Health Effects of Early-Life Exposure to Air Pollution

- Babies are not just little adults -

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HEI Annual Conference
Seattle, 2019
Aging and Disease

- Neurodegenerative disease
- Cardiovascular disease
- Respiratory disease
- Metabolic disease
Aging and Disease
Aging and Disease

Initiation and progression of disease
What is *Early Life*?

Before! Conception  Pregnancy  Birth  Infancy  Childhood  Adolescence  Adulthood  Old Age
Important developments in *Early Life*

- Organ development and growth
  - Priming immune system
  - Reduced function
  - Clinical disease
Examination of critical time windows

• More complex spatio-temporal models necessary

• Uncertainty regarding time of conception

• High correlation of exposure (e.g. prenatal and postnatal)

• Intergenerational and transgenerational effects (via the epigenome): exposure of parents and grandparents
Popular outcomes in *Early Life* epidemiology

Measures of …

- **intrauterine growth** – low birth weight (LBW), head circumference, small for gestational age (SGA)
- **prenatal pathologies** – preterm birth
• Low birth weight, preterm delivery and their relevance for later life
• Biologic mechanisms
• Overview of the epidemiological evidence
• Study design challenges
  – Multiple exposures
  – Timing of exposure
• Research gaps

Epidemiological Evidence for Adverse Birth Effects Associated with Prenatal Exposure to Air Pollution

Marie Pedersen
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Danish Cancer Society Research Center, Denmark

Health Effect Institute Annual Meeting 2019, Seattle, US
Popular outcomes in *Early Life* epidemiology

Measures of ...

- **intrauterine growth** – LBW, head circumference, SGA
- **prenatal pathologies** – preterm birth
- **organ development** – lung volumes, brain MRI
- **functional capacity** – cognitive function, insulin secretion
- **subclinical pathologies** – airway hyperreactivity, insulin resistance
- **disease** – asthma, autism, obesity, diabetes mellitus

**LBW** - low birth weight  
**SGA** - small for gestational age  
**MRI** - magnetic resonance imaging
Respiratory Effects and Asthma in Children – Rosalind Wright

- From lung function development to manifest disease
- Programming and onset of asthma
- Critical time windows
- Different exposures
- Differences by socioeconomic status
• Explain different outcomes and their assessment methods
• Novel outcomes
• Etiology and critical time windows
• Biological plausibility

AIR POLLUTION AND NEURODEVELOPMENT
Obesity and Type 2 Diabetes in Children

Health Effects of Early-Life Exposure to Air Pollution
HEI 2019 Annual Conference

Tanya L. Alderete, Ph.D.
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Department of Integrative Physiology
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- Relevance of the outcomes for later disease
- Critical time windows and biology
- Vulnerable groups
*Early Life* effects

- Children are not just little adults – developing organism, different physiology, different exposures and exposure pathways
- Special attention to critical time windows, methodologically challenging
- Effects of early life exposure can have long-term consequences – up to 100 years or more!
- Underestimation of true burden of disease
Ongoing studies – take a look at the posters

- Marie Pedersen
- Payam Dadvand, Jordi Sunyer
- Monica Guxens
- Meredith Franklin
Thank you

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8:00   Introduction
       *Barbara Hoffmann*

8:10   Adverse Birth Effects
       *Marie Pedersen*, University of Copenhagen, Denmark

8:35   Respiratory Effects and Asthma in Children
       *Rosalind Wright*, Icahn School of Medicine at Mount Sinai

9:00   Neurodevelopmental Effects
       *Sharon Sagiv*, University of California, Berkeley

9:25   Obesity and Type 2 Diabetes in Children
       *Tanya Alderete*, University of Colorado, Boulder
Environmental influences during the life course

Pregnancy - Infancy - Childhood

- Functional capacity
  - Low exposure
  - High exposure

Adulthood - Old Age

- High exposure
- Low exposure

- Impaired function
- Manifest disease

Birth

Life course