

US EPA ARCHIVE DOCUMENT

Longitudinal Variability in Urinary Pesticide Metabolites Among Children

Start Date: 9/2004

Completion Date: 9/2006

Project Purpose:

This study will characterize the daily variability in exposure to current-use pesticides among children in a region where intermittent pesticide exposure is likely. As a part of EPA's Border XXII research initiative, we propose to conduct a longitudinal study among children at the U.S.-Mexico border where multiple urine samples are collected to (1) characterize the variation of pesticide metabolite levels in urine samples of children over time; (2) determine whether measurements in a single spot sample represents the daily average excretion of pesticide metabolites; (3) to determine the effectiveness of three different techniques for urine adjustment for normalizing urine dilution resulting from variable hydration states of the participants; (4) determine whether a first morning void is more predictive of the average daily exposure than a spot sample taken at other points during the day; and (5) determine whether a single sample is sufficient to characterize exposure, and if not, how many samples are necessary to accurately categorize the exposure.

Background:

The variability of nonpersistent chemical concentrations in urine samples collected from an individual over time is of concern. If a single sample taken at a given point in time cannot accurately assess a person's average exposure over a given time frame, then multiple samplings are necessary, though this can become costly and potentially burdensome to the participant. Temporal variability can include the variation of a given chemical in multiple samples collected on a single day or can include variation among days, months or seasons. How accurately can a single sample represent a day's exposure to a given chemical or how accurately can a single sample represent an individual's exposure over a longer period of time? These questions can be more easily answered for chronic exposures to nonpersistent chemicals because the exposure is repeated thus the amount in a given sample would likely be representative of that average exposure. However, for episodic exposures, which is often the case with current-use pesticide exposures, the questions become more difficult to answer and may vary among pesticides and study populations.

For urine as a matrix, a 24-hour sample is preferred, rather than a single spot sample on a given day; however, this is often logistically difficult. If a 24-hour sample cannot be obtained, a first-morning void is then preferred because the urine is more concentrated and the collection represents a longer window of accumulation (usually >8 hours), thus the analyte level is more likely to reflect an average daily concentration, and perhaps a maximum urinary concentration. Regardless of whether the sample collected is a first morning void, if the sample does not represent a full 24-hour collection, the variability in urine concentrations (i.e., degree of dilution of the urine components as a result of water intake) must be considered.

To evaluate daily, monthly and/or seasonal variations of analyte in urine, sequential samples are often taken days or weeks apart to evaluate the intraindividual variation over time and to determine whether an accurate classification of exposure is possible from a single spot sample. Several studies have evaluated the weekly or seasonal variation for certain pesticide metabolites in urine, though most pesticide metabolites have not been evaluated and most studies have considered only adults. The existing data indicate that a single sample may not sufficient to accurately identify

exposure to the target pesticide, thus multiple samples must be collected over time.

Project Description:

Children will be enrolled from Webb (Rio Bravo) and Hidalgo (San Carlos) counties in the Rio Grande Valley near the Texas-Mexico border. Two different sampling areas will be used to provide a range of exposures to evaluate. Rio Bravo community is older. San Carlos is a newer community but is located adjacent to a cotton field which is sprayed aerially. Ideally, about about 2/3 of the population sampled will be obtained from Rio Bravo and 1/3 from San Carlos. Samples will be collected from children aged 2-6 years at the height of the growing seasons (i.e., early spring or late summer). Promotoras familiar with the community will recruit members of the community by telephone and by going door-to-door. Parental consent will be sought for the child participants. Only children of parents over 18 years of age will be enrolled.

An exposure questionnaire will be administered at each of the collection periods to collect data regarding potential pesticide exposure. The questionnaire will inquire about demographic information, parental occupation, and pesticide-related exposure information. Parents of each of the study participants will be asked to collect each urine sample from their child for an entire day. A single urine sample will be collected the following two days to determine if measurements from multiple spot samples will help provide more consistent classifications of exposure than a single spot sample when 24-hr collections are not feasible. The urine collection and questionnaire process will be performed again two weeks later, then again four weeks later. Daily urine samples can be stored in a sealed container in their refrigerator until collected by field staff. These specimens will be shipped on dry ice to the CDC. After all participants are enrolled and have submitted their samples, CDC will analyze each sample for metabolites of commonly used pesticides including pyrethroid and OP insecticides.

Accomplishments:

- Fall 2004 – Draft protocol reviewed by study investigators and submitted for Institutional Review Board and Human Subjects approvals. Sampling is expected to begin in the spring of 2005.

Expected Outcome(s):

This research will help define the excretion rates and variability of urinary metabolites for frequently-used pesticides. This is vital to the interpretation of urinary biomarker data for exposure assessments. In addition, this research will explore different methods of correcting urinary metabolite levels for level of hydration. The expected outcome is guidance for the frequency and timing of urine samples to best estimate the individuals pesticide exposure based on urinary metabolite levels. This would be an obvious advantage to future exposure field studies of pesticides in terms of cost and convenience.

Journal articles will be published detailing the relationship of concentration of metabolites and frequency and timing of urine sample collection. The first article is scheduled for publication in June 2006.

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