

The Primary Prevention of Asthma

Risk Factors Associated with Asthma Onset

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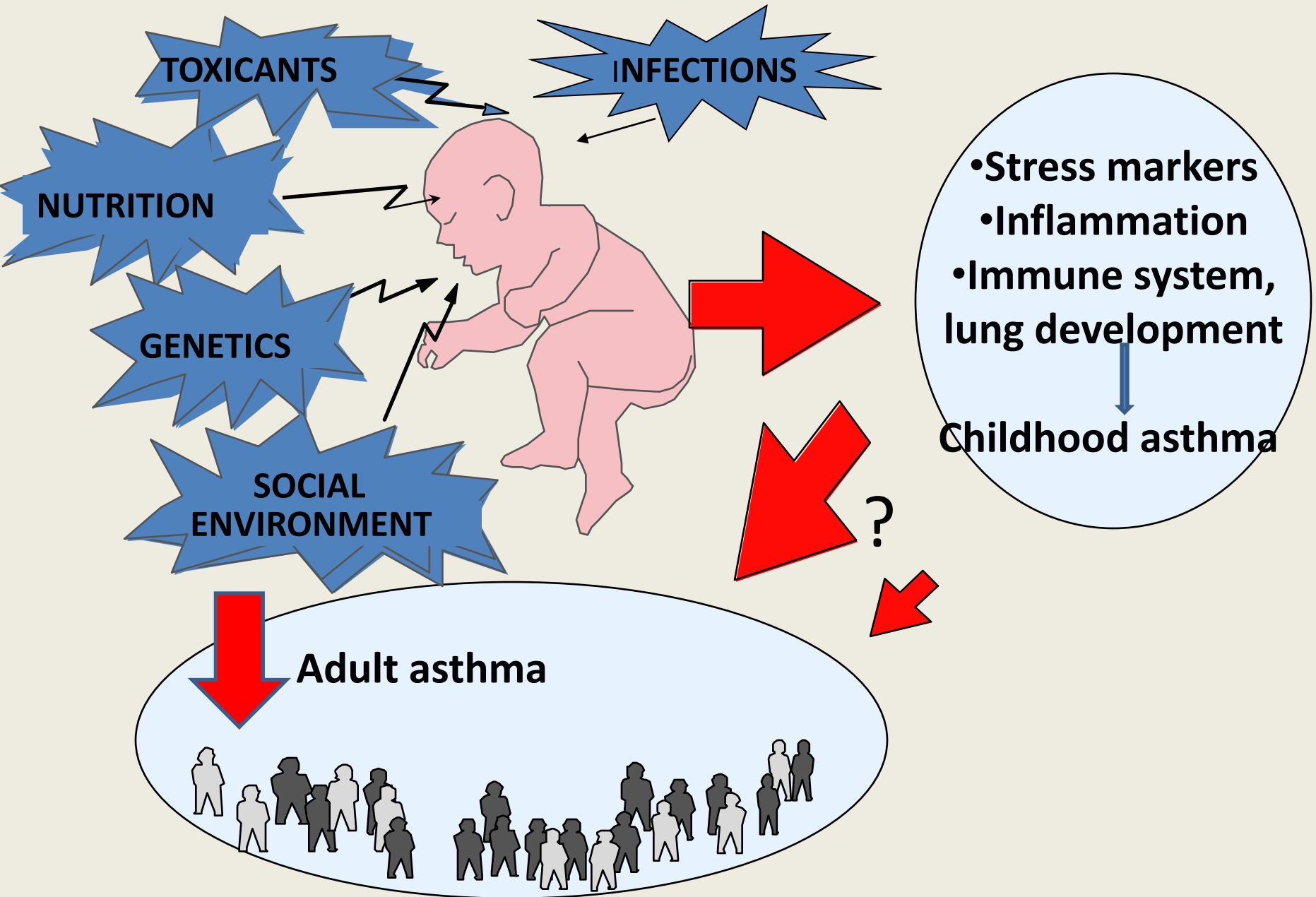
Collaborative on Health and Environment

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Asthma: a complex disease(s)

- Common signs and symptoms: airway narrowing, wheeze, cough, shortness of breath
- Different kinds of asthma; pathophysiology varies
- Implications for primary prevention differ

Asthma: Lifecourse perspective



Key Risk Factors in Asthma Onset

- Pets
- Obesity, Nutrition
- Immigration and Infection
- Prenatal exposures to chemical contaminants
- Psychosocial environment/stress
- Allergens indoors
- Asthmagens in the workplace
- Air pollution
- Tobacco

Pets in the home

- “Pet exposure” is complex:
 - Allergen exposure
 - Inhaled and ingested microbial exposure
 - Exposure to support or stress (bites)
 - Exercise

Pets

- Early-life “pet exposure” is probably associated with asthma onset
- But, the evidence for the direction of the association (beneficial, risk factor, no association) varies, and it varies more for cat than for dog ownership.

Pets

- Variability in response to pet allergens or microbes likely depends on
 - Dose from pet in the home
 - Timing of exposure
 - Inheritance
 - Background dose of pet allergen in the community
 - The microbial organisms that the pet carries
 - Unmeasured or measured cofactors influencing susceptibility to allergy, airway inflammation, airway irritability and asthma

Immigration and infection

- Enough studies have been done to show that asthma prevalence is lower in people living in many low-income countries and that it increases after immigration to developed countries.
- The effect sizes are large.
- BUT, the reasons for this are not yet clear.
- Therefore research needs to focus on why.

Immigration and Infection: hypotheses

- Language, culture, and literacy
- “Hygiene” hypothesis
- Chemicals, including air pollution
- Vitamin D
- Selection bias in immigration

Obesity and Nutrition

- **Obesity**

- Maternal obesity during pregnancy
- Early childhood obesity
- Adult obesity

- **Nutrition**

- Antioxidants (eg, fruits & vegetables)
- omega-3 fatty acids (eg, fish)
- Vitamin D (sunlight + diet/supplements)

Obesity, nutrition

- **Obesity** across life span:
 - During pregnancy: probably associated
 - Early childhood: probably associated
 - Adult: known association
- **Nutrition** during pregnancy & early childhood:
 - Antioxidants (fruit & vegetables): possibly associated
 - omega-3 fatty acids (fish): possibly associated
 - Vitamin D (sunlight + intake): not classifiable

Chemicals

- Metals: Possibly associated with asthma
- Organochlorine Compounds: Not classifiable; inadequate evidence
- Bisphenol A: Possibly associated with asthma
- Perfluorinated Compounds: Not classifiable; inadequate evidence
- Phthalates: Not classifiable; inadequate evidence
- [Magnetic field: Not classifiable; inadequate evidence]

Psychosocial stress and asthma

- Biological plausibility
- Temporal sequence – prospective prenatal & early childhood cohorts a particular strength
- Exposure-response relationship
- Robust to adjustment for a number of important confounders
- Robust to sensitivity analyses
- Known to be associated with early asthma phenotypes

Psychosocial stress

- Socially toxic environments are NOT simply a marker of a more toxic physical environments
- Social contexts and consequent stress may be as detrimental to children's health as chemical toxicants
- "Social pollutants"
- Psychological stress disrupts biological systems overlapping with those altered by physical pollutants/toxicants

Psychosocial stress

- Independent effects
- Interactive (joint) effects
- Individual- and place-based psychosocial stress may impact host resistance such that physical toxicants (e.g., indoor allergens, traffic-related air pollution) may have adverse effects at relatively lower doses
- Epidemiological studies and interventions need to address physical toxicants and social stress jointly to impact public health most effectively

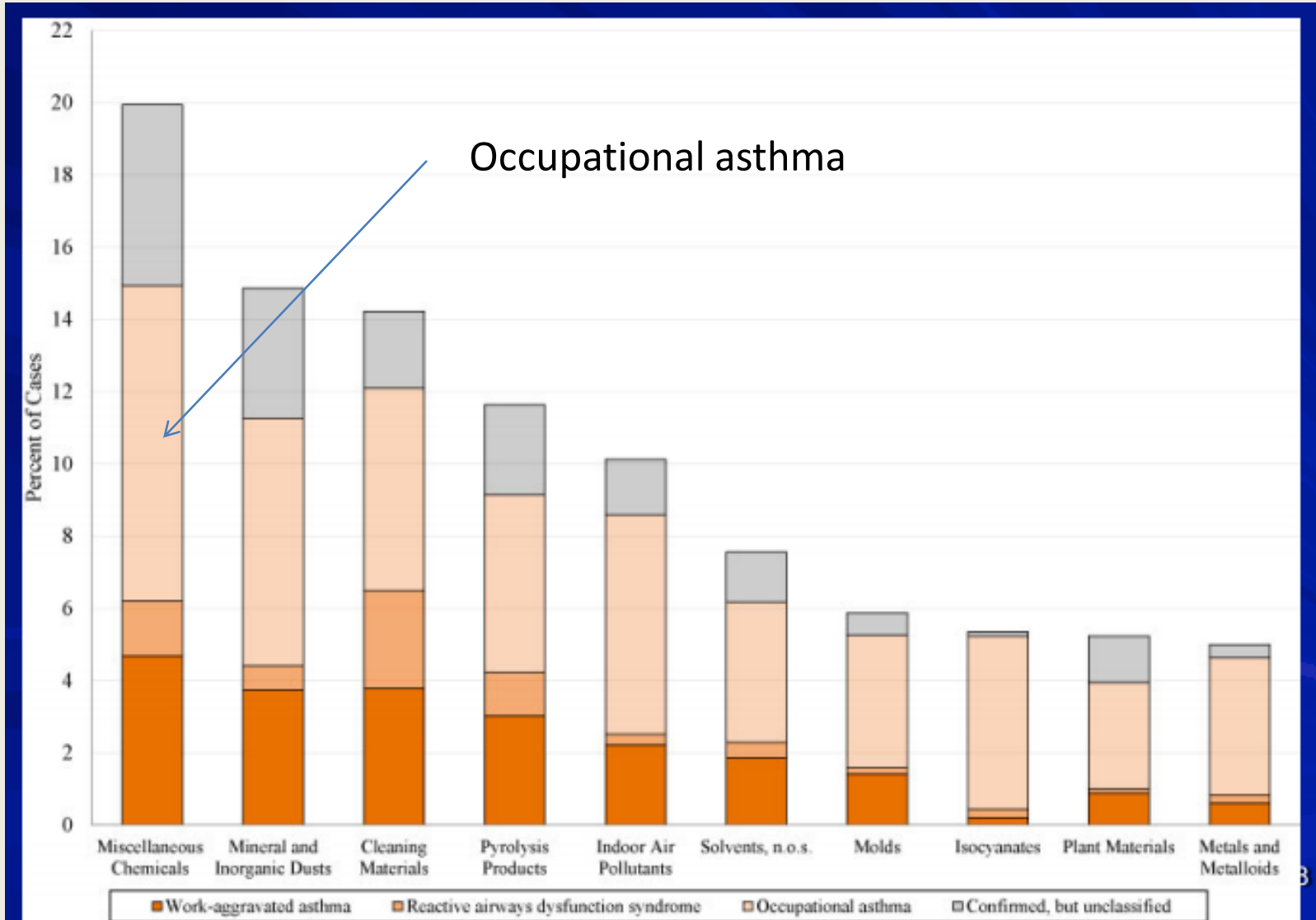
Indoor allergens

- Exposure to cockroach and mouse allergens: probably associated with asthma onset
- Sensitization to dust mites, cat and dog dander known to be associated with asthma onset
 - Timing of exposure to animal dander is important
 - Most wheezers with no atopy lose their symptoms by school age
- Sensitization to molds known to be associated with asthma onset
 - As with animal dander, differs between atopic and non-atopic wheezers
 - May be variable response to various mold species
- Interactions with stress, chemicals, and outdoor air pollution may be important

Occupational asthma

- Occupational Asthma
 - Sensitizer induced
 - Irritant induced
 - Reactive Airways Dysfunction Syndrome (RADS)
 - Low dose irritant induction of asthma
- Work-exacerbated asthma
 - Irritant exposures
 - Workplace exposures to sensitizers

Ten most frequently reported agent categories; state-based surveillance systems



Outdoor air pollution

- Traffic related air pollution:
 - Probably associated with asthma onset
- Ozone and PM 2.5
 - Possibly associated with asthma onset
- Special considerations:
 - Non-specific exposure metrics, (e.g. TRAP and proximity to traffic)
 - Possible synergistic effects with stress and allergens

Tobacco smoke

- Meets all Bradford Hill criteria for causality
 - Consistency and coherence
 - Strength of association
 - Plausible mechanism(s)
 - Oxidative stress from free radicals, epithelial damage, inflammation
 - Temporality
 - Dose-response relationship
- Thus, tobacco smoke exposure is known to be associated with risk of asthma onset