Information From Field Studies for Exposure Assessment in the National Children's Study

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Purpose:

What lessons can we learn about exposure assessment from the publications and field studies commissioned by the National Children's Study?

Lessons Learned from the NIEHS/EPA Centers for Children's Environmental Health and Disease Prevention Research: *Exposure to Pesticides and Air Pollution*

A series of seven "Lessons Learned" papers commissioned by the National Children's Study and published in *Environmental Health Perspectives* as a mini-monograph included one on lessons learned from experience with pesticide exposures, and another on exposure to air pollutants with several of the NIEHS/EPA Children's Environmental Health Research Centers.

Pesticides (Fenske et al., 2005)

- Questionnaires alone are unlikely to capture the complexity of children's pesticide exposure. Environmental measurements, such as surface and toy wipes, and indoor air or house dust samples can characterize residential pesticide contamination, but both their validity for exposure classification and their value in epidemiologic studies need further investigation.
- Biological monitoring appears to be the best available method for assessment of children's exposure to pesticides; however, pesticide biomarkers have limitations. It is likely that a combination of biomarkers, environmental measurements, and questionnaires will be needed for considering specific hypotheses involving pesticides and the limitations of each exposure metric.
- Personal sampling in conjunction with urine or blood sampling is likely to be most effective at characterizing exposure.

Air Pollution (Gilliland et al., 2005)

- Selecting Study participants with a wide range of pollution exposures can maximize exposure contrasts for key pollutants and thus the ability to test exposure-response relationships.
- Understanding issues of spatial and temporal correlations of air pollutants, how specific pollutants can act as surrogates for others in a complex mixture, and the misclassification inherent in exposure estimates is critical for analysis and interpretation.
- Due to the large size, long duration, diverse outcomes, and exposures of interest in the National Children's Study, exposure assessment efforts should rely on modeling to provide estimates for the entire cohort, supported by questionnaire data and individual measurements.

References:

Fenske RA, Bradman A, Whyatt RM, Wolff MS, and Barr DB. 2005. **Lessons Learned for the Assessment of Children's Pesticide Exposure: Critical Sampling and Analytical Issues for Future Studies** *Environmental Health Perspectives* 113:1455–1462 (2005). doi:10.1289/ehp.7674. [Online 24 June 2005] http://ehp.niehs.nih.gov/docs/2005/7674/abstract.html

Gilliland F, Avol E, Kinney P, Jerrett M, Dvonch T, Lurmann F, Buckley T, Breysse P, Keeler J, de Villiers T, and McConnell R. 2005. **Air Pollution Exposure Assessment for Epidemiologic Studies of Pregnant Women and Children: Lessons Learned from the Centers for Children's Environmental Health and Disease Prevention Research** *Environmental Health Perspectives* 113:1447–1454 (2005). doi:10.1289/ehp.7673. [Online 24 June 2005] http://ehp.niehs.nih.gov/docs/2005/7673/abstract.html

Exposures and Health of Farm Worker Children in California

EPA's National Exposure Research Laboratory and the University of California at Berkeley Center for Children's Environmental Health and Disease Prevention Research conducted a pesticide exposure study with children of farm workers in the Salinas Valley, California during the summer and fall of 2002.

- Twenty children ages 5 to 27 months were monitored. Target pesticides included organophosphate and pyrethroids. Samples collected and analyzed included indoor and outdoor air, house dust (HVS3 sampler), wipes from surfaces such as floors and toys, children's urine, duplicate diet food samples, and cotton union suits and socks. Information gathered on the children's activities during a 24-hour monitoring period included an activity timeline, recall log, food diary, exposure questionnaires, and videotaping, along with a home inspection.
- Diazinon, Chlorpyrifos, Dacthal, *cis*-Permethrin, and *trans*-Permethrin were the predominant pesticides observed (detection frequency >95% in house dust). Pesticides were measured on the provided toy (detection frequency approximately 60% for the toy wipes). Union suit and socks were useful for assessing children's pesticide exposure.
- Pesticide levels in different matrices are correlated, but this may not be adequate to select a single indicator of residential pesticide contamination.

	House Dust ng/g	Indoor Air ng/m³	Outdoor ng/m³	Surface Wipe ng/cm²	Socks ng	Union Suit ng
Chlorpyrifos	49 (1200)	1.8 (6)	0.9 (6)	0.05 (0.20)	24 (66)	60 (280)
Diazinon	21 (820)	1.9 (44)	3.4 (21)	0.04 (0.10)	11 (590)	43 (2100)
Dacthal	31 (110)	1.8 (7)	4 (14)	0.04 (0.30)	17 (200)	80 (350)
***cis*-Permethrin**	150 (2900)	0.5 (1.3)	0.1 (1.5)	0.1 (1.7)	120 (5600)	580 (39,000)
***trans*-Permethrin**	230 (5800)	0 (1.7)	0 (0.4)	0.2 (3.6)	220 (350)	260 (42,000)

Preliminary Results: Median Concentrations in Environmental Samples (Maximum Concentrations in parentheses)

The Tampa Asthmatic Children's Study

The Tampa Asthmatic Children's Study (TACS) is a 9-child pilot study conducted in 2002 in Florida. The study piloted participant recruiting tools for children 1–5 years of age and developed and evaluated simple, cost-effective methods for assessing environmental exposures relevant to pre-school children with asthma. These are some of the preliminary results:

- The Actical® 3-D accelerometer has potential for activity monitoring.
- A lunchbox near-personal exposure monitor was developed for personal air pollution exposure assessment for combustion-related products, particulate matter (PM), and selected air toxics. (Reduction in size/mass of the lunchbox is needed to reduce burden.)
- Dansylhydrazine (DNSH)-coated sorbent methodology may be suitable for measuring acrolein.
- GPS was used successfully to locate participants relative to sources.
- Homes had low air exchange rates.
- Participants spent about 80% of their time indoors.

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Lunchbox Near-Personal Exposure Monitor

North Carolina Herald Cohort

The North Carolina Herald Study provides an opportunity to field test the National Children's Study protocol. This cohort can serve as a platform for validation studies to estimate and, ideally, lower the burden for National Children's Study participants and suggest strategies to lower burden. Pilot study data can also improve and/or replace the methods and approaches proposed.

- The study will enroll women of child-bearing age and pregnant women. Approximately 10,000 households will be screened and about 2,700 women who meet initial eligibility criteria are expected to be enrolled in early 2006. Approximately 200–400 pregnancies are expected within a year of screening. There will be periodic visits until the child is 18 months old.
- Four locations within two North Carolina counties (one metropolitan, one non-metropolitan) have been selected for the study, providing demographic diversity. The locations do not overlap with the North Carolina counties selected to participate in the National Children's Study.
- The sampling strategy, recruitment and retention, timing of visits, questionnaires, and data collection will follow those outlined in the National Children's Study Vanguard Site RFP Study Plan, to the extent possible. The Herald Study will collect information including environmental exposures and measures of fetal and infant growth and development.
- The Herald Study precedes the Vanguard sites by approximately 12 months, and this, in addition to accelerated screening (4 months compared to five years), enrollment, and expanded eligibility criteria should result in the accrual of data far enough in advance to support the design of the Vanguard protocols.

Implications for the National Children's Study

The field studies on exposure assessment from the NIEHS/EPA Centers for Children's Environmental Health and Disease Prevention Research and those commissioned by the National Children's Study, including the North Carolina Herald Cohort study (now in progress), will provide an important foundation for methods to be used in the National Children's Study.

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