julia Gray, ASPH EPA Fellow

US EPA Office of Child Health Protection and Environmental Education

Overview

- Child care settings
- Indoor pollutants
  - Mold
  - Pesticides
  - Allergens
- Limitations
- Public policy and health

Child care settings

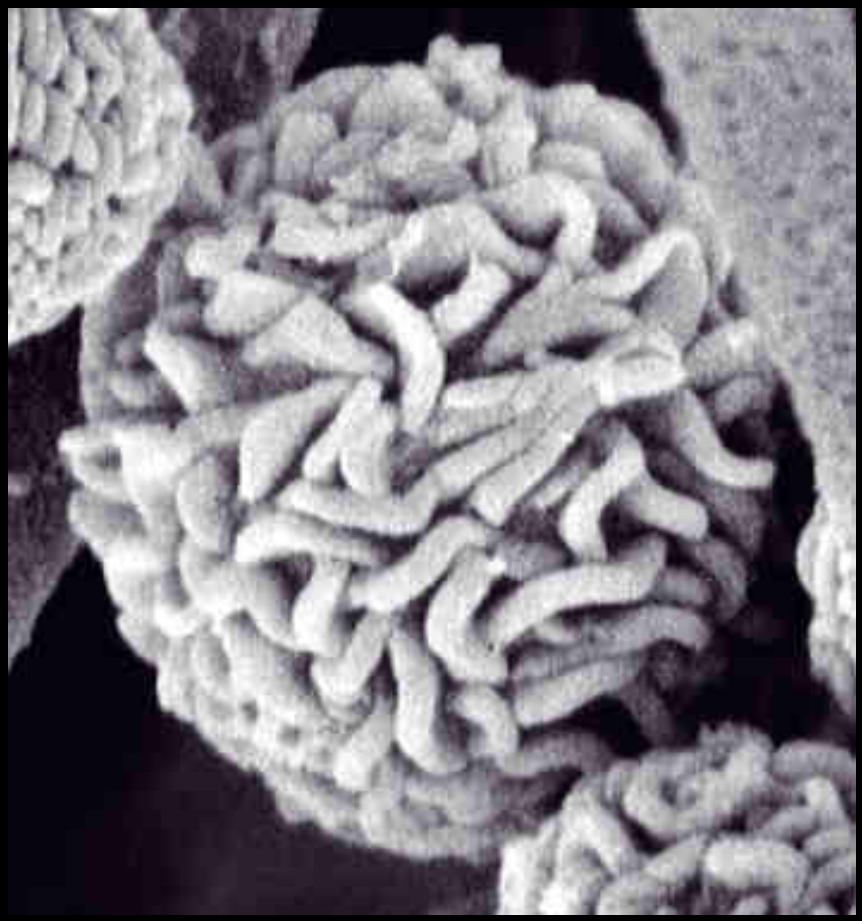
Mold

Mold

- 16 mold studies of child care centers
- Study locations: North America, Northern Europe, Southeast Asia
- Preexisting indoor air quality problem
- Most studies assessed indoor environmental factors
- Only 6 out of the 16 studies looked at health impacts of mold or related exposures on children attending child care centers

Mold

- Study variables:
  - Presence of mold
  - Water damage
  - Ventilation efficiency
  - Air quality indicators
  - Air pollutants
  - Building materials
- Health Assessment:
  - Cross-sectional and case control studies
  - Qualitative questionnaire



Mold:
Children's Health Outcomes

- Mold as a preexisting problem
  - Respiratory symptoms
  - Frequent absenteeism
- Inefficient ventilation systems
  - Increased risk of respiratory diseases

Mold:
Indoor Air Assessment Findings

- Presence and type of fungal and bacteria microorganisms varied widely

- Greater ventilation of indoor air resulted in:
  - lower microorganism presence and indoor air pollutant concentrations
  - better temperature and humidity control
  - fewer health complaints

Pesticides

Pesticides

- Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP)
- National Environmental Health Survey of Child Care Centers (CCC Survey)
- Unpublished surveys in CA and MN

CTEPP Study Objectives

- To measure concentrations of target pollutants in multimedia samples collected at the homes and child care centers of study population
- To determine the distributions of child characteristics, activities, and locations contributing to exposure
- To estimate the aggregate exposures of preschool children to pollutants they may encounter in their everyday environments
- To apportion the routes of exposure

CTEPP Study

- Study population:
  - 257 children attending 29 NC and OH preschools
- Methods
- Pesticides included:
  - Organophosphate (OP) pesticides & metabolites
  - Organochlorine (OC) pesticides
  - Pyrethroid Pesticides & metabolites
  - Acid herbicides

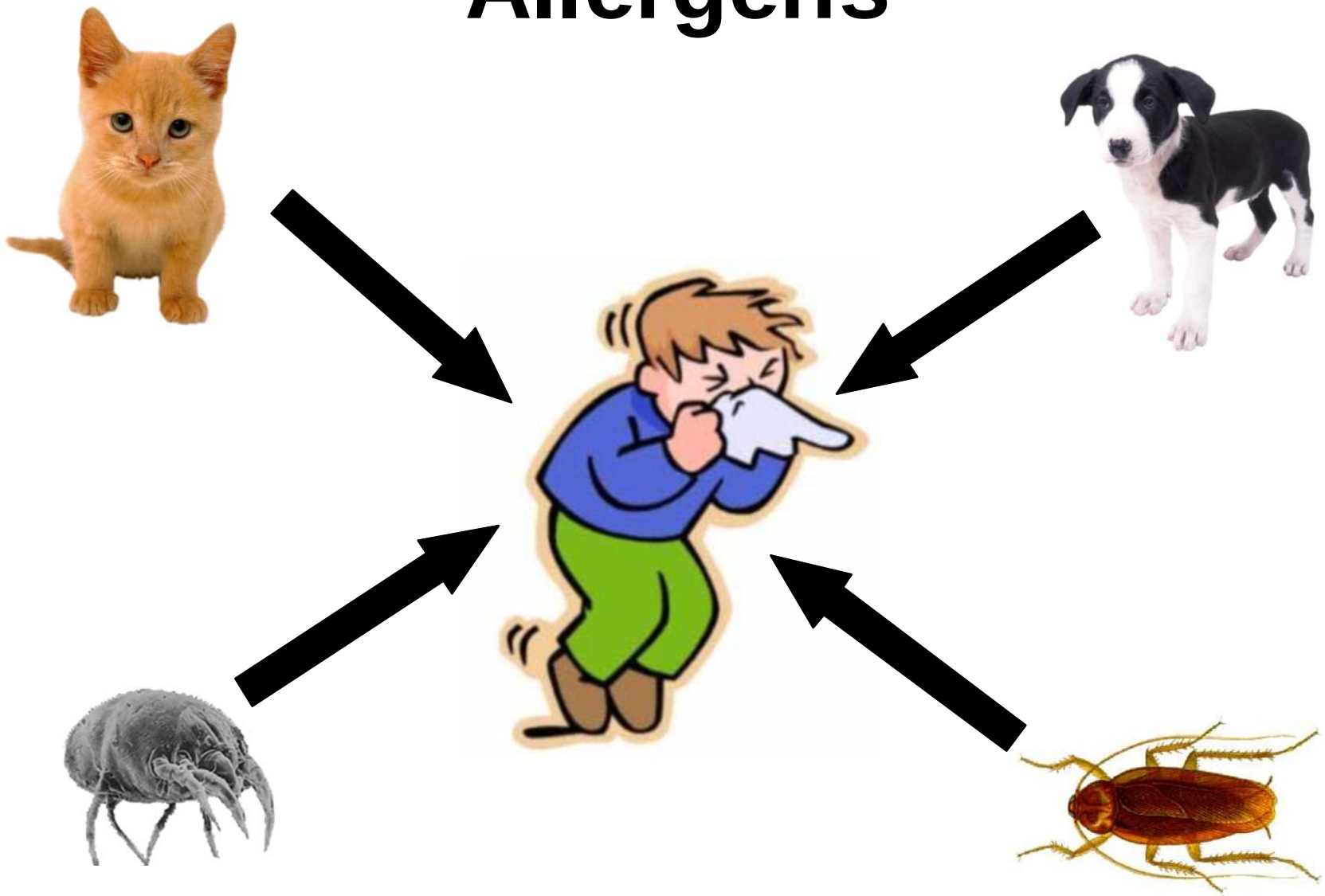
Table 1. Median levels of pesticides in indoor air and dust samples collected from NC and OH child care centers

(US EPA CTEPP Report adapted from tables 9.3.2 and 9.3.4)

Pollutant/ Metabolite	NC			OH		
	Air (ng/m^3)	Dust (ng/g)	Dust (ng/m^2)	Air (ng/m^3)	Dust (ng/g)	Dust (ng/m^2)
Chlorpyrifos	3.0	140	570	2.0	170	450
Diazinon	2.3	65	180	0.96	40	220
3,5,6-TCP	0.93	66	200	0.71	58	170
alpha-Chlordane	0.51	43	190	0.18	11	41
gamma-Chlordane	0.78	67	270	0.26	13	53
Cyfluthrin	<	<	<	<	340	1400
cis-Permethrin	0.11	810	6900	<	1000	2700
trans-Permethrin	<	860	4100	<	550	2600
2,4-D	0.33	23	56	<	140	640

< indicates that the median value falls below the MDL for the pollutant within the specified sample medium

Allergens



Allergens

- 10 allergen studies
- Study location: North America, South America, Asia, Australia, and Europe
- 5 of the 10 studies used similar methodologies to assess allergen exposures
- CCC Suvery

Table 2. A summary of indoor allergen levels in child care settings

Allergy Study	#	Indoor Allergen Levels			
		Cockroach	Mite	Cat	Dog
Andrade (France)	**30**	low	low	low	low
Arbes (US)	**89**	low	high	low	low
Engelhart (Germany)	**41**		high		
Fernandez-Caldas (US)	**20**	low	high	low	
Rullo (Brazil)	**60**	low	high		

(Andrade, 1995: Arbes, 2005: Engelhart 2002: Frennandez-Caldas, 2001; Rullo, 2002.)

CCC Survey[1]

- Dust mite and cockroach allergens
  - 13 – 15 % detection of allergens
  - < 22% of centers had detectable levels
  - Below sensitization threshold

[1]US Dept HUD. First National Environmental Health Survey of Child Care Centers. Volume II, 2003.

Limitations

- Few studies
- Differences in study design methodologies
- International studies with varied settings (i.e., temperature variation, ventilation systems, and cleaning practices)

Public Policy and Health

- Limited information about children's health and indoor air quality in child care settings
- More research is needed
- Topic for future discussion among public policy experts