USEPA Research Activities to Characterize Children's Environmental Exposures

Elaine Cohen Hubal and Linda Sheldon
National Exposure Research Laboratory, U.S. EPA
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ORD/NERL Exposure Research

- Improve scientific basis of risk assessments
  - Identify important stressors, sources, pathways
  - Identify determinants of exposure
  - Characterize potential for exposure
- Contribute to human health studies (tox, clinical, epi)
  - Predict, measure, classify exposure and dose
- Test intervention and regulation
  - Predict and measure exposure and dose

Mandate to Address Children's Health

- 1996 Food Quality Protection Act (FQPA)
- 1996 Safe Drinking Water Act Amendments
- 1997 Presidential Task Force on Environmental Health and Safety Risks to Children
- 1998 and 2000 Initiatives on children's environmental health
- 2000 ORD Strategy for Research on Environmental Risks to Children

FQPA Basis for Research

- The Food Quality Protection Act of 1996 (FQPA) requires
  - Children's risks to pesticide exposures be considered
  - Exposure assessments to be conducted for all exposure pathways
  - Assessments use high quality and high quantity exposure data or models based on exposure factors generated from existing, reliable data
- Protocols for children's exposure analysis are not developed and evaluated
- Limited data on exposures, activities, and exposure factors for children
- Models are needed to characterize children's exposure for multiple pollutants across multiple pathways, including variability and uncertainty

Children's Focus - Framework

- Develop a conceptual model
- Identify potential exposure pathways and scenarios
- Define algorithms, exposure factors, and data requirements
- Perform a screening assessment to evaluate the range of exposures for, and significance of, each pathway
- Identify data gaps and uncertainties associated with current defaults
- Design research needed to address data gaps and reduce uncertainty

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Critical Gaps

- Product use patterns in locations where children spend time
- Distribution of contaminants in locations
- Age/developmental benchmarks for categorizing children's exposure
- Activity pattern data, especially for young kids
- Approaches and factors for estimating dermal and non-dietary exposures
- Population exposure data on children

Many On-going Studies

- Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP)
- Targeted Laboratory and Field Studies in support of FQPA
  - Feasibility of Macroactivity Approach – Day Care Jazzercise
  - Characterize Important Factors for Transfer Activities
  - Post Application Exposure Studies
  - Transport of Pesticides in Test House
  - Survey of Environmental Hazards in Child Care Centers
  - CDC Duval County Pesticide Exposure Study
  - Pet Study
  - Kid's in Agricultural Communities
  - Kid's Dietary Ingestion Study
- Longitudinal Exposure Study for Infants and Toddlers

CTEPP: Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants

(P.I.: Marsha Morgan)

- Study assessing exposures of preschool children (3-5 year) to common contaminants in their everyday surroundings.
- 260 children and their primary caregivers
  - North Carolina and Ohio
  - Urban and rural
  - Day care centers and residential settings
  - Low-income and middle/upper income
- Samples collected over 48 hours:

-Food	-Indoor Air	-Hand Wipes
-Beverages	-Outdoor Air	-Dust
-Water	-Urine	-Play Area Soil

- Questionnaires, diaries, and videotapes

-Food Diaries -Daycare Menus -Activity Diaries -Videotaping (10%)

CTEPP — Targeted Pollutants

1. Polycyclic Aromatic Hydrocarbons (benzo[a]pyrene)
2. Phthalates (di-n-butyl phthalate)
3. Phenols (bisphenol-A)
4. Chlorinated Biphenyls (PCBs)
5. Organochlorine Pesticides (lindane, heptachlor, DDT, DDE)
6. Organophosphorus Pesticides (diazinon, chlorpyrifos)
7. Acid Herbicides (2, 4-D, dicamba)
8. Triazine Pesticide (atrazine)
9. Pyrethrin Pesticides (permethrins)

Reason for Selection: Possible carcinogens, endocrine disruptors, teratogens, neurotoxins, or residues are commonly found indoors or in food or water.

Key Outputs

- Greater understanding of children's total exposure and doses to pollutants
- Important exposure pathways for young children
- Important environmental media that contribute to children's exposures to pollutants
- Improved approaches for estimating children's exposures and potential doses to pollutants
- FQPA - Critical data gaps, model inputs
- High quality exposure data and tools to improve risk assessments, and to reduce children's exposures to environmental contaminants.

Field Studies in Support of FQPA

- Developing Empirically Derived Transfer Coefficients to Assess Dermal Exposure for Children (Elaine Cohen Hubal)
  - Screened 8 daycare centers following pesticide application
  - Selected one daycare for monitoring of children following a scheduled application.
  - Two classrooms; 4-5 children from each classroom
  - Two age groups: infants (6-12 months) and 2-3 year olds.
  - Three post-application monitoring visits
  - Two monitoring sessions of 35-55 minutes per visit in each classroom.
  - The children were clothed in full-body cotton suits to measure dermal loading.
  - Surface residues were measured on classroom surfaces.
  - Videotaping to verify the children's activity levels and location

- First National Survey of Environmental Hazards in Child Care Centers (HUD, CPSC, EPA) (Nicolle Tulve)
  - Probability sample of 150 child care centers in U.S.
  - Lead, allergens, and pesticides

Field Studies in Support of FQPA

- EOHSI Post-Application Exposure Study (Nicolle Tulve)
  - Nine homes in urban NJ; children 2-5 years old
  - Exposure Assessment – indoor air, surface wipes, dust wipes, toys, dermal wipes, urine, activity diary, videotaping, cotton dosimeters

- CDC/Duval County Children's Pesticide Exposure Study (Nicolle Tulve)
  - Urine samples -200 children -analysis by CDC Organophosphate and pyrethroid pesticide metabolites
  - Environmental screening - 50 homes - Duval County Health Department Urine, surface press, surface wipes, activity diary, pesticide inventory
  - Aggregate Exposure -9 homes - EPA Urine, air, surface press, wipes, duplicate diet, activity diary, cotton dosimeters

Other Field and Laboratory Studies

- Characterize Pesticide Residue Transfer Efficiencies Using Fluorescent Tracer Imaging Techniques
- Measuring Dietary Intake of Young Children (Lisa Melnyk)
- Characterizing Pesticide Transfer to Foods from Household Surfaces (Lisa Melnyk)
- Pet study - exposure to pet-borne diazinon residues following residential turf applications (Dan Stout and Marsha Morgan)
- Children's post-application pesticide exposure study (Nicolle Tulve)
- Pesticide distributions in the EPA test house (Dan Stout)
- Factors affecting transport and behavior of pesticides - environmental chamber testing (Dan Stout)

Targeted Studies - Critical Benefits

- Demonstrate approaches for assessing dermal exposures
- Develop exposure factors to address gaps in children's exposure assessments
- Develop approaches, methods, and protocols for measuring multimedia exposures to children, including methods that account for important activities that take place in home, school, and day care settings
- Collect data on multimedia pesticide concentrations, pesticide biomarkers, and exposure factors that can be used as inputs to aggregate exposure models for children

Available Data

- Pesticide use patterns in homes, daycares, schools
- Pesticide levels and distribution in homes, daycares, schools
- Levels of some persistent organic pollutants in homes and daycares
- Children's activity data for 3-5 year olds - questionnaires, videotapes
- Exposure factor data (transfer efficiencies, dermal transfer coefficients
- Urinary biomarkers for children 3-5 years

Longitudinal Exposure Study for Infants and Toddlers

(Roy Fortmann)

- Assess exposures of infants and toddlers to chemicals in the residential environment
- Two-year longitudinal study of 80-100 infants/toddlers
- Two cohorts: (1) enrolled shortly after birth, (2) enrolled at 1 year
- To be conducted in Jacksonville, Florida
- Up to six monitoring visits over two years on schedule related to child development (based on RAF proposed age bins)
- Monitoring prior to, and immediately following, a pesticide application
- Analyze for current-use pesticides and pesticide metabolites
- Measure phthalates, BFRs (polybrominated diphenyl ethers), perfluorinated compounds (PFOS, PFOA)

Key Outputs - Longitudinal Data

- Evaluated approaches and algorithms for assessing children's exposures
- Critical inputs to aggregate exposure models
- Data on exposure factors
- Data on age and developmentally related differences in children's exposures to pesticides in homes
- Data on impact of children's locations and activities on exposures to pesticides in homes
- Current-use residential pesticide exposure data for very young children (0-3 years)

Other Activities

- VCCEP Voluntary Children's Chemical Evaluation Program (OPPT)
- Children's Risk Assessment Framework (NCEA, ILSI Workshop)
- Considering developmental changes when assessing exposures to children (RAF - NCEA)
- Activity pattern survey platform (NCER)
- Children's Centers - current focus on asthma and pesticides (US EPA, NIEHS)
- Pilots to support the National Children's Study

Research Needs

- Still need to understand determinants of exposure. What do we need to measure, and how do we interpret measures to efficiently characterize exposures for health studies and risk assessment
- Approaches for characterizing and classifying behavior for exposure assessment
- Methods for collecting biomarker data in children and approaches for interpreting these measures
- Approaches for conducting risk assessments that systematically identify and address developmental/behavioral windows of potentially high exposures as well as windows of susceptibility
- Screening approaches (tiered exposure assessment and standard exposure "tests") to focus research on exposures that are potentially the most significant

Disclaimer

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