# Innovative Tools and Methods for Assessing Children's Potential Chemical Exposures

Nicolle S. Tulve<sup>1</sup>, Kacee Deener<sup>2</sup>, Chris Saint<sup>2</sup>, Elaine Cohen Hubal<sup>3</sup>, Lisa Melnyk<sup>1</sup>, Linda Sheldon<sup>1</sup>, Daniel Stout<sup>1</sup>

## Research

hildren's exposures to environmental contaminants are different than adults, due in part, to differences in physiologic function, surface-to-volume ratio, and the way in which children interact with their environment (i.e., sitting on the floor, eating off the floor, hand-to-mouth activity). Therefore, the tools and methods used to assess exposure for adults can't be directly applied to children. Although research on children's exposure to environmental contaminants is being performed within EPA academia, industry, and other research organizations, protocols that have been developed by individual researchers for specific studies do not always collect all of the data required for reliable exposure assessments, and the data collected can not always be interpreted. Prior to the work undertaken by ORD, standardized protocols for conducting exposure field studies that provided useful data for measurement-based exposure assessments did not exist Likewise, protocols for developing exposure factor data to be used for modeling assessments were not available. The development of innovative tools and methods for assessing children's pesticide exposures are integral to ORD's human health research program. In order to evaluate whether a to have differential risks, tools and methods that are capable of measuring differential risks must be developed and tested. Numerous tools and methods have been developed by ORD to characterize children's pesticide exposures. Development of these innovative tools and methods puts ORD on the leading edge of sure and risk as fields. In addition, it allows ORD to reduce health risks by working closely with community stakeholders, industry, and academia to share these tools and methods. This poster highlights the innovative tools and methods

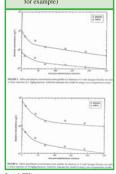
# Research **Organizations**

that have been developed and used

- Columbia Center for Children's Environmental Health at the Columbia University School of Public Health, Frederica Perera, PI
- Mount Sinai Center for Children's Environmental Health and Disease Prevention Research at the Mount Sinai School of Medicine, Mary Wolff, PI
- Center for Child Environmental Health Risks Research at the University of Washington, Elaine
- · Center for Children's Environmental Health Research at the University of California : Berkeley, Brenda Eskenazi, PI
- · Center for Environmental Health Sciences, College of Veterinary Medicine, Mississippi State University, Mississippi State,

## Methods/Results

- A SALIVA BIOMONITORING pesticide exposures in young
- > Improves participant mpliance
- > Reduces burden
- > More acceptable to parents (as compared to a blood sample,



· DUST SAMPLE COLLECTION

> Greatly improves ability to

measure pesticide residue locations accessible to children

A VISUAL CHILD ACTIVITY DIARY

children's activity patterns in

Spanish-speaking populations

> Improves collection of

- > Improves participant compliance > Units are "stylish" and easily
- Significantly improves ability to gather chemical concentrations near the participant's personal space



CHILDREN'S DIETARY EXPOSURE

measurements for children by

> More accurate intakes can be calculated to estimate total dietary exposures of children

• Surface sampling methods

> Usable on many surfaces

found in the residential

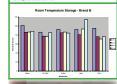
> Greatly improves ability to measure pesticide residues

> Improves dietary

- DRAFT PROTOCOL for Measuring Children's Non-Occupationa Exposure to Pesticides by all Relevant Pathways (US EPA 2001. EPA/600/R-03/026)
  - > Provides guidance for generating data that can be used to improve exposure essments for young children
    - \* Framework
  - \* Exposure algorithms and data needs
  - > Provides approaches and methods that can be used for conducting field studies to collect exposure measurement data and to develop exposure factors
  - \* Fills a critical need for standardized approaches and methods
  - Facilitates comparison of data

- URINE COLLECTION METHOD using commercially-available disposable diapers
- > Improves participation
- > Easy to collect and store for the field technician and participant

overage Efficiency of E	struction of Metabolites from Dispers				
Metabolite	Extraction Efficiency (%)*				
3-PBA	16				
4F-3PBA	76				
ris-DMCA					
mon-DMCA	62				
rsr-DCCA	X1				
trans-DOCA	10				
DBCA	71				
CTAA	99				
TOPy	102				
MPy	79				
Creatining	104				



- · COTTON GARMENTS, SOCKS AND dermal exposure
- > Improves our understanding children's skin during normal activities





# A MULTI-RESIDUE MULTI-MEDIA

Multi-Res	idue Anal	yea	Method	
 ADathein (cia/trone) Bifostrie Cyflation Cyflation Cybaidnis Cypermetlein Delametlein Edwarderin Edwarderin Engrethein Permetlein (cia/trone) Permetlein (cia/trone)	•		Pysidein Keenetlein Sanillein Tetranetlein Unknostlein Unknostlein Dazinen Pipersejl batoside Fignesi perr	

	Abidocei (curanini)	-	
*	Billethrin		
*	Cythathrin	-	-
+	Cybuloticis		
+	Opernellein		
	Deltamethrin de		
	Edwardenie		
	Fingripathrin		
	Improfes		
	Persethin (clatron)		
٠	Profestria	CERN.	

- Novel global positioning SYSTEM TECHNOLOGY
- > Characterizes child activity patterns
- > Captures and understands children's activities with less burden





Where shiften most. Fraction of anothery little (%) is each location and lotal remainsed time (%) for shiften mosting (275-251, ands.							
	Worker		Today				
Location	(3681)	Chorz	Child 9	Chief	Child 9	Child	
Trybicki (mide)	4.0	150	8.7	21.4	194	0.0	
Ashed Dodler	167	81.0	0.0	14	9.6	0.0	
None (build)	.536	4.6	92.1	6.6	8.6	EL4	
Station (Inches	.00	0.0	31.6	764	\$1.0	44	
Children P	96.7	8.0	0.4	14	0.0	160	
Manager of Stone (1999)	.703	480	440	510	981	760	

- GLOVE PROTOCOL
- > Improves the ability to estimate children's potential pesticide exposures from their

Time	Assessed on glove (egi <sup>2</sup>	12% Crelia			
		Lower	View	Some	1994
-	8.36	her	0.00	10.44	9.79
19	6,23	600	197.1	477	1996
TARY	187.0	78.8	111		2784
10 dept	79.4	81.5	138.4	- 1	2612
to Arra	76.6	18.5	10.4		Last



# Impact and **Outomes**

- · ORD research program has developed numerous innovative tools and methods that have been shared with other groups, including
- > EPA's Program Offices
- > Other Federal Agencies
- > Researchers in academia and industry
- · Glove protocol has been incorporated into the revised pesticide exposure guidelines for use in the pesticide registration process
- Environmental health policy changes in Washington, California, and Minnesota have resulted from this research
- · On-going exposure and environmental epidemiology studies are using these validated

### **Conclusions**

- · Numerous tools and methods have been developed within the ORD human health research program to characterize children's pesticide exposures
- · Development and current evaluating children's aggregate exposures to chemicals
- Validation of a method for collecting urine samples using commercially-available diapers to analyze for pesticide metabolites
- Evaluation of a non-invasive saliva biomonitoring method using rat models showing the relationship between saliva and plasma chemical levels
- · Refinement of methods for collecting and analyzing dust
- · Development and evaluation of a glove protocol method to ass pesticide exposures from pets
- · Evaluation of a visual child activity diary to improve collection of time activity data from targeted populations
- Use of a new global positioning system technology to characterize child activity patterns in order to collect relevant time activity data
- Evaluation of methods to use cotton garments for estimating dermal exposure
- · Development and evaluation of
- Validation of a multi-residue multi-media analysis method for pyrethroid pesticides
- Improved methods for surface



