

A large, faint watermark of the EPA logo is centered in the background. It features a stylized flower with three leaves and a scalloped top, surrounded by the text "UNITED STATES ENVIRONMENTAL PROTECTION AGENCY".

Children's Environmental Health Research Roadmap

Draft, Deliberative, April 29, 2013

Disclaimer. Although this work was reviewed by EPA and approved for presentation, it may not necessarily reflect official Agency policy.



Acknowledgements

ORD Elaine Cohen Hubal
Tina Bahadori
Sally P. Darney
Tim Watkins
Beth Hassett-Sipple
Andrew Geller
Maureen Gwinn
Michael McDonald
Elizabeth Corona
OCHP Michael Firestone



Objectives

- Share ***evolving*** EPA roadmap for children's environmental health research
 - Overarching Goal
 - Priority Research Areas
 - Key Science Questions
 - Major Outputs

Context



- Sustainable decisions and actions are those that improve the health of individuals and communities today without compromising the health and welfare of future generations.
- Children's Environmental Health (CEH) research is conducted by US EPA to improve the scientific understanding required to support:
 - Regulatory decisions protective of children's health now and in the future
 - Community decisions that protect and promote children's health across generations
 - Ecological decisions that provide sustainable healthy environments for children.



Overarching Research Goal:

To provide the Agency and others with the information needed to incorporate consideration of early lifestage susceptibility and vulnerability into decision making.



Priority Research Areas

1. Knowledge infrastructure to provide early lifestage-specific data and information
2. Systems understanding of the relationship between environmental exposures and health outcomes across development
3. Methods and models fit for purpose to evaluate early lifestage-specific risks and to support decisions protective of all early lifestages
4. Translational research to incorporate CEH into tools fit for purpose to inform community actions and decisions

Implemented by ORD's Research Programs



Sustainable & Healthy Communities Research

Protecting children and other susceptible populations

Supporting citizen decisions to foster community health and sustainability

Cleaning up contamination for productive sites



Air, Climate & Energy Research

Addressing changes in climate and air quality

Assessing impacts of air pollutants and climate change

Preventing and reducing emissions



Safe & Sustainable Water Resources Research

Supporting the nation's water infrastructure systems

Protecting our coastal and inland waters

Ensuring drinking water quality and availability



Human Health Risk Assessment Research

Supporting communities with environmental and health risk assessments

Developing assessments for improved public health

Providing the science to support the air quality standards

Modernizing risk assessment



Chemical Safety for Sustainability Research

Providing 21st century data on chemical risks to health and environment

Facilitating faster and more effective chemical safety assessments

Advancing sustainability by using green chemistry principles



Homeland Security Research

Characterizing contamination and determining risks

Securing and sustaining water systems

Remediating indoor and outdoor locations



<http://epa.gov/research>

Integrated across health outcomes



CHILDREN'S HEALTH OUTCOMES

KEY RESEARCH AREA	Adverse Birth Outcomes	Childhood Obesity	Cognitive Function	Asthma & Airway Function
Knowledge Infrastructure and Lifestage	CHEMICALS, AIR, WATER	COMMUNITIES	CHEMICALS, COMMUNITIES, AIR	COMMUNITIES, AIR
Systems Understanding: exposure to health across development	CHEMICALS, COMMUNITIES	CHEMICALS, COMMUNITIES	CHEMICALS, COMMUNITIES	COMMUNITIES, AIR
Methods & Models for Risk Assessment	CHEMICALS, COMMUNITIES, HUMAN HEALTH RISK ASSESSMENT	CHEMICALS, HUMAN HEALTH RISK ASSESSMENT	CHEMICALS, COMMUNITIES, HUMAN HEALTH RISK ASSESSMENT	AIR, HUMAN HEALTH RISK ASSESSMENT
Community decision support	COMMUNITIES, AIR	COMMUNITIES,	CHEMICALS, COMMUNITIES,	COMMUNITIES, AIR



1. Knowledge infrastructure to provide early lifestage-specific data and information

Research questions:

What data and information are most critical for

- Improving our understanding of early life stage susceptibility: exposure, toxicokinetic (ADME), toxicodynamic (toxic response) and disease etiology (health outcomes)?
- Improving our understanding of the linkages between environmental exposures at susceptible early lifestages with health outcomes that may appear later in life?
- Reducing early lifestage-related uncertainties in exposure and risk assessment to provide the basis for EPA's regulatory actions?

Examples of active and anticipated research

- High throughput bioactivity data for developmental and endocrine endpoints
- Data on the influence of the built environment on children's health/development (e.g. schools and performance metrics, STAR)
- More accurate soil and dust ingestion metrics and exposure factors for very young children
- Observational exposure data for pregnant women and children in “real world” settings (CEHC)

Output: Information on early life stage exposure and hazard are incorporated into ORD integrated applications to provide accessible data and tools that support Agency program- and decision-specific needs for chemical and pathogen evaluation, multiple stressor characterization, and risk assessment.



2. Systems understanding of the relationship between environmental exposures and health outcomes across development

Research questions:

- By what biological *Adverse Outcome Pathways* do environmental contaminants contribute to important childhood health outcomes (adverse birth outcomes, obesity, cognitive disorders, asthma)?
- What are the systems-level influences of the chemical, natural and built environments on these health outcomes?
- How can we evaluate the cumulative risk of chemicals including the contribution of non-chemical stressors?

Examples of active and anticipated research

- *Virtual Embryo* Systems Model and Simulations
 - High throughput assays for developmental neurotoxicity (STAR) and early development (mouse stem cells).
 - Predictive toxicity pathways for developmental and endocrine toxicity (ToxCast)
- Research on Lifestage Susceptibility (planned – CSS STAR)
- Complex determinants of obesity (chemicals/epigenetic reprogramming: CEHC), built environment (walkability), behavior (diet)
- Epidemiology studies that evaluate linkages between early exposures, birth outcomes, and later health outcomes: EPA-NIEHS CEHC

Output: Systems information across all levels of organization associated with development and childhood disease and wellbeing is incorporated into predictive modeling to inform Agency risk assessments and environmental programs.



3. Methods and models to evaluate early lifestage-specific risks and to support decisions protective of all early lifestages

Research questions

- How and to what extent are pregnant women and children exposed to environmental stressors? How does risk vary by specific early lifestages and exposure duration?
- What tools are needed to provide the Agency with access to all the available data needed for a regulatory action?
- What models are needed to support cumulative risk assessments that consider multiple developmental processes and stages and integrates non-chemical stressors?

Examples of active and anticipated research

- “Dashboards” for Agency access to data and models specific to CEH
- Risk assessment tools for evaluating complex exposures and exposure duration across vulnerable lifestages to estimate risks to children’s health, including risks that may accrue over time.
- Web-based tools that incorporate early lifestage-specific factors for predicting source-to-effects for risk assessment (EPA ExpoBox)
- Exposure models that incorporate children’s exposure factors specific to EPA age groups for linking exposure and internal dose specific to CEH; e.g. transplacental and lactational pathways

Output: Evaluated, accessible risk assessment tools are developed to provide and enhance agency capacity for advanced analysis to support program-specific children’s environmental health evaluations and sustainable decisions.



4. Translational research to incorporate CEH into tools to inform community actions and decisions

Research questions:

- What are the real-world environmental exposures to children in their homes, schools and communities and how do they contribute to children's health risks?
- How do social and economic factors, including those specific to place, influence exposure and risk?
- What tools can provide communities with the lifestage-specific information needed to support local decisions and actions?
- How can this information inform community-based decisions in key sectors (land use; buildings & infrastructure; transportation) to meet community needs?

Examples of active and anticipated research

- Longitudinal children's cohort studies (intervention components) in urban and rural communities considering multiple environmental factors (CEHC) and health outcomes
- Strategies to reduce children's health disparities (asthma and indoor/outdoor environmental stressors)
- CEH modules for incorporating social and environmental determinants of CEH into user-friendly community assessment tools (C-FERST/ATLAS) and Health Impact Assessments (e.g. school renovations in Springfield MA)

Output: Tools are developed for incorporating CEH factors when evaluating impacts of community-level decisions on sustainable, health-promoting environments for children.

ORD Research Partnerships in CEH



- EPA-NIEHS Children's Centers Program
- EPA-NIMHD Health Disparities Centers Program
- Collaboration with CDC on biomonitoring for very young age groups
- Research aligned with President's Taskforce:
 - *Coordinated Federal Action Plan to Reduce Racial and Ethnic Asthma Disparities (2012)*
 - *Healthy Homes*
- NCS: input and opportunities for future collaborations
- International efforts to develop and validate assays for endocrine active chemicals (OECD; WHO)