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Relationships Between Questionnaire Responses and Children's Pesticide Exposure Measurements

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Relationships Between Questionnaire Responses and Children's Pesticide Exposure Measurements

by

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Executive Summary

Children are widely acknowledged to be more vulnerable than adults to many environmental health hazards, including pesticides, because they are more exposed, and because they may have elevated susceptibility. The effect of relatively low levels of pesticide exposure in children is an area of great scientific uncertainty and has, therefore, become the focus of substantial research and regulatory activities. The work of the Pesticides in Young Children Border States Program to identify the major exposure risk factors for intervention requires studying children across the exposure measurement distribution, especially those with higher exposure measurements. Questions that could be used for exposure classification as a prescreening tool would help produce either an enriched population (i.e., a larger percentage of individuals with higher exposure levels) or would eliminate individuals with lower exposure levels from further review. Considerable savings in time and money may then be realized in selecting the desired population for a study.

The objective of this project is to identify questions that indicate a higher likelihood of predicting a child's level of exposure to pesticides as input to future study designs. This report reviews the state of the science in relating questionnaire responses to environmental and biological measurements, primarily for children, based on results and data from previous exposure studies. A two-part approach was used for this evaluation:

- A literature review of previous exposure studies to summarize the existence of such quantitative and qualitative relationships, and
- An analysis of Phase II of the Pesticide Exposure and Health Effects on Children Initiative (Yuma Study), which contained questionnaires and measurements.

The literature review of previous exposure studies identified 20 publications that met the criteria set for this evaluation. These publications were reviewed in detail to determine the relationships that were considered and statistically analyzed in each study. Relationship, as used here, is defined as a systematic correspondence between the values of two variables, that is, questionnaire responses and analytical measurements. Detailed information about each relationship was compiled to allow for more in-depth evaluations by other researchers as their interests dictated. The questions were grouped into categories for evaluation, and questions showing overall significance across the publications were identified.

From the 20 relevant publications, 603 statistically significant and non-significant relationships across 117 questions in 14 question categories were identified. Eighty-six percent of the relationships were in the categories of residential pesticide use, household characteristics, household occupation, residential proximity to agricultural fields, subject's personal characteristics, and family hygienic practices. These six categories represent questions whose relationships with exposure measurements have both a strong theoretical basis and the quality of being reasonably evaluated through the study designs. Sixty-six percent of the relationships considered metabolites in urine measurements, primarily with DAP-based metabolites, and 31 percent of the relationships considered dust measurements. Three risk factors related to the take-home or para-occupational exposure pathways were

analyzed as separate question categories: household occupation, family hygiene practices, and work exposure/practices.

The relationships for each question and chemical/metabolite combination were reviewed to determine the question's effectiveness for differentiating exposure levels. Generally the questions showing the most effectiveness were:

- residential pesticide use (inside and outside)
- occupation of household members
- child's characteristics (age, ethnicity, family income)
- family hygiene practices.

Several other questions, which were tested less extensively in the publications, also showed some effectiveness:

- pets
- household location: urban vs non-urban
- dietary behaviors (organic food)
- exposure levels of household members
- health status (diseases)
- smoking behaviors
- proximity to agricultural fields (for house dust only).

The Yuma Study was conducted from October 1999 through February 2000 for 152 households of permanent residents of the area with children in kindergarten or first grade. The children's urine samples were measured for the six most common dialkylphosphates (DAPs) associated with OP pesticides. Dust samples collected from each household and from classrooms were measured for specific organophosphorous (OP), organochlorine, pyrethroid, and carbamate pesticides. One set of statistical analyses considered the urine, dust, and questionnaire data to identify any associations between questionnaire data and pesticide exposure levels. Traditional statistical techniques were performed to test predefined hypotheses on the principal participant children and their siblings between 2 and 11 years of age. Of the questions analyzed, recent indoor pesticide use, household members working in agriculture, and distance from home to agricultural fields have statistically significant relationships with the ethylated DAP sum and with individual ethyl and methyl DAPs; however, the direction of some relationships was opposite of what might be expected.

A second set of statistical analyses was performed only on principal participant children from the eight schools and two grades in the initial study design. A data mining approach, Classification and Regression Trees (CART), was used to identify potential predictors without specifying a priori hypotheses between the biomarker measurements and the questions and dust measurements. Six scenarios with increasing levels of measurement burden from questions, household dust, and school dust were analyzed for the ethylated and methylated DAPs sums.

Although there are differences in the subpopulations considered and the statistical analyses performed, a summary of the questions selected under either approach for both DAP sums provides a view of the effective differentiators from the Yuma Study. The best use of these results is as "indicators" of predictors that are more useful in differentiating the exposure levels.

Table ES-1 Comparison of Questions Selected from the Yuma Study for the Sum of Methylated and Ethylated DAPs Based on Two Analysis Approaches

Sum of Methylated DAPs	Sum of Ethylated DAPs
	Recent use of pesticides inside home
Child's characteristics (height, weight)	Child's characteristics (weight, ethnicity)
	Other adult in household working in agriculture
Proximity to agricultural fields, spraying conditions	Proximity to agricultural fields, spraying conditions
	Child's time spent away from home
Where in house child spends time	
Child's school	
Father's occupation	
	Diet - local fruits/vegetables

Questions that seem to have stronger relationships with the exposure levels across both the literature review and the Yuma Study include the following:

- occupation of adults living in household
- residential pesticide use
- residential proximity to spraying and agricultural fields
- characteristics of the subject that may indicate potential exposure activities
- family hygiene practices that may mitigate the take-home pathway exposure
- where the child spends time (in home, away from home)
- diet with respect to locally-grown fresh fruits and vegetables.

This report reviews the state of the science in relating questionnaire responses to environmental and biological measurements primarily for children. Future studies that use biological monitoring and questionnaires should draw upon this and other recent research to refine study protocols with the following recommendations.

Based on the literature review, 41 questions were identified as effective in differentiating exposure levels of at least one chemical/metabolite in urine and dust measurements. These questions are offered as a resource of recommended questions with specific chemicals or metabolites for future study designs. Note that the questions were evaluated here as a screening tool to create an enriched population of participants with higher exposure levels. Thus, their future use is better suited to similar purposes.

Table ES-2 Questions Considered Effective Differentiators of Children's Pesticide Exposure Levels (Extracted from Table 2.11)

Medium		Q Category	Q Description
Urine	Dust		
		Residential Pesticide Use	
X			Were the "bedrooms" in the house treated with pesticides?
X			Were the "closets" in the house treated with pesticides?
X			Was the "dining room" in the house treated with pesticides?
X			Was the "living room" in the house treated with pesticides?
X			Was an "other room" in the house treated with pesticides?
X	X		Was the outside of the house treated with pesticides?
X			Was the garden treated with pesticides?
X			Was the lawn or yard treated with pesticides?
X			Level of household pesticide use
X			Number of times personally applied pesticides inside the house
X			Number of times personally applied pesticides outside the house
X			Was the inside or outside of the house treated with pesticides by a family member?
X			Did you personally mix pesticide inside the house?
		Household characteristics	
	X		Is the property used as a farm?
	X		Number of persons living in household
X			Do you have pets in the house?
X			Do you have pets inside or outside the house?
X			Does household have a garden or vegetable garden?
		Household occupation	
	X		Number of agricultural workers in household
	X		Applicator vs farm worker
	X		Applicator vs non-applicator
X	X		Applicator and farm worker vs reference
X			Applicator vs reference
	X		Fieldworker vs pesticide handler
X			Did head of household spray fields?
X			Was a household member recently involved in fieldwork?

Medium		Q Category	Q Description
Urine	Dust		
	X		Are household members involved in tree thinning?
	X		Number of household members with high pesticide contact jobs
		Residential proximity to agricultural fields	
X	X		Proximity of home to pesticide-treated farmland/orchard
		Residential location	
X			Urban vs non-urban
		Subject's personal characteristics	
X			Age
X			Ethnicity
X			Income
		Child's behaviors	
X			Hand wipe concentration per unit area
		Dietary behaviors	
X			Was diet conventional or organic?
		Family hygiene practices	
	X		Are work clothes worn inside the house?
	X		Number of weeks since last house was last vacuumed
		Related exposure levels	
X			Number of adult household members with high metabolite levels
		Health	
X			Have you ever had bowel disease?
X			Have you ever had intestinal disease?
X			Have you ever had ulcers?

Analyses of the association between questionnaire data and pesticide metabolites in children's urine are conducted on the assumption that the urinary metabolite measurements provide an accurate estimate of children's exposure. Metabolites under study are processed and excreted relatively quickly in humans (1-3 days), which is in contrast to the general nature, in terms of the time frame of a particular activity or behavior, of most questions asked of parents or children. It is therefore worthwhile to consider the variability in measurements in urinary pesticide metabolites. Recent studies suggest that if complete 24- or 48-hour urine samples are collected rather than spot urine samples, it may be possible to better identify major risk factors for exposure.

Validity of questionnaire data is an essential consideration in epidemiologic studies, and future studies of children's pesticide exposure should be preceded by validation studies. Such studies might include validating the basis for classifying each applicator's exposure through biological monitoring, or evaluating the correlations between self-reported behavioral data from potential participants and the urinary metabolite data.

Studies of children's pesticide exposure should work to improve the quality of data related to behavior. At present, researchers rely primarily on parental reports of behavior for young children. Yet the validity of parental reports has not been scrutinized in a systematic fashion. There is clearly a need for more objective measures of children's activities and behaviors in conjunction with systematic biological monitoring to ensure identification of key predictors of children's exposure to pesticides.

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Abstract

Children are deemed to be more vulnerable than adults to many environmental health hazards, including pesticides, and the effect of relatively low levels of pesticide exposure in children has become the focus of substantial research and regulatory activities. To identify the major exposure risk factors for intervention, the Pesticides in Young Children Border States Program requires studying children across the exposure measurement distribution, especially those with higher exposure measurements. Questions that could be used for exposure classification as a pre-screening tool may prove to be a cost-effective way to select the desired population for a study. A two-part approach was implemented to identify questions that indicate a higher likelihood of predicting a child's level of exposure to pesticides as input to future study designs:

- A literature review of previous exposure studies to evaluate questions used, and
- An analysis of a recent children's pesticide exposure study.

From the 20 relevant exposure study publications, 603 relationships, statistically significant and not, across 117 questions in 14 question categories were identified. The relationships for each question and chemical/metabolite combination were reviewed to determine the question's effectiveness for differentiating exposure levels. Generally the questions showing the most effectiveness were: residential pesticide use (inside and outside), occupation of household members, child's characteristics (age, ethnicity, income, and family hygienic practices. Several other questions, which were used less extensively in the studies, also showed some effectiveness.

Data from a recent study of children's exposure to pesticides conducted in Yuma, Arizona, was analyzed from two perspectives: traditional statistical analyses on predefined hypotheses of potential risk factors, and a data mining approach to explore the relationships existing in the data. Both analyses evaluated the relationships between the dialkylphosphate (organophosphate pesticide) metabolite levels in the children's urine samples, the pesticide levels in the household and school dust samples, and the questionnaire responses.

Questions that seem to have stronger relationships with the exposure levels across both the literature review and the analysis of the exposure study include the following: occupation of adults living in household, residential pesticide use, residential proximity to spraying and agricultural fields, characteristics of the subject that may indicate potential exposure activities, family hygienic practices that may mitigate the take home pathway exposure, where the child spends time (in home, away from home), and diet with respect to locally-grown fresh fruits and vegetables.

This report reviews the state of the science in relating questionnaire responses to environmental and biological measurements, primarily for children. Future studies that use biological monitoring and questionnaires should draw upon this and other recent research to refine study protocols with the recommendations noted.

Acknowledgements

No large project like this report is accomplished by the co-authors alone, and we would like to gratefully acknowledge those who helped in this process. Andy Tsang, Anteon Corporation, helped with some of the statistical analyses and facilitated the transition of the relationship database entries for the tables in Appendices B, C, and D. Dr. Peter Stephan, Anteon Corporation, was responsible for the technical preparation of the document, which included valuable comments for making the information-intensive tables more readable. Guadalupe Chapa, Fellow of Associated Schools of Public Health, provided comments and clarifications. Thank you.

None of this work would be possible without the continued commitment of the researchers focused on children's exposure to pesticides, both through the publications we reviewed and their willingness to answer questions related to their work. There are many other researchers in this area whose work, though not directly relevant to this report, is part of the set of building blocks upon which this area of research depends. We hope that those engaged in this field find the results of this work useful in their future research efforts. Finally, we gratefully acknowledge all of the families who have participated in these studies; without their cooperation we would not be able to progress in our understanding of these important issues.

Contents

Tables

Figures

1.0 INTRODUCTION

1.1 Introduction

The Pesticides in Young Children Border States Program (USEPA 2002) includes a series of studies designed to develop and implement an approach for examining the cumulative risks and potential health effects in children from repeated exposure to pesticides via multiple sources and pathways. The work of this program includes identifying the major exposure risk factors for intervention that require studying the full range of the exposure measurement distribution for children, especially for children with high exposure measurements. Various screening processes have been studied to help identify populations of interest. This report presents an evaluation of questions and environmental measures used in previous exposure studies as potential indicators of pesticide exposure (e.g., metabolite levels in children's urine).

1.2 Children's Exposure to Pesticides

Pesticides represent a wide range of chemicals that are used in agricultural production, vector control, and food preservation, as well as in residential environments for aesthetic and pest control purposes. Many pesticides currently registered in the United States have documented health effects, including acute toxicity and carcinogenicity. The effect of relatively low levels of pesticide exposure in children is an area of great scientific uncertainty, and has, therefore, become the focus of substantial research and regulatory activities. It is widely acknowledged that children are more vulnerable to many environmental health hazards than adults, including pesticides, because they are more exposed and because they may have elevated susceptibility (Needham and Sexton 2000).

The 1993 National Academy of Sciences report, *Pesticides in the Diets of Infants and Children*, highlighted this concern, and pointed out the complexities involved in the evaluation of aggregate exposures and cumulative risks (NRC 1993). The Food Quality Protection Act (FQPA) of 1996 called upon the U.S. Environmental Protection Agency (U.S. EPA) to implement risk assessment procedures that would be protective of children in their dietary exposures to pesticides, and that would factor in exposures from other sources, such as residential pesticide use (http://www.epa.gov/opppsps1/fqpa/).

The last decade has seen a substantial increase in studies aimed at characterizing children's exposure to pesticides. The U.S. EPA Science to Achieve Results (STAR) grant program (http://www.epa.gov/ncer/grants/), established in 1996, has provided an ongoing source of funds that are distributed to investigators throughout the country, based on peer review of proposed projects for scientific excellence. Several of the STAR grant programs have addressed children's exposure to pesticides (http://www.epa.gov/ncer/grants/ and USEPA 1997). A substantial research program on children's pesticide exposure (USEPA 2000b, USEPA 2003) has also been developed within the Agency, and in conjunction with other federal agencies, such as the Centers for Disease Control and Prevention (CDC). The work produced by these studies affords the first opportunity to evaluate systematically the effectiveness of particular exposure assessment methods.

1.3 Populations of Concern

Recent studies (Aprea 2000, Lu 2001, Adgate 2001, Curl 2003, Heudorf 2004, Morgan 2004**)** have tended to focus on relatively young children – either pre-school or elementary school age. It is believed that such children may be at greater risk, both in terms of exposure and susceptibility. Several sub-groups of children have been studied because they were believed to be at particularly high risk. For example, numerous studies (Koch 2002, Shalat 2003, Fenske 2002, Royster 2002) have focused on children in agricultural communities due to the high use rates of pesticides in and around these communities. Children of minority or disadvantaged groups have also been examined (Mills and Zahm 2001, Grossman 2001, Krinsley 1998, McCauley 2001, Quandt 2004) as part of a broader environmental justice initiative within the federal government. Finally, children whose parents are exposed to pesticides in the workplace have received special attention (Loewenherz 1997, Lu 2000, Azaroff 1999, Curl 2002), as it is well documented that workplace contaminants can contribute to the exposure of children. Participant recruitment strategies for these studies have ranged from convenience to probability-based sampling approaches.

1.4 Exposure Pathways and Patterns

Children's exposure to pesticides typically involves multiple pathways and multiple routes as shown in Figure 1.1, which is adapted from Cohen Hubal (2000a) and Cohen Hubal (2000b).

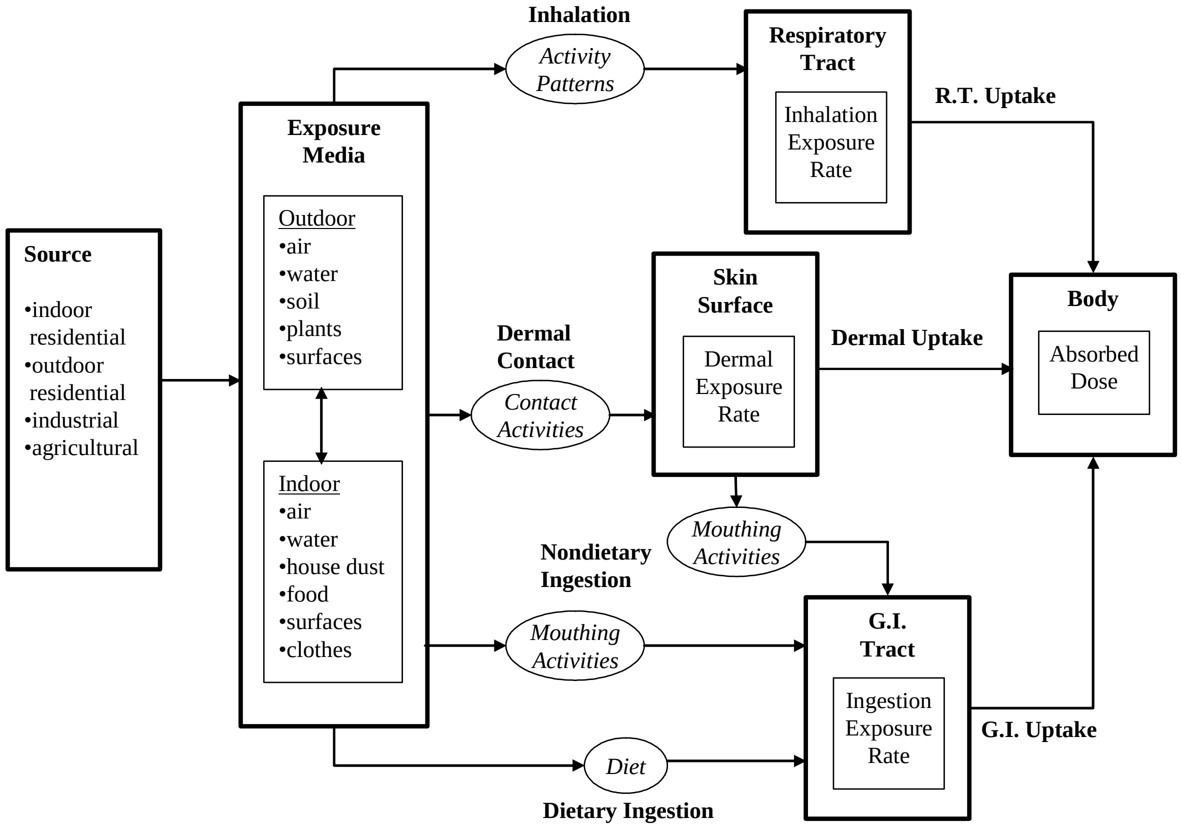

Figure 1.1 Activities, Pathways, and Routes Related to a Child's Exposure to Pesticides
(adapted from Cohen Hubal 2000a and Cohen Hubal 2000b)

Although most of the pathways and routes for children are similar to those for adults, the types of, and amount of time spent at, activities will differ from adults, and between children of different ages. As a result, the assessment of such exposures is among the most challenging tasks faced by exposure assessment scientists. In addition to exposure from diet and drinking water, children naturally explore their environment. Contact with surfaces, frequent mouthing activities, and even the consumption of soil or dust can contribute to exposures, and the temporal and spatial patterns of these exposures can be unpredictable (Black 2005).

1.5 Questionnaire Data

Questionnaires have long been used as a primary source of exposure data in epidemiologic studies. Most epidemiologic investigations are initiated after exposure has begun, and structured interviews or questionnaires are used to reconstruct historical exposure patterns. Such an approach raises questions regarding recall accuracy and possible bias (Teitelbaum 2002).

In contrast, contemporaneous studies of children's pesticide exposure often include some type of exposure measurement. In such study designs, questionnaires are generally used to identify important risk factors or exposure pathways. The exposure measurements are usually considered objective measures of exposure and are treated statistically as outcome variables. Questionnaire data are more easily collected than environmental measurements and are, therefore, more cost-effective. In large population studies questionnaires may be the only means available to ascertain exposure information. Yet questionnaires carry with them some important limitations. Questions are often posed in very general terms (e.g., "ever/never") and so fail to specify the temporal pattern of the exposure. Questions may also lack specificity in regard to behavior (e.g., does a child practice hand-to-mouth behavior), so that the frequency of the behavior remains unknown. While many researchers have attempted to address these limitations, there is also a limit to the number of questions that can be posed and the level of detail that can be requested before study participants become reluctant or unable to continue with the study.

Two large-scale research endeavors have made great strides in the development and use of questionnaires in exposure assessment and epidemiology. First, the National Human Exposure Assessment Survey (NHEXAS) (Sexton 1995b) was developed by the U.S. EPA with the specific goal of improving the quality of exposure data. Studies sponsored under this program have included probability-based subject recruitment, carefully tested questionnaires and diaries, and accompanying environmental measurements for a variety of environmental contaminants including pesticides. Second, the Agricultural Health Study (http://www.aghealth.org), led by the National Cancer Institute (NCI), has incorporated a prospective study design, using questionnaires at the outset of the study, and periodically throughout the life of the study. NCI has also worked collaboratively with U.S. EPA to examine the validity of questionnaire responses through the collection of exposure measurements (Dosemeci 2002). These studies are likely to add significant new knowledge to the field of exposure assessment.

1.6 Exposure Measurements

Measurements used in studies of children's exposure to pesticides have focused primarily on samples collected in the children's microenvironments (e.g., homes, daycare centers, special play areas). Sampling media have included soil, house dust, and wipes of surfaces. The hands of children have also been washed or wiped to provide a relative indicator of dermal exposure. An important feature of many of these studies has been the quantitation of children's behavior (e.g., frequency of hand-to-mouth contact), although most data on behavior have been collected in studies that have not included exposure measurements (Cohen Hubal 2000b). Finally, biological exposure methods have been used to evaluate pesticide exposure (Barr 1999, Barr and Needham 2002). Urine sampling has been used most frequently in studies of children's exposure, as it does not involve invasive sampling. Saliva monitoring of pesticides has proven feasible in animal models (Lu 2003). Current studies include the collection and analysis of saliva samples from young children in an effort to measure pesticides directly rather than as metabolic byproducts (www.sph.emory.edu/eoh/faculty/Lu.html).

Environmental and biological samples are considered objective measures of exposure, and they are sometimes viewed as representing a kind of "gold standard" when compared with questionnaire data. However, these measurements can have substantial analytic variability. For example, house dust is a complex matrix that may vary from location to location within a residence. Extraction procedures may produce a range of values for the same measured sample. Metabolites in urine may require derivatization before analysis, a step that can introduce variability in the analytical results.

Furthermore, exposure measurements can vary over time. This is most pronounced in the case of spot urine samples collected to measure exposure to pesticides that are rapidly excreted (1-3 days). Significant variability can be observed day to day for the same individual as well as for a group of individuals whose exposures are presumably the same. Thus, it is important to consider both the quality and the potential for variability in exposure measurements when assessing the utility of questionnaire data in predicting exposure levels.

1.7 Border States Program: Pesticides in Young Children

Research for the Pesticides in Young Children Border States Program is being, and has been, conducted in the U.S.-Mexico Border States of Arizona, California, New Mexico, and Texas as part of the Environmental Health Workgroup on the U.S.-Mexico Border program (http://www.epa.gov/orsearth) which was developed with the passage of the North American Free Trade Agreement (NAFTA). A three-phase approach was undertaken to address the project objectives. Phase I was a planning phase. It included a review of existing environmental pesticide exposure and health data, and the identification/review of techniques for measuring pesticides and pesticide biomarkers in environmental and biological media Phase II evaluated the extent and distribution of pesticide exposure in children living in the border region with the intent of identifying those children with the highest levels of exposure. Phase II also included methods development and evaluation studies to fill data gaps needed for the design of Phase III. The initial Phase II analyses suggest that the existing Phase II studies have not identified a definitive population for the Phase III activities.

The planned Phase IIIa would include a more complete monitoring of children classified in Phase II as "high end exposures." Follow-up on these children would include detailed measurements of their environmental exposure and biological monitoring for levels of metabolites. From the Phase IIIa effort, a study would be designed to evaluate the relationships between pesticide exposures and selected health outcomes and to define specific hypotheses to be tested. An epidemiological study (Phase IIIb) may then be performed to examine the specific hypotheses about the impact of pesticide exposure on health status/outcome of children. In order for the Pesticides in Young Children Border States Program to move towards the Phase III goals, better exposure classification tools are needed to identify a subset of children likely to have higher exposure levels so that a Phase IIIa study can be performed in a cost effective manner.

1.8 Motivation and Goal of the Project

The current goal of many exposure assessment studies is to collect information using questionnaires and diaries, environmental measurements and biomarkers, to develop an understanding of the levels of chemicals to which people are exposed and to understand how these exposures might occur. This approach is useful when the objective of the study is to determine the population distribution of exposure to a chemical. A different approach is needed; however, when the objective is to identify those individuals with higher exposure levels for intervention and additional study. In many exposure assessment studies, the chemical/metabolite levels from most of the participants are either not detectable or below the level of concern for the chemical of interest. Thus, a large proportion of the available funding for a study may be used to collect data that has little value in identifying and subsequently protecting the most highly exposed individuals. Since the collection and analysis of environmental and biological samples is an expensive portion of the exposure evaluation process, considerable savings in time and money may be realized if questionnaires could be used in an effective manner to predict those individuals with higher exposure levels.

Because of the potential reduced costs and other benefits, the Pesticides in Young Children Border States Program would like to employ questionnaires in the Phase IIIa study for exposure classification to aid in selecting the desired population for study. This selection would produce either an enriched population (i.e., a larger percentage of individuals with higher exposure levels) or would eliminate from further analysis individuals with lower exposure levels. These interests require having questions that can predict the likelihood that an individual has been exposed to pesticides.

1.9 General Approach and Report Contents

The work presented in this report offers researchers another tool for selecting the questions to be included in a study's design. In some studies, experts using a Delphi consensus process (http://www.scu.edu.au/schools/gcm/ar/arp/delphi.html) to consider hypothetical and observed relationships described in the research literature that are pertinent to the study's interests. This report reviews the state of the science in terms of how well questionnaire responses, from previous exposure studies, are statistically related to environmental and biological measurements for children. The approach for evaluating these relationships was twofold, and includes:

- A literature review of previous exposure studies to summarize the existence of such quantitative and qualitative relationships, and
- An analysis of a recent children's pesticide exposure study in Yuma, Arizona, which included questionnaires and measurements.

Section 2 of this report provides a summary of this project's results and recommendations for additional work. It describes both the questions and categories of questions that were found to be the most useful in differentiating children's pesticide exposure levels to pesticides in the context of future study designs. Section 3 describes the methodology used for the literature review and the statistical analysis of the Yuma study data. Section 4 includes details of the results from the literature review and from the Yuma Study data. Section 5 lists the references cited in this report. Appendix A lists the publications included in the literature review. Appendices B, C, and D present the overview, detail, and comments tables describing the relationships between questionnaire responses and pesticide exposure measurements extracted from the literature review, as summarized in Section 4. Appendix E describes the questions for which relationships from the literature review were tracked. Appendix F lists the chemicals used in the Yuma Study analyses, and describes the molar weighting process used to create the combinations of the chemicals/metabolites. Appendix G describes the methodology and provides detailed results of the data mining approach for the Yuma Study as summarized in Section 4.

2.0 SUMMARY AND RECOMMENDATIONS

2.1 Introduction

Children are widely acknowledged to be more vulnerable than adults to many environmental health hazards, including pesticides, because they are more exposed, and because they may have elevated susceptibility (Needham and Sexton 2000). The effect of relatively low levels of pesticide exposure in children is an area of great scientific uncertainty and has, therefore, become the focus of substantial research and regulatory activities. The work of the Pesticides in Young Children Border States Program (USEPA 2002) includes identifying the major exposure risk factors for intervention, which requires studying children across the exposure measurement distribution, especially those with higher exposure measurements.

The goal of many exposure assessment studies is to collect information using questionnaires and time-activity diaries, environmental measurements and biomarkers, to develop an understanding of the levels of chemicals to which people are exposed and to understand how the exposures might occur. In the typical exposure assessment study, the measurements from most of the participants are either not detectable or below the level of concern for the chemical of interest; thus, a large proportion of available funding for a study may be spent collecting data that has little value in identifying, and subsequently protecting, the most highly exposed individuals. Considerable savings in time and money may be realized if questionnaires could be used for exposure classification that would aid in selecting the desired population for a study. Such a screening tool would help produce either an enriched population (i.e., a larger percentage of individuals with higher exposure levels) or would eliminate individuals with lower exposure levels from further review.

The objective of this project is to identify questions that indicate a higher likelihood of predicting a child's level of exposure to pesticides as input to future study designs. The work presented in this report reviews how well questionnaire responses, based on previous exposure studies, are statistically related to environmental and biological measurements for children. The approach for evaluating these relationships was twofold, and includes:

- A literature review of previous exposure studies to summarize the existence of such quantitative and qualitative relationships, and
- An analysis of a recent children's pesticide exposure study in Yuma, Arizona, which contained questionnaires and measurements.

This section describes both the questions and categories of questions that were found to be the most useful in differentiating children's pesticide exposure levels to pesticides in the context of future study designs, discusses issues in developing effective screening tools, and includes recommendations for additional work.

2.2 Methods

Questions for a new exposure study design are usually selected based on theoretically-defined or hypothesis-driven relationships, the results of relationships tested in previous exposure studies, and the interests of the new study. Relationship, as used in this report, is defined as a systematic correspondence between the values of two variables, that is, questionnaire responses and analytical measurements. This correspondence may or may not be statistically significant. Some questions or categories of questions become the typical selections for exposure studies because of the results from previous studies. This report reviews the state of the science in relating questionnaire responses to environmental and biological measurements, primarily for children, based on results and data from previous exposure studies. A two-part approach evaluated questions from the studies to identify those showing strong, that is, statistically significant, relationships with pesticide exposure levels.

One part of the approach was based on a literature review of previous exposure studies. A search through several resources identified over 100 citations that might meet the criteria set for this evaluation. The abstracts and full publications, where necessary, were reviewed with respect to the following criteria:

- Was pesticide exposure studied?
- Were relationships between questions and measurements from monitoring, and preferably urine, samples described? and
- Were children included as part of the population studied?

The 20 publications that were selected as being relevant for evaluating the usefulness of questions were reviewed in detail to determine the relationships that were considered and statistically analyzed in each study. A simple MS Excel database was created to track the relationships between questions, and environmental and biological measurements, as noted in the publications, whether or not the statistical tests of the relationships were statistically significant. Detailed information about each relationship was compiled to allow for more in-depth evaluations by researchers as their interests dictated. The questions were grouped into categories for evaluation and questions showing overall significance across the publications were highlighted. It should be noted that the 20 publications represent 14 distinct studies. Details on the publication selection process and the extraction of the relationship information are described in section 4.2.

The second part of the approach reviewed a recent study of children's exposure to pesticides from Phase II of the Pesticide Exposure and Health Effects on Children Initiative (section 1.6). Some analyses had already been performed to meet the study's objectives and were summarized in a report (CDC 2002). Subsequent analyses of the data using a data mining approach were then performed for this project to identify relationships that exist in the data rather than ones that are predetermined by the study's hypotheses. Preliminary bivariate analyses and principal component analyses were performed to fine-tune the analysis approach and to help understand some of the underlying structures within the data. The main type of analysis performed was Classification and Regression Trees (CART). This technique was used to investigate several scenarios of questions and dust measurements as potential predictors for the sum of the ethylated dialkylphosphates (DAPs) and the sum of the methylated DAPs (Appendix F). The questions and dust measurements that were selected as predictors from the CART analysis in more than 50% of the scenarios were identified as useful in differentiating exposure levels.

2.3 Results

2.3.1 Literature Review

Relationships are evaluated as the means for testing a study's hypotheses, and results of these evaluations are included in publications based on the study. From the 20 relevant publications, 603 relationships across 117 questions in 14 question categories were identified. All statistically significant and non-significant relationships were noted except for a large number of non-significant relationships alluded to in Sexton (2003) (section 4.2.2.2). Appendix E lists the questions included under each of the 14 categories.

Table 2.1 Distribution of Questions and Relationships Across 14 Question Categories

Group	Category	# questions[a]	# relationships[b,c]	% relationships	# publications[d]
Source	Residential pesticide use	32	100	16.6	11
Source	Household characteristics	17	73	12.1	7
Source	Residential sources (environmental measurements)	3	13	2.2	4
Source	Household occupation	16	115	19.1	11
Source	Residential proximity to agricultural fields	2	72	11.9	10
Source	Residential location	5	14	2.3	4
Behavior	Subject's personal characteristics	6	78	13.0	9
Behavior	Child's behaviors	6	20	3.3	4
Behavior	Dietary behaviors	4	16	2.7	3
Behavior	Family hygiene practices	11	81	13.4	7
Behavior	Smoking-related activities	3	4	0.7	1
Behavior	Work exposure practices	4	4	0.7	2
Other	Related exposure levels	2	5	0.8	1
Other	Health	6	8	1.3	1
	Total	117	603	100	

[a] See Appendix E for list of questions tracked in the literature review.
[b] # relationships obtained by totaling numbers from tables in Appendix B for each category.
[c] See section 4.2.2.2 regarding relationships from Sexton (2003).
[d] Number of publications from the relevant list that were sources for the relationships.

Eighty-six percent of the relationships were in the categories of residential pesticide use, household characteristics, household occupation, residential proximity to agricultural fields, subject's personal characteristics, and family hygiene practices (Table 2.1). These six categories represent questions whose relationships with exposure measurements have both a strong theoretical basis, and could be reasonably evaluated through the study designs.

Table 2.2 Distribution of Questions and Relationships Across Medium Measured

Medium	# questions[a,b]	# relationships[c,d]	% relationships	# publications[e]
Urine – DAP	47	267	44.3	12
Urine – non-DAP	68	129	21.4	5
Dust	42	187	31.0	8
Indoor Air	2	3	0.5	1
Outdoor air	1	2	0.3	1
Personal air	2	4	0.7	1
Soil	2	8	1.3	1
Solid food	2	3	0.5	1
Total	166[f]	603	100	

[a] See Appendix E for list of questions tracked in the literature review.
[b] Some questions were related to measurements in more than one medium.
[c] See section 4.2.2.2 regarding relationships from Sexton (2003).
[d] # relationships obtained by totaling numbers from tables in Appendix B for each category.
[e] Number of publications from the relevant list that were sources for the relationships.
[f] Some questions are used with more than one medium, thus, the total differs from the total in Table 2.1.

Sixty-six percent of the relationships considered metabolites in urine measurements (Table 2.2). The majority of these relationships were with DAP-based metabolites. Dust measurements have the next largest number of relationships with 31%. Both urine and dust have been shown in other studies, mostly with adults, to be more useful indicators of exposure level, and easier to collect from participants than other media. Few studies extended measurement collection to other media. Studies with measurements of other environmental media in conjunction with children's urine are not plentiful and were not evaluated.

The questions identified in the publications were reviewed for their ability to differentiate children's pesticide exposure levels based on whether the majority of the question's relationships were found to be statistically significant ($p \leq 0.05$) or marginally significant ($0.05 < p \leq 0.10$). This criterion summarizes the results of the relationships at a very high level, and does not take into account any differences in populations sampled or in interview/measurement situations for the studies described in the publications. Thus, the relationships for a question or category of interest should be reviewed in more detail with information in Section 4 and in Appendices B, C and D to determine their applicability to a particular situation.

Summary statistics for the exposure measurements, when available, were extracted from the publications for each relationship to provide researchers with additional information to help understand the relationships analyzed. When judging the appropriateness of a question for a future study, the researcher should also consider the difference between statistical and practical significance. The p-value associated with each relationship analyzed measures the strength of the relationship from the statistical perspective. Measures of central tendency, e.g., means, medians and coefficients from a multiple or logistic regression, give insights into the strength of the relationship from a practical level. The difference in the medians of two groups may be statistically significant, but both median values may be lower than measurement levels of interest for mitigating potential exposure. Thus, the magnitude of the difference between the two groups may not be useful for practical considerations.

Dust and urine measurements were found in 97% of the relationships. Measurements for the other media were found in only two of the 20 publications: Sexton (2003) and Simcox (1995). The relationships for each question and chemical/metabolite combination were reviewed to determine the question's effectiveness in differentiating the exposure levels. Not all question/chemical combinations were evaluated in the studies to the same extent. The number of relationships in which a question is evaluated, especially when the question is used with more than one study population, gives additional credence to the question as a potential differentiator. Generally the questions showing the most effectiveness are:

- residential pesticide use (inside and outside)
- occupation of household members
- child's characteristics (age, ethnicity, income)
- family hygiene practices
- household dust.

Several other questions also show some effectiveness:

- pets
- household location (urban vs non-urban)
- dietary behaviors (organic food)
- exposure levels of household members
- health status (diseases)
- smoking behaviors
- proximity to agricultural fields (for house dust only).

The number of relationships evaluated for the second group of questions was small, indicating that their effectiveness has not been tested as extensively as for the questions in the first group.

For urine measurements, questions showing usefulness as indicators of a child's pesticide exposure level cover the areas of residential pesticide use both indoors and outdoors, household occupation, subject's personal characteristics, family hygiene practices, and smoking behavior. Each of these indicators seems plausible, in that such relationships have been seen in previous investigations of environmental exposures (e.g., lead exposure in children). Some smoking activities were identified as potential differentiators (section 4.2.5.5); however, considerations regarding the study population in which they occurred and the very limited transferability of any pesticides through second-hand smoke makes this question less effective for purposes of this project. For dust measurements, the questions showing usefulness as indicators of a child's pesticide exposure level cover the areas of household occupation, residential proximity to spraying, and family hygienic behavior. Each of these indicators also seems plausible in terms of pesticides being present in the child's environment. These questions represent potential exposure from the take-home pathway and from agricultural pesticide spraying. A list of the specific questions and chemical/metabolite combinations found to be generally effective as differentiators of the exposure levels are presented in section 2.5.

The set of question categories used in this report provides one perspective for organizing the relationships. Three risk or exposure factors related to the take-home or para-occupational exposure pathway were analyzed as separate categories in this report: household occupation, family hygiene practices, and work exposure/practices. Household occupation was considered a source that would result in measurable differences in children's pesticide exposures, because it may represent a surrogate for the actual exposure levels of household members employed in agriculture. Children may be exposed to agricultural chemicals through this pathway and their exposure levels are dependent on the occupational status, work, handling, and hygiene practices of agricultural workers in their households.

Two other risk factors examined in this report also contribute to the para-occupational exposure pathway. Family hygiene practices and work exposure/practices were considered behavioral practices that could modify pesticide exposure to agricultural workers and their family members. There were fewer relationships in these two categories because the studies under review were primarily environmental exposures studies conducted in agricultural communities with a focus on children. If these studies had been strictly occupational exposure assessment studies, more questions related to the work and family hygiene practices might have been included in these studies.

2.3.2 Children's Pesticide Exposure Study (Yuma Study)

A study of children's exposure to pesticides was conducted in Yuma, Arizona for 152 households. In cooperation with eight local schools in the study area, families who were permanent residents of the area with children in kindergarten or first grade were self-selected to participate in a study conducted from October 1999 through February 2000. A urine sample was collected from each of these children (principal participants) and from any sibling in the household between the ages of 2 and 11 years. The urine samples were measured for the six most common dialkylphosphate (DAP) metabolites associated with OP pesticides. A dust sample was collected from each household, and from classrooms, with principal participants. These samples were measured for specific organophosphorous (OP), organochlorine, pyrethroid, and carbamate pesticides. A questionnaire regarding characteristics and practices of the family and the principal participant child was administered to each household. The study included 152 children as principal participants and 127 siblings. A total of 244 urine samples were available for analysis. Dust samples were available from 152 households and from 25 kindergarten and first-grade classrooms in six of the participating schools.

In the Yuma Study report (CDC 2002), the urine, dust, and questionnaire data were analyzed in order to describe levels of pesticide exposure and to identify any associations between questionnaire data and pesticide exposure levels. Traditional statistical techniques were performed to test predefined hypotheses. Urine measurements from all children in a household, household and school dust measurements, and responses for a selected subset of questions were included in the statistical analyses.

A second set of statistical analyses was performed on the Yuma study data specifically for this project. The analyses included only principal participants from the eight schools and two grades in the initial study design. A data mining approach was used to identify potential predictors without specifying a priori hypotheses between the biomarker measurements and the questions and dust measurements, that is, the approach was used to explore the relationships that exist in the data (Hand 1999).

The statistical analyses in CDC (2002) focused on six DAPs (DEP, DETP, DEDTP, DMP, DMTP, DMDTP) and the molar-weighted sums of the ethylated and methylated DAPs (Appendix F).

Table 2.3 Questions and Dust Measurements from the Yuma Study Having Strong Relationships with the DAPs, Adjusted for Creatinine (CDC 2002)

	DEP, DETP, or DEDTP[a]	DEAP[b]	DMP, DMTP, or DMDTP[a]	DMAP[c]
Questions[d,e]				
Used pesticide inside home in last month	X	X	X	
Distance from home to agricultural field	X			
Father working in agriculture			X	
Other adult in house working in agriculture	X	X	X	
Father, mother or other adult working in agriculture			X	
Household and/or School Dust[f]				
carbaryl		X		X
chlorpyrifos[g]	X[g]	X[g]	X	X
cis-permethrin	X	X	X	X
cy-permethrin	X	X	X	X
diazinon[g]	X[g]		X	X
gamma-chlordane		X		
proxopur	X	X	X	
trans-permethrin	X	X	X	X

[a] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.

[b] DEAP is a summary variable made from summing molar weights of DEP, DETP and DEDTP, and is noted as DEOP in CDC (2002). (Concentrations < Limit of detection (LOD) were replaced with LOD/2.)
[c] DMAP is a summary variable made from summing molar weights of DMP, DMTP and DMDTP, and is noted as DMOP in CDC (2002). (Concentrations < LOD were replaced with LOD/2.)
[d] See Tables 4.3.4, 4.3.5, and 4.3.6 for relationships with specific metabolites or sums.
[e] Full description of questions can be found in Table 3.1.
[f] See Tables 4.3.7, 4.3.8, 4.3.9, and 4.3.10 for relationships with specific metabolites or sums
[g] These are the only OPs for which relationships with ethylated DAPs are expected. All other significant relationships may be indicative of heavy pesticide use, although they do not correspond to the metabolite found.

Of the questions analyzed, recent indoor pesticide use, household members working in agriculture, and distance from home to agricultural fields have statistically significant relationships with the ethylated DAP sum, and individual ethyl and methyl DAPs (Table 2.3). The directions for some of the relationships, however, are the opposite of what might be expected based on current knowledge, that is, an exposure activity is not related to a higher measurement level. Dust measurements of chlorpyrifos and the permethrins are strongly related with both the ethylated and methylated DAP sums. Some of the significant relationships between house/school dust measurements and the DAP measurements are unexpected. These may be indicators of heavy pesticide use, although they do not correspond to the metabolite found. The regression coefficients for these statistical analyses are very small and may indicate that the relationships are not necessarily practically significant. The report authors note:

> The regression models in which the slopes were small but were statistically significant may suggest either that a) true associations existed, but the numbers of significance were less than the numbers measured in the statistical programs or b) the associations were meaningless and based solely [on] the probability of finding statistical significance if enough tests were run. (CDC 2002)

Another set of analyses was conducted for this project using the data mining technique Classification and Regression Trees (CART). Six scenarios (Table 2.4) of potential predictors containing questions, and house and school dust measurements were evaluated for the sums of ethylated and methylated DAPs (Appendix F). The scenarios covered three levels of increasing measurement burden (questions, household dust, and school dust) with two sets of questions for each level.

Table 2.4 Questions and Measurements Included in the Yuma Study CART Analysis Scenarios for Each DAP Sum

Scenario	Full Set of Questions[a]	Limited Set of Questions[b]	House Dust Measurements	School Dust Measurements
1	X			
2		X		
3	X		X	
4		X	X	
5	X		X	X

Scenario	Full Set of Questions[a]	Limited Set of Questions[b]	House Dust Measurements	School Dust Measurements
6		X	X	X

[a] Full set includes limited set of questions.
[b] Questions from full set considered more likely to be predictors of children's pesticide exposure level.

Only the limited set of questions was included in all six scenarios. Thus, the remaining questions and dust measurements did not have as many opportunities to be selected as predictors in the CART analyses. The criterion used to determine whether a question or dust measurement had a strong relationship with one of the DAP sums was that it was selected in the CART analyses a majority of times (> 50%) based on the number of scenarios in which the predictor was included. Thus, for a house dust measurement to denote a strong relationship with the biomarker measurement, the dust measurement would have to be selected in at least three of the four CART analyses. This type of criterion identifies predictors that are strong, because they are more universal across the scenarios.

The CART analyses were conducted using responses from the principal participant children in the initial study design, that is, the children who were in one of the eight schools and were in kindergarten or first grade. All six scenarios were conducted with 130 principal participants. An explanation of the CART technique and details of the CART analyses can be found in Appendix G.

Table 2.5 Questions and Dust Measurements from the Yuma Study Having Strong Relationships with the Sum of Methylated DAPs Based on the Data Mining Approach

Predictor	Description	LTD Q[a]	% Scenarios Predictor Selected	Number of Scenarios with Predictor Included
Questions				
HEIGHT	Child's height (inches)	X	100	6
NCATWRKD	Father's occupation -- categories		67	3
SCHOOL	Child's school	X	83	6
WEIGHT	Child's weight (lbs)	X	67	6
WHEEL	Distance between home and field - rotary wheel		67	3
WHERTIME	Room where child spends most awake time	X	100	6
WHNCHEMO	Last time field treated with pesticides?		100	3
House Dust Measurement Sums[b]				
WCHLPYRF	Weighted chlorpyrifos		100	4
WDIAZNON	Weighted diazinon		75	4
WPERMSUM[c]	Weighted sum of cis-permethrin and trans-permethrin		100	4

School Dust Measurement Sums[b]				
None				

[a] X -- Question was in the limited subset and thus included in all six scenarios.
[b] Description of measurement sums can be found in Appendix F.
[c] Although these relationships do not correspond to the metabolite found, they may be indicative of heavy pesticide use or may be a surrogate for some other exposure event.

Questions related to agricultural fields and child size, and household dust measurements were selected as having strong relationships for the sum of methylated DAPs; however, school dust measurements were not selected (Table 2.5). Initial analyses for the sum of ethylated DAPs included CHLDTM3 (Child spends time at school) as a strong predictor, however, it was difficult to understand the responses in the context of the population analyzed, that is, children in kindergarten and first grade. Analyses were then performed excluding CHLDTM3. Subsequently, CHLDTM3 was considered a possible indicator of additional time spent at school, which might reflect additional exposure from the home environment for the "NO" respondents because they were not spending more time at school (Table G.3.6). Questions relating to diet, residential pesticide use, time spent at home, and agricultural fields, and measurements from both the house and school were selected for the sum of the ethylated DAPs excluding CHLDTM3 (Table 2.6).

Table 2.6 Questions and Dust Measurements from the Yuma Study Having Strong Relationships with the Sum of Ethylated DAPs Based on the Data Mining Approach (Excluding CHLDTM3)

Predictor	Description	LTD Q[a]	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
Questions				
ETHNIC	Child's ethnic and racial background		67	3
HOURAWAY	Number hours/wk child not at home	X	100	6
NRMSPRYD	Number of rooms sprayed last month		100	3
VEGGIES	How often child eats local fresh fruit/veg?		67	3
WEIGHT	Child's weight (lbs)	X	100	6
WHEEL	Distance between home and field - rotary wheel		100	3
WHNCHEMO	Last time field treated with pesticides?		100	3
House Dust Measurement Sums[b]				
WCHLPYRF[c]	Weighted chlorpyrifos		75	4
WDUSTBAL	Weighted sum of dust analytes except OP pesticides		100	4
WDUSTSUM	Weighted sum of all dust analytes		100	4
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin		100	4
School Dust Measurement Sums[b]				

Predictor	Description	LTD Q[a]	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
SWCHLPYR[c]	Weighted chlorpyrifos		100	2
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol		100	2
SWOPSUM	Weighted sum of OP pesticides		100	2

[a] X -- Question was in the limited subset and thus included in all six scenarios.
[b] Description of measurement sums can be found in Appendix F.
[c] Although these relationships do not correspond to the metabolite found, they may be indicative of heavy pesticide use or may be a surrogate for some other exposure event.

2.4 Summary of Results from Two Approaches

The Yuma Study report (CDC 2002) looked at each question or measurement individually and included siblings as well as principal participants using a general linear estimating model with repeated measures for 152 households. The potential risk or exposure factors selected for analysis were the subset of the full set of questions that were available for siblings as well as principal participants, that is, the child's physical characteristics and household characteristics or practices. The data mining approach used all the questions and measurements simultaneously in CART analyses for only 130 principal participants in kindergarten and first grade. Given these and other differences, it may be useful, with caution, to look at a summary of the predictors selected under both approaches to evaluate the universal strength of the predictors. It should be noted that some of the significant relationships between house/school dust measurements and the DAP measurements may be indicators of heavy pesticide use, although they do not correspond to the metabolite found.

Table 2.7 Comparison of Selected Predictors from Yuma Study Report[a] (CDC 2002) and Data Mining Approach[b] for Methylated Sum of DAPs[c]

Yuma Study Report	Data Mining Approach
No Questions	Child's characteristics (height, weight)
	Proximity to agricultural fields, spraying conditions
	Father's occupation
	Where in house child spends time[d]
	Child's school[d]
Household dust[e]: diazinon, chlorpyrifos, permethrins, carbaryl	Household dust[e]: diazinon, chlorpyrifos, permethrins
School dust[e]: diazinon, permethrins,	School dust: none

[a] Based on Tables 4.3.4, 4.3.7, and 4.3.9 and the molar-weighted sum of methylated DAPs (adjusted for creatinine).
[b] Based on Table G.3.5 and log (molar-weighted sum of methylated DAPs-adjusted for creatinine).
[c] See definition in Appendix F.

[d] Questions were not analyzed in CDC (2002) because responses were not available for siblings.
[e] Although these relationships do not correspond to the metabolite found, they may be indicative of heavy pesticide use or may be a surrogate for some other exposure event.

Table 2.8 Comparison of Selected Predictors from Yuma Study Report[a] (CDC 2002) and Data Mining Approach[b] for Ethylated Sum of DAPs[c]

Yuma Study Report	Data Mining Approach
Recent use of pesticides inside home	Recent use of pesticides inside home
	Child's characteristics (weight, ethnicity)
Other adult in household working in agriculture	
	Proximity to agricultural fields, spraying conditions
	Child's time spent away from home[d]
	Diet - local fruits/vegetables[d]
Household dust[e]: OPs, permethrins, non-OPs	Household dust[e]: OPs, permethrins, non-OPs
School dust[e]: permethrins	School dust[e]: OPs

[a] Based on Tables 4.3.4, 4.3.7, and 4.3.9 and the molar-weighted sum of ethylated DAPs (adjusted for creatinine).
[b] Based on Table G.3.4 without CHLDTM3 as a potential predictor and log (molar-weighted sum of ethylated DAPs-adjusted for creatinine).
[c] See definition in Appendix F.
[d] Questions were not analyzed in CDC (2002) because responses were not available for siblings.
[e] Although these relationships do not correspond to the metabolite found, they may be indicative of heavy pesticide use or may be a surrogate for some other exposure event.

The analyses in the Yuma Study report (CDC 2002) consider questions and measurements that would apply as risk factors to the siblings as well as the principal participants, and for which there were available responses. These factors may affect explanations of the variability of the pesticide metabolite levels across siblings within a household. The data mining approach focuses the analyses on a group of children with less diverse characteristics in terms of school and grade level and includes all questions regarding the principal participants. For the sum of methylated DAPs, no pesticides in household dust were similar across both approaches and no questions were found significant in the Yuma Study report (Table 2.7). For the sum of ethylated DAPs, recent use of pesticides inside the home, and OPs, non-OPs, and permethrins in the household dust stand out as differentiators of children's pesticide exposure level across both approaches (Table 2.8). The difference in analysis techniques and the difference in participants included in the analyses may help explain the differences in the predictors selected across the two approaches. Also, some questions regarding sibling activities were not analyzed in CDC (2002) because that information was not collected as part of the study design. The best use of these results is as "indicators" of predictors that are more useful in differentiating the exposure levels.

Two approaches were taken in this project to identify questions that were useful in differentiating children's pesticide exposure levels as a screening tool for selecting participants of interest in future exposure studies. One approach reviewed relationships with questions described in the literature from previous exposure studies. The second approach reviewed relationships with questions based on a study of children's pesticide exposure in Yuma, Arizona.

Table 2.9 Summary of Predictors Selected as Useful in Differentiating Children's Pesticide Exposure Levels Across Two Approaches

Literature Review[a]	**Yuma Study**[b]
Residential pesticide use	Residential pesticide use
Pets[c]	
Occupation of household members	Occupation of household members
Household location: urban vs non-urban[c]	
Child's personal characteristics	Child's personal characteristics
Dietary behaviors (organic food) [c]	Dietary behaviors (local fruits/vegetables)
Family hygiene practices	
Exposure levels of household members[c]	
Health status (diseases) [c]	
(Proximity to agricultural fields) [d]	Proximity to agricultural fields, spraying conditions
	Where child spent time at home/not, or within home

[a] Based on the "c" tables: Tables 4.2.6.c - 4.2.21.c.
[b] Based on Tables G.3.5 and G.3.7.
[c] Only a small number of relationships evaluated these questions.
[d] Proximity to agricultural fields for the literature review was related to dust measurements only.

The types of questions that seem to be strong differentiators of children's pesticide exposure levels based on both approaches are:

- occupation of adults living in household
- residential pesticide use
- residential proximity to spraying and agricultural fields
- characteristics of the subject that may indicate potential exposure activities
- family hygiene practices that may mitigate the take-home pathway exposure
- where the child spends time (in home, away from home)
- diet with respect to locally-grown fresh fruits and vegetables (Table 2.9).

It seems clear from this review that children's proximity to pesticide use can increase the likelihood of their exposures, whether the source is residential pesticide use, agricultural pesticide use near the residence, or pesticide exposure in the workplace that results in residential contamination. It is also evident from one study that replacement of conventionally produced fresh fruits and vegetables (i.e., pesticides used in production) with organic produce can result in substantial decreases in urinary pesticide metabolite levels.

Future studies that use biological monitoring and questionnaires should draw upon recent research to refine study protocols. Several suggestions are provided in the following section of recommendations.

2.5 Recommendations

2.5.1 Effective Differentiators of Exposure Level

Based on an evaluation of the relationships found in the literature review, forty-two questions were identified as effective in differentiating exposure levels of at least one chemical/metabolite in Table 2.11. These questions are offered as a resource of recommended questions with specific chemicals or metabolites for future study designs. Note that the questions were evaluated here as a screening tool to create an enriched population of participants with higher exposure levels. Thus their future use is better suited to similar purposes.

The chemicals and metabolites found in the publications were assigned to seven groups, for presentation purposes, based on medium and type of chemical metabolite measured (Table 2.10).

Table 2.10 Description of Code Names and Groups Assigned to the Chemicals and Metabolites, Sorted by Code

	Chemicals/Metabolites		
Medium	**Grouping**	**Code**	**Description**
urine	1-Non-DAP	1NAP	1-Naphthol
urine	1-Non-DAP	4NITR	4-Nitrophenol
other[a]	6-Chemical	ATZ	Atrazine
urine	1-Non-DAP	ATZM	Atrazine mercapturate
other	6-Chemical	AZM	Azinphosmethyl
other	6-Chemical	AZMPH	Azinphosmethyl+Phosmet
other	6-Chemical	CHLR	Chlorpyrifos
urine	3-DAP Sum	DAP1	DMP+DMTP+DMDTP+DEP+DETP+DEDTP
urine	4-DAP Detect	DAP2	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
urine	5-DAP High	DAP3	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement)[b]
urine	2-DAP	DEDTP	Diethyldithiophosphate (DEDTP)
urine	2-DAP	DEP	Diethylphosphate (DEP)
urine	2-DAP	DETP	Diethylthiophosphate (DETP)
urine	2-DAP	DMDTP	Dimethyldithiophosphate (DMDTP)
urine	2-DAP	DMP	Dimethylphosphate (DMP)
urine	2-DAP	DMTP	Dimethylthiophosphate (DMTP)
other	6-Chemical	EPAR	Ethyl parathion

	Chemicals/Metabolites		
Medium	**Grouping**	**Code**	**Description**
urine	3-DAP Sum	ETHL1	DEP+DETP
urine	3-DAP Sum	ETHL2	DEP+DETP+DEDTP
urine	4-DAP Detect	ETHL3	DEP, DETP, DEDTP (at least one detectable measurement)
other	6-Chemical	MAL	Malathion
urine	1-Non-DAP	MDA	Malathion dicarboxylic acid
urine	3-DAP Sum	MTHL1	DMTP+DMDTP
urine	3-DAP Sum	MTHL2	DMP+DMTP+DMDTP
urine	4-DAP Detect	MTHL3	DMTP (detectable measurement)
urine	4-DAP Detect	MTHL4	DMP, DMTP (at least one detectable measurement)
urine	5-DAP High	MTHL5	DMP, DMTP (at least one high measurement)[b]
urine	7-Metabolite NA	NA	Specific metabolite was not provided
other	6-Chemical	OPSUM	OP sum[c]
other	6-Chemical	PHSM	Phosmet
urine	1-Non-DAP	TCPY	3,5,6-Trichloro-2-pyridinol

[a] Medium is noted as urine or other (any other medium sampled).
[b] See definition of high measurement in Azaroff (1999)
[c] OP sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet.

Forty-eight questions across 12 question categories were considered effective differentiators of the exposure measurement levels of at least one chemical/metabolite evaluated in the relevant publications (Table 2.11). Their effectiveness was determined by whether a majority (> 50%) of the relationships for a given chemical/metabolite were statistically or marginally significant.

Table 2.11 Questions Considered Effective Differentiators of Children's Pesticide Exposure Levels Based on a Literature Review of Previous Exposure Studies

Medium	Q Category	Q #[a]	Q Description[b]	Chemicals/ Metabolites [c]
Dust				
	Residential pesticide use	Q119	Outside Treated[d]	CHLR
	Household characteristics	Q202	Property Used As a Farm[d]	CHLR
		Q213	Size of Household	AZM
	Residential sources (environmental measures)	Q303	Outdoor Soil	EPAR
	Household occupation	Q401	Agricultural Workers in Household	AZM

Medium	Q Category	Q #[a]	Q Description[b]	Chemicals/ Metabolites [c]
		Q404	Applicator vs Farmworker	AZMPH, EPAR
		Q405	Applicator vs Non-applicator	CHLR, EPAR
		Q407	Applicator and Farm worker vs Reference	AZM, AZMPH, CHLR, EPAR, PHSM
		Q412	Fieldworker vs Pesticide Handler	AZM
		Q415	Tree Thinning	OPSUM
		Q416	Number in Household with High Pesticide Contact	OPSUM
	Residential proximity to agricultural fields	Q501	Proximity of Home to Pesticide-Treated Farmland/Orchard	AZMPH, EPAR
	Residential location	Q605	Vehicle vs House	AZM
	Family hygiene practices	Q1006	Work Clothes Worn Indoors	AZM, OPSUM
		Q1009	Number of Weeks Since Last Vacuuming	OPSUM
Indoor Air				
	Household characteristics	Q202	Property Used As a Farm[d]	CHLR
Personal Air				
	Residential pesticide use	Q102	Inside Treated	CHLR
		Q124	Level of Pesticide Use[d]	ATZ
Soil				
	Household occupation	Q409	Farmer and Farm Worker vs Reference	AZM
Solid Food				
	Residential pesticide use	Q119	Outside Treated[d]	CHLR
Urine				
	Residential pesticide use	Q104	Inside Treated - Bedroom	TCPY
		Q106	Inside Treated - Closets	TCPY
		Q108	Inside Treated – Dining Room	TCPY
		Q111	Inside Treated –– Living Room	TCPY
		Q117	Inside Treated –– Other Room	TCPY
		Q119	Outside Treated[d]	MDA, TCPY
		Q120	Garden Treated	TCPY, ETHYL1, METHYL2
		Q121	Lawn/Yard Treated[d]	TCPY
		Q124	Level of Pesticide Use[d]	MDA, TCPY

Medium	Q Category	Q #[a]	Q Description[b]	Chemicals/ Metabolites [c]
		Q125	Frequency Personal Application Inside	TCPY
		Q126	Frequency Personal Application Outside	TCPY
		Q127	Inside/Outside Treated by Family Member	ETHYL3, METHYL3, METHYL4, DAP2, DAP3
		Q130	Personally Mixed Pesticide Inside	TCPY
	Household characteristics	Q208	Pets in House	METHYL2
		Q209	Pets Inside/Outside House[d]	MDA
		Q211	Existence of Garden or Vegetable Garden[d]	ETHYL1, MDA
	Residential sources (environmental measures)	Q301	Household Dust	METHYL2, NA
	Household occupation	Q402	Household Member Spraying Fields	DAP2, DAP3, ETHYL3, METHYL3, METHYL4, METHYL5
		Q403	Recent Fieldwork	DAP2, DAP3, METHYL4, METHYL5
		Q406	Applicator vs Reference	DMTP
		Q407	Applicator and Farm Worker vs Reference	DMTP, METHYL1
	Residential proximity to agricultural fields	Q501	Proximity of Home to Pesticide-Treated Farmland/Orchard	DMTP
	Residential location	Q601	Urban vs Non-urban	TCPY
	Subject's personal characteristics	Q702	Age	DAP1, METHYL2
		Q703	Ethnicity	1NAP, MDA
		Q705	Income	1NAP, MDA, TCPY, DMTP, DAP1
	Child's behaviors	Q806	Loading from Hand Wipe	DAP1
	Dietary behaviors	Q904	Organic Diet	METHYL2
	Smoking-related activities	Q1101	Current Smoker[e]	TCPY
		Q1102	Subject Smoked[e]	TCPY
	Related exposure levels	Q1302	High Levels in Adult Household Members	DAP2, DAP3, METHYL4
	Health	Q1403	Bowel Disease	TCPY
		Q1405	Intestinal Disease	TCPY
		Q1406	Ulcers	TCPY

[a] For some of the significant relationships, the effect of the exposure factor was not in the direction expected.

See Appendix C for details on specific relationships.
[b] See Appendix C for specific question phrasings included under each question description.
[c] Chemicals or metabolites for which > 50% of the relationships with the question were statistically or marginally significant. See Table 2.10 for chemical/metabolite description.
[d] See section 4.2.2 regarding relationships from Sexton (2003).
[e] Included only in Krinsley (1998) (section 4.2.5.5).

2.5.2 Urinary Metabolite Monitoring

A substantial proportion of the analysis in this report has focused on the association between questionnaire data and pesticide metabolites in children's urine. These analyses have been conducted on the assumption that the urinary metabolite measurements provide an accurate estimate of children's exposure; that is, if statistical associations were not observed, it was concluded that the questionnaire information was probably not a useful indicator of children's pesticide exposure. Yet we know that the metabolites under study are processed and excreted relatively quickly in humans (1-3 days) and, therefore, represent recent exposures. In contrast, most of the questions asked of parents or children were of a general nature in terms of the time frame of a particular activity or behavior. It is, therefore, worthwhile to consider the variability in measurements in urinary pesticide metabolites.

Nearly all of the studies examined in this report have used spot urine samples as the outcome that is compared to questionnaire data. A number of these studies have collected at least two spot samples from children, but only one collected complete urine samples over a fixed time period (Curl 2003). Several recent exposure studies have observed that intra-individual variability in pesticide metabolite concentrations in urine can be high (Macintosh 1999, Adgate 2001, Koch 2002). In these studies, an attempt was made to address this issue by collecting samples on a repeated basis: Macintosh (1999) collected up to six samples from each of up to 80 adult participants in the Maryland NHEXAS study, but the samples were approximately eight weeks apart; Koch (2002) collected samples from pre-school children on a bi-weekly basis for approximately one year. In both of these studies, the urine samples were essentially independent from one another in relation to exposure sources, although in the Koch study the 4-6 week agricultural spray season was identified as a time of elevated exposure. Adgate (2001) introduced more of a TEAM (Total Exposure Assessment and Monitoring) study design, that is, multiple samples over time, by collecting three morning voids from children in the course of one week. Such repeated measures would have a better chance of separating high and low exposed children if, for instance, a pesticide application had occurred at the residence at the beginning of the week. However, none of these study designs addresses directly the high day-to-day variability that seems to be the norm for pesticide metabolite excretion in children, even when creatinine adjustments are performed. In contrast Curl (2003) collected a full 24-hour urine sample to compare conventional and organic dietary behavior, and was able to demonstrate a large difference in exposure between these two groups. Krieger (2001) also collected 24-hour urine samples from children after the use of total aerosol release devices (foggers) in residences and was able to discern clear patterns in child exposure levels over time.

Two occupational exposure studies may serve as useful models for the design of future studies of children's pesticide exposure that involve urinary metabolite monitoring. Arbuckle (2002) examined the relationship between self-reported behaviors during pesticide applications and urinary excretion of two herbicides--2,4-dichlorophenoxyacetic acid (2,4-D) and 4-chloro-2-methylphenoxyacetic acid (MCPA). Urine samples were complete 24 hour voids from the beginning of application through the following day. With this sampling scheme the questionnaire's prediction of exposure had a sensitivity of 57% and a specificity of 86% for 2,4-D; for MCPA the sensitivity and specificity were 92% and 67%, respectively. A multivariate analysis was able to identify several variables as predictive of urinary metabolite concentrations. Harris (2002) studied commercial pesticide applicator exposure collecting two consecutive 24-hour urine samples from each participant. Investigators then modeled weekly exposure and dose based on knowledge of the amount of pesticide used by each applicator. This analysis was able to identify two major exposure factors: type of nozzle used and use of gloves during application. These studies suggest that if complete 24 or 48 hour urine samples are collected, it may be possible to identify major risk factors for exposure.

2.5.3 Questionnaire Validation

Few of the studies analyzed in this report have used validated questionnaires as a part of their examination of children's pesticide exposure. Questionnaire validation includes a test for accuracy (i.e., determine if the answer reported on the questionnaire by the study participant is correct), usually by comparison of the study instrument results with a "gold standard" for some subset of the study population. For example, answers to a question regarding a child's absence from school could be checked against school attendance records. Validation may also include tests for reliability (i.e., determine if the study participant provides the same answer to the question when tested on several occasions.) Validity of questionnaire data is an essential consideration in epidemiologic studies and future studies of children's pesticide exposure should be preceded by validation studies. A good example of this approach is available from the ongoing Agricultural Health Study conducted by the National Cancer Institute in collaboration with other federal agencies in the United States (Alavanja 1994). Dosemeci (2002) developed a quantitative metric for applicator exposure based on an analysis of the existing scientific literature. This metric provides quantitative adjustment factors for certain behaviors (e.g., use of gloves) reported in questionnaires and provides the basis for classifying each applicator's exposure for epidemiologic analysis. A critical component of the development of this model has been its validation through biological monitoring. The U.S. Environmental Protection Agency has conducted a study of pesticide applicators, collecting urinary metabolite data and comparing these to the questionnaire data collected by the National Cancer Institute (Thomas 2004). This work has demonstrated good correlations between self-reported behavioral data from applicators and the urinary metabolite data. It would behoove those involved in the study of children's pesticide exposure to consider this approach in the development of epidemiologic investigations.

2.5.4 Objective Measures of Children's Behaviors

Studies of children's pesticide exposure should work to improve the quality of data related to behavior. At present, researchers rely primarily on parental reports of behavior for young children. Yet the validity of parental reports has not been scrutinized in a systematic fashion. Duplicate diet sampling over 24 hours (Macintosh 1999, Fenske 2002) is a good example of an objective measure of pesticide exposure for the dietary pathway. In a recent study, researchers have found that NHEXAS-style parental diaries of children's time-location (macro-activities) were not accurate when compared with global positioning system (GPS) measurements over a 24 hour period (Elgethun 2003, Elgethun 2004, Elgethun 2005). Similarly, parental reports of children's contact with objects and mouthing behavior (micro-activities) are not necessarily accurate when compared to videotaping (Reed 1999, Black 2005). There is clearly a need for more objective measures of children's activities and behaviors in conjunction with systematic biological monitoring to ensure identification of key predictors of children's exposure to pesticides.

3.0 METHODOLOGY

3.1 General Description of Approach

Reconciling the sources and outcomes of exposure is a complex process because of the multitude of potential sources, interactions between sources and other factors, and timing issues between an actual exposure and evidence of the exposure. When preparing for an exposure study, investigators are likely to take into consideration both the hypothetical and observed relationships described in the research literature for their study design. Examples of hypothetical or theoretical relationships are found in the general environmental health paradigm (Sexton 1995a) as models for source, concentration, exposure, and dose. Examples of observed relationships are those identified in data analyses from an exposure study as in Clayton (1999) which described the result of examining question-measurement relationships for the NHEXAS Region 5 Study.

As a reference for the design efforts of the Pesticides in Young Children Border States Program, and for other future exposure studies, this project compiled the observed relationships between questions and measures of children's exposure to pesticides. The assimilation and review of these relationships was performed using two approaches:

- A literature review of previous exposure studies to summarize the existence of such quantitative and qualitative relationships, and
- An analysis of a recent children's pesticide exposure study in Yuma, Arizona, which included questionnaires and measurements.

Relationship, as used in this report, is defined as a systematic correspondence between the values of two variables from an exposure study, that is, questionnaire responses and analytical measurements. This correspondence may or may not be statistically significant. Similarities and differences in the results from the two approaches are discussed in section 4 (Results and Discussion).

3.2 Literature Review Methods

3.2.1 Sources

The literature review began with a search of several online citation indexes available at the University of Nevada, Las Vegas library using keywords pertinent to this project's objective. The following indexes were searched: MEDLINE (PubMed), Medline (FirstSearch), Infotrieve, NTIS (National Technical Information Service), Wiley Interscience Journals, Environmental Sciences And Pollution Management, and Toxline. The keywords survey, questionnaire, children, pesticide, measurement, and biomonitoring were used in combination to search the indexes. When an index limited the number of keywords used, multiple searches were performed using subsets of the keyword list.

Abstracts of over 100 citations from the search results were evaluated to determine if they fit the project's focus. To be considered for the next level of review, a publication was required to:

- address the pesticide exposure of children,
- have collected monitoring samples, preferably urine, and
- indicate the use of a survey or questionnaire in the study.

Two types of publications were excluded from further review: those describing studies of infants or pre-natal situations and those that did not include an evaluation of relationships between questions and monitoring measurements. The former type of publication was not included because the exposure scenarios for children at such very young ages are somewhat different from those for children of toddler age and up. Including such publications in this review might add another layer of variability in evaluating the literature results.

Other sources of publications or pertinent results were also considered. They included:

- references cited in the relevant articles from the first round of searches,
- Masters' theses that were the basis for some of the relevant articles,
- Status Report on Biological Monitoring Research Relevant to Aggregate Exposure Assessment under the Food Quality Protection Act (Fenske 1998), and
- Report on the Phase II NAFTA studies (USEPA 2002).

A more in-depth review of the publications considered potentially pertinent was performed with an adjusted set of criteria. To be included in the next round, a publication was required to:

- study pesticide exposure,
- describe relationships between questions and measurements from monitoring samples, and
- include children as part of the population studied.

These criteria expanded the base of articles with studies of children and adults for potential take-home exposure, while narrowing the list of pertinent articles to those that evaluated relationships. No limitation was placed on the pesticides considered; however, most of the relevant articles described organophosphorous (OP) pesticides because they are generally the most toxic of the pesticides. Although the primary interest was in biomarker data, relationships for any medium were noted.

Based on the second level of review, the publications were sorted into two groups: relevant and not applicable. The relevant publications were the basis for identifying the relationships to be reviewed (Table A.1). The rest of the publications were considered not applicable to this project's objective (Table A.2).

3.2.2 A Database of Relationships

A simple database was created using MS Excel to track the relationships noted in the set of relevant publications and to facilitate presentation of the relationships as tables for this report. For each relationship in the database, the following information was recorded:

- citation abbreviation,
- question,
- medium of the measurement,
- chemical or metabolite measured,
- type of statistical analysis performed to evaluate the relationship,
- statistical significance of the analysis,
- p-value for the statistical analysis (as available),
- study sub-population included in the analysis,
- groups compared in the analysis (depending on the type of analysis performed),
- descriptive statistics or parameters produced by the analysis (as available),
- descriptors for the chemical measurements, such as log transformed, adjusted for creatinine, etc., and
- comments.

An attempt was made to extract the maximum amount of information from each publication for the database. Any of the very few instances of interpretation or assumptions are noted in Appendix D.

To evaluate the track record of potentially effective questions for future studies, this report includes relationships that are both statistically significant and non-significant. Several publications listed or alluded to questions that were asked in the study interviews, but their relationships with a measurement were not addressed in the publication. Phone or email contact was made with the respective principal author to determine the status of the missing relationship descriptions while recognizing the boundaries of unpublished research. In most cases, it was determined that the relationships were excluded by the authors because the relationships were not significant, were never analyzed, were analyzed and reported in another article, or were to be reported in future publications. Information about these unaddressed relationships was not included in the database.

Lastly, to facilitate the presentation of the literature review, several levels of organization were added to the database. The questions were first grouped into 14 categories, such as residential pesticide use, dietary habits, and household occupation. These categories were then grouped into three super categories of risk factors: source, behavior, and other. An abbreviated version of the question was assigned to each relationship to allow questions with similar intent, but slightly different phrasing, to be presented together.

The relationships extracted from the relevant publications are presented in Appendices B, C, and D. An evaluation of the questions' usefulness in differentiating levels of pesticide exposure in children is presented in section 4.2 (Results and Discussion) and section 2 (Summary and Recommendations).

3.3 Children's Pesticide Exposure Study

A recent study of children's exposure to pesticides from Phase II of the Pesticide Exposure and Health Effects on Children Initiative (Section 1.6) was also considered. A report (CDC 2002) describing the study and its evaluation of predefined hypotheses was reviewed in a manner similar to the literature review. Data from the study were also made available for exploratory analysis to determine if relationships, other than those predefined by the study's objective, might surface.

3.3.1 Background

The U. S. Centers for Disease Control and Prevention (CDC), specifically the Health Studies Branch, and the Toxicology Branch of the National Center for Environmental Health, in collaboration with the U. S. Environmental Protection Agency (U.S. EPA), and the Arizona Department of Health Services, conducted a study of pesticide exposure in children living in Yuma County, Arizona. The Children's Pesticide Exposure Study is one of the studies funded by the Environmental Health Working Group in the Border 2012 Program (USEPA 2004b), through the Pesticide Exposure and Health Effects on Children Initiative, to assess the association of health outcomes in children with chronic exposure to pesticides. The study collected objective measures of pesticide exposure in the children to help determine the need for mitigation and prevention strategies for children and families living near the border. Its objective was to determine the impact of living, or attending school, near pesticide-treated fields on children's exposure to organophosphorous (OP) pesticides. Subsequently, this study will be referred to as the Yuma Study.

In cooperation with eight local schools in the study area, families who were permanent residents of the area with children in kindergarten or first grade were self-selected to participate in a study conducted from October 1999 through February 2000. Promatores, that is, lay health-care workers from a local non-government agency in Yuma, recruited a convenience sample of participants by sending informational flyers home with children in kindergarten and first grade, by approaching parents at Women, Infant and Children (WIC) clinics, and by referrals from other participants. The data collection was performed during a time period when large quantities of OP pesticides were expected to be applied to crops. The promatores performed the data collection including the administration of a questionnaire regarding characteristics and practices of the family and principal participant child. A urine sample was collected from each of these children (principal participants) and from any sibling in the household between the ages of 2 and 11 years. The urine samples were measured for the six most common dialkylphosphate (DAP) metabolites associated with OP pesticides. A dust sample was also collected from each household, and from classrooms, with principal participants. These samples were measured for specific OP, organochlorine, pyrethroid, and carbamate pesticides.

The study included 152 children as principal participants and 127 siblings. A total of 244 urine samples were available for analysis. Dust samples were available from 152 households and from 25 kindergarten and first-grade classrooms in six of the participating schools. The study analyzed the urine, dust, and questionnaire data to describe levels of pesticide exposure, and to identify any associations between questionnaire data and pesticide exposure levels.

The study report (CDC 2002) describes the statistical analysis approach that evaluated the predefined hypotheses between children's pesticide exposure and risk factors like distance from agricultural fields. Most of the analyses in this study were performed on urine measurements for the principal participant and the siblings in each household, included measures of intra-household correlation, and compared the measurements of principal participants with their siblings. Geometric means and 95% confidence intervals were calculated for variables that were not normally distributed. When considering the relationships between risk factors and measures of pesticide metabolites, regression models on log-transformed concentrations, controlling for intra-house correlation, were used. These relationships were evaluated for metabolite concentrations adjusted, and not adjusted, for creatinine. Regression models and Spearman correlations evaluated associations between the concentrations of the urinary metabolites, adjusted and unadjusted for creatinine, and household or school dust.

As a supplement to the initial findings in the Yuma Study report (CDC 2002), the study's data were also evaluated using a data mining approach. Data mining describes an analysis approach that searches through data for relationships that may or may not be defined a priori. This process is exploratory in nature in comparison to a confirmatory analysis that is interested in determining whether a proposed relationship adequately explains the observed set of data (Hand 1999). The data mining approach used in this project focused on identifying relationships that would be useful in classifying children by their OP pesticide exposure level, with a specific interest in being able to identify children with high or low exposure levels. The first stage of this approach prepared the data for analysis, the second stage reviewed basic relationships in the data, and the third stage performed classification type analyses. The data manipulation and analysis steps were carried out with SPSS versions 11.5 and 12.0 (SPSS, Inc., Chicago, IL), and S-Plus version 6 (Insightful, Inc., Seattle WA).

3.3.2 Stage 1 – Data Preparation

The Yuma Study data were reviewed to determine the types of analyses to be performed. Adjustments were made to the data only to facilitate analyses and not to change the intent of any responses. These adjustments included changes in data formats, the addition of code values to describe certain situations, the creation of additional variables based on the original data, and the identification of subgroups within the study to be used for the analyses. Steps were taken to assure the quality of any changes made to the data and for any additional variables created. A general description of the adjustments made to the Yuma Study data is described in Appendix G.

After making these adjustments, the questions from the study were reviewed to determine which would be used in the analyses. Questions that expanded on an "other" response, or that were open-ended questions, such as "type of pesticide used in the field," were excluded from analysis. In Table 3.1, the "Type" column denotes whether a variable was originally used as a question in the Yuma Study, or whether a variable was created for the additional analyses in this report. (A variable is defined as the set of participant responses for a specific question that are assigned codes for analysis.) The "Brief Description" is used to identify the questions in subsequent tables. The "Extended Description" includes the full statement of the question. "Principal child" and "participant" are used interchangeably in Table 3.1 to refer to the principal participant child.

Table 3.1 Questionnaire Variables from the Yuma Study Used in Data Mining Analyses, Sorted by the Questionnaire Order

Type[a]	Name	Brief Description	Extended Description
Original	AGE	Age of principal child	Age of principal child calculated from date of birth
Original	SEX	Child's gender	Gender of principal child
Original	HEIGHT	Child's height (inches)	Measurement of principal child's height without shoes (inches)
Original	WEIGHT	Child's weight (lbs)	Measurement of principal child's weight without shoes or other heavy articles (lbs)
Original	SCHOOL	Child's school	School where principal child attends
Original	GRADE	Child's grade	What grade is the principal child in?
Original	ETHNIC	Child's ethnic and racial background	Child's ethnic and racial background
Original	LIVEYEAR	Number of years child lives at this address	Number of years child lives at this address
Original	LIVEAREA	Children/respondent lives in area part-time	Children/respondent live in area < 10 months/year
Original	PEOPLIVE	Number of people in household including participant	Number of people in household including participant
Original	YOUNGSIB	Number of children in household $\leq$ 11 years old	Number of additional children in household $\geq$ 2 years and $\leq$ 11 years old?
Original	CHEMINHS	Pesticides used inside home last month?	Were chemicals to control insects used inside the house during the last month?
Original	WHOCHEMI	Who applied pesticides inside the house?	Who applied chemicals inside the house?
Original	LIVINGRM	Living room treated with pesticides?	Was living room treated with pesticides?
Original	FAMILYRM	Family room treated with pesticides?	Was family room treated with pesticides?
Original	DININGRM	Dining room treated with pesticides?	Was dining room treated with pesticides?
Original	KITCHEN	Kitchen treated with pesticides?	Was kitchen treated with pesticides?
Original	BATHROOM	Bathroom treated with pesticides?	Was bathroom treated with pesticides?
Original	BEDROOM	Bedroom treated with pesticides?	Was bedroom treated with pesticides?
Original	CHILDBED	Child's bedroom treated with pesticides?	Was child's bedroom treated with pesticides?
Original	BASEMENT	Basement treated with pesticides?	Was basement treated with pesticides?
Additional	NRMSPRYD	Number of rooms sprayed last month	Number of rooms in house sprayed with pesticides in past month

Type[a]	Name	Brief Description	Extended Description
Original	OTHERRM	Other rooms treated with pesticides?	Were other rooms in the house treated with pesticide?
Original	OFTCHEMI	How often is home treated for pests?	How often is participant's home treated for pests?
Original	CHEMOUTH	Pesticides used outside home last month?	Were chemicals to control insects used on the exterior or foundation of the house during the last month?
Original	WHOCHEMO	Who applied pesticides outside house?	Who applied chemicals outside house?
Original	FARFIELD	Distance between home and agricultural field	How far is participant's home from a field where crops are grown?
Original	CLOSEAPP	Distance between home and nearest application of pesticides	In past month, how close to participant's home was the nearest application of agricultural or gardening chemicals?
Original	GPS	Distance between home and field using GPS	How far is participant's home from a field where crops are grown?
Original	WHEEL	Distance between home and field - rotary wheel	Distance from home to field measured with rotary wheel - categories
Original	HOWCHEMO	How pesticides were applied to fields	How were agricultural chemicals applied to field close to participant's home?
Original	WHNCHEMO	Last time field treated with pesticides?	When was the last time the field was sprayed or treated with pesticides?
Original	VEGGIES	How often child eats local fresh fruit/veg?	During the year, how often does principal child eat locally grown fresh fruits or vegetables?
Original	WASHVEGI	How often wash local fresh fruit/veg before eating?	How often are the locally grown fresh fruits and vegetables washed before they are eaten?
Original	HOURAWAY	Number hours/wk child not at home	During school year, about how many hours per week does principal child spend away from home?
Additional	CHLDTM1	Child spends time in another home?	Principal child routinely spends time away from home – in another home
Additional	CHLDTM2	Child spends time at day care center?	Principal child routinely spends time away from home – at day care center
Additional	CHLDTM3	Child spends time at school?	Principal child routinely spends time away from home – at school
Additional	CHLDTM4	Child spends time at sport event?	Principal child routinely spends time away from home – at sport event
Additional	CHLDTM5	Child spends time playing in field?	Principal child routinely spends time away from home – playing in field
Additional	CHLDTM6	Child spends time playing in irrigation water?	Principal child routinely spends time away from home – playing in irrigation water
Additional	CHLDTM7	Child spends time playing outside?	Principal child routinely spends time away from home – playing outside
Original	WHERTIME	Room where child spends most awake time	Room where principal child spends most of their awake time
Original	SPRAYFLD	Child in yard when fields sprayed or dusted?	Does principal child play outside in the yard when the fields are sprayed or dusted?
Original	WATERSR1	Drinking water source - public/commercial	Source of drinking water in participant's home is public/commercial

Type[a]	Name	Brief Description	Extended Description
Original	WATERSR2	Drinking water source - private well	Source of drinking water in participant's home is private well
Original	WATERSR3	Drinking water source - cistern	Source of drinking water in participant's home is cistern
Original	DADWORK	Is the father currently employed?	Is the father currently employed?
Original	NCATWRKD	Father's occupation -- categories	Father's occupation -- categories
Additional	DADPEST	Are pesticides used where father works?	Are pesticides used where father works? -- categories
Additional	DADCON2	Father's occupation -- location and pesticide use	Does father work indoors or outdoors and with or without pesticides?
Original	MOMWORK	Mother now employed (not as housewife)?	Is the mother currently employed?
Original	NCATWRKM	Mother's occupation -- categories	Mother's occupation -- categories
Additional	MOMPEST	Are pesticides used where mother works?	Are pesticides used where mother works? -- categories
Additional	MOMCON2	Mother's occupation -- location and pesticide use	Does mother work indoors or outdoors and with or without pesticides?
Original	ADLTPEST	Non-parent in home works where pesticides used?	Is there another person living in the house (other than parent) who works in a place where pesticides are used?
Original	ADTPSWK	Non-parent in home works where pesticides used?	Any adult in household works where pesticides used?
Original	NUMADLTS	Number of additional adults in home	Number of non-parent adults in home working with pesticides
Original	CHILDFLD	Child worked in fields last month?	Has principal child been to the work field(s) during past month?
Original	WHENFILD	Last time child was in work field	When was the last time principal child was in the work field?
Additional	WHERMD1	Family med care at private medical clinic	Where principal child's family receives medical care – private medical clinic
Additional	WHERMD2	Family med care at health dept clinic	Where principal child's family receives medical care – local health department clinic
Additional	WHERMD3	Family med care at other med clinic	Where principal child's family receives medical care – other medical clinic
Additional	WHERMD4	Family med care in Mexico	Where principal child's family receives medical care – Mexico
Additional	WHERMD5	No access to medical care	Where principal child's family receives medical care – no access
Additional	WHERMD6	Family med care at other place	Where principal child's family receives medical care – at other facility
Additional	WHERMD7	Family med care - do not know	Where principal child's family receives medical care – do not know
Original	POISON	Anyone treated for pesticide poison?	Has anyone in the household been treated for pesticide poisoning in past year?
Original	HOWCHILD	Child's health in general	Description of principal child's health in general

Type[a]	Name	Brief Description	Extended Description
Original	LICE	Child treated for head lice past six months?	Has principal child been treated for head lice in past six months?
Original	INSURED	Is child covered by medical insurance?	Is principal child covered by medical insurance?

[a] Original variables existed in the data set provided from the Yuma Study. Additional variables were created based on the original variables.

Code values were reassigned for non-responses, conditional questions, and to create an underlying continuum of potential exposure. See Appendix G for information on coding schemes and additional variables created.

The chemical/metabolite measurements for the urine, house dust, and school dust samples that were used in the data mining analyses were analyzed as molar-weighted sums (Table 3.2). Appendix F includes a list of all the chemicals and metabolites measured in the Yuma Study, the specific chemicals included in each sum, and an example of how the sums are calculated. For the urinary metabolite sums, the log of the sum was used as the dependent variable.

Table 3.2 Analytical Measurement Variables from the Yuma Study Used in Data Mining Analyses

Name	Description[a]
Urine from Child	
LWETHSUM	Log of weighted sum of DEP, DETP, and DEDTP (adjusted for creatinine) [b]
LWMETHSM	Log of weighted sum of DMP, DMTP, and DMDTP (adjusted for creatinine) [c]
Household Dust	
WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane
WCHLPYRF	Weighted chlorpyrifos
WCYPRMET	Weighted cy-permethrin
WDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT
WDIAZNON	Weighted diazinon
WDUSTBAL	Weighted sum of dust analytes except chlorpyrifos, diazinon, permethrins, and o-phenylphenol
WDUSTSUM	Weighted sum of all dust analytes
WOPBAL	Weighted sum of OP pesticides except chlorpyrifos and diazinon
WOPHNYLP	Weighted o-phenylphenol
WOPSUM	Weighted sum of OP pesticides
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin

Name	Description[a]
School Dust	
SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane
SWCHLPYR	Weighted chlorpyrifos
SWCYPRME	Weighted cy-permethrin
SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT
SWDIAZNO	Weighted diazinon
SWDSTBAL	Weighted sum of dust analytes except chlorpyrifos, diazinon, permethrins, and o-phenylphenol
SWDUSTSM	Weighted sum of all dust analytes
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos and diazinon
SWOPHNYL	Weighted o-phenylphenol
SWOPSUM	Weighted sum of OP pesticides
SWPERMSM	Weighted sum of cis-permethrin and trans-permethrin

[a] See Appendix F for definition of weighted sums.
[b] DEP – diethylphosphate, DETP – diethylthiophosphate, DEDTP – diethyldithiophosphate
[c] DMP – dimethylphosphate, DMTP – dimethylthiophosphate, DMDTP – dimethyldithiophosphate.

3.3.3 Stage 2 – Review of Basic Relationships

In Stage 2, relationships between questionnaire and analytical measurement data were reviewed. This stage was exploratory rather than inferential and helped determine the sets of variables to be analyzed in Stage 3. As the basic analyses were performed and seeming inconsistencies in the relationships appeared, the data were reviewed. Stage 2 included evaluating simple indicators of high exposure levels, identifying relationships between questionnaire variables, and refining the group of participants to be included in the Stage 3 analyses.

3.3.4 Stage 3 – Classification Approach

The Stage 3 analyses were performed using the data mining technique Classification and Regression Trees (CART). This method divides the study population into subsets of participants where the between-subset variability of the dependent variable (e.g., LWETHSUM from Table 3.2) is maximized and the within-subset variability is minimized. The predictors or independent variables (questions and dust measurements in this study) can be nominal, ordinal, or continuous in nature and are the basis for defining the subsets. CART attempts to identify a model of predictors and their interactions that optimally classify subjects by the dependent variable, in this case, the child's measured exposure level for a specific metabolite. The output from CART is a classification map, or tree, that describes the subsets of the study population in terms of the dependent variable values and provides characteristics of the subsets in terms of the predictors and the predictors' values. This is analogous to a regression equation without a functional form. The predictors selected in the CART analyses can help differentiate children's pesticide exposure levels as measured by the molar-weighted DAP sums.

Details of the methodology for the data mining approach can be found in Appendix G.

4.0 RESULTS AND DISCUSSION

4.1 Introduction

The objective of this project is to evaluate questions that are potential indicators of pesticide metabolite levels in children's urine and to identify the more useful questions as input for future study design. The evaluation reviewed relationships between questions and exposure measurements under two approaches:

- A literature review of previous exposure studies to summarize the existence of such quantitative and qualitative relationships, and
- An analysis of a recent children's pesticide exposure study in Yuma, Arizona, which included questionnaires and measurements.

As work proceeded, it became obvious that environmental measurements were also useful in completing the link between questions and metabolite levels. The results from each approach are described and discussed in this section. A summary of the results is also presented in section 2.

4.2 Literature Review

Most of the pertinent studies on children's exposure to pesticides began in the 1990's, a much shorter period of study than for adults. The publications reviewed were those published through early 2003. Multiple searches of the literature resulted in over 100 citations (section 3.2). The abstracts and publications were reviewed against the first set of criteria, which required a pertinent publication to:

- address the pesticide exposure of children,
- have collected monitoring samples, preferably urine, and
- indicate the use of a survey or questionnaire in the study.

Of the publications meeting the first set of criteria, 64 were reviewed against a second set of criteria, which required a pertinent publication to:

- study pesticide exposure,
- describe relationships between questions and measurements from monitoring samples, and
- include children as part of the population studied.

These criteria categorized 20 of the 64 publications as "relevant" (Table A.1) and the remaining 44 publications as "not applicable" (Table A.2). Twenty publications of the relevant publications were peer-reviewed journal articles. Four of the twenty relevant publications were subsequently categorized as not applicable. Bradman (1997), Mills (2001), O'Rourke (2000), and Thompson (2003) included study designs that were pertinent to this review; however, either the particular publication did not include the required relationship information, or the study was a pilot that contained only a small number of subjects. The

Bradman (1997) and Mills (2001) publications had sample sizes less than 10. The O'Rourke (2000) and Thompson (2003) publications included information on pesticide metabolites in children's urine, but did not attempt to draw associations between this information and questionnaire data. Four Masters' theses were subsequently added to the relevant publications list. Two of the theses produced journal articles that are among the relevant publications, and were included because they provided details not available in the articles: the Carrel (1996) thesis was published as Loewenherz (1997), and was expanded upon in Lu (2000); the Koch (1999) thesis was published as Koch (2002). The other two Masters' theses were included because their findings have not been published in the peer-reviewed literature: the Grossman (2001) thesis was based on the same field study reported on by Curl (2002) and Thompson (2003), but the analysis conducted by Grossman was not included in either of these publications. The Krinsley (1998) thesis work has not been published elsewhere. Future references to the relevant publications list will denote the 20 publications from which relationship information was extracted. These 20 publications covered aspects of 14 different exposure studies. Appendix A includes references for all publications reviewed.

Results from the literature review are presented as information on each "relationship" between a question and exposure measurement described in the relevant publications. Relationship, as used in this report, is defined as a systematic correspondence between the values of two variables from an exposure study, that is, questionnaire responses and analytical measurements. This correspondence may or may not be statistically significant. As the review of the publications progressed, the scope of relationships considered for this report was expanded to include relationships with environmental media as well as biomarkers to enhance the information base relating to potential exposure pathways. When reviewing individual relationships to ensure comparability, the reader should be cognizant of study and analysis particulars. Unless stated otherwise in the Results and Discussion section, significant and statistically significant will be interchangeable.

In the process of extracting pertinent relationship information, each publication was reviewed several times. Since the publications were not consistent in the manner or level of information provided for the relationships, a structure was developed to capture the variety of information available. The objective of this review process was to ensure that the relationship information was extracted correctly, as the authors intended it to be interpreted, and to make few if any assumptions. In a few instances, authors were contacted to clarify information presented in the publications.

4.2.1 Publications Reviewed for Relationships

The studies on which the 20 relevant publications are based were assigned abbreviated citation references to be used in this and other sections of the report. The studies as used in the publications are briefly described with information about the study's location, population, media, pesticides measured, and types of questions asked (Table 4.2.1). Some studies generated more than one publication. Related publications and a study number are included for those instances.

Table 4.2.1 Brief Descriptions of the Studies Included in the 20 Relevant Publications

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
Adgate 2001 STUDY 1[c]	Minnesota: Urban (Minneapolis/St. Paul) and non-urban areas (Rice and Goodhue counties)	102 children 3-13 years old -- Preferences were for households with more frequent pesticide use, more than 1 eligible child, use of a private well in non-urban areas, children having greater potential for recent exposure to target pesticides.	Urine	Metabolites: 1-naphthol, atrazine mercapturate, malathion dicarboxylic acid, 3,5,6-trichloro-2-pyridinol.	Characteristics of the participating child and housing, usual frequency of activities over a period of a month or year, detailed (daily) time and location information of activities for the child, and information on less than daily activities during the monitoring period.	Sexton 2003
Aprea 2000 STUDY 2	Tuscany, Italy	195 children 6-7 years old -- Children were enrolled in elementary schools in Siena, Italy, which does not have major industries. Population is employed mostly at banks, hospitals, universities, or as shopkeepers, and professionals.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP, DEDTP	Lifestyle and dietary habits -- sex, date of birth, weight, height, school, class, father and mother's occupations, illness and hospitalization of child, existence of garden or vegetable garden, existence of ornamental plants in house, purchase of cut flowers for the house, domestic animals in house, use of pesticides inside or outside house, food and drink ingested day before urine sample, and ate lunch at school. Diet, parent's occupation, height, weight and height/weight ratio were used for qualitative classification of population.	

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
Azaroff 1999 <u>STUDY 3</u>	Rural El Salvador	103 farmer households and family members at least 8 years old -- Families were recruited from five agricultural communities who lived there during planting season. Household members who lived in the home during planting season and were able to answer questions were included.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP, DEDTP	Application of pesticides to crops, age and sex of household members, laundry practices, field work, and pesticide use for the house.	
Carrel 1996[d] <u>STUDY 4</u>	Washington (Douglas and Chelan counties)	88 children no more than 6 years old -- Two family types were selected: pesticide applicator in family living near sprayed orchard, and family with no pesticide applicator living further from orchard. One child selected per family.	Urine	Metabolites: DMP, DMTP, DMDTP	Occupational and residential pesticide use, cleaning activities, laundry practices, protective equipment use, proximity to spray sites, and child activity.	Published as Loewenherz 1997; expanded in Lu 2000; analysis of diethyl metabolites in Fenske 2002

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
Curl 2003 STUDY 5	Seattle, Washington	43 children 2-5 years old – Children were recruited based on whether their juice, fresh fruit, and fresh vegetable consumption was either nearly all organic or nearly all conventional.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP	Age and weight of child, parental age, and occupation, annual family income, home ownership, length of time at the current residence, housekeeping practices, residential pesticide use (in the home, on the home structure, in the garden, on the lawn, and on pets), time since last pesticide application and who applied the pesticide, child behaviors: thumb-sucking, hand washing, hand-to-mouth activity, and amount of time spent outside of home. Food diary for child with type and amount of food and beverage and whether each item was organic or not. Food diary was used for classification of child's diet.	
Curl 2002 STUDY 6	Washington	218 farm-worker households in 24 agricultural communities -- One farm-worker actively involved in field work or pesticide application and one 2-6 year old child were sampled from each household.	Urine, dust	Pesticides: azinphosmethyl, malathion, methyl parathion, phosmet, chlorpyrifos, diazinon Metabolites: DMP, DMTP, DMDTP, DEP, DETP	Types of agricultural job tasks, occupational pesticide exposure, perceived health effects of pesticide exposure, occupation and personal protective practices, and demographics.	Grossman 2001
Fenske 2002 STUDY 4	Central Washington	75 homes and 109 children up-to-6-years old -- Three family types were selected: pesticide applicator in family living near sprayed orchard, pesticide applicator in family living further from orchard, and no pesticide applicator in family living further from orchard.	Urine, dust, dermal wipe	Pesticides: chlorpyrifos, ethyl parathion. Metabolites: 3,5,6-trichloro-2-pyridinol, 4-nitrophenol.	Occupational and residential pesticide use, hygienic and housekeeping practices, child behavior and activity, and proximity of home to pesticide-treated fruit orchard.	Carrel 1996, Lu 2000, Loewenherz 1997

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
Grossman 2001[d] STUDY 6	Lower Yakima Valley, Washington	148 households with children 2-6 years old -- Hispanic farm-worker households were selected from For Healthy Kids, a community intervention study of take-home pesticide exposures.	Dust	Pesticides: azinphosmethyl	Sociodemographic characteristics and acculturation, agricultural tasks, knowledge about pesticides and related health effects, perceived exposure to pesticides, workplace facilities, and work and home practices related to pesticide exposure.	Curl 2002
Koch 2002 STUDY 7	Central Washington	44 children 2-5 years old -- Households were recruited from a Women, Infants and Children (WIC) clinic in a fruit tree production region. One child per family was selected.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP	Characteristics of the study child, parental occupations, household pesticide use, and children's activities	Koch 1999
Koch 1999[d] STUDY 7	Central Washington	44 children 2-5 years old -- Households were recruited from a Women, Infants and Children (WIC) clinic in a fruit tree production region. One child per family was selected.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP	Characteristics of the study child, parental occupations, household pesticide use, and children's activities	Koch 2002
Krinsley 1998[d,e] STUDY 8	Arizona, including US-Mexico border	179 households that were full-time Arizona residents and were a subset of the Arizona NHEXAS study. The focus was on high risk subgroups of minorities, children, and US-Mexico border residents.	Urine	Pesticides: chlorpyrifos Metabolites: 3,5,6-trichloro-2-pyridinol	Health status, occupation, pesticide use characteristics, home characteristics, demographic information, behavior, time-activity, and daily diet diaries.	

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
Loewenherz 1997 STUDY 4	Washington (Douglas and Chelan counties)	88 children no more than 6 years old -- Two family types were selected: pesticide applicator in family living near sprayed orchard, and family with no pesticide applicator living further from orchard. One child selected per family.	Urine	Metabolites: DMP, DMTP, DMDTP	Occupational and residential pesticide use, cleaning activities, laundry practices, protective equipment use, proximity to spray sites, and child activity.	Carrel 1996, Fenske 2002, Lu 2000
Lu 2001 STUDY 9	Seattle, Washington	110 children 2-5 years old -- Families recruited from clinic and outpatient waiting rooms in two communities -- an urban, densely-populated one with lower to middle income families, and a suburban one with middle to upper income families. One focus child was selected from each family.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP, DEDTP	Characteristics of the child, parental occupation and family income level, home ownership status, length of time at current residence, housekeeping practices, residential pesticide use regarding pets, lawn or vegetable/flower garden, professional application of pesticides in last 6 months, which pesticide products were applied, and child's activities and behaviors.	
Lu 2000 STUDY 4	Central Washington	109 children from 9 months to 6 years old from 76 households -- Three family types were selected: pesticide applicator in family living near pesticide-treated orchard, farm-worker in family living near pesticide-treated orchard, and no pesticide applicator in family living > .25 mi from pesticide-treated orchard.	Urine, dust, dermal wipe	Pesticides: azinphosmethyl, phosmet. Metabolites: DMP, DMTP, DMDTP.	Occupational and residential pesticide use, hygienic and housekeeping practices, child behavior and activity, and proximity of home to pesticide-treated fruit orchard.	Carrel 1996, Fenske 2002, Loewenherz 1997

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
McCauley 2003 STUDY 10	Hood River, Oregon	24 fruit-tree orchard agricultural families with at least one adult member working in an orchard full time, and with at least one 0-7 year old child; four control families.	Dust	Pesticides: azinphosmethyl, chlorpyrifos, malathion, phosmet, diazinon, parathion	Demographics, agricultural work practices of all adult family members residing in the home, self-reported protective practices at work and upon coming home, residential pesticide use, a household pesticide inventory, land use and proximal crop information, child play locations, and precautions taken by family during pesticide spraying events.	
McCauley 2001a STUDY 11	Oregon (Washington and Hood River counties)	96 families with preschool children -- Families were recruited from children enrolled in Migrant Head Start centers.	Dust	Pesticides: azinphosmethyl	Demographics, agricultural work practices of all adult family members residing in the home, self-reported protective practices at work and upon coming home, residential pesticide use, a household pesticide inventory, and land use and proximal crop information.	
Royster 2002 STUDY 12	Imperial County, California	20 children 12-18 months old – Children were recruited during well-child visits at clinics, when due for their first MMR (measles, mumps, rubella) vaccination, without certain health issues.	Urine	Metabolites: DMP, DMTP, DMDTP, DEP, DETP, DEDTP	Family's occupational pesticide exposure, the child's and family's health histories, pesticide usage, proximity to agricultural fields, location of residence, source of drinking water, history of smoking within household, and demographic characteristics.	

Citation Reference[a]	Location	Population	Media Studied	Pesticides Studied[b]	Type of Questions Asked	Related Work
Sexton 2003 STUDY 1	Minnesota: Urban (Minneapolis/St. Paul) and non-urban (Rice and Goodhue counties) areas	102 children 3-13 year-olds -- Preferences were for households with more frequent pesticide use, more than 1 eligible child, use of a private well in non-urban areas, children having greater potential for recent exposure to target pesticides.	Urine, dust, hand rinse, soil	Pesticides: chlorpyrifos, diazinon, malathion, atrazine. Metabolites: malathion dicarboxylic acid, 3,5,6-trichloro-2-pyridinol	Occupant characteristics, household characteristics, household pesticide use and occupant activities. Characteristics of the participating child and housing, usual frequency of activities over a period of a month or year, detailed (daily) time and location information and activities for the child, and information on less than daily activities during the monitoring period.	Adgate 2001
Shalat 2003 STUDY 13	Rio Bravo, Texas	52 children 7-53 months old -- 29 households were selected from an agricultural community on the US-Mexico border.	Urine, dust, hand rinse, soil	Pesticides: azinphosmethyl, chlorpyrifos, demoton O, demoton S, diazinon, ethion, fenithrothion, ethyl parathion, methyl parathion. Metabolites: DMP, DMTP, DMDTP, DEP, DETP, DEDTP	Medical information, occupational information, time/activity information, children's hand-to-mouth activities, diet, residential pesticide use, and pets or animals in the household.	
Simcox 1995 STUDY 14	Central Washington	59 households with at least one child 1-6 years old -- Households included reference families, and agricultural families where at least one family member living in the home was employed as an orchardist, field worker, and/or pesticide applicator.	Dust, soil	Pesticides: azinophosmethyl, chlorpyrifos, ethyl parathion, phosmet	Occupational pesticide use, residential and agricultural pesticide use in past 6 months, proximity of home to orchards, protective practices, and family hygiene practices.	

[a] See Table A-1 (Appendix A) for citations.
[b] DEP – diethylphosphate, DETP – diethylthiophosphate, DEDTP – diethyldithiophosphate
DMP – dimethylphosphate, DMTP – dimethylthiophosphate, DMDTP – dimethyldithiophosphate.
[c] Some studies generated multiple publications and are identified with the same study number.

[d] Masters theses related to publications in the initial relevant list.
[e] Data used for the Krinsley thesis are available at EPA's Human Exposure Database System (HEDS) web site at: http://www.epa.gov/heds/index.htm under the NHEXAS Arizona Study.

4.2.2 Description of Relationship Information

4.2.2.1 Content

Detailed information was extracted for each relationship to provide a useful reference tool for diverse research needs. A simple database was created using MS Excel to capture the relationship information presented in Sections 4.2.4, 4.2.5, and 4.2.6, and in Appendices B, C, and D. The types of information included are descriptive, general analysis, and statistical analysis (Table 4.2.2). The data fields under the analysis types of information refer to the results of a statistical analysis or to the groups compared in the statistical analysis.

Table 4.2.2 Information Extracted from Relevant Publications for Each Relationship

Type of Information	Data Fields[a]
Descriptive	
	Citation reference
	Question asked
	Sample medium
	Chemical measured
	Type of measurement, e.g., concentration or loading
	Log transformation indicator
	Subpopulation included in the analysis
	Type of statistical analysis performed
	Groups compared in the analysis, if relevant
	Significance indicator for analysis
	Comments about the chemical measurement
Analysis: General	
	p-value for the statistical analysis
	p-value for model or predictor indicator
	Comments about the analysis
Analysis: Statistics	
	Units of chemical measurement
	Geometric mean
	Geometric standard deviation
	Median
	Mean
	Standard deviation
	Percent detectable measurements
	Number of subjects
	Odds ratio (from logistic regression)
	Confidence interval (95% level for either Odds Ratio or Beta)

Type of Information	Data Fields[a]
	Beta (coefficient from regression analysis)
	R^2 -- square of multiple correlation coefficient from regression analysis

[a] Analysis refers to statistical analysis unless otherwise noted.

The available statistical parameters differ across publications and relationships. Relationships were included in the database based on the type of relationship measured and the types of information available. Two types of relationships were not included in the database: relationships for which no information on a statistical analysis was provided even though statistical parameters at a group level (e.g., means by age group) were provided, and relationships where the analysis did not fit the project's objective (e.g., a relationship between two questions). As much of the pertinent information as possible was extracted for each relationship from the publications for inclusion in the database.

The descriptive fields in the database (Table 4.2.2), and the study information (Table 4.2.1) set the context for each relationship that was evaluated because a study's design or the study subgroups compared in a statistical analysis can affect the significance of the relationship between the question and the measurement. The general and statistical analysis fields in the database allow for additional evaluation of a question's usefulness in understanding exposure-related activities and their potential impact. For example, knowing that a question showed a statistically significant relationship to a particular type of measurement in two separate relationships provides one type of information. Also knowing that in one of the relationships the median for group A was greater than the median for group B, and in the other relationship the median for group B was greater than the median for group A provides a different type of information. The inconsistent relationship between the medians of the two groups is a cue for the reader to consider the possibility of confounding factors (e.g., related to design) in the analyses or to recognize that the usefulness of the question in predicting exposure level may not yet be adequately proven. The database of information, as included in Appendices, B, C, and D, allows the reader to review the relationships from these perspectives.

4.2.2.2 Organization

Each relationship was assigned a unique ID number that will be shown in the tables describing the relationships. This ID number was used primarily for tracking and for preparing the information in table format. Because the breadth of information extracted for the relationships could not easily be presented in a single table format, the relationship information was grouped into three types of tables, an overview, details, and comments, which are included in Appendices B, C, and D, respectively. The ID number can be used to match information between Appendices C and D.

Another level of organization for the relationships was introduced at the question level. The publications differ in how, and to what extent, the questions are described. Some provide the full question, and some provide an abbreviated or generalized description of the question. To analyze their usefulness, question descriptions that at least implied the same question are grouped together, and a question number, e.g., Q102, has been assigned to each question phrasing for ease of reference in other tables. Thus, for each relationship, an abbreviated question phrasing was assigned. For example, the abbreviated question phrasing or description "inside treated" includes the following questions:

- pesticide use inside
- pesticide used inside in past 6 months
- Was there indoor pesticide application in past 6 months?
- In the past 6 months were any chemicals for the control of fleas, roaches, ants or other insects used inside this house/apartment?

Judgments were made regarding the level of abbreviated question descriptions to use. Since, in a few instances, the specificity of the question may affect the comparison of relationships, the description of the question as it is presented in the publication is included in Appendix D with supplemental information about the relationship. Reviewing the question descriptions allows the reader to evaluate the summary results and any influence from the question groupings.

A third level of organization arranges the question phrasings (the abbreviated question descriptions) into 14 question categories, and three risk factor groups for presentation and discussion purposes (Table 4.2.3). These groupings provide the organization of information and relationships in sections 4.2.4, 4.2.5, and 4.2.6, and in Appendices B, C, and D.

Table 4.2.3 Distribution of Relationships Across Risk Factor Groups and Question Categories[a] of Questions Used to Organize Sections 4.2.4, 4.2.5, 4.2.6, Appendix B, Appendix C, and Appendix D

Risk Factor Group	Question Category		Relationships	
Description	**#**	**Description**	**N**	**%**
Source	1	Residential pesticide use[b]	100	17
Source	2	Household characteristics[b]	73	12
Source	3	Residential sources (environmental measures)	13	2
Source	4	Household occupation	115	19
Source	5	Residential proximity to agricultural fields	72	12
Source	6	Residential location	14	2
Behavior	7	Subject's personal characteristics	78	13
Behavior	8	Child's behaviors	20	3

Risk Factor Group	Question Category		Relationships	
Description	#	Description	N	%
Behavior	9	Dietary behaviors	16	3
Behavior	10	Family hygiene practices	81	13
Behavior	11	Smoking-related activities	4	1
Behavior	12	Work exposure/practices	4	1
Other	13	Related exposure levels	5	1
Other	14	Health	8	1
		Total	603	100

[a] Based on counts in Appendix B tables.
[b] See note in the following paragraph regarding relationships from Sexton (2003).

Sexton (2003) evaluated many relationships between questions in the residential pesticide use and household characteristics categories, and measurements of atrazine, diazinon, malathion, and chlorpyrifos in personal air, indoor air, outdoor air, solid food, beverages, dust, soil, and urine under several statistical analysis scenarios. The majority of the relationships analyzed were not statistically significant. Since these relationships represented a large number of relationships for which no additional statistical information is provided, they were not included in the relationship database. The reader should be cognizant of this exclusion because it affects the percentages of statistically significant versus non-significant results in subsequent summary tables. However, if included, the large number of non-significant analyses would give more weight to the results from this publication than perhaps reasonable. Each table affected by this exclusion will be footnoted for the reader's awareness. All statistically significant relationships, and any non-significant relationships specifically noted in the publications' tables or text, were included in the database.

Six question categories had the largest number of relationships: residential pesticide use, household characteristics, household occupation, residential proximity to agricultural fields, subject's personal characteristics, and family hygiene practices. These categories are likely considered the most appropriate questions for the type of exposures studied because of expected or proven relationships. The fact that these categories have more relationships than the other categories may provide more credence overall to predictors selected from these categories. That judgment will specifically depend on the number of relationships available for a given combination of question and chemical or metabolite. Potential predictors from the other eight categories may also be useful, but have not been tested enough to make adequate judgments.

The number of relationships for the urine and dust media overwhelms the number from any other medium, with twice as many relationships for urine as for dust (Table 4.2.4).

Table 4.2.4 Distribution of Relationships across Question Categories and Mediums Measured[a]

Question Category		Number of Relationships, by Medium							
#	**Description**	**Urine**	**Dust**	**Indoor Air**	**Outdoor Air**	**Personal Air**	**Soil**	**Solid Food**	**All Media**
1	Residential pesticide use[b]	81	8	2	2	4		3	100
2	Household characteristics[b]	54	18	1					73
3	Residential sources (environmental measurements)	5	8						13
4	Household occupation	48	59				8		115
5	Residential proximity to agricultural fields	30	42						72
6	Residential location	13	1						14
7	Subject's personal characteristics	80							80
8	Child's behaviors	18							18
9	Dietary behaviors	16							16
10	Family hygiene practices	33	48						81
11	Smoking-related activities	4							4
12	Work exposure/practices	1	3						4
13	Related exposure levels	5							5
14	Health	8							8
	Total	396	187	3	2	4	8	3	603
	Percent of Total	65.7	31.0	0.5	0.3	0.7	1.3	0.5	

[a] Based on counts in Appendix B tables.
[b] See the paragraph immediately following Table 4.2.3 regarding relationships from Sexton (2003).

4.2.2.3 Assumptions and Caveats

Great care was taken and quality assurance was applied when extracting the relationship information from the publications. Each publication was reviewed several times to identify all hypothesized relationships noted. The ID# for each relationship was noted on a copy of the publication for cross-checking and the information extracted was reviewed by more than one person. The intent was to extract information without assumptions or interpretation. There are a few situations where judgments or assumptions were made to provide as much, and as consistent, information as possible (Appendix D). Relationships mentioned in a publication's text, but not specifically included in tables, were also extracted.

In several publications, questions were identified as part of the study's interview process; however, no results from analyzing relationships were mentioned. To determine the reason for the absence, and to glean any additional information for the database, an author of the publication was contacted. In most instances, the relationships in question were excluded from the publication because they were not significant or were to be included in future publications. In four instances, these contacts led to the inclusion of four Masters' theses as relevant citations: Carrel (Loewenherz) (1996), Grossman (2001), Koch (1999), and Krinsley (1998). Complete copies of the Grossman and Krinsley theses were reviewed. Parts of the Koch and Carrel theses were made available for this report in response to specific questions in the related publications.

Significance levels for the statistical analyses are reported in various ways, even within a publication. For example, p-values may be specified as a value ($p = 0.042$) or as an interval ($p < 0.05$). Sometimes the significance level is noted only as an indicator, that is, significant, not significant, marginally significant, or as a trend. Since knowing the p-value rather than a general indicator of significance allows the reader to make decisions based on their research objectives, the p-values were added to the database as a separate field. In cases where the significance indicator rather than the p-value is given, the publication was reviewed to identify the p-value used as the critical value for statistical significance. In all of the publications, the p-value for identifying significant relationships was 0.05. When the marginally significant or trend indicator was noted, the critical values are either 0.10 or 0.20. When no p-value is noted for a relationship, one was added based on the publication's significance indicator. For example, if the publication's critical value for significance is $p = 0.05$, $p > 0.05$ was noted in the database for a relationship identified as not significant. If the publication's critical value for being marginally significant was $p = 0.10$, $p > 0.10$ is noted in the database for a relationship identified as not marginally significant.

The extent of inferences that can be made from the relationships presented must be taken into account. Most of the studies conducted were convenience samples. Analyses from such studies are descriptive of the particular group sampled, and may or may not generalize to similar populations. The value of these relationships, however, is that they identify potential trends that may exist in the populations. When evaluating the effectiveness of a question for a particular research situation, it is also important to review and understand the similarities and differences in the samples taken, the type of measurements taken and analyzed, and the subgroups compared across the relationships available for the question. The reader may need to review the pertinent publications for some of these details.

4.2.3 Description of Relationships Presented

The amount and variety of information available across the relationships made it difficult to create a presentation format that was easy to read without being burdensome in other respects. The selected formats are more compact, but require more introduction to, and scrutiny by, the reader. This section briefly describes the content and organization of the tables in the upcoming sections, and gives an introduction to the related tables in Appendices B, C, and D.

The question categories (Table 4.2.3) provide the framework for the presentation and discussion of the results from the literature review. Questions for each of the three risk factors are discussed in separate sections. Source relationships are presented in section 4.2.4, behavior relationships are presented in section 4.2.5, and other relationships are included in section 4.2.6. The questions included under each risk factor and question category can be found in Appendix E. For each question category, three types of summary tables are presented as part of the evaluation and discussion. These tables describe the effectiveness of the questions in differentiating exposure levels by describing the extent of statistically significant relationships for each question and metabolite/chemical combination.

The first table type, "a," for each question category, e.g., Table 4.2.6.**a**, lists the coded names and descriptions for the chemicals/metabolites with significant relationships in the question category. Thus, of all the chemicals/metabolites measured in relationships with questions from this category (Tables B.3.1.1.a-g), only the 11 listed in Table 4.2.6.a had significant relationships. The second table type, "b," e.g., Table 4.2.6.**b**, shows the number and percentage of significant relationships by medium for the category. Thus, in Table 4.2.6.b, there are three significant relationships for ATZ (atrazine) in personal air and residential pesticide use questions. Four relationships for personal air were found for this category, and 75% of the relationships are statistically significant (Table B.3.1.1.f). The third table type, "c," e.g., Table 4.2.6.**c**, lists each question/medium/chemical-metabolite combination for which a majority (>50%) of the relationships are either significant or marginally significant. Thus, in Table 4.2.6.c, the question Q119-outside treated, overall has statistically significant relationships for MDA and TCPY in urine (Table B.3.1.1.a) and for chlorpyrifos (CHLR) in dust (Table B.3.1.1.c) and solid food (Table B.3.1.1.g). This majority criterion will be described as "overall" in subsequent tables. Note that questions with spotty levels of significant relationships are not included in the type "c" table, although they are included in the type "a", and type "b" tables, and in the appendices.

It is important for the reader to review any results of interest with the details of the relationships, since information in the following tables is summarized across different studies and thus, across different populations, questionnaire instruments, and analytical measurement techniques. A starting point for this level of review is Appendix C, where the reader can examine both the defining situation and the results for individual relationships associated with a specific combination of questions, chemicals measured, and significance level.

Appendices B, C, and D include specific information about the relationships through overview, detail, and comment tables, respectively. The tables in each appendix are organized by question category, and then question within the category. A complete list of questions by category is included in Appendix E. The overview tables in Appendix B are a high level summary of the relationships found in the literature review, by question, medium, and chemical/metabolite measured. They provide a general indication of each question's effectiveness in identifying the exposure level to a specific chemical or metabolite. The detail tables in Appendix C present the specific statistical analysis and descriptive information for each relationship counted in that question category's overview table. Additional information about each relationship with respect to the subpopulation analyzed, the chemical measurement, and the statistical analysis are included in the comment tables in Appendix D. Instructions for reading these tables are included in each appendix. Information in both summary and detailed forms can be found for each question category as shown in Table 4.2.5.

Table 4.2.5 Cross-Reference for Relationship Tables by Question Category Group

Category			Section #	Table #[a]	Overview Table #	Detailed Table #	Comment Table #
Group	#	Description	Results	Results	Appendix B	Appendix C	Appendix D
Source	1	Residential pesticide use	4.2.4.1	4.2.6.x	B.3.1.1	C.3.1.1	D.3.1.1
Source	2	Household characteristics	4.2.4.2	4.2.7.x	B.3.1.2	C.3.1.2	D.3.1.2
Source	3	Residential sources (environmental measures)	4.2.4.3	4.2.8.x	B.3.1.3	C.3.1.3	D.3.1.3
Source	4	Household occupation	4.2.4.4	4.2.9.x	B.3.1.4	C.3.1.4	D.3.1.4
Source	5	Residential proximity to agricultural fields	4.2.4.5	4.2.10.x	B.3.1.5	C.3.1.5	D.3.1.5
Source	6	Residential location	4.2.4.6	4.2.11.x	B.3.1.6	C.3.1.6	D.3.1.6
Behavior	7	Subject's personal characteristics	4.2.5.1	4.2.13.x	B.3.2.1	C.3.2.1	D.3.2.1
Behavior	8	Child's behaviors	4.2.5.2	4.2.14.x	B.3.2.2	C.3.2.2	D.3.2.2
Behavior	9	Dietary behaviors	4.2.5.3	4.2.15.x	B.3.2.3	C.3.2.3	D.3.2.3
Behavior	10	Family hygiene practices	4.2.5.4	4.2.16.x	B.3.2.4	C.3.2.4	D.3.2.4
Behavior	11	Smoking-related activities	4.2.5.5	4.2.17.x	B.3.2.5	C.3.2.5	D.3.2.5
Behavior	12	Work exposure/practices	4.2.5.6	4.2.18.x	B.3.2.6	C.3.2.6	D.3.2.6
Other	13	Related exposure levels	4.2.6.1	4.2.20.x	B.3.3.1	C.3.3.1	D.3.3.1
Other	14	Health	4.2.6.2	4.2.21.x	B.3.3.2	C.3.3.2	D.3.3.2

[a] x in this column refers to the three table types, a, b, and c, described above.

The results for question categories under each of the three risk factors are presented in the following sections: source (section 4.2.4), behavior (section 4.2.5), and other (section 4.2.6).

Within each of these major sections, there is a subsection for each question category. Finally, a parallel construction of three summary table types (a, b, and c) is included for each question category.

4.2.4 Presentation of Source Relationships

Questions related to pesticide sources produced 387, or 64%, of the relationships found in this review (Table 4.2.3). The term "source" is used broadly here to include purposeful application of pesticides in the residential environment, measurements of pesticide levels in the residential environment, and incidental or accidental introduction of pesticides into the residential environment. The questions included in each of these categories can be found in Appendix E.

4.2.4.1 Category 1: Residential Pesticide Use

This category of questions (Appendix E) focuses on the purposeful application of pesticides in or around the residence, including indoor treatments for pests, outdoor treatments for insects, weeds, and other garden pests, and commercial applications of residential property.

The chemicals/metabolites measured in the study samples having the most medium/question relationships in this category include: azinphosmethyl+phosmet, DAPs, and TCPY (Tables B.3.1.1.a-g); however, azinphosmethyl+phosmet did not have any significant relationships with questions from this category (Table B.3.1.1.c).

Table 4.2.6.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Residential Pesticide Use Category

Code(s)	Medium[a]	Description[b]
ATZ	other	Atrazine
CHLR	other	Chlorpyrifos
DAP2	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
DAP3	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement) [c]
ETHL1, ETHYL1	urine	DEP+DETP
ETHL3, ETHYL3	urine	DEP, DETP, DEDTP (at least one detectable measurement)
MDA	urine	Malathion dicarboxylic acid
MTHL2, METHYL2	urine	DMP+DMTP+DMDTP
MTHL3, METHYL3	urine	DMTP (detectable measurement)

Code(s)	Medium[a]	Description[b]
MTHL4, METHYL4	urine	DMP, DMTP (at least one detectable measurement)
TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] Medium is noted as urine or other (any other medium sampled).
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.
[c] See definition of high measurement in Azaroff (1999).

The residential pesticide use category includes 100 or 17% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions has the second highest occurrence of relationships. It is considered an important exposure source because children may be exposed during the application procedures, or may contact pesticide residues in the residential environment soon after application when residue levels can be relatively high.

Table 4.2.6.b Distribution of Significant Medium/Question Relationships for Residential Pesticide Use Questions, by Medium

	Medium/Question Relationships[a,b]			
	Significant[c]			
Medium Sampled	Chemicals/Metabolites Measured[d]	N	%[e]	Total N
Urine	MDA, TCPY, ETHYL1, ETHYL3, METHYL2, METHYL3, METHYL4, DAP2, DAP3	30	38	81
Dust	CHLR	1	13	8
Indoor air		0	0	2
Outdoor air		0	0	2
Personal air	ATZ, CHLR	3	75	4
Solid food	CHLR	1	33	3
Total		35	35	100

[a] See the paragraph immediately following Table 4.2.3, above, regarding relationships from Sexton (2003).
[b] Based on counts in Tables B.3.1.1.a through B.3.1.1.g.
[c] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[d] See descriptions in Table 4.2.6.a.
[e] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 81% of the relationships in this category (Tables B.3.1.1.a-g). This is much higher than the overall percentage of relationships with urine measurements (65.6%).

- The percent of relationships with dust measurements, 8%, is much lower than the overall percentage of 31% (Table B.3.1.1.c). This is not unexpected, since only a few of the studies for this category included dust sampling.
- TCPY and DAPs are the predominant metabolites measured in this category's urine-based relationships, 37% and 31%, respectively (Tables B.3.1.1.a-b).
- For TCPY, about 50% of the relationships are significant; for the DAPs, about 23% are significant (Table B.3.1.1.a). This difference may be due to the higher specificity of the TCPY metabolite; i.e., it is specific for chlorpyrifos or chlorpyrifos methyl, whereas the DAPs can be the result of multiple OP pesticides.
- Thirty-eight percent of the relationships with urine metabolites are significant or marginally significant (Table 4.2.10.b).
- Only one of the relationships with dust chemicals is significant (Table 4.2.10.b).

Relationships with other environmental measurements were found; however, they were found only in Sexton (2003) and the number of relationships was small (Tables B.3.1.1.d-g). The relationships were in the direction expected, that is, the activity was associated with higher exposure measurements.

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.6.c Residential Pesticide Use Questions and Chemicals/Metabolites with Overall[a] Significant Relationships[b]

Q#	Description	Medium	Chemicals/Metabolites Analyzed[c]
Q102	Inside Treated	Personal Air	CHLR
Q104	Inside Treated - Bedroom	Urine	TCPY
Q106	Inside Treated - Closets	Urine	TCPY
Q108	Inside Treated – Dining Room	Urine	TCPY
Q111	Inside Treated – Living Room	Urine	TCPY
Q117	Inside Treated – Other Room	Urine	TCPY
Q119	Outside Treated	Urine	MDA, TCPY
		Dust	CHLR
		Solid Food	CHLR
Q120	Garden Treated	Urine	TCPY, ETHYL1, METHYL2
Q121	Lawn/yard Treated	Urine	TCPY
Q124	Level of Pesticide Use	Urine	MDA, TCPY
		Personal Air	ATZ
Q125	Frequency Personal Application Inside	Urine	TCPY
Q126	Frequency Personal Application Outside	Urine	TCPY
Q127	Inside/Outside Treated by Family Member	Urine	ETHYL3, METHYL3, METHYL4, DAP2, DAP3
Q130	Personally Mixed Pesticide Inside	Urine	TCPY

[a] Overall indicates that > 50% of the question/medium/chemical relationships are significant.

[b] See the paragraph immediately following Table 4.2.3, above, regarding relationships from Sexton (2003).
[c] See descriptions in Table 4.2.6.a.

In most instances, and where information regarding the direction of the relationships is provided, the significant or marginally significant medium/question relationships are in agreement with the expectation that the exposure or activity is associated with a higher measurement level (Table C.3.1.1). Many of the significant relationships in Sexton (2003) (e.g., ID#s 562 and 567) show an effect opposite of what is expected. The publication speculated that the unexpected direction occurs either due to chance given the large number of relationships tested and/or in instances having a large number of non-detects. Note that questions regarding room-specific treatment are only available from Krinsley (1998) where the majority of respondents are adults. Overall the questions selected from this category (Table 4.2.6.c) appear to be useful predictors of exposure level for the chemicals and metabolites noted.

4.2.4.2 Category 2: Household Characteristics

Questions in this category (Appendix E) focus on unusual circumstances related to the household characteristics that might be associated with pesticide exposure. In particular, if property was used as a farm, there was a presumption that pesticide use might be greater or different than for other residences. Also, the movement of pets in and out of the house might lead to the track-in of pesticides that would not occur otherwise.

The chemicals/metabolites measured in the study samples having the most medium/question relationships in this category include: azinphosmethyl, DAPs, a sum of selected OP pesticides, and TCPY (Tables B.3.1.2.a-d).

Table 4.2.7.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Household Characteristics Category

Code(s)	Medium[a]	Description[b]
AZM	other	Azinphosmethyl
CHLR	other	Chlorpyrifos
ETHL1, ETHYL1	urine	DEP+DETP
MDA	urine	Malathion dicarboxylic acid
MTHL2, METHYL2	urine	DMP+DMTP+DMDTP
OPSUM	other	OP Sum

[a] Medium is noted as urine or other (any other medium sampled).
[b] DEP = diethylphosphate, DETP = diethylthiophosphate;
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate
OP Sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet.

The household characteristics category of questions includes 73 or 12% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the mid-range occurrence level of relationships. It is considered an important exposure source because young children spend a majority of their time in this environment -- their residence. Further the pesticide does not degrade as quickly indoors as it does outdoors, because there is less sunshine and air circulation indoors.

Table 4.2.7.b Distribution of Significant Medium/Question Relationships with Household Characteristics Questions, by Medium

	Medium/Question Relationships[a,b]			
	Significant[c]			Total
Medium Sampled	**Chemicals/Metabolites Measured[d]**	**N**	**%[e]**	**N**
Urine	ETHYL1,MDA, METHYL2	4	7	54
Dust	AZM, CHLR, OPSUM	3	17	18
Indoor air	CHLR	1	100	1
Total		8	11	73

[a] See the paragraph immediately following Table 4.2.3, above, regarding relationships from Sexton (2003).
[b] Based on counts in Tables B.3.1.2.a through B.3.1.2.d.
[c] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[d] See descriptions in Table 4.2.7.a.
[e] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 74% of the relationships in this category (Tables B.3.1.2.a-b). This is slightly higher than the overall percentage of relationships with urine measurements (65.6%).
- The percent of relationships with dust measurements, 25%, is slightly lower than the overall percentage of 31% (Table B.3.1.2.c).
- TCPY and DAPs are the predominant metabolites measured in this category's urine-based relationships (Tables B.3.1.2.a-b). Fifty percent of these relationships are with ethylated DAPs, and 31% are with methylated DAPs. This difference may be due to the higher specificity of the TCPY metabolite; i.e., it is specific for chlorpyrifos or chlorpyrifos methyl, whereas the DAPs can be the result of multiple OP pesticides.
- Seven percent of all the relationships with urine metabolites are significant (Table 4.2.7.b).
- Seventeen percent of the relationships with dust chemicals, and the one relationship with the indoor air chemical are significant (Table 4.2.7.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.7.c Household Characteristics Questions and Chemicals/Metabolites with Overall[a] Significant Relationships[b]

Q#	Description	Medium	Metabolites Analyzed[c]
Q202	Property Used As a Farm	Dust	CHLR
		Indoor Air	CHLR
Q209	Pets Inside/Outside House	Urine	MDA
Q211	Existence of Garden or Vegetable Garden	Urine	ETHYL1, MDA
Q213	Size of Household	Dust	AZM

[a] Overall indicates that > 50% of the question/medium/chemical relationships are significant.
[b] See the paragraph immediately following Table 4.2.3, above, regarding relationships from Sexton (2003).
[c] See descriptions in Table 4.2.7.a.

In most instances, and where information regarding the direction of the relationships is provided, the significant or marginally significant medium/question relationships are in agreement with the expectation that the exposure or activity is associated with a higher measurement level (Table C.3.1.2). Q202 includes only two relationships from Sexton (2003), and although they are significant and marginally significant, the relationships are in the opposite direction from what is expected. For example, property used as a farm would be expected to have higher measurement levels because of additional uses of pesticides; however, the levels in dust and indoor air were lower for farm property. The publication speculated that the unexpected direction occurred either due to chance given the large number of relationships tested and/or in instances having a large number of non-detects. Thus, the question may not be a useful predictor of a child's exposure level. The other questions selected from this category (Table 4.2.7.c) appear to be useful in predicting exposure level for the chemical or metabolite noted.

4.2.4.3 Category 3: Residential Sources (Environmental Measures)

This category of questions (Appendix E) focused on relationships between measurements of pesticides in the soil of residential environments and pesticides in house dust, as well as between measurements of pesticides in house dust and/or soil and pesticide metabolite levels in urine. In these cases the source of the pesticides in the environment was not known. Pesticide contamination could have occurred for any number of reasons. While the specific reason was not known in most cases, there was clear evidence that pesticides were present in the residential environment.

The chemicals/metabolites measured in the study samples are azinphosmethyl, chlorpyrifos, DAPs, ethyl parathion, and phosmet (Tables B.3.1.3.a-b).

Table 4.2.8.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Residential Sources Category

Code(s)	Medium[a]	Description[b]
AZM	other	Azinphosmethyl
CHLR	other	Chlorpyrifos
EPAR	other	Ethyl parathion
MTHL2, METHYL2	urine	DMP+DMTP+DMDTP
NA	urine	Not available in publication
PHSM	urine	Phosmet

[a] Medium is noted as urine or other (any other medium sampled)
[b] DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate

The residential source category of questions includes 13 or 2% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the low-range occurrence level of relationships. Relatively few of the studies under review collected house dust and urine samples concurrently and only Simcox (1995) collected soil and house dust samples concurrently. The very low pesticide concentrations found in soil in this study led later investigators to focus on house dust and other sources rather than soil.

Table 4.2.8.b Distribution of Significant Medium/Question Relationships with Residential Sources Questions, by Medium

	Medium/Question Relationships[a]			
	Significant[a]			Total
Medium Sampled	Chemicals/Metabolites Measured[c]	N	% [d]	N
Urine	METHYL2, NA	4	80	5
Dust	AZM, CHLR, EPAR, PHSM	5	63	8
Total		9	69	13

[a] Based on counts in Tables B.3.1.3.a and B.3.1.3.b.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.8.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships in this category were found only between urine or dust sample concentrations and other environmental measurements (Tables B.3.1.3.a-b).
- The relationships with urine sample concentrations account for 38% of the relationships in this category (Table B.3.1.3.a). This is much lower than the overall percentage of relationships with urine measurements (65.6%).
- The percent of relationships with dust measurements, 62%, is much higher than the overall percentage of 31% (Table B.3.1.3.b). The higher percent of relationships with

dust as compared to urine is likely due to the role of house dust as a reservoir for pesticides in the home, whereas metabolite measurements reflect only exposure that may have occurred in the last 1-3 days.
- Eighty percent of the relationships with urine metabolites are significant (Table 4.2.8.b).
- Sixty-three percent of the relationships with dust chemicals are significant (Table 4.2.8.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.8.c Residential Sources Questions and Chemicals/Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Chemicals/Metabolites Analyzed[b]
Q301	Household Dust	Urine	METHYL2, NA
Q303	Outdoor Soil	Dust	EPAR

[a] Overall indicates that > 50% of the question/medium/chemical relationships are significant.
[b] See descriptions in Table 4.2.8.a.

The relationships in this question category compared measurements, environmental to environmental, or environmental to urinary, and the statistical analyses used were correlations or regression analysis (Table C.3.1.3). When the direction of the relationships was provided for the significant or marginally significant relationships, the measurements generally increased together as expected. Thus, house dust and soil measurements (Table 4.2.8.c) may be considered useful in predicting exposure level.

4.2.4.4 Category 4: Household Occupation

Children who live in households where one or more of the adults has occupational exposures to pesticides may be at risk for increased exposure. This para-occupational exposure has been well demonstrated in studies of lead battery workers, asbestos workers, and others. A number of studies have been conducted recently to examine the extent to which pesticides used in the workplace are found in the home and whether this exposure pathway contributes to the body burden of children living in those homes. A list of the questions included in this category can be found in Appendix E.

The chemicals/metabolites measured in the study samples having the most medium/question relationships in this category include: azinphosmethyl, chlorpyrifos, DAPs, ethyl parathion, and phosmet (Tables B.3.1.4.a-d).

Table 4.2.9.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Household Occupation Category

Code(s)	Medium[a]	Description[b]
AZM	other	Azinphosmethyl
AZMPH	other	Azinphosmethyl+Phosmet
CHLR	other	Chlorpyrifos
DAP2	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
DAP3	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement) [c]
DMTP	urine	Dimethylthiophosphate (DMTP)
EPAR	other	Ethyl parathion
ETHL3, ETHYL3	urine	DEP, DETP, DEDTP (at least one detectable measurement)
MTHL1, METHYL1	urine	DMTP+DMDTP
MTHL3, METHYL3	urine	DMTP (detectable measurement)
MTHL4, METHYL4	urine	DMP, DMTP (at least one detectable measurement)
MTHL5, METHYL5	urine	DMP, DMTP (at least one high measurement) [c]
OPSUM	other	OP Sum
PHSM	other	Phosmet

[a] Medium is noted as urine or other (any other medium sampled).
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate
OP Sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet.
[c] See definition of high measurement in Azaroff (1999).

The household occupation category of questions includes 115 or 19% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions has the highest level of relationship occurrence. The pesticides used in agricultural workplaces can normally be identified with a high degree of specificity and the presence of these compounds in the home environment is clear evidence of workplace-to-residence chemical transmission.

Table 4.2.9.b Distribution of Significant Medium/Question Relationships with Household Occupation Questions, by Medium

	Medium/Question Relationships[a]			
	Significant[b]			Total
Medium Sampled	**Chemicals/Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	DAP2, DAP3, DMTP, ETHYL3, METHYL1, METHYL3, METHYL4, METHYL5	19	40	48
Dust	AZM, AZMPH, CHLR, EPAR, OPSUM, PHSM	28	47	59
Soil	AZM	1	13	8
Total		48	42	115

[a] Based on counts in Tables B.3.1.4.a through B.3.1.4.d.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.9.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 42% of the relationships in this category (Tables B.3.1.4.a-b). This is much lower than the overall percentage of relationships with urine measurements (65.6%).
- The percent of relationships with dust measurements, 51%, is much higher than the overall percentage of 31% (Table B.2.1.4.c). Dust is a convenient and stable medium for assaying the presence of agricultural chemicals in the home.
- Ethylated and methylated DAPs are the predominant metabolites measured in this category's urine-based relationships, 23% and 56%, respectively (Tables B.3.1.4.a-b).
- For ethylated DAPs, 18% of the relationships are significant (Table B.3.1.4.a-b).
- For methylated DAPs, 48% of the relationships are significant (Table B.3.1.4.a-b).
- Forty percent of the relationships with urine metabolites are significant or marginally significant (Table 4.2.9.b).
- Azinphosmethyl, chlorpyrifos, ethyl parathion, and phosmet are the predominant chemicals measured in this category's dust-based measurements. The percent of significant relationships for these chemicals is 42, 43, 56, and 8, respectively (Table B.3.1.4.c).
- Overall 47% of the relationships with dust chemicals are significant, and one relationship (13%) with a soil chemical is significant (Table 4.2.9.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.9.c Household Occupation Questions and Chemicals/Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Chemicals/Metabolites Analyzed[b]
Q401	Agricultural Workers in Household	Dust	AZM
Q402	Household Member Spraying Fields	Urine	DAP2, DAP3, ETHYL3, METHYL3, METHYL4, METHYL5
Q403	Recent Fieldwork	Urine	DAP2, DAP3, METHYL4, METHYL5
Q404	Applicator vs Farmworker	Dust	AZMPH, EPAR
Q405	Applicator vs Non-applicator	Dust	CHLR, EPAR
Q406	Applicator vs Reference	Urine	DMTP
Q407	Applicator and Farmworker vs Reference	Urine	DMTP, METHYL1
		Dust	AZM, AZMPH, CHLR, EPAR, PHSM
Q409	Farmer and Farmworker vs Reference	Soil	AZM
Q412	Fieldworker vs Pesticide Handler	Dust	AZM
Q415	Tree Thinning	Dust	OPSUM
Q416	Number in household with high pesticide contact	Dust	OPSUM

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.9.a.

Based on the available information, the significant or marginally significant medium/question relationships seem to be in agreement with the expectation that the exposure or activity is associated with a higher measurement level (Table C.3.1.4). In some instances, no information regarding the direction of the relationships was provided. Questions under the Family Hygiene Practices and Work Practices/Exposures categories are also related to this exposure pathway. Overall, the questions selected in this category (Table 4.2.9.c) appear to be useful in predicting pesticide exposure levels.

4.2.4.5 Category 5: Residential Proximity to Agricultural Fields

Pesticide spray application remains a concern for families in agricultural communities and may contribute to a child's exposure. This is of particular concern as new housing developments are situated adjacent to working farms and where agricultural workers are housed, within or on the boundaries of agricultural fields. The distance between the residence and agricultural fields has been used as a surrogate metric for home contamination that can result from pesticide application spraying events. The accuracy of this metric is open to question, particularly when it is self-reported. More advanced methods of characterizing the link between agricultural pesticide use and human exposure are a topic of current scientific inquiry. A list of the questions included in this category can be found in Appendix E.

The chemicals/metabolites measured in the study samples having the most medium/question relationships in this category include: azinphosmethyl, chlorpyrifos, ethyl parathion, and phosmet (Tables B.3.1.5.a-b).

Table 4.2.10.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Residential Proximity to Agricultural Fields Category

Code(s)	Medium[a]	Description[b]
AZM	other	Azinphosmethyl
AZMPH	other	Azinphosmethyl+Phosmet
CHLR	other	Chlorpyrifos
DMTP	urine	Dimethylthiophosphate (DMTP)
EPAR	other	Ethyl parathion
MTHL1, METHYL1	urine	DMTP+DMDTP

[a] Medium is noted as urine or other (any other medium sampled).
[b] DMP = dimethylphosphate, DMTP = dimethylthiophosphate.

The residential proximity to agricultural fields category of questions includes 72 or 12% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the mid-range occurrence level of relationships. The possibility of misclassification of exposure potential through use of a simple residential proximity metric is relatively high. In most cases, it is not known when, or even if, the nearby fields were treated with pesticides nor is it known what compounds may have been used. Factors, such as wind direction and application procedures, are important variables that are not accounted for in the use of residential proximity.

Table 4.2.10.b Distribution of Significant Medium/Question Relationships with Residential Proximity to Agricultural Fields Questions, by Medium

	Medium/Question Relationships[a]			
	Significant[b]			Total
Medium Sampled	Chemicals/Metabolites Measured[c]	N	%[d]	N
Urine	DMTP, METHYL1	4	13	30
Dust	AZM, AZMPH, CHLR, EPAR	16	38	42
Total		20	28	72

[a] Based on counts in Tables B.3.1.5.a and B.3.1.5.b.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.10.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 42% of the relationships in this category (Table B.3.1.5.a). This is much lower than the overall percentage of relationships with urine measurements (65.6%).
- The percent of relationships with dust measurements, 58%, is much higher than the overall percentage of 31% (Table B.3.1.5.b). Dust is a convenient and stable medium for attempting to track the impact of agricultural pesticide use on residential environments.
- Methylated DAPs are the predominant metabolites measured (67%) in this category's urine-based relationships, but only 20% of those relationships are significant (Table B.3.1.5.a). Many of the studies that have explored this relationship have been conducted in agricultural regions where methyl DAPs are used for insect control.
- Thirteen percent of the relationships with urine metabolites are significant (Table 4.2.10.b).
- Azinphosmethyl, chlorpyrifos, ethyl parathion, and phosmet are the predominant chemicals measured in this category's dust-based measurements. The percent of significant relationships for these chemicals is 31, 38, 56, and 0, respectively (Table B.3.1.5.b).
- Overall 38% of the relationships with dust chemicals are significant (Table 4.2.10.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.10.c Residential Proximity to Agricultural Fields Questions and Chemicals/Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Chemicals/Metabolites Analyzed[b]
Q501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Urine	DMTP
		Dust	AZMPH, EPAR

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.10.a

In most instances, the significant or marginally significant media/question relationships are in agreement with the expectation that the exposure or activity is associated with a higher measurement level (Table C.3.1.5). In some instances, no information regarding the direction of the relationships is provided. Thus, proximity of the home to pesticide-treated farmland or orchards appears to be useful for predicting exposure for the chemicals and metabolites noted (Table 4.2.10.c).

4.2.4.6 Category 6: Residential Location

This category of questions (Appendix E) was developed to capture aspects of residential location other than proximity to agricultural fields. In particular, some studies have compared urban and rural residential environments on the assumption that rural environments might provide a greater opportunity for children's exposure to pesticides. Also, some studies have examined the relationship between pesticide concentrations in house dust and vehicle dust, based on the theory that the vehicle may serve as a vector for pesticide transmission into the home and as a direct source of exposure when children are transported.

The chemicals/metabolites measured in the study samples are 1-naphthol, malathion dicarboxylic acid, TCPY, ethylated DAPs, and azinphosmethyl (Tables B.3.1.6.a-b); however, only azinphosmethyl and TCPY had any significant relationships.

Table 4.2.11.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Residential Location Category

Code(s)	Medium[a]	Description
AZM	other	Azinphosmethyl
TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] Medium is noted as urine or other (any other medium sampled)

The residential location category of questions includes 14 or 2% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the low-range occurrence level of relationships. Only a few studies have examined these relationships, so data for this category is limited.

Table 4.2.11.b Distribution of Significant Medium/Question Relationships with Residential Location Questions, by Medium

	Medium/Question Relationships[a]			
	Significant[b]			Total
Medium Sampled	**Chemicals/Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	TCPY	3	23	13
Dust	AZM	1	100	1
Total		4	29	14

[a] Based on counts in Tables B.3.1.6.a and B.3.1.6.b.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.11.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 93% of the relationships in this category (Table B.3.1.6.a). This is much higher than the overall percentage of relationships with urine measurements (65.6%). Most studies that have explored these relationships have focused on urinary metabolite measurements.

- There is only one relationship with a dust sample concentration (Table B.3.1.6.b). Studies of this kind have not been conducted frequently. They focus on worker commuter vehicles as part of an exposure pathway for children, and this has only recently been recognized as a potential contributor to exposure.
- TCPY is the predominant metabolite measured (36%) in this category's urine-based relationships, but only 3 (60%) of its relationships are significant (Table B.3.1.6.a). It is not surprising to find that the relationships between questions and TCPY metabolites were not found to be significant. Chlorpyrifos, the parent compound of the TCPY metabolite, has been until recently the most widely used OP pesticide in the United States. Furthermore, diet is an important source of chlorpyrifos exposure, so a simple categorization of homes as urban or rural would be unlikely to demonstrate differential body burdens in children.
- Overall, 23% of the relationships with urine metabolites are significant (Table 4.2.11.b)
- The one relationship with azinphosmethyl in dust is also significant (Table 4.2.11.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.11.c Residential Location Questions and Chemicals/Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Chemicals/Metabolites Analyzed[b]
Q601	Urban vs Non-urban	Urine	TCPY
Q605	Vehicle vs House	Dust	AZM

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.11.a.

In most instances where information regarding the direction of the relationships is provided, the significant or marginally significant media/question relationships were in agreement with the expectation that the exposure or activity would be associated with a higher measurement level (Table C. 3.1.6). Thus, although the number of relationships evaluated for questions in this category is small, the questions selected (Table 4.2.11.c) appear to be useful in predicting exposure level for the chemical and metabolite noted.

4.2.4.7 Summary of Results from Source Relationships

The six question categories under the source risk factor represent sources of exposure in the residential environment. Thirty-five questions from these categories are considered overall statistically significant (and effective differentiators of pesticide exposure levels) for the chemicals/metabolites noted (Table 4.2.12). For each of the question and chemical/metabolite combinations, the majority (> 50%) of the relationships were statistically or marginally significant.

Table 4.2.12 Questions from Source Categories Considered Overall Statistically Significant, by Medium

Medium	Q Category	Q #[a]	Q Description	Chemicals/ Metabolites[b]
Dust				
	Residential pesticide use	Q119	Outside Treated[c]	CHLR
	Household characteristics	Q202	Property Used As a Farm[c]	CHLR
	Residential environment (environmental measures)	Q213	Size of Household	AZM
	Residential sources	Q303	Outdoor Soil	EPAR
	Household occupation	Q401	Agricultural Workers in Household	AZM
		Q404	Applicator vs Farmworker	AZMPH, EPAR
		Q405	Applicator vs Non-applicator	CHLR, EPAR
		Q407	Applicator and Farm worker vs Reference	AZM, AZMPH, CHLR, EPAR, PHSM
		Q412	Fieldworker vs Pesticide Handler	AZM
		Q415	Tree Thinning	OPSUM
		Q416	Number in Household with High Pesticide Contact	OPSUM
	Residential proximity to agricultural fields	Q501	Proximity of Home to Pesticide-Treated Farmland/Orchard	AZMPH, EPAR
	Residential location	Q605	Vehicle vs House	AZM
Indoor Air				
	Household characteristics	Q202	Property Used As a Farm[c]	CHLR
Personal Air				
	Residential pesticide use	Q102	Inside Treated	CHLR
		Q124	Level of Pesticide Use[c]	ATZ
Soil				
	Household occupation	Q409	Farmer and Farm worker vs Reference	AZM
Solid Food				
	Residential pesticide use	Q119	Outside Treated[c]	CHLR
Urine				
	Residential pesticide use	Q104	Inside Treated - Bedroom	TCPY
		Q106	Inside Treated - Closets	TCPY
		Q108	Inside Treated – Dining Room	TCPY

Medium	Q Category	Q #[a]	Q Description	Chemicals/ Metabolites[b]
		Q111	Inside Treated –– Living Room	TCPY
		Q117	Inside Treated –– Other Room	TCPY
		Q119	Outside Treated[c]	MDA, TCPY
		Q120	Garden Treated	TCPY, ETHYL1, METHYL2
		Q121	Lawn/Yard Treated[c]	TCPY
		Q124	Level of Pesticide Use[c]	MDA, TCPY
		Q125	Frequency Personal Application Inside	TCPY
		Q126	Frequency Personal Application Outside	TCPY
		Q127	Inside/Outside Treated by Family Member	ETHYL3, METHYL3, METHYL4, DAP2, DAP3
		Q130	Personally Mixed Pesticide Inside	TCPY
	Household characteristics	Q208	Pets in House	METHYL2
		Q209	Pets Inside/Outside House[c]	MDA
		Q211	Existence of Garden or Vegetable Garden[c]	ETHYL1, MDA
	Residential sources (environmental measures)	Q301	Household Dust	METHYL2, NA
	Household occupation	Q402	Household Member Spraying Fields	DAP2, DAP3, ETHYL3, METHYL3, METHYL4, METHYL5
		Q403	Recent Fieldwork	DAP2, DAP3, METHYL4, METHYL5
		Q406	Applicator vs Reference	DMTP
		Q407	Applicator and Farm worker vs Reference	DMTP, METHYL1
	Residential proximity to agricultural fields	Q501	Proximity of Home to Pesticide-Treated Farmland/Orchard	DMTP
	Residential location	Q601	Urban vs Non-urban	TCPY

[a] For some of the significant relationships, the effect of the exposure factor was not in the direction expected. See Appendix C for details on specific questions.
[b] Chemicals or metabolites for which > 50% of the relationships with the question were statistically or marginally significant. (See "a" tables: Tables 4.2.6.a through 4.2.11.a for descriptions.)
[c] See Section 4.2.2 regarding relationships from Sexton (2003).

Household occupation was a strong differentiator for pesticide levels in dust which relate to the take-home pathway exposure. Residential pesticide use and household occupation were strong differentiating categories for the urine metabolite levels (Table 4.2.12).

4.2.5 Presentation of Behavior Relationships

Many exposure studies include questions that focus on the behavior of household members or children. The temporal and spatial patterns of children's activities are important variables in exposure assessment, generally referred to as macro-activities. Additionally, activities conducted in specific microenvironments, such as crawling, contact with objects, hand-to-mouth behavior, and object-to-mouth behavior – generally referred to as micro-activities – are thought to contribute significantly to dermal, oral, and respiratory exposures among children. Behavior accounted for 203, or 34%, of observed relationships in this review (Table 4.2.3).

4.2.5.1 Category 7: Subject's Personal Characteristics

A number of studies have collected demographic information, such as age, gender, ethnicity, and income level, and have explored possible associations with pesticide metabolite levels in urine. These analyses have been undertaken in an effort to determine if there are consistent trends related to subject information that is often readily available through census or other databases. A list of the questions included in this category can be found in Appendix E.

The chemicals/metabolites measured in the study samples having the most medium/question relationships in this category are DAPs (Tables B.3.2.1.a-b).

Table 4.2.13.a Codes and Descriptions for Metabolites with Significant Relationships for Questions in the Subject's Personal Characteristics Category

Code(s)	Medium[a]	Description[b]
1NAP	urine	1-Naphthol
DAP1	urine	DMP+DMTP+DMDTP+DEP+DETP+DEDTP
DMTP	urine	Dimethylthiophsophate (DMTP)
ETHL2, ETHYL2	urine	DEP+DETP+DEDTP
MDA	urine	Malathion dicarboxylic acid
MTHL2, METHYL2	urine	DMP+DMTP+DMDTP
TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] Medium is noted as urine or other (any other medium sampled).
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.

The subject's personal characteristics category of questions includes 78 or 13% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the mid-range occurrence level of relationships. Information regarding age, gender, ethnicity and income is relatively easy to obtain, but, with the exception of age, it is not clear that these characteristics would be related to pesticide exposures.

Table 4.2.13.b Distribution of Significant Medium/Question Relationships with Subject's Personal Characteristics Questions, by Medium

Medium/Question Relationships[a]				
	Significant[b]			Total
Medium Sampled	**Chemicals/Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	1NAP, DAP1, DMTP, ETHYL2, MDA, METHYL2, TCPY	22	28	78
Total		22	28	78

[a] Based on counts in Tables B.3.2.1.a and B.3.2.1.b.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.13.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Only urine concentrations were found for this category (Tables B.3.2.1.a-b).
- Twenty-eight percent of the relationships are significant (Table 4.2.13.b).
- The percent of significant relationships for each metabolite is (Tables B.3.2.1.a-b):
  - Ethylated DAPs – 12%,
  - Methylated DAPs – 27%
  - Ethylated+methylated DAPs – 40%
  - 1-Naphthol – 50%
  - MDA – 67%
  - TCPY – 30%.

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.13.c Subject's Personal Characteristics Questions and Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Metabolites Analyzed[b]
Q702	Age	Urine	DAP1, METHYL2
Q703	Ethnicity	Urine	1NAP, MDA
Q705	Income	Urine	1NAP, MDA, TCPY

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.13.a.

Based on the significant relationships, younger children have higher levels of metabolites than older children, and children have higher levels than adults (Table C.3.2.1). Thus, age appears to be a useful predictor of pesticide exposure level in the metabolites noted (Table 4.2.13.c). The significant ethnic and income relationships found in Adgate (2001) were not consistently in the same direction, and given the small number of relationships found in the publications, they do not appear to be useful predictors of pesticide exposure levels.

4.2.5.2 Category 8: Child's Behaviors

This category includes children's behaviors, actions, and activities that may differentiate children's pesticide exposure levels. Factors include both habits and hygiene practices of children such as sucking thumbs and the frequency and timing of hand washing. Time related activities such as the amount of time children spend in certain environments (e.g. indoors, outdoors, or at school) can also contribute to measurable differences in their pesticide exposure levels. A limited number of studies have included children's hand wipes as an exposure metric and compared pesticide loading values with metabolite levels. A list of the questions included in this category can be found in Appendix E.

The metabolites measured in the study samples are 4-nitrophenol, DAPs, and TCPY (Table B.3.2.2.a); however, only the DAP metabolite has significant relationships with the questions in this category (Table 4.2.14.a).

Table 4.2.14.a Codes and Descriptions for Metabolites with Significant Relationships for Questions in the Child's Behaviors Category

Code(s)	Medium[a]	Description[b]
DAP1	urine	DMP+DMTP+DMDTP+DEP+DETP+DEDTP

[a] Medium is noted as urine or other (any other medium sampled).
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.

The child's behaviors category of questions includes 20 or 3% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the low-range occurrence level of relationships. It is considered an important exposure factor, since most investigators believe that a child's behavior will have a significant impact on pesticide exposure (e.g., see Cohen Hubal (2000b), Black (2005), Reed (1999), Freeman (2005)).

Table 4.2.14.b Distribution of Significant Medium/Question Relationships with Child's Behaviors Questions, by Medium

Medium/Question Relationships[a]				
	Significant[b]			Total
Medium Sampled	**Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	DAP1	2	10	20
Total		2	10	20

[a] Based on counts in Table B.3.2.2.a
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.14.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Only urine-based relationships were found for this category (Table B.3.2.2.a).
- Ten percent of the relationships are significant or marginally significant (Table 4.2.14.b), and the significant relationships were with the DAP metabolite (Table B.3.2.2.a).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.14.c Child's Behaviors Questions and Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Metabolites Analyzed
Q806	Loading from hand wipe	Urine	DAP1

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.

No questions in this category have overall significant relationships with urine measurements (Table C.3.2.2); however, the loading measurement from the hand wipe (Table 4.2.14.c) does have a significant relationship. Overall, questions available in the category of child's behaviors do not appear to be useful in predicting the child's pesticide exposure level.

4.2.5.3 Category 9: Dietary Behaviors

Diet is likely to be a major pathway of pesticide exposure for most children, yet few studies have examined this issue directly. The U.S. EPA has made a substantial effort to develop quantitative estimates of dietary pesticide through the combination of food consumption surveys and analysis of pesticide residues in common food products. Nonetheless, there remains substantial uncertainty in the ability to predict an individual's pesticide ingestion based on food diaries or food frequency questionnaires. In this review, only one study was placed in this category. Additional studies are underway, and should add to the understanding of this pathway. A list of the questions included in this category can be found in Appendix E.

The metabolites measured in the study samples are DAPs and TCPY (Table B.3.2.3.a); however, only a DAP metabolite had significant relationships for this category.

Table 4.2.15.a Codes and Descriptions for Metabolites with Significant Relationships for Questions in the Dietary Behaviors Category

Code(s)	Medium[a]	Description[b]
MTHL2, METHYL2	urine	DMP+DMTP+DMDTP

[a] Medium is noted as urine or other (any other medium sampled).
[b] DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.

The dietary behaviors category of questions includes 16 or 3% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the low-range occurrence level of relationships, which is due primarily to the lack of studies that have focused on this pathway.

Table 4.2.15.b Distribution of Significant Medium/Question Relationships with Dietary Behaviors Questions, by Medium

Medium/Question Relationships[a]				
	Significant[b]			Total
Medium Sampled	**Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	METHYL2	2	13	16
Total		2	13	16

[a] Based on counts in Table B.3.2.3.a.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.15.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Only urine-based relationships were found for this category (Table B.3.2.3.a).
- The significant relationships are for a methylated DAP sum (Table B.3.2.3.a), and account for 13% of the urine-based relationships (Table 4.2.15.b). A number of studies have found that the methyl DAPs are more common than ethyl DAPs in urine. See, for example, the most recent NHANES data (Barr 2004).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.15.c Dietary Behaviors Questions and Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Metabolites Analyzed[b]
Q904	Organic Diet	Urine	METHYL2

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.15.a

Based on the significant relationships, a conventional diet has higher pesticide metabolite levels than an organic diet (Table C.3.2.3). Although the number of relationships for this question is small, it appears to be useful in predicting methylated DAP metabolite levels.

4.2.5.4 Category 10: Family Hygiene Practices

Many investigators have placed an emphasis on good hygienic practices within the home as a means of reducing children's exposure to pesticides. For example, it is common for public health scientists and practitioners to recommend that agricultural workers remove their work boots before entering the home and that work clothing be washed separately from the family clothing. Thus, family hygiene is an important variable to investigate in studies of children's pesticide exposure. A list of the questions included in this category can be found in Appendix E.

The chemicals/metabolites measured in the study samples having the most medium/question relationships in this category include: azinphosmethyl, chlorpyrifos, dimethylthiophosphate (DMTP), and ethyl parathion (Tables B.3.2.4.a-b).

Table 4.2.16.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Family Hygiene Practices Category

Code(s)	Medium[a]	Description
AZM	other	Azinphosmethyl
DMTP	urine	Dimethylthiophosphate
OPSUM	other	OP Sum[b]

[a] Medium is noted as urine or other (any other medium sampled)
[b] OP Sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet.

The family hygiene practices category of questions includes 81 or 13% of the relationships extracted from the relevant publications. This category of questions falls into the mid-range occurrence level of relationships (Table 4.2.3). Many of the studies under review have been conducted in agricultural communities, so it is not surprising that questions related to family hygiene would occur with some frequency.

Table 4.2.16.b Distribution of Significant Medium/Question Relationships with Family Hygiene Practices Questions, by Medium

	Medium/Question Relationships[a]			
	Significant[b]			Total
Medium Sampled	**Chemicals/Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	DMTP	2	6	33
Dust	AZM, OPSUM	3	6	48
Total		5	6	81

[a] Based on counts in Tables B.3.2.4.a and B.3.2.4.b.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.16.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 41% of the relationships in this category (Table B.3.2.4.a). This is much lower than the overall percentage of relationships with urine measurements (65.6%).
- The percent of relationships with dust measurements, 59%, is much higher than the overall percentage of 31% (Table B.3.2.4.b). Dust is used commonly as a metric for home contamination by workplace chemicals, since its measurement is more stable than urinary metabolites.
- DMTP is the predominant metabolite measured (48%) in this category's urine-based relationships (Table B.3.2.4.a).
- Only 6% of the relationships with DMTP are significant (Table 4.2.16.b), and these are the only urine-based relationships that are significant (Table B.3.2.4.a).
- For dust concentrations, azinphosmethyl, chlorpyrifos, and ethyl parathion were the predominant chemicals measured, 25%, 21%, and 21%, respectively (Table B.3.2.4.b).
- Overall, only six percent of the relationships with dust concentrations are significant (Table 4.2.16.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.16.c Family Hygiene Practices Questions and Chemicals/Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Chemicals/Metabolites Analyzed[b]
Q1006	Work Clothes Worn Indoors	Dust	AZM, OPSUM
Q1009	Number of Weeks Since Last Vacuuming	Dust	OPSUM

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.16.a.

In instances where information regarding the direction of the relationships is provided, the significant or marginally significant media/question relationships are in agreement with the expectation that the exposure or activity is associated with a higher measurement level (Table C.3.2.4). Both longer periods of wearing work clothes indoors and more weeks since last vacuuming were associated with higher measurement levels of dust. Although there are a small number of relationships for these questions, they appear to be useful in predicting exposure levels in dust for the chemicals noted (Table 4.2.16.c).

4.2.5.5 Category 11: Smoking-Related Activities

Several studies have included the measurement of urinary cotinine, the primary metabolite of nicotine, as a marker of children's exposure to smoking. Smoking at the workplace has been associated with higher pesticide exposures since cigarettes or other smoking material may become contaminated during work. It is not clear, however, that there is a plausible hypothesis for an effect of adult smoking behavior on children's pesticide exposure. A list of the questions included in this category can be found in Appendix E.

The only chemical/metabolite measured in the study samples was TCPY (Table B.3.2.5.a).

Table 4.2.17.a Codes and Descriptions for Metabolites with Significant Relationships for Questions in the Smoking-Related Activities Category

Code(s)	Medium[a]	Description
TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] Medium is noted as urine or other (any other medium sampled).

The smoking-related activities category of questions includes 4 or 1% of the relationships extracted from the relevant publications (Table 4.2.3) and falls into the low-range occurrence level. This finding is not surprising, since there would appear to be little relationship between smoking and pesticide metabolite levels in children.

Table 4.2.17.b Distribution of Significant Medium/Question Relationships with Smoking-Related Activities Questions, by Medium

	Medium/Question Relationships[a]			
	Significant[b]			Total
Medium Sampled	Metabolites Measured[c]	N	%[d]	N
Urine	TCPY	3	75	4
Total		3	75	4

[a] Based on counts from Table B.3.2.5.a.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.17.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Only urine-based relationships were found for this category (Table B.3.2.5.a).
- Seventy-five percent of the relationships with TCPY are significant (Table 4.2.17.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.17.c Smoking-Related Activities Questions and Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Metabolites Analyzed[b]
Q1101	Current Smoker	Urine	TCPY
Q1102	Subject Smoked	Urine	TCPY

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.17.a.

The two questions in Table 4.2.17.c were from Krinsley (1998) whose study population was focused on adults, but included children greater than 10 years of age. For Q1102, the two relationships are significant; however, the direction of the relationship differs depending on the other questions included in the regression analysis. For Q1101, the direction of the effect is opposite of what is expected; that is, higher measurement levels are not associated with currently smoking. Thus, the relationship between smoking and TCPY levels in urine appears not to be supported by a plausible hypothesis (Table C.3.2.5).

4.2.5.6 Category 12: Work Exposure/Practices

Work exposure and work practices may lead to children's pesticide exposure if pesticides are transmitted from the workplace to the home. The studies under review were primarily environmental exposures studies conducted in agricultural communities with a focus on children. If these studies had been strictly occupational exposure assessment studies, more questions related to the work and family hygiene practices might have been included in these studies. A list of the questions included in this category can be found in Appendix E.

The chemicals/metabolites measured in the study samples are azinphospmethyl and TCPY (Table B.3.2.6.a); however, none of the chemicals/metabolites have significant relationships with questions in this category (Table 4.2.18.a).

Table 4.2.18.a Codes and Descriptions for Chemicals/Metabolites with Significant Relationships for Questions in the Work Exposure/Practices Category

Code(s)	Medium	Description
None	urine, dust	No chemicals

The work exposure/practices category of questions includes 4 or 1% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the low-range occurrence level of relationships.

Table 4.2.18.b Distribution of Significant Relationships with Work Exposure/Practices Questions, by Medium

	Media/Question Relationships[a]			
	Significant[b]			Total
Medium Sampled	**Chemicals/Metabolites Measured[c]**	**N**	**%[d]**	**N**
Urine	None	0	0	1
Dust	None	0	0	3
Total		0	0	4

[a] Based on counts in Table B.3.2.6.a.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.18.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Relationships between questions and urine sample concentrations account for 25% of the relationships in this category (Table B.3.2.6.a).
- Seventy-five percent of the relationships are dust-based (Table B.3.2.6.b).
- None of the relationships with urine metabolites or dust chemicals are significant or marginally significant (Table 4.2.18.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.18.c Work Exposure/Practices Questions and Chemicals/Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Chemicals/Metabolites Analyzed
N/A	Not applicable	Urine, dust	Not applicable

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.

No questions (Table 4.2.18.c) in this category have significant relationships with the urine and dust measurements (Table C.3.2.6) for the studies considered in this review.

4.2.5.7 Summary of Results from Behavior Relationships

The six question categories under the behavior risk factor focus on the behaviors of the household members or children in both macro and micro environments. Nine questions from five of the six question categories are considered overall statistically significant (and effective differentiators of exposure level) for the chemicals/metabolites noted. For each of the question and chemical/metabolite combinations, the majority (> 50%) of the relationships were statistically or marginally significant.

Table 4.2.19 Questions from Behavior Question Categories Considered Overall Statistically Significant, by Medium

Medium	Q Category	Q #[a]	Q Description	Chemicals/ Metabolites[b]
Dust				
	Family hygiene practices	Q1006	Work Clothes Worn Indoors	AZM, OPSUM
		Q1009	Number of Weeks Since Last Vacuuming	OPSUM
Urine				
	Subject's personal characteristics	Q702	Age	DAP1, METHYL2
		Q703	Ethnicity	1NAP, MDA
		Q705	Income	1NAP, MDA, TCPY, DMTP, DAP1
	Child's behaviors	Q806	Loading from Hand Wipe	DAP1
	Dietary behaviors	Q904	Organic Diet	METHYL2
	Smoking-related activities	Q1101	Current Smoker[c]	TCPY
		Q1102	Subject Smoked[c]	TCPY

[a] For some of the significant relationships, the effect of the exposure factor was not in the direction expected. See Appendix C for details on specific questions.
[b] Chemicals or metabolites for which > 50% of the relationships with the question were statistically or marginally significant. (See "a" tables: Tables 4.2.13.a through 4.2.18.a for descriptions.)
[c] Included only in Krinsley (1998) whose study population was focused on adults, but included children greater than 10 years of age.

Family hygiene practices were the strong differentiators for pesticide levels in dust measurements; the subject's personal characteristics, the child's behaviors, and dietary behaviors were the strong differentiators for the pesticide metabolite levels in urine (Table 4.2.19).

4.2.6 Presentation of Other Relationships

Several other relationships were tested in the studies under review, but these were difficult to categorize. Two types of relationships are discussed here: exposure levels in populations (in particular, in adults living with children), and health outcomes. This category included 13, or 2%, of the relationships identified in this review.

4.2.6.1 Category 13: Related Exposure Levels

Several studies examined the relationship between pesticide metabolite levels in adults and children. It was hypothesized in these studies that adults living in the same environment as children, and perhaps consuming similar foods, would exhibit similar metabolite levels. A list of the questions included in this category can be found in Appendix E.

Table 4.2.20.a Codes and Descriptions for Metabolites with Significant Relationships for Questions in the Related Exposure Levels Category

Code(s)	Medium[a]	Description[b]
DAP2	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
DAP3	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement)[c]
MTHL4, METHYL4	urine	DMP, DMTP (at least one detectable measurement)

[a] Medium is noted as urine or other (any other medium sampled).
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate
[c] See definition of high measurement in Azaroff (1999).

The related exposure levels category of questions includes 5 or 1% of the relationships extracted from the relevant publications. This category of questions falls into the low-range occurrence level for relationships (Table 4.2.3). An association between adult and child pesticide metabolite levels suggests similar exposure sources for these populations, and may help in understanding how to reduce or prevent exposures. However, few studies have examined this relationship.

Table 4.2.20.b Distribution of Significant Relationships with Related Exposure Levels Questions, by Medium

	Media/Question Relationships[a]			
Medium Sampled	Significant[b]			Total
	Metabolites Measured[c]	N	%[d]	N
Urine	DAP2, DAP3, METHYL4	4	80	5
Total		4	80	5

[a] Based on counts in Table B.3.3.1.a.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.20.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Only urine-based relationships were found for this category (Table B.3.3.1.a).

- Eighty percent of the relationships are significant (Table 4.2.20.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.20.c Related Exposure Levels Questions and Metabolites with Overall[a] Significant Relationships

Q#	Description	Medium	Metabolites Analyzed[b]
Q1302	High Levels in Adult Household Members	Urine	DAP2, DAP3, METHYL4

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.20.a

In most instances where information regarding the direction of the relationships is provided, the significant medium/question relationships are in agreement with the expectation that more adults in the household with high measurement levels is associated with a higher measurement level for the children (Table C.3.3.1). Although there are a small number of relationships for this question, it appears to be a useful predictor of DAP levels in urine.

4.2.6.2 Category 14: Health

In some of the studies under review investigators included general health status questionnaires. It is not clear whether such questions were included to collect general health status information on the population, or to explore specific hypotheses related to pesticide exposure. For example, it is not immediately evident why pesticide exposure would be associated with intestinal disease or ulcers, unless one considers a possible change in diet to be associated with such diseases. Nevertheless, possible associations between health outcomes and pesticide exposure metrics were tested in some instances. A list of the questions included in this category can be found in Appendix E.

The only metabolite measured in the study samples for this category is TCPY (Table B.3.3.2.a).

Table 4.2.21.a Codes and Descriptions for Metabolites with Significant Relationships for Questions in the Health Category

Code(s)	Medium[a]	Description
TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] Medium is noted as urine or other (any other medium sampled).

The health category of questions includes 8 or 1% of the relationships extracted from the relevant publications (Table 4.2.3). This category of questions falls into the low-range occurrence level. The possible association of TCPY metabolites in urine with health outcomes does not imply causality in either direction. Associations that do not involve the nervous system are generally not supported by a well-established hypothesis; however, the OP pesticides may affect the nervous system such that other organ systems can also be affected. Analyses of these types of possible associations should be considered exploratory.

Table 4.2.21.b Distribution of Significant Relationships with Health Questions, by Medium

	Media/Question Relationships[a]			
Medium Sampled	Significant[b]			Total
	Chemicals/Metabolites Measured[c]	N	%[d]	N
Urine	TCPY	5	63	8
Total		5	63	8

[a] Based on counts in Table B.3.3.2.a.
[b] Significant ($p < 0.05$) and marginally significant ($p < 0.10$).
[c] See descriptions in Table 4.2.21.a.
[d] Percent of significant relationships for medium, that is, (N*100)/Total N.

The relationships in this question category can be summarized as follows:

- Only urine-based relationships were found for this category (Table B.3.3.2.a).
- Sixty-three percent of the relationships with TCPY are significant (Table 4.2.21.b).

See Table 4.2.5 for tables with related information for the questions in this category.

Table 4.2.21.c Health Questions and Metabolites with Overall[a] Significant Relationships

	Description	Medium	Metabolites Analyzed[b]
Q1403	Bowel Disease	Urine	TCPY
Q1405	Intestinal Disease	Urine	TCPY
Q1406	Ulcers	Urine	TCPY

[a] Overall indicates that > 50% of the question/medium/chemical relationships were significant.
[b] See descriptions in Table 4.2.21.a

In most of the significant relationships, not having the disease is associated with a higher TCPY level than having the disease; however several of these analyses included the question as one of several in a regression analysis, and the direction of the relationship cannot be determined by the regression coefficient alone (Table C.3.3.2). These relationships did not necessarily consider the health outcome of pesticide exposure; however, it is possible that health status may signal changes in dietary or other behaviors that may affect exposure levels. One example is the inclusion or exclusion of additional vegetables and fruits in the diet.

4.2.6.3 Summary of Results from Other Relationships

The two question categories under the "other" risk factor were difficult to categorize. Four questions from the two question categories are considered overall statistically significant (and effective differentiators of pesticide exposure levels) for TCPY. For each of the question and chemical/metabolite combinations, the majority (> 50%) of the relationships were statistically or marginally significant.

Table 4.2.22 Questions from Other Question Categories Considered Overall Statistically Significant, by Medium

Medium	Q Category	Q #[a]	Q Description	Chemicals/ Metabolites[b]
Urine				
	Related exposure levels	Q1302	High Levels in Adult Household Members	DAP2, DAP3, METHYL4
	Health	Q1403	Bowel Disease	TCPY
		Q1405	Intestinal Disease	TCPY
		Q1406	Ulcers	TCPY

[a] For some of the significant relationships, the effect of the exposure factor was not in the direction expected. See Appendix C for details on specific questions.
[b] Chemicals or metabolites for which > 50% of the relationships with the question were statistically or marginally significant. (See "a" tables: Tables 4.2.21.a and 4.2.22.a for descriptions.)

Neither of the question categories showed differentiating capability for pesticide levels in dust measurement levels (Table 4.2.22). Both categories have some questions that differentiate pesticide metabolite levels in urine.

4.2.7 Summary of Results from Literature Review

Tables 4.2.12, 4.2.19, and 4.2.22 list the questions that are strong differentiators for the chemical or metabolite levels for each of the three risk factors, source, behavior, and other. Dust and urine measurements were found in 97% of the relationships. Measurements for the other media were found in only two of the 20 publications: Sexton (2003) and Simcox (1995). The relationships for each question and chemical/metabolite combination were reviewed to determine the question's effectiveness for differentiating the exposure levels. Not all question/chemical combinations were evaluated in the studies to the same extent. The number of relationships evaluated with a question, especially when the questions are used with more than one study population, gives additional credence to the question as a potential differentiator for a specific chemical or metabolite. Generally the questions showing the most effectiveness were:

- residential pesticide use (inside and outside)
- occupation of household members
- child's characteristics (age, ethnicity, income)
- family hygiene practices
- household dust.

Several other questions also show some effectiveness:

- pets
- household location (urban vs non-urban)
- dietary behaviors (organic food)
- exposure levels of household members
- health status (diseases)
- smoking behaviors
- proximity to agricultural fields (for house dust only).

The number of relationships evaluated in the publications for this second group of questions is small, indicating that their effectiveness has not been tested as extensively as for the questions in the first group.

For urine measurements, questions showing usefulness as indicators of a child's pesticide exposure level cover the areas of residential pesticide use both indoors and outdoors, household occupation, subject's personal characteristics, family hygiene practices, and smoking behavior. Each of these indicators seems plausible, in that such relationships have been seen in previous investigations of environmental exposures (e.g., lead exposure in children). The smoking questions appeared only in Krinsley (1998), whose study population was focused on adults, but included children greater than 10 years of age. Although second-hand smoke is noted as a significant predictor, the age of the majority of the study population and the very limited transferability of any pesticides from the smoke makes this question less effective for purposes of this project. For dust measurements, the questions showing usefulness as indicators of a child's pesticide exposure level cover the areas of household occupation, residential proximity to spraying, and family hygiene behavior. Each of these indicators also seems plausible in terms of pesticides being present in the child's environment. These questions represent potential exposure from the take-home pathway and from agricultural pesticide spraying.

The set of question categories used in this report (Table 4.2.3) provide one perspective for organizing the relationships. Three risk or exposure factors, related to the take-home or para-occupational exposure pathway, were analyzed as separate categories in this report: household occupation, family hygiene practices, and work exposure/practices. Household occupation is considered a source that may result in measurable differences in children's pesticide exposures. Most of the questions in this category involve the occupational status of household members. The occupations considered were pesticide applicators, farm workers, pesticide handlers, growers, and reference groups (non-agricultural workers). The occupation of household workers within the agricultural sector produced a substantial number of statistically significant relationships for urine and dust and the corresponding DAPs and OP parent compound levels. For these relationships, occupation may represent a surrogate for the actual exposure levels of household members employed in agriculture. These workers become reservoirs for the chemicals to which they are exposed at work. They subsequently transfer these chemicals into their homes and to their family members. This para-occupational exposure pathway involves the transport of contaminants from the workplace to the residence on a worker's clothing or person (Curl 2002). Children may be exposed to agricultural chemicals through the take-home or para-occupational pathway and their exposure levels are dependent on the occupational status, work, handling, and hygiene practices of agricultural workers in their households.

Two other risk factors examined in this report also contribute to the para-occupational exposure pathway. Family hygiene practices and work exposure/practices are considered behavioral practices that may modify pesticide exposure to agricultural workers and their family members. There were fewer relationships in these two categories because of the nature of the studies analyzed. The studies under review were primarily environmental exposures studies conducted in agricultural communities with a focus on children. If these studies had been strictly occupational exposure assessment studies, more questions related to the work and family hygiene practices might have been included in these studies. The findings which produced significant results such as laundering practices, vacuuming, and removal of work clothing and boots are also integral components required to fully understand the para-occupational exposure pathway.

4.3 Children's Pesticide Exposure Study (Yuma Study)

The second approach for evaluating questions useful in differentiating children's pesticide exposure levels was based on information available from a recent exposure study with this goal. The Children's Pesticide Exposure Study collected questionnaire responses and sample measurements from 152 households in Yuma County, Arizona. Throughout this section, the Children's Pesticide Exposure Study will be referred to as the Yuma Study.

In the Yuma Study, one child in each household was considered the principal participant. Urine samples were collected from the principal participant and a dust sample was collected from the household. An interview was conducted regarding the household's characteristics and activities, and the principal participant's behaviors. Siblings from the household were included in the study if they were available and in the appropriate age range (2-11 years old); however, only urine samples and minimal demographic information were collected for the siblings. For 77 of the households, one sibling was included in the study, and for 15 of the households two siblings were included.

The study design initially focused the selection of households on eight schools and of principal participants in kindergarten and first grade (Table 4.3.1). Seventeen children outside the initial school and grade list were included as principal participants. There were five "other" school categories including none. There were five "other" grade categories including: second grade, third grade, Head Start, preschool, and none.

Table 4.3.1 Number of Yuma Study Principal Participants, by School and Grade Level

	Grade of Principal Child			Total
School Attended by Principal Child	**Kindergarten**	**First Grade**	**Other Grades**	
School # 1	6	4	1	11
School # 2	16	25	0	41
School # 3	5	8	1	14
School # 4	4	6	0	10
School # 5	12	7	3	22
School # 6	3	8	0	11
School # 7	16	10	1	27
School # 8	4	1	0	5
Other Schools	1	0	10	11
Total	67	69	16	152

Urine samples were measured for the six dialkylphosphates: DEP, DETP, DEDTP, DMP, DMTP, and DMDTP. Unadjusted urinary metabolite measurements were available for 150 of the 152 principal participants; urinary metabolite measurements adjusted for creatinine were available for 148 of the 152 principal participants. Household dust samples were available for the 152 households. Dust samples were also collected from rooms where principal participants attended class in the six schools that gave permission (Table 4.3.2). School dust measurements were available for a subset of the schools and grades. These samples cover 82% of the principal participants from the eight schools in the initial Yuma Study design.

Table 4.3.2 Number of Principal Participants Where Yuma Study Dust Samples Were Collected, by School and Grade Level

	Grade of Principal Child		Total
School Attended by Principal Child	**Kindergarten**	**First Grade**	
School # 1	6	4	10
School # 2	16	25	41
School # 3	5	8	13
School # 4	4	6	10
School # 6	3	8	11
School # 7	16	10	26
Total	50	61	111

Household and school dust samples were measured for pesticides in the classes organophosphates, organochlorines, permethrins, and miscellaneous (Table 4.3.3).

Table 4.3.3 Pesticides Measured in Yuma Study Household and School Dust Samples

atrazine	4,4-' DDT	methyl parathion[a]
azinphos-methyl[a]	diazinon[a]	methoxychlor
bendiocarb	dichlorvos[a]	metolachlor
bensulide	dicofol	pendimethalin
benzamide	dieldrin	cis-permethrin
captan	disulfoton[a]	trans-permethrin
carbaryl	endosulfan 1	o-phenylphenol
carbofuran	endosulfan 2	phorate[a]
alpha-chlordane	ethyl parathion[a]	prometryn
gamma-chlordane	folpet	propoxur
chlorpyrifos[a]	fonophos[a]	simazine
chlorthal-dimethyl	heptachlor	terbufos[a]
cy-permethrin	hexachlorobenzene	trifluralin
4,4-' DDD	lindane	
4,4-' DDE	malathion[a]	

[a] Organophosphorous (OP) pesticides

Relationships found in the Yuma Study are described in two segments. Section 4.3.1 describes the relationships that are relevant to the interests of this project, based on the Yuma Study report (CDC 2002). Section 4.3.2 and Appendix G describe the relationships identified from the data mining analysis. Both analysis paths use the same study data set, but consider different subsets of the Yuma Study participants, and performed analyses for different purposes. These differences should be taken into consideration when comparing results from the two approaches.

4.3.1 Relationships Explored in the Yuma Study Report

The Yuma Study analyzed potential risk factors, based on the questionnaire responses, for children in a household, that is, the principal participant and any siblings. The objective of the study was to determine the effect and levels of pesticide exposure on children living or attending schools near pesticide-treated fields (CDC 2002). A child's exposure level was determined by the level of pesticide metabolites in the urine. The study's report uses the terms risk factors, associations, and borderline, and those terms will be used in section 4.3.1 when describing the report's results. For purposes of this report, the terms risk (or exposure) factors and questions, association and relationship, and borderline and marginal (regarding statistical significance) are interchangeable in section 4.3.

4.3.1.1 Relationships Between Questions and DAP Metabolites

For the Yuma Study report (CDC 2002), the children's exposure levels were evaluated with regression models controlled for intra-household correlation with household as the repeated measurement. The potential risk factors selected for analysis were the subset of the full set of questions that could be applied to, and were available for, siblings as well as principal participants. These factors included the child's physical characteristics and household characteristics or practices. Child-specific behaviors were not used for the analyses because they were not collected on any siblings. The pesticide metabolite concentrations were log transformed to better meet the normality assumptions of the analyses and generalized estimating equations (SAS version 8.2, SAS Institute, Cary, NC) were used to measure the associations. Discussions about whether to analyze urinary metabolites in children as adjusted or unadjusted for creatinine can be found in the literature, e.g., O'Rourke (2000).

Table 4.3.4 Results of Regression Models[a] with DMOP and DEOP, Unadjusted and Adjusted for Creatinine, for 152 Households

Risk Factor	DMOP[b] unadj[c] Slope[f] (p-value)[g]	DMOP[b] adj[d] Slope[f] (p-value)[g]	DEOP[e] unadj[c] Slope[f] (p-value)[g]	DEOP[e] adj[d] Slope[f] (p-value)[g]
Sex of participant	-0.07 (0.68)	-0.21 (0.25)	0.01 (0.94)	-0.12 (0.30)
Age of participant	-0.02 (0.70)	-0.06 (0.23)	-0.01 (0.71)	-0.05 (0.21)
Size of participant	0.00 (0.98)	0.00 (0.94)	-0.03 (0.40)	-0.02 (0.49)
Use of lice shampoo in last year	0.06 (0.78)	-0.01 (0.98)	-0.07 (0.67)	-0.13 (0.56)
Distance from home to agricultural field	0.18 (0.36)	-0.05 (0.82)	0.00 (0.99)	-0.23 (0.12)
Use of pesticides inside home in last month	0.03 (0.87)	0.27 (0.16)	**0.23 (0.06)**	***0.45 (0.00)***
Use of pesticides outside of home in last month	0.19 (0.31)	0.31 (0.11)	0.14 (0.25)	0.24 (0.10)
Father working in agriculture	-0.12 (0.54)	-0.19 (0.33)	-0.03 (0.83)	-0.11 (0.49)
Mother working in agriculture	0.27 (0.54)	0.19 (0.68)	**0.44 (0.06)**	0.39 (0.18)
Father or mother working in agriculture	0.09 (0.84)	-0.22 (0.63)	0.04 (0.86)	-0.24 (0.42)
Other adult in house working in agriculture	-0.19 (0.46)	-0.30 (0.22)	-0.23 (0.23)	***-0.32 (0.04)***
Father, mother or other adult working in agriculture	-0.23 (0.56)	0.46 (0.25)	0.00 (0.99)	-0.20 (0.46)

[a] Regression model included all participating children controlling for intra-household correlation with household as a repeated measure. Slope and p-value provided. N varies according to available responses for a risk factor.
[b] DMOP is a summary variable made from summing molar weights of DMP, DMTP, and DMDTP. (Concentrations < Limit of detection (LOD) were replaced with LOD/2.)
[c] Unadjusted for creatinine (ug/l urine).
[d] Adjusted for creatinine (ug/g Creatinine).
[e] DEOP is a summary variable made from summing molar weights of DEP, DETP, and DEDTP. (Concentrations < LOD were replaced with LOD/2.)
[f] The slope estimates the increase in the pesticide level per unit increase in the independent variable. Slopes associated with statistically significant p-values ($p < 0.05$) are in bold italics. Slopes associated with borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold. For questions answered by a yes or no, a yes response was assigned a value of 1 and a no response was assigned a value of 2.
[g] Statistically significant p-values (<0.05) are in bold italics. Borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.

No risk factors were found to be associated with DMOP, the sum of methylated DAPs (Table 4.3.4). For DEOP, the sum of ethylated DAPs, the strongest association is with the questions for *recent pesticide use in the home*. Secondary associations are identified with questions about *the mother or another adult (not father) working in agriculture,* which may relate to the level of daily interactions between these adults and the children. The coding assigned to the yes and no responses was 1 and 2, respectively. Thus, negative slopes indicate that the "yes" respondents have a higher measurement level than the "no" respondents, and positive slopes indicate that the "yes" respondents have a lower measurement level than the "no" respondents. Some of the slopes are in the direction expected (negative slope) based on current knowledge, while others like *recent pesticide use in the home* or *mother working in agriculture* appear to be in the reverse direction (positive slope). Alternatively, the reverse direction for *mother working in agriculture* may be a surrogate measure for time away from home rather than the take-home pathway.

Statistical analyses were also performed on the individual DAPs, and in a few instances, risk factors that are significant or marginally significant for an individual DAP metabolite are not significant for the metabolite sum. One such example is *recent pesticide use in the home* for methylated DAPs. There is a significant association for DMP, and no significant association for DMTP, DMDTP and DMOP (Tables 4.3.4 and 4.3.5). This might indicate the impact of combining associations having different directions of association or of combining strong and weak associations.

Table 4.3.5 Results of Regression Models[a] with Individual DAP Metabolites, Unadjusted and Adjusted for Creatinine, for 152 Households

Risk factor	DMP Slope[b] (p-value)[c]	DMTP Slope[b] (p-value)[c]	DMDTP Slope[b] (p-value)[c]	DEP Slope[b] (p-value)[c]	DETP Slope[b] (p-value)[c]	DEDTP Slope[b] (p-value)[c]
	Unadjusted for Creatinine[d]					
Sex of participant	-0.01 (0..96)	-0.15 (0.46)	0.02 (0.93)	-0.02 (0.85)	0.00 (0.97)	0.12 (0.31)
Age of participant	-0.02 (0.69)	0.05 (0.44)	0.04 (0.62)	-0.03 (0.41)	-0.00 (0.87)	***0.07 (0.03)***
Size of participant	-0.05 (0.27)	0.05 (0.44)	-0.03 (0.79)	-0.04 (0.26)	-0.02 (0.62)	-0.00 (0.97)
Use of lice shampoo in last year	-0.01 (0.95)	0.26 (0.41)	-0.12 (0.78)	-0.07 (0.73)	-0.14 (0.19)	0.09 (0.70)
Distance from home to agricultural field	0.08 (0.66)	0.10 (0.72)	0.31 (0.37)	-0.07 (0.63)	-0.00 (0.99)	***0.30 (0.02)***
Use of pesticides inside home in last month	***0.39 (0.02)***	-0.04 (0.87)	-0.12 (0.70)	***0.31 (0.03)***	**0.19 (0.09)**	-0.22 (0.13)
Use of pesticides outside of home in last month	0.12 (0.49)	0.17 (0.52)	0.16 (0.64)	0.18 (0.22)	0.06 (0.57)	-0.21 (0.16)
Father working in agriculture	-0.30 (0.12)	-0.02 (0.95)	0.16 (0.65)	-0.13 (0.41)	0.07 (0.58)	0.27 (0.11)
Mother working in agriculture	**0.67 (0.08)**	0.32 (0.57)	1.27 (0.10)	0.39 (0.16)	0.28 (0.22)	**0.87 (0.08)**
Father or mother working in agriculture	-0.33 (0.32)	0.09 (0.88)	***1.46 (0.04)***	-0.08 (0.77)	0.09 (0.68)	0.53 (0.16)
Other adult in house working in agriculture	-0.21 (0.39)	-0.64 (0.11)	0.14 (0.77)	**-0.34 (0.08)**	-0.16 (0.29)	0.33 (0.30)

Risk factor	**DMP Slope[b] (p-value)[c]**	**DMTP Slope[b] (p-value)[c]**	**DMDTP Slope[b] (p-value)[c]**	**DEP Slope[b] (p-value)[c]**	**DETP Slope[b] (p-value)[c]**	**DEDTP Slope[b] (p-value)[c]**
Father, mother or other adult working in agriculture	-0.19 (0.56)	-0.67 (0.25)	0.44 (0.51)	-0.06 (0.83)	0.01 (0.97)	0.35 (0.30)
	Adjusted for Creatinine[e]					
Sex of participant	-0.14 (0.43)	-0.29 (0.18)	-0.10 (0.71)	-0.15 (0.30)	-0.14 (0.16)	-0.01 (0.97)
Age of participant	-0.05 (0.35)	-0.00 (0.98)	-0.00 (0.97)	-0.07 (0.14)	-0.04 (0.20)	0.03 (0.31)
Size of participant	-0.05 (0.37)	0.06 (0.39)	-0.02 (0.86)	-0.04 (0.39)	-0.02 (0.63)	0.00 (0.93)
Use of lice shampoo in last year	-0.07 (0.82)	0.17 (0.65)	-0.20 (0.63)	-0.13 (0.63)	-0.20 (0.19)	0.03 (0.89)
Distance from home to agricultural field	-0.14 (0.53)	-0.18 (0.53)	0.05 (0.89)	**-0.31 (0.08)**	**-0.22 (0.05)**	0.06 (0.67)
Use of pesticides inside home in last month	***0.61 (0.00)***	0.25 (0.33)	0.15 (0.63)	***0.53 (0.00)***	***0.40 (0.00)***	0.01 (0.94)
Use of pesticides outside of home in last month	0.21 (0.32)	0.34 (0.19)	0.31 (0.33)	0.28 (0.11)	0.15 (0.18)	-0.10 (0.47)
Father working in agriculture	**-0.38 (0.09)**	-0.10 (0.71)	0.08 (0.81)	0.22 (0.25)	-0.00 (0.99)	0.19 (0.23)
Mother working in agriculture	0.63 (0.17)	0.18 (0.75)	1.14 (0.14)	0.33 (0.34)	0.23 (0.35)	0.79 (0.11)
Father or mother working in agriculture	-0.60 (0.14)	-0.30 (0.63)	1.10 (0.11)	-0.37 (0.25)	-0.17 (0.42)	0.23 (0.57)
Other adult in house working in agriculture	-0.30 (0.22)	***-0.76 (0.03)***	0.02 (0.96)	***-0.44 (0.02)***	***-0.25 (0.02)***	0.23 (0.44)
Father, mother or other adult working in agriculture	-0.37 (0.33)	**-0.99 (0.07)**	0.14 (0.82)	-0.27 (0.39)	-0.17 (0.38)	0.13 (0.71)

[a] Regression model included all participating children controlling for intra-household correlation with household as a repeated measure. Slope and p-value provided. N varies according to available responses for a risk factor. (Concentrations < LOD were replaced by LOD/2.)
[b] The slope estimates the increase in the pesticide level per unit increase in the independent variable. Slopes associated with statistically significant p-values ($p < 0.05$) are in bold italics. Slopes associated with borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold. For questions answered by a yes or no, a yes response was assigned a value of 1 and a no response was assigned a value of 2.
[c] Statistically significant p-values (<0.05) are in bold italics. Borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.
[d] ug/l urine.
[e] ug/g Creatinine.

When looking at the individual DAPs, associations of the methylated DAPs occur with the questions about *recent pesticide use in the home* and *household members working in agriculture* (Table 4.3.5). As expected, based on the significant associations for DEOP (Table 4.3.4), these risk factors are associated with some of the individual ethylated DAPs, DEP and DETP (Table 4.3.5). *Distance from home to agricultural fields* also shows significant associations with DEP and DETP (Table 4.3.5). The significant associations with these two DAPs are likely the basis for the significant relationships with DEOP (Table 4.3.4).

The positive valued slopes for the questions with yes/no responses show an association opposite of what might be expected for the risk factor, that is, a yes response is predicted to have a lower measurement level than a no response.

Statistical analyses were also performed on the risk factor *distance from household to agricultural field*. The households were divided into two groups, those whose distance to the agricultural fields was < 250 feet, and those whose distance was $\geq$ 250 feet. The question *distance from home to the agricultural fields* for principal participants shows statistical significance (borderline) only for the DEDTP metabolite, with distances closer to the agricultural fields having higher concentration values, as expected (Table 4.3.6).

Table 4.3.6 Results Comparing Distance from Home to Agricultural Fields with Six DAP Metabolites, Unadjusted and Adjusted for Creatinine, for Principal Participants

Analyte (unadjusted, ug/l urine) (adjusted, ug/g Creatinine)	**N_1**	**Mean and range of urine samples in area < 250 feet[a]**	**N_2**	**Mean and range of urine samples in area $\geq$ 250 feet[a]**	**t-statistic**	**p-value**
DMP (unadjusted)	108[b]	4.06 (0.29 – 29.00)	42	3.33 (0.29 – 14.00)	1.00	0.32
DMP (adjusted)	107[c]	7.21 (0.18 – 60.13)	41[d]	6.67 (0.28 – 49.82)	0.31	0.76
DMTP (unadjusted)	108[b]	13.43 (0.09 – 200.00)	42	11.10 (0.09 – 120.00)	0.48	0.63
DMTP (adjusted)	107[c]	21.15 (0.09 – 409.00)	41[d]	18.10 (0.30 – 223.33)	0.36	0.72
DMDTP (unadjusted)	108[b]	5.61 (0.04 – 160.00)	42	4.02 (0.04 – 51.00)	0.67	0.50
DMDTP (adjusted)	107[c]	8.78 (0.02 – 215.25)	41[d]	6.71 (0.03 – 94.29)	0.53	0.59
DEP (unadjusted)	108[b]	3.24 (0.59 – 21.00)	42	2.92 (0.55 – 11.00)	0.57	0.57
DEP (adjusted)	107[c]	5.37 (0.41 – 40.32)	41[d]	5.61 (0.81 – 39.15)	-0.19	0.85
DETP (unadjusted)	108[b]	1.32 (0.50 – 5.70)	42	1.73 (0.50 – 9.2)	-1.32	0.19
DETP (adjusted)	107[c]	2.04 (0.24 – 9.09)	41[d]	2.42 (0.67 – 10.53)	-1.16	0.25
DEDTP (unadjusted)	108[b]	0.50 (0.08 – 14.00)	42	0.24 (0.08 – 1.10)	1.71	0.09
DEDTP (adjusted)	107[c]	0.64 (0.07 – 11.75)	41[d]	0.39 (0.06 – 1.42)	1.62	0.11

[a] Concentrations < LOD were replaced with LOD/2.
[b] Results from urine samples of two principal participants were not available.
[c] Results from urine samples of two principal participants were not available and creatinine level from urine sample of one principal participant was not reported.
[d] Creatinine level from urine sample of one principal participant was not reported.

4.3.1.2 Relationships Between Dust Measurements and DAP Metabolites

The Yuma Study (CDC 2002) evaluated associations between the DAP metabolite levels and levels of the ten pesticides most detected in the household dust samples. The associations were evaluated with the ethylated (DEOP) and methylated (DMOP) DAP sums, adjusted and unadjusted for creatinine (Table 4.3.7), and for the six individual DAPs, adjusted and unadjusted for creatinine (Table 4.3.8).

Table 4.3.7 Results of Regression Models[a] with DMOP and DEOP, Unadjusted and Adjusted for Creatinine, and the Ten Pesticides Most Detected in Household Dust Samples for 152 Households

Household dust pesticide	DMOP[b] unadj[c] Slope[f] (p-value)[g]	DMOP[b] adj[d] Slope[f] (p-value)[g]	DEOP[e] unadj[c] Slope[f] (p-value)[g]	DEOP adj[d] Slope[f] (p-value)[g]
Trans-permethrin	0.00 (0.23)	***0.00 (0.03)***	**0.00 (0.07)**	**0.00 (0.06)**
Cis-permethrin	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.03)***
Chlorpyrifos	***-0.00 (0.00)***	***-0.00 (0.03)***	0.00 (0.20)	***0.00 (0.01)***
Diazinon	-0.00 (0.32)	**-0.00 (0.06)**	***-0.00 (0.00)***	0.00 (0.14)
Propoxur	***-0.00 (0.00)***	-0.00 (0.61)	***-0.00 (0.00)***	***0.00 (0.01)***
O-phenylphenol	-0.00 (0.92)	0.00 (0.92)	0.00 (0.59)	-0.00 (0.44)
Cy-permethrin	**-0.00 (0.07)**	-0.00 (0.10)	**0.00 (0.06)**	***0.00 (0.00)***
4,4'-DDT	***-0.00 (0.01)***	-0.00 (0.49)	-0.00 (0.18)	0.00 (0.54)
Gamma-chlordane	-0.00 (0.66)	0.00 (0.84)	**-0.00 (0.05)**	**-0.00 (0.07)**
Carbaryl	***0.00 (0.00)***	***0.00 (0.00)***	**-0.00 (0.09)**	***-0.00 (0.00)***

[a] Regression model included all participating children controlling for intra-household correlation with household as a repeated measure. Slope and p-value provided. N varies according to available responses for a risk factor.
[b] DMOP is a summary variable made from summing molar weights of DMP, DMTP, and DMDTP. (Concentrations < LOD were replaced with LOD/2.)
[c] Unadjusted for creatinine (ug/l urine).
[d] Adjusted for creatinine (ug/g Creatinine).
[e] DEOP is a summary variable made from summing molar weights of DEP, DETP, and DEDTP. (Concentrations < LOD were replaced with LOD/2.)
[f] The slope estimates the increase in the pesticide level per unit increase in the independent variable. Slopes associated with statistically significant p-values ($p < 0.05$) are in bold italics. Slopes associated with borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.
[g] Statistically significant p-values (<0.05) are in bold italics. Borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.

Table 4.3.8 Results of Regression Models[a] with Individual DAP Metabolites, Unadjusted and Adjusted for Creatinine, and the Ten Pesticides Most Detected in Household Dust Samples for 152 Households

Household dust pesticide	DMP Slope[b] (p-value)[c]	DMTP Slope[b] (p-value)[c]	DMDTP Slope[b] (p-value)[c]	DEP Slope[b] (p-value)[c]	DETP Slope[b] (p-value)[c]	DEDTP Slope[b] (p-value)[c]
	Unadjusted for Creatinine[d]					
Trans-permethrin	0.00 (0.10)	0.00 (0.171)	**0.00 (0.07)**	***0.00 (0.01)***	0.00 (0.44)	-0.00 (0.60)
Cis-permethrin	***0.00 (0.01)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	**0.00 (0.07)**	-0.00 (0.76)
Chlorpyrifos	-0.00 (0.22)	***-0.00 (0.05)***	0.00 (0.24)	0.00 (0.20)	0.00 (0.10)	-0.00 (0.13)
Diazinon	0.00 (0.33)	-0.00 (0.13)	-0.00 (0.12)	***0.00 (0.00)***	***0.00 (0.00)***	0.00 (0.74)
Propoxur	**0.00 (0.00)**	-0.00 (0.42)	-0.00 (0.62)	***-0.00 (0.00)***	**-0.00 (0.07)**	**-0.00 (0.08)**
O-phenylphenol	0.00 (0.30)	-0.00 (0.94)	-0.00 (0.29)	-0.00 (0.72)	-0.00 (0.89)	***-0.00 (0.00)***
Cy-permethrin	-0.00 (0.52)	-0.00 (0.31)	-0.00 (0.68)	**0.00 (0.08)**	***0.00 (0.02)***	***-0.00 (0.04)***
4,4'-DDT	-0.00 (0.43)	***-0.00 (0.03)***	***-0.00 (0.00)***	-0.00 (0.48)	***-0.00 (0.02)***	-0.00 (0.64)
Gamma-chlordane	0.00 (0.32)	0.00 (0.62)	0.00 (0.52)	**-0.00 (0.05)**	**-0.00 (0.09)**	0.00 (0.97)
Carbaryl	-0.00 (0.30)	***0.00 (0.01)***	-0.00 (0.85)	-0.00 (0.17)	***-0.00 (0.01)***	-0.00 (0.89)
	Adjusted for Creatinine[e]					
Trans-permethrin	0.00 (0.17)	***0.00 (0.01)***	***0.00 (0.00)***	**0.00 (0.07)**	***0.00 (0.00)***	-0.00 (0.82)
Cis-permethrin	0.00 (0.13)	***0.00 (0.00)***	***0.00 (0.00)***	**0.00 (0.05)**	***0.00 (0.00)***	-0.00 (0.98)
Chlorpyrifos	-0.00 (0.14)	-0.00 (0.24)	0.00 (0.20)	***0.00 (0.03)***	***0.00 (0.00)***	-0.00 (0.41)
Diazinon	-0.00 (0.89)	***-0.00 (0.03)***	***-0.00 (0.02)***	0.00 (0.23)	***0.00 (0.03)***	0.00 (0.41)
Propoxur	0.00 (0.49)	***0.00 (0.02)***	0.00 (0.26)	0.00 (0.16)	***0.00 (0.00)***	***0.05 (0.03)***
O-phenylphenol	-0.00 (0.24)	0.00 (0.39)	-0.00 (0.48)	-0.00 (0.55)	-0.00 (0.59)	***-0.00 (0.00)***
Cy-permethrin	0.00 (0.73)	-0.00 (0.48)	0.00 (0.99)	***0.00 (0.00)***	***0.00 (0.02)***	-0.00 (0.51)
4,4'-DDT	0.00 (0.58)	-0.00 (0.41)	***-0.00 (0.01)***	-0.00 (0.44)	-0.00 (0.98)	-0.00 (0.44)
Gamma-chlordane	0.00 (0.47)	0.00 (0.77)	0.00 (0.62)	**-0.00 (0.08)**	***-0.00 (0.04)***	0.00 (0.82)

Household dust pesticide	DMP Slope[b] (p-value)[c]	DMTP Slope[b] (p-value)[c]	DMDTP Slope[b] (p-value)[c]	DEP Slope[b] (p-value)[c]	DETP Slope[b] (p-value)[c]	DEDTP Slope[b] (p-value)[c]
Carbaryl	-0.00 (0.10)	**0.00 (0.05)**	0.00 (0.57)	***0.00 (0.00)***	***-0.00 (0.00)***	**-0.00 (0.06)**

[a] Regression model included all participating children controlling for intra-household correlation with household as a repeated measure. Slope and p-value provided. N varies according to available responses for a risk factor.
[b] The slope estimates the increase in the pesticide level per unit increase in the independent variable. Slopes associated with statistically significant p-values ($p < 0.05$) are in bold italics. Slopes associated with borderline statistically significant p-values ($0.05 \le p < 0.10$) are in bold.
[c] Statistically significant p-values (<0.05) are in bold italics. Borderline statistically significant p-values ($0.05 \le p < 0.10$) are in bold.
[d] ug/l urine.
[e] ug/g Creatinine.

The Yuma Study (CDC 2002) also evaluated associations between the DAP urinary metabolite levels and the levels of the seven pesticides most detected across the household and school dust samples. The associations were evaluated with the ethylated (DEOP) and methylated (DMOP) DAP sums, adjusted and unadjusted for creatinine (Table 4.3.9), and for the six individual DAPs, adjusted and unadjusted for creatinine (Table 4.3.10). The statistical analyses were performed only for the principal participants whose school/classroom dust was measured, that is, in only six of the eight schools from the initial study design (Table 4.3.2).

Table 4.3.9 Results of Regression Models[a] with DMOP and DEOP, Unadjusted and Adjusted for Creatinine, and the Seven Pesticides Most Detected in Household and School Dust Samples, for Principal Participants

Household and school dust pesticide	DMOP[b] unadj[c] Slope[f] (p-value)[g]	DMOP[b] adj[d] Slope[f] (p-value)[g]	DEOP[e] unadj[c] Slope[f] (p-value)[g]	DEOP[e] adj[d] Slope[f] (p-value)[g]
Trans-permethrin (n^h = 80/n^i =79)	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***
Cis-permethrin (n^h = 82/n^i =81)	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***
Chlorpyrifos (n^h = 110/n^i =108)	-0.00 (0.15)	-0.0 (0.28)	0.00 (0.45)	0.00 (0.18)
Diazinon (n^h = 110/n^i =108)	-0.00 (0.14)	***-0.00 (0.01)***	***-0.00 (0.00)***	0.00 (0.11)
Propoxur (n^h = 110/n^i =108)	-0.00 (0.56)	0.00 (0.32)	***-0.00 (0.00)***	0.00 (0.20)
O-phenylphenol (n^h = 110/n^i =108)	-0.00 (0.74)	0.00 (0.76)	-0.00 (0.97)	-0.00 (0.96)
Cy-permethrin (n^h = 79/n^i =77)	-0.00 (0.27)	**-0.00 (0.06)**	***-0.00 (0.01)***	***-0.00 (0.00)***

[a] Regression model included only principal participants where school dust samples were collected from their classrooms. Slope and p-value provided.

[b] DMOP is a summary variable made from summing molar weights of DMP, DMTP, and DMDTP. (Concentrations < LOD were replaced with LOD/2.)
[c] Unadjusted for creatinine (ug/l urine).
[d] Adjusted for creatinine (ug/g Creatinine).
[e] DEOP is a summary variable made from summing molar weights of DEP, DETP, and DEDTP. (Concentrations < LOD were replaced with LOD/2.)
[f] The slope estimates the increase in the pesticide level per unit increase in the independent variable. Slopes associated with statistically significant p-values ($p < 0.05$) are in bold italics. Slopes associated with borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.
[g] Statistically significant p-values (<0.05) are in bold italics. Borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.
[h] Number of measurements unadjusted for creatinine.
[i] Number of measurements adjusted for creatinine.

Table 4.3.10 Results of Regression Models[a] with Individual DAP Metabolites, Unadjusted and Adjusted for Creatinine, and the Seven Pesticides Most Detected in Household and School Dust Samples, for Principal Participants

Household and school dust pesticide	DMP Slope[b] (p-value)[c]	DMTP Slope[b] (p-value)[c]	DMDTP Slope[b] (p-value)[c]	DEP Slope[b] (p-value)[c]	DETP Slope[b] (p-value)[c]	DEDTP Slope[b] (p-value)[c]
	Unadjusted for Creatinine[d]					
Trans-permethrin (n = 80)	***0.00 (0.01)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***
Cis-permethrin (n = 82)	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	0.00 (0.20)
Chlorpyrifos (n = 110)	***-0.00 (0.00)***	-0.00 (0.53)	0.00 (0.29)	0.00 (0.61)	0.00 (0.15)	-0.00 (0.51)
Diazinon (n = 110)	0.00 (0.84)	-0.00 (0.33)	-0.00 (0.33)	***0.00 (0.00)***	***-0.00 (0.00)***	***-0.00 (0.00)***
Propoxur (n=110)	***-0.00 (0.00)***	-0.00 (0.22)	**0.00 (0.07)**	***-0.00 (0.00)***	-0.00 (0.87)	-0.00 (0.31)
O-phenylphenol (n = 110)	-0.00 (0.41)	-0.00 (0.61)	-0.00 (0.65)	-0.00 (0.79)	-0.00 (0.63)	***-0.00 (0.01)***
Cy-permethrin (n = 79)	-0.00 (0.57)	0.00 (0.22)	***-0.00 (0.01)***	***0.00 (0.00)***	***0.00 (0.01)***	***0.00 (0.01)***
	Adjusted for Creatinine[e]					
Trans-permethrin (n = 79)	***0.00 (0.01)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	0.00 (0.63)
Cis-permethrin (n = 81)	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.00)***	0.00 (0.81)
Chlorpyrifos (n= 108)	***-0.00 (0.01)***	-0.00 (0.53)	0.00 (0.29)	0.00 (0.40)	***0.00 (0.01)***	0.00 (0.77)
Diazinon (n= 108)	-0.00 (0.21)	-0.00 (0.62)	0.00 (0.22)	0.00 (0.24)	***0.00 (0.00)***	***-0.00 (0.00)***
Propoxur (n= 108)	**-0.00 (0.07)**	***0.00 (0.03)***	**0.00 (0.07)**	0.00 (0.58)	***0.00 (0.00)***	***0.00 (0.04)***
O-phenylphenol (n= 108)	-0.00 (0.38)	0.00 (0.52)	0.00 (0.76)	0.00 (0.91)	-0.00 (0.40)	-0.00 (0.65)
Cy-permethrin (n = 77)	-0.00 (0.47)	0.00 (0.38)	***-0.00 (0.00)***	***0.00 (0.00)***	***0.00 (0.01)***	***-0.00 (0.00)***

[a] Regression model included only principal participants where school dust samples were collected from their classrooms. Slope and p-value provided. (Concentrations < LOD were replaced by LOD/2.)
[b] The slope estimates the increase in the pesticide level per unit increase in the independent variable. Slopes associated with statistically significant p-values ($p < 0.05$) are in bold italics. Slopes associated with borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.
[c] Statistically significant p-values (<0.05) are in bold italics. Borderline statistically significant p-values ($0.05 \leq p < 0.10$) are in bold.
[d] ug/l urine.
[e] ug/g Creatinine.

Many associations between the DAP urinary metabolites and the most detected OP pesticides in household and school dust were found; however, the regression coefficients are very small

(Tables 4.3.7 – 4.3.10). Thus, the associations may be statistically significant, but may not necessarily be practically significant. The report authors note:

> The regression models in which the slopes were small but were statistically significant may suggest either that a) true associations existed, but the numbers of significance were less than the numbers measured in the statistical programs or b) the associations were meaningless and based solely [on] the probability of finding statistical significance if enough tests were run. (CDC 2002)

Some of the most detected pesticides in household and school dust samples are other than OP pesticides and associations between the DAPs and pesticides exist regardless of the class of pesticide. These relationships may indicate heavy pesticide use, although they do not correspond to the metabolites found.

4.3.1.3 Summary of Results

The analyses from the Yuma Study report (CDC 2002) show that the most significant associations with DAP urinary metabolites are questions about *recent pesticide use in the home*, *adult household members working in agriculture*, and *distance from home to agricultural fields*. Table 4.3.11 summarizes the significant associations between questions and DAP metabolites based on Tables 4.3.4, 4.3.5, and 4.3.6. Not all of the significant associations are in the directions expected. In some cases, it is either the concentration adjusted, or unadjusted, for creatinine that is significant, but not both. O'Rourke (2000) and Barr (2004) include discussions about differences in the use of the two measures for statistical analysis.

Questions about *recent pesticide use in the home*, *take-home pathway from the mother or other adult working in agriculture*, and *distance from home to agricultural fields* seem to be the most useful in predicting ethylated DAP exposure measurements in urine. Questions about the *father working in agriculture* seem to be somewhat useful in predicting methylated DAP exposure measurements, which is to be expected since methylated OPs are commonly used in agriculture. In many of the associations, however, the direction of the association is the opposite of what is expected (Table 4.3.11). Many strong associations are shown between the pesticides most detected in household and school dust samples and the DAP metabolites. Most of the significant regression coefficients are in the direction expected for the association based on current knowledge.

Table 4.3.11 Questions and DAP Metabolites with Significant[a] Relationships in the Yuma Study Based on Tables 4.3.4, 4.3.5, and 4.3.6

Questions	DAP Metabolites[b]															
	DEP		DETP		DEDTP		DEOP[c]		DMP		DMTP		DMDTP		DMOP[d]	
	u[e]	a[e]	u	a	u	a	u	a	u	a	u	a	u	a	u	a
Age of participant					X											
Used pesticide inside home in last month	X	X	X	X			X	X	X	X						
Distance from home to agricultural field		Y		Y	X											
Mother working in agriculture					X		X		X							
Father working in agriculture										Y						
Father or mother working in agriculture													X			
Other adult in house working in agriculture	Y	Y		Y				Y				Y				
Father, mother or other adult working in agriculture												Y				

[a] Statistically significant or borderline significant.
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.
[c] DEOP is a summary variable made from summing molar weights of DEP, DETP, and DEDTP. (Concentrations < LOD were replaced with LOD/2.)
[d] DMOP is a summary variable made from summing molar weights of DMP, DMTP, and DMDTP. (Concentrations < LOD were replaced with LOD/2.)
[e] u = unadjusted for creatinine.
a = adjusted for creatinine.
X = occurrence of risk factor associated with lower levels of pesticide metabolite.
Y = occurrence of risk factor associated with higher levels of pesticide metabolite.

4.3.2 Results from the Data Mining Approach

In the Yuma Study report (CDC 2002), hypotheses were defined a priori which set the direction for the data analyses performed. Based on these hypotheses, the risk factors were analyzed individually with the urinary DAP metabolites measured. The data mining approach provides options for exploring the Yuma Study data for relationships between risk factors and exposure levels without specifying a priori views, that is, based on relationships that exist in the data. In some cases, the risk factors were analyzed in groups and interactions between risk factors in the relationships were considered. In this section, the term relationships will be used instead of the term associations used in Section 4.3.1, to be consistent with the use of relationships in Section 4.2. Their meaning, however, is considered interchangeable.

4.3.2.1 Subpopulation Selected for Analysis

Since questionnaire responses and school dust measurements were not collected for siblings, the analyses reported here were performed only on data from principal participants. To further limit the impact of factors relating to children not defined in the initial study design, the principal participants from kindergarten and first grade and from the initial eight schools, were selected as the core set of participants for the data mining analysis. Comparisons of questionnaire responses between the 135 core participants (Table 4.3.12), and the other 17 participants (Table 4.3.1) showed little difference. Depending on the particular statistical analysis, and the urinary metabolite or sum selected as the dependent variable, up to five additional core participants were excluded because of a lack of, or suspicions about, the urinary metabolite measurements. Subsequent use of the phrase principal child will denote the core principal participant children described above.

Table 4.3.12 Number of Yuma Study Core Principal Participants, by School and Grade Level

	Grade of Principal Child		Total
School Attended by Principal Child	**Kindergarten**	**First Grade**	
School # 1	6	4	10
School # 2	16	25	41
School # 3	5	8	13
School # 4	4	6	10
School # 5	12	7	19
School # 6	3	8	11
School # 7	16	10	26
School # 8	4	1	5
Total	66	69	135

4.3.2.2 Preliminary Analyses

Two types of preliminary analyses were performed to begin understanding potential relationships: bivariate analyses to identify simple indicators of exposure level and principal component analysis to understand the underlying dimensions or structure in the data. These analyses are described in Appendix G, sections G.2.2.1 and G.2.2.2. The bivariate analyses included the principal participants with usable urinary metabolite measurements (approximately 148 children), and were performed before any recoding of questionnaire responses for conditional questions and non-responses (Appendix G, sections G.2.1.3 and G.2.1.4). Because the questions were used as categorical grouping variables, the lack of recoding did not affect the evaluation of the relationships. Questionnaire variables that indicate some differences in levels for at least three of the six DAP metabolites (DEP, DETP, DEDTP, DMP, DMTP, DMDTP) are:

Variable Name	Variable Description
cheminhs	Pesticides used inside home last month?
chemouth	Pesticides used outside home last month?
closeapp	Distance between home and nearest application of pesticides
washvegi	How often wash local fruit/veg before eating?
momwork	Mother now employed (not as housewife)?
insured	Is child covered by medical insurance?

Since house dust measurements are potential indicators of exposure, non-parametric correlations between the dust and urine measurements were also performed. Fourteen of the forty-three dust chemicals from Table 4.3.3 show some correlation with the urine measurements. Chlorpyrifos, diazinon, endosulfan I, endosulfan II, pendimethrin, trifuralin, and terbufos show a correlation with more than one of the DAP metabolites. The non-OPs in this list may be indicative of heavy pesticide use, although they do not correspond to the DAP metabolites.

4.3.2.3 Analysis for Underlying Structure

A principal component analysis (PCA) was performed to identify the dimensions (groups of questions) explaining the most variability among the potential predictors. When considering relationships of questions with urine measurements, questions in the same dimension can be considered like surrogate questions, although each question in a dimension is not a replacement for the information contained in the group of questions forming the dimension. Questionnaire responses were recoded to ensure that responses affected by a conditioning question would be analyzed appropriately (G.2.1.3). This type of recoding affects the questions included in a PCA dimension. For example, the question *cheminhs*, about pesticide treatment inside the house, is the condition question for all questions regarding specific rooms that were treated. This conditioning of the code values for the room-treated questions was a likely influence on all of the room questions being grouped together in one dimension.

Two scenarios were run in the PCA. One scenario was based on 67 of the questions in Table G.2.1; the other scenario was based on the same 67 questions and the 22 house and school dust measurement sums in Table G.2.4. Note that the number of cases used in the two PCA scenarios differ because school dust measurements were not available for all principal participants. The complete listing of the principal components (PCs), or dimensions, can be found in Table G.3.1 in Appendix G. The ten PCs explaining the most variability in the data for each scenario are listed in Table 4.3.13.

The dimensions explaining the most variability across the two scenarios were:

- Pesticide sprayed inside house
- School and school dust measurements
- Child working in agricultural field
- Relationship of home to agricultural fields
- House dust measurements--OPs
- Adults in household working with pesticides.

Although these dimensions were not analyzed with respect to the urine measurements, they are consistent with the findings in Stage 3 which were so analyzed. School dust measurements took prominence in the dimensions extracted when they were included in the second scenario. These dimensions are useful in understanding the relationships between questions or questions and dust measurements; however, they do not directly represent questions having statistically significant relationships with the urine measurement concentrations. They do represent sets of questions that have more variability, which may help differentiate pesticide metabolite levels.

Table 4.3.13 First Ten Principal Components[a] from Two Scenarios Using Yuma Study Data

	Questions-only Scenario (N=130)		Questions and House/School Dust Scenario (N=107)	
PC#[b]	**Dimension Description**	**% variability explained**	**Dimension Description**	**% variability explained**
1	Pesticide sprayed in house and rooms sprayed	17.7	Pesticide sprayed in house and rooms sprayed	13.7
2	Child working in field	7.4	School and school dust measurements	8.8
3	Distance from home to agricultural field	4.9	Child working in field	5.8
4	Relationship to fields where pesticides sprayed	4.2	House dust measurements - OPs	4.3
5	Additional adults at home and working with pesticides	3.6	Grade, age, school dust sum and school dust permethrins	3.9
6	Sources of drinking water	3.6	Sources of drinking water	3.6
7	Number and age of people in household	3.1	Additional adults at home and working with pesticides	3.1
8	Pesticide sprayed outside home	3.0	Relationship to fields where pesticides sprayed	3.0
9	Mother's occupation	2.9	Distance from home to agricultural field	2.9
10	Height and weight of principal participant	2.5	Household dust sum and household dust permethrins	2.6
	Total for top/first 10 PCs	53	Total for top/first 10 PCs	52
	Total for all 29 PCs[c]	86	Total for all 35 PCs[c]	89
	Number of variables included in PCA	67	Number of variables included in PCA	89

[a] Based on Varimax-rotated component matrix and absolute loadings values greater than or equal to 0.6.
[b] PC# = principal component number.
[c] Based on PCs with eigenvalues $\geq$ 0.7 (Jolliffe 1986).

4.3.2.4 Classification Analyses

The technique Classification and Regression Trees (CART) (Breiman 1984) was selected as the primary type of data mining analysis. Details of the technique can be found in Appendix G, section G.2.4.1. The principal participants included in these analyses was limited to 130 children, those in kindergarten or first grade, from the initial eight study schools, and with available and non-suspect urine measurement data. Twelve CART analyses were performed (Table 4.3.14). Six of the analyses were performed with the log of the molar-weighted sum of ethylated DAPs (LWETHSUM), and six were performed with the log of the molar-weighted sum of the methylated DAPs (LWMETHSM).

The six CART analyses performed for each DAP sum evaluated the predictors selected under, or relative effectiveness of, increasing levels of information and measurement collection. Three levels of information were analyzed: questions, questions and household dust measurements, and questions, household dust and school dust measurements. For each of the three levels, two sets of questions were analyzed to compare the question predictors selected or relative effectiveness of the questions. The smaller set (LTD) included questions considered the more likely predictors of exposure levels; the larger set included all of the questions from the study. The analysis results can be used to compare the effectiveness of the information levels as screening tools to help identify participants with higher exposure levels, based on whether predictors from the dust measurements are selected when questions are available. CART analyses can handle independent variables with missing values; thus, scenarios including school dust measurements did not have to be analyzed with a smaller number of cases as for the PCA (section 4.3.2.3).

Table 4.3.14 Cross-Reference for CART Analyses Performed on Yuma Study Data

	Predictors Included				
Dependent Variable[a]	**Question Group**[b]	**House Dust**	**School Dust**	**Summary Table**	**CART Details-- Figures in Appendix G**
LWETHSUM	ALL	No	No	G.3.4 [c]	G.2.1.a, G.2.1.b
LWETHSUM	LTD	No	No	G.3.4 [c]	G.2.2.a, G.2.2.b
LWETHSUM	ALL	Yes	No	G.3.4 [c]	G.2.3.a, G.2.3.b
LWETHSUM	LTD	Yes	No	G.3.4 [c]	G.2.4.a, G.2.4.b
LWETHSUM	ALL	Yes	Yes	G.3.4 [c]	G.2.5.a, G.2.5.b
LWETHSUM	LTD	Yes	Yes	G.3.4 [c]	G.2.6.a, G.2.6.b
LWMETHSM	ALL	No	No	G.3.5	G.2.7.a, G.2.7.b
LWMETHSM	LTD	No	No	G.3.5	G.2.8.a, G.2.8.b
LWMETHSM	ALL	Yes	No	G.3.5	G.2.9.a, G.2.9.b
LWMETHSM	LTD	Yes	No	G.3.5	G.2.10.a, G.2.10.b
LWMETHSM	ALL	Yes	Yes	G.3.5	G.2.11.a, G.2.11.b
LWMETHSM	LTD	Yes	Yes	G.3.5	G.2.12.a, G.2.12.b

[a] LWETHSUM is log (molar-weighted sum of ethylated DAPs adjusted for creatinine); LWMETHSM is log (molar-weighted sum of methylated DAPs adjusted for creatinine). See Appendix F for more details.
[b] ALL represents analyses with all 67 questions used (Table G.2.1). LTD represents analyses with 29 of the 67 questions considered to be more likely predictors.
[c] See also Tables G.3.4 and G.3.7 for comparisons of CART analyses with and without CHLDTM3.

For ease of presentation, these classifiers will be termed predictors, although these analyses are not performed with the intent of offering traditional predictive tools as in regression analysis. Instead CART is used as a tool to understand the factors and the interactions of the factors that may affect the exposure measurement levels found in the Yuma Study participants. A summary of the predictors selected by the CART analyses gives an overview of the questions or measurements that were found useful in differentiating the levels of pesticide exposure for children in the Yuma Study (Table 4.3.15).

Table 4.3.15 Categories of Selected Predictors[a] from CART Analyses of DAP Sums for Yuma Study Participant Children

LWETHSUM[b,c]	LWMETHSM[d]
Child's characteristics (weight, ethnicity)	Child's characteristics (height, weight)
Proximity to agricultural fields, spraying conditions	Proximity to agricultural fields, spraying conditions, child outside when fields sprayed
Child's time spent away from home	
Diet - local fruits/vegetables	
Pesticide use inside home	Pesticide use inside home, where in house child spends time
	Father's occupation
	Child's school
Household dust: OPs, permethrins, non-OPs	Household dust: non-OPs, permethrins
School dust: OPs	School dust: none

[a] Predictors selected for CART analyses across more than 50% of the scenarios.
[b] Log (molar-weighted sum of ethylated DAPs) - section F.3.2.
[c] Predictors based on CART analyses without CHLDTM3 (Table G.3.4)
[d] Log (molar-weighted sum of methylated DAPs) - section F.3.2

Several predictors are similar across the two DAP sums:

- child's characteristics
- proximity of home to agricultural fields
- pesticide use in the home
- permethrins (in house dust).

The ethylated sum levels consider the time spent at home, locally-grown fruits/vegetables in the diet, and OPs in house and school dust. The methylated sum levels also consider the father's occupation and time spent outside when the agricultural fields are sprayed. These results seem plausible given the differences in the DAP metabolites expected from pesticide use scenarios in residences and in agriculture.

Note that although the details of the CART analyses are presented in Appendix G, it is important to recognize that the CART analyses were performed on a maximum of 130 cases. This level of N, and the range of the DAP sum measurements used as the dependent or target variables, may make the subpopulations identified in the CART analyses less precise than needed for prediction. The best use of the CART results is as "indicators" of predictors that are more useful in differentiating the exposure levels. The CART tree allows the user to note the localized interactions (at each node's split) between predictors making up the higher or lower exposure level subpopulations, especially for the first few levels of each tree. When trying to sort through a large number of predictors, the ability to identify localized rather than global interactions in a data set is one advantage CART analysis provides over traditional regression analyses.

4.3.2.5 Comparison of Questionnaire Responses for High and Low Ends of Measurements

A non-statistical approach was implemented to identify any predictors that could differentiate between the high and low exposure levels based on the DAP urinary metabolites. In the previous analyses, CART and CDC (2002), the questionnaire responses, dust measurements, and urine measurements for all of the participant children were considered. Because the range of the distribution of the urine and dust measurement values is limited, it seemed reasonable to compare the information of participants from the extremes of the available distribution. Thus, approximately 10% of the respondents from the low end of a specific distribution and approximately 10% of the respondents from the high end of the distribution were selected.

Twenty-one questions considered more likely to be predictors of a child's pesticide exposure level were identified. The weighted sum of the responses for each participant was created from 18 of the questions where the weight was added to the sum if the response indicated a potential exposure to pesticides. Table G.3.5 in Appendix G shows the questions used in the exposure weighted sum, and the amounts added to the sum based on the responses. The values of this weighted sum and the responses to the 18 individual questions (and to school, grade, and number of rooms treated) were compared between the high- and low-end values of each measurement sum to determine if any patterns in the responses were evident.

Table 4.3.16 Results from Non-statistical Comparison of Questionnaire Responses Between High and Low Ends of Measurement Sum Distributions

Measurement Sum[a]	Questions[b] Differentiating Between the High and Low Measurement Groups
WETHSUM + WMETHSUM	EXPOSURE SUM [d], FARFIELD [c], WHNCHMO[d, e], WHEEL [d], DADCON2 [d], MOMCON2 [c]
WOPSUM	SCHOOL, HOWCHEMO [d, e], FARFIELD [d], CLOSEAPP [d, e], WHEEL [d], CHLDTM7 [d], WHENFILD [d], CHLDFLD [d]
WDUSTSUM	SCHOOL, NRMSRYD [c], HOWCHEMO [d, e], OFTCHEMI [c], FARFIELD [d], WHNCHMO [d,e], WHEEL [d], SPRAYFLD [d], DADCON2 [c], MOMCON2 [d]

[a] See Appendix F for description of sums. Exposure sum is created using weighting scheme in Table G.3.5.
[b] See Table 3.5 for abbreviated description of question variables.
[c] Some difference ($\geq$ 15%) in responses between participants at both ends of measurement distribution was evident. Difference was in direction expected, that is, exposure to factor is associated with high-end measurement value.
[d] Some difference ($\geq$ 15%) in responses between participants at both ends of measurement distribution was evident. Difference was not in direction expected based on current knowledge; that is, t exposure to factor is associated with low-end measurement values.
[e] Some difference ($\geq$ 15%) in responses between participants at both ends of measurement distribution was evident. Difference is based on response (some exposure to factor) compared to non-response (Don't know, No response).

The questions that point to some differentiation of the exposure levels are reasonable; however, most of them show the difference to be in the direction opposite of what is expected based on current knowledge (Table 4.3.16). As in the results of CDC (2002), relationships with the responses are considered one question at a time. This view may hide interactions with other risk factors or it may point to other factors that have a related effect.

4.3.2.6 Summary of Results

The Yuma Study report (CDC 2002) looked at each question or dust measurement individually and included siblings as well as principal participants from 152 households using a general linear estimating model with repeated measures. The data mining approach used the questions and dust measurements simultaneously in CART analyses for only 130 principal participants in kindergarten and first grade. Given these and other differences, it may be useful to look with caution at a summary of the predictors selected under both approaches to evaluate the universal strength of the predictors for the ethylated DAP sum (Table 4.3.17) and the methylated DAP sum (Table 4.3.18). Only questions that could be applied, or were available for siblings as well as principal participants, were analyzed for the Yuma Study report (CDC 2002).

Table 4.3.17 Comparison of Selected Predictors from Yuma Study Report[a] and Data Mining Approach[b] for Sum of Ethylated DAPs[c]

Yuma Study Report	Data Mining Approach
Recent use of pesticides inside home	Recent use of pesticides inside home
Other adult in household working in agriculture	Child's characteristics (weight, ethnicity)
	Proximity to agricultural fields, spraying conditions
	Child's time spent away from home[d]
	Diet - local fruits/vegetables[d]
Household dust: OPs, permethrins, non-OPs	Household dust: OPs, permethrins, non-OPs
School dust: permethrins	School dust: OPs

[a] Based on Tables 4.3.4, 4.3.7, and 4.3.9 and molar-weighted sum of ethylated DAPs (adjusted for creatinine).
[b] Based on Table G.3.7 without CHLDTM3 and log (molar-weighted sum of ethylated DAPs-adjusted for creatinine).
[c] See definition in Appendix F.
[d] Question was not analyzed in CDC (2002).

Table 4.3.18 Comparison of Selected Predictors from Yuma Study Report[a] and Data Mining Approach[b] for Sum of Methylated DAPs[c]

Yuma Study Report	Data Mining Approach
No Questions	Child's characteristics (height, weight)
	Proximity to agricultural fields, spraying conditions
	Father's occupation
	Where in house child spends time[d]
	Child's school[d]
Household dust: diazinon, chlorpyrifos, permethrins, carbaryl	Household dust: diazinon, chlorpyrifos, permethrins
School dust: diazinon, permethrins,	School dust: none

[a] Based on Tables 4.3.4, 4.3.7, and 4.3.9 and molar-weighted sum of methylated DAPs (adjusted for creatinine).
[b] Based on Table G.3.5 and log (molar-weighted sum of methylated DAPs-adjusted for creatinine).
[c] See definition in Appendix F.
[d] Question was not analyzed in CDC (2002).

The analyses in the Yuma Study report (CDC 2002) consider questions and measurements that would apply as risk or exposure factors to the principal participants and the siblings. These factors may affect explanations of the variability of the pesticide metabolite levels across siblings within a household. The data mining approach focuses the analyses on a potentially less variable group of children. For the ethylated sum of DAPs, recent use of pesticides inside the home, and OPs, non-OPs, and permethrins in the household dust stand out as differentiators of children's exposure level across both approaches. For the methylated sum of DAPs, only permethrins and OPs in household dust were similar across both approaches, since no questions were found significant in the Yuma Study report.

4.4 Effective Predictors of Pesticide Exposure Levels

Two approaches were considered in this project: a literature review across multiple exposure studies and multiple metabolites, and a more in-depth review of one exposure study in Yuma County, Arizona (Yuma Study). Although the literature review covers many different studies, results about significant relationships may be more limited because of the focus of each publication reviewed. For the Yuma Study, all questions asked were available for analysis. Access to this level of detail for the studies in the literature review was not available, although it is likely that the statistically significant relationships are noted in the publications for questions asked in the study. Taking these differences into consideration, a summary of the broad categories of predictors selected as differentiators of children's pesticide exposure (based on urinary metabolites or environmental measurements) can be enumerated as in Table 4.4.1.

Table 4.4.1 Summary of Predictor Categories Selected as Useful in Differentiating Children's Pesticide Exposure Levels Across Two Approaches

Literature Review[a]	Yuma Study[b]
Residential pesticide use (inside and outside)	Residential pesticide use (inside)
Pets[c]	
Occupation of household members	Occupation of household members
Household location: urban vs non-urban[c]	
Child's characteristics (age, ethnicity, family income)	Child's characteristics (age, ethnicity, height, weight)
Child's behaviors (loading from hand wipe)[c]	
Dietary behaviors (organic food)[c]	Dietary behaviors (local fruits/vegetables)
Family hygiene practices	
Exposure levels of household members[c]	
Health status (diseases)[c]	
Smoking behavior	
(Proximity to agricultural fields)[d]	Proximity to agricultural fields, spraying conditions
	Where child spent time at home/not, or within home
Household dust	Household and school dust: permethrins, OPs and non-OPs

[a] Based on the "c" Tables 4.2.10.c - 4.2.20.c.
[b] Based on Tables 4.3.17 and 4.3.18.
[c] Small number of relationships using these questions categories.
[d] Proximity to agricultural fields for the literature review was related to dust measurements only.

It would therefore appear that residential use of pesticides, the occupation of household members, certain demographic characteristics of the children, dietary behaviors, and proximity to agricultural spraying are the strongest predictors of exposure. Household dust levels are also predictive of exposures in some cases. Future studies should focus on more accurate questionnaire information, and more complete urine sample collection to improve the likelihood of identifying key risk or exposure factors for children's pesticide exposure.

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Appendix A

References from the Literature Review

Appendix A
References from the Literature Review

The following tables show three sets of citations from the literature review for this report. Table A.1 lists the citations that were relevant to the objectives of this report from which relationships were extracted. Table A.2 lists citations that were reviewed, but which did not meet the objectives of this report. The literature review for this report was conducted on literature published through early 2003. Table A-3 includes some references published after that date that may provide additional information regarding the type of relationships discussed in section 4.2 (Results)

Table A-1. Citations and Citation Abbreviations Referenced in the Relationship Results (Section 4, Appendix B, and Appendix C)

Citation Abbreviation	Citation
Adgate 2001	Adgate JL, Barr DB, Clayton CA, Eberly LE, Freeman NCG, Lioy PJ, Needham LL, Pellizzari ED, Quackenboss JJ, Roy A, Sexton K. 2001. Measurement of children's exposure to pesticides: analysis of urinary metabolite levels in a probability-based sample. *Environ Health Perspect* 109(6): 583-590.
Aprea 2000	Aprea C, Strambi M, Novelli MT, Lunghini L, Bozzi N. 2000. Biologic monitoring of exposure to organophosphorus pesticides in 195 Italian children. *Environ Health Perspect* 108(6): 521-525.
Azaroff 1999	Azaroff LS. 1999. Biomarkers of exposure to organophosphorous insecticides among farmers' families in rural El Salvador: factors associated with exposure. *Environ Res* 80(2 Pt 1): 138-147.
Carrel 1996	Carrel CL. Urinary Metabolite Monitoring in Children With Paraoccupational Exposure to Dimethyl Organophosphorous Pesticides [thesis]. Seattle (WA): University of Washington. 141 pp. U of WA Health Sciences Library, call number WA 7 Th44574.
Curl 2003	Curl CL, Fenske RA, Elgethun K. 2003. Organophosphorus pesticide exposure of urban and suburban preschool children with organic and conventional diets. *Environ Health Perspect* 111(3): 377-382.
Curl 2002	Curl CL, Fenske RA, Kissel JC, Shirai JH, Moate TF, Griffith W, Coronado G, Thompson B. 2002. Evaluation of take-home organophosphorus pesticide exposure among agricultural workers and their children. *Environ Health Perspect* 110(12): A787–A792.
Fenske 2002	Fenske RA, Lu C, Barr D, Needham L. 2002. Children's exposure to chlorpyrifos and parathion in an agricultural community in central Washington state. *Environ Health Perspect* 110(5): 549-553.
Grossman 2001	Grossman JE. 2001. The take-home pathway for agricultural pesticides: contribution of occupational factors to home contamination [thesis]. Seattle (WA): University of Washington, 168 p. U of WA Health Sciences Library, call number W 7 Th50727.

Citation Abbreviation	Citation
Koch 1999	Koch D. 1999. Longitudinal Biological Monitoring Study of Organophosphate Pesticide Exposure among Children Living in an Agricultural Community [thesis]. Seattle (WA): University of Washington. 137pp. U of WA Health Sciences Library, call number WA 7 Th48906.
Koch 2002	Koch D, Lu C, Fisker-Andersen J, Jolley L, Fenske RA. 2002. Temporal association of children's pesticide exposure and agricultural spraying: report of a longitudinal biological monitoring study. *Environ Health Perspect* 110(8): 829-833.
Krinsley 1998	Krinsley, JS. Exposure to chlorpyrifos and use of pesticides in Arizona [thesis], Tucson (AZ): The University of Arizona. 204 pp. Available from: Arizona Health Sciences Library, call number W4A 1998 K92E.
Loewenherz 1997	Loewenherz C, Fenske RA, Simcox NJ, Bellamy G, Kalman D. 1997. Biological monitoring of organophosphorus pesticide exposure among children of agricultural workers in central Washington state. *Environ Health Perspect* 105:1344-1353. Corrections and clarifications in *Environ Health Perspect* 107(2): A61.
Lu 2000	Lu C, Fenske RA, Simcox NJ, Kalman D. 2000. Pesticide exposure of children in an agricultural community: evidence of household proximity to farmland and take home exposure pathways. *Environ Res* 84(3): 290-302.
Lu 2001	Lu C, Knutson DE, Fisker-Andersen J, Fenske RA. 2001. Biological monitoring survey of organophosphorus pesticide exposure among pre-school children in the Seattle metropolitan area. *Environ Health Perspect* 109(3): 299-303.
McCauley 2001	McCauley LA, Lasarev MR, Higgins G, Rothlein J, Muniz J, Ebbert C, Phillips J. 2001. Work characteristics and pesticide exposures among migrant agricultural families: a community-based research approach. *Environ Health Perspect* 109(5): 533-538.
McCauley 2003	McCauley LA, Michaels S, Rothlein J, Muniz J, Lasarev M, Ebbert C. 2003. Pesticide expsosure and self-reported home hygiene: practices in agricultural families. *AAOHN Journal* 51(3): 113-119.
Royster 2002	Royster MO, Hilborn ED, Barr D, Carty CL, Rhoney S, Walsh D. 2002. A pilot study of global positioning system/geographical information system measurement of residential proximity to agricultural fields and urinary organophosphate metabolite concentrations in toddlers. *J Expo Anal Environ Epidemiol* 12(6): 433-440.
Sexton 2003	Sexton K, Adgate JL, Eberly LE, Clayton CA, Whitmore RW, Pellizzari ED. 2003. Predicting children's short-term exposure to pesticides: results of a questionnaire screening approach. *Environ Health Perspect* 110:123-128.
Shalat 2003	Shalat SL, Donnelly KC, Freeman NCG, Calvin JA, Ramesh S, Jimenez M, Black K, Coutinho C, Needham LL, Barr DB, Ramirez J. 2003. Nondietary ingestion of pesticides by children in an agricultural community on the US/Mexico border: preliminary results. *J Expo Anal Environ Epidemiol* 13: 42-50.
Simcox 1995	Simcox NJ, Fenske RA, Wolz SA, Lee I-C, Kalman DA. 1995. Pesticides in household dust and soil: exposure pathways for children of agricultural families. *Environ Health Perspect* 103:1126-1134.

Table A-2. Citations Reviewed and Considered Not Applicable For This Report

Citation Abbreviation	Citation
Adgate 2000a	Adgate JL, Kukowski A, Stroebel C, Shubat PJ, Morrell S, Quackenboss JJ, Whitmore RW, Sexton K. 2000. Pesticide storage and use patterns in Minnesota households with children. *J Expo Anal Environ Epidemiol* 10(2): 159-167.
Adgate 2000b	Adgate JL, Clayton CA, Quackenboss JJ, Thomas KW, Whitmore RW, Pellizzari ED, Lioy PJ, Shubat P, Stroebel C, Freeman NC, Sexton K. 2000. Measurement of multi-pollutant and multi-pathway exposures in a probability-based sample of children: practical strategies for effective field studies. *J Expo Anal Environ Epidemiol* 10(6 Pt 2): 650-661.
Akland 2000	Akland GG, Pellizzari ED, Hu Y, Roberds M, Rohrer CA, Leckie JO, Berry MR. 2000. Factors influencing total dietary exposures of young children. *J Expo Anal Environ Epidemiol* 10(6 Pt 2): 710-722.
AmNurse 2001	[Anonymous]. Environmentally healthy homes and communities. Children's special vulnerabilities. *AmNurse* 33(6): 26-38.
Arbuckle 2002	Arbuckle TE, Burnett R, Cole D, Teschke K, Dosemeci M, Bancej CN, Zhang J. 2002. Predictors of herbicide exposure in farm applicators. *Int Arch Occup Environ Health* 75(6): 406-414.
Balluz 2001	Balluz L, Moll D, Diaz Martinez MG, Merida Colindres JE, Malilay J. 2001. Environmental pesticide exposure in Honduras following hurricane Mitch. *Bull World Health Organ* 79(4): 288-295.
Bernstein 1999	Bernstein, IL; Bernstein, JA; Miller, M; Tierzieva, S; Bernstein, DI; Lummus, Z; Selgrade, MK; Doerfler, DL; Seligy, VL. 1999. Immune responses in farm workers after exposure to Bacillus thuringiensis pesticides. *Environ Health Perspect* 107(7): 575-582.
Boone 2001	Boone JS, Tyler JW, Chambers JE. 2001. Transferable residues from dog fur and plasma cholinesterase inhibition in dogs treated with a flea control dip containing chlorpyrifos. *Environ Health Perspect* 109:1109-1114.
Bradman 1997	Bradman MA, Harnly ME, Draper W, Seidel S, Teran S, Wakeham D, Neutra R. 1997. Pesticide exposures to children from California's Central Valley: results of a pilot study. *J Expo Anal Environ Epidemiol* 7(2):217-234.
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Citation Abbreviation	Citation
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Citation Abbreviation	Citation
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London 1998	London L, Nell V, Thompson ML, Myers JF. 1998. Health status among farm workers in the Western Cape--collateral evidence from a study of occupational hazards. *S African Med J. (Suid-Afrikaanse tydskrif geneeskunde)* 88(9): 1096-1101.
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McCauley 2001	McCauley LA, Beltran M, Phillips J, Lasarev M, Sticker D. 2001. The Oregon migrant farmworker community: an evolving model for participatory research. *Environ Health Perspect* 109(Suppl 3): 449-455.
Mills 2001	Mills PK, Zahm SH. 2001. Organophosphate pesticide residues in urine of farmworkers and their children in Fresno County, California. Am J Ind Med 40(5): 571-577.
Moschandreas 2001	Moschandreas DJ, Karuchit S, Kim Y, O'Rourke MK, Ari H, Lebowitz MD, Robertson G, Gordon S, Moschandreas DJ. 1994. In-residence, multiple route exposures to chlorpyrifos and diazinon estimated by indirect method models. *Atmosph Environ* 35(12): 2201-2224.
NASS 2001	[NASS] National Agricultural Statistics Service (US). 2001 Oct. Agricultural chemical usage: 2000 restricted use summary. Report Number NASSZUP2001. Washington, DC: Agricultural Statistics Board. Available from: http://www.ntis.gov/search/product.asp?ABBR=NASSZUP2001&starDB=GRAHIST
O'Rourke 2000	O'Rourke MK, Lizardi PS, Rogan SP, Freeman NC, Aguirre A, Saint CG. 2000. Pesticide exposure and creatinine variation among young children. *J Expo Anal Environ Epidemiol* 10(6 Pt 2): 672-681.
Park 2001	Park JH, Spiegelman DL, Gold DR, Burge HA, Milton DK. 2001. Predictors of airborne endotoxin in the home. *Environ Health Perspect* 109(8): 859-864.
Perera 1999	Perera FP, Jedrychowski W, Rauh V, Whyatt RM. 1999. Molecular epidemiologic research on the effects of environmental pollutants on the fetus. *Environ Health Perspect* 107(Suppl 3): 451-460.

Citation Abbreviation	Citation
Quackenboss 2000	Quackenboss JJ, Pellizzari ED, Shubat P, Whitmore RW, Adgate JL, Thomas KW, Freeman NC, Stroebel C, Lioy PJ, Clayton AC, Sexton K. 2000. Design strategy for assessing multi-pathway exposure for children: the Minnesota Children's Pesticide. *J Expo Anal Environ Epidemiol* 10(2):145-158.
Rigas 2001	Rigas ML, Okino MS, Quackenboss JJ. 2001. Use of a pharmacokinetic model to assess chlorpyrifos exposure and dose in children, based on urinary biomarker measurements. *Toxicol Sci* 61(2): 374-81.
Seifert 2000	Seifert B, Becker K, Hoffmann K, Krause C, Schulz C. 2000. The German Environmental Survey 1990/1992 (GerES II): a representative population study. *J Expo Anal Environ Epidemiol* 10(2): 103-114,
Sexton 2000	Sexton K, Greaves IA, Church TR, Adgate JL, Ramachandran G, Tweedie RL, Fredrickson A, Geisser M, Sikorski M, Fischer G, Jones D, Ellringer P. 2000. A school-based strategy to assess children's environmental exposures and related health effects in economically disadvantaged urban neighborhoods. *J Expo Anal Environ Epidemiol* 10(6 Pt 2): 682-694.
Stuetz 2001	Stuetz W, Prapamontol T, Erhardt JG, Classen HG. Organochlorine pesticide residues in human milk of a Hmong hill tribe living in Northern Thailand. *Sci Total Environ* 273(1-3): 53-60.
Thompson 2003	Thompson B, Coronado GD, Grossman JE, Puschel K, Solomon CC, Islas I, Curl CL, Shirai JH, Kissel JC, Fenske RA. 2003. Pesticide take-home pathway among children of agricultural workers: study design, methods, and baseline findings. *J Occup Environ Med* 45: 42-53.
Vela-Acosta 2002	Vela-Acosta MS, Bigelow P, Buchan R. 2002. Assessment of occupational health and safety risks of farmworkers in Colorado. *Am J Ind Medicine* 42 (Suppl 2): 19-27.
Ward 2001	Ward MH, Prince JR, Stewart PA; Zahm, SH. 2001. Determining the probability of pesticide exposures among migrant farmworkers: Results from a feasibility study. *Am J Ind* Med 40(5): 538-553.
Wilson 2003	Wilson NK, Chuang JC, Lyu C, Menton R, Morgan MK. 2003. Aggregate exposures of nine preschool children to persistent organic pollutants at day care and at home. *J Expo Anal Environ Epidemiol* 13(3): 187-202.
Zartarian 2000	Zartarian VG, Ozkaynak H, Burke JM, Zufall MJ, Rigas ML, Furtaw EJ Jr. 2000. A modeling framework for estimating children's residential exposure and dose to chlorpyrifos via dermal residue contact and nondietary ingestion. *Environ Health Perspect* 108(6): 505-14

Table A-3. References Published After Early 2003 That May Provide Additional Relationship Information

Citation Abbreviation	Citation
Arbuckle 2004	Lu C, Kedan G, Fisker-Andersen J, Kissell JC, Fenske RA. 2004. Multipathway organophosphorus pesticide exposures of preschool children living in agricultural and nonagricultural communities. *Environ Res* 96(3): 283-9.
Barr 2004	Barr DB, Garry VF. 2004. Pesticides and Children. *Toxicol Appl Pharmacol* 198(2): 152-63.
Coronado 2004	Arbuckle TE, Cole DC, Ritter L, Ripley BD. Farm children's exposure to herbicides: comparison of biomonitoring and questionnaire data. *Epidemiology* 15(2): 187-94.
Freeman 2005	Freeman NC, Hore P, Black K, Jimenez M, Sheldon L, Tulve N, Lioy PJ. Contributions of children's activities to pesticide hand loadings following residential pesticide application. *J Expo Anal Environ Epidemiol* 15(1): 81-8.
Garry 2004	Garry VF, Barr DB, Bravo R, Weerasekera G, Caltabiano LM, Whitehead RD Jr, Olsson AO, Caudill SP, Schober SE, Pirkle JL, Sampson EJ, Jackson RJ, Needham LL. Concentration of dialkyl phosphate metabolites of organophosphorus pesticides in the U.S. population. *Environ Health Perspectives* 112(2): 186-200.
Lu 2004	Coronado GD, Thompson B, Strong L, Griffith WC, Islas I. Agricultural task and exposure to organophosphate pesticides among farmworkers. *Environ Health Perspectives* 112(2): 142-7.

Appendix B

Overview Tables for Relationships from Literature Review

Appendix B
Overview Tables for Relationships from Literature Review

Contents

Tables

Appendices B, C, and D provide specific information about the relationships extracted from the literature review and summarized in Results sections 4.2.4, 4.2.5, and 4.2.6. The information is presented as overview, detail, and comment tables. Each appendix includes one type of table for all the question categories and relationships. This appendix presents the overview tables.

B.1 Description

Table B.1.1 is an example of an overview table and provides a high-level view of the relationships found in the literature review for the source category of residential pesticide use. The highest level of organization for this example is the sampling medium, that is, all relationships for urine are grouped together, all relationships for dust are grouped together, etc. The next level of organization within a table is the chemical. The chemicals analyzed for the medium are columns in the table. There may be more than one subtable for a particular medium depending on how many chemicals or metabolites are represented in the relationships for the category. The chemicals for each medium are listed alphabetically except for the urinary metabolites. These columns are arranged alphabetically within the following chemical groupings: non-DAPs (dialkylphosphates), single DAPs, DAP sums, and level of DAPs. In example Table B.1.1, relationships for urine appear first, followed by those for dust. There are two subtables for the urine relationships, one for the DAP metabolites, the other for molar-weighted sums of the DAP metabolites. There is only one table for the dust relationships.

Table B.1.1 Example of Relationship Overview Table for Question Category: Residential Pesticide Use

Urine, Part 1

Q#	Description	Citation	1NAP		4NITR		ATZM		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
101	Pesticide Use	Krinsley 1998										1										
101	Pesticide Use	Royster 2002																				
102	Inside Treated	Krinsley 1998										1										
102	Inside Treated	Lu 2001																				
102	Inside Treated	Sexton 2003							1	1												
103	Inside Treated - Bathroom	Krinsley 1998										1										

Urine, Part 2

Q#	Description	Citation	ETHL1		ETHL2		MTHL1		MTHL2		ETHL3		MTHL3		MTHL4		DAP2		DAP3	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
101	Pesticide Use	Krinsley 1998																		
101	Pesticide Use	Royster 2002				2				2										
102	Inside Treated	Krinsley 1998																		
102	Inside Treated	Lu 2001		1						1										
102	Inside Treated	Sexton 2003																		
103	Inside Treated - Bathroom	Krinsley 1998																		

Dust

Q#	Description	Citation	AZM		AZMPH		CHLR		OPSUM	
			S	NS	S	NS	S	NS	S	NS
101	Pesticide Use	McCauley 2001a		1						
101	Pesticide Use	McCauley 2003								1
102	Inside Treated	Sexton 2003						1		

The rows within a medium's table(s) are the questions assigned to the residential pesticide use category, and are identified by a question number and the abbreviated question description. When a medium's information is presented in more than one subtable, e.g., urine in Table B.1.1, combinations of question/citation rows are repeated in all of the medium's subtables. Thus in Table B.1.1 Urine Part 1, the "inside treated-bathroom" question (Q# 103) appears in both urine subtables even though relationships are available only for the metabolites in the first subtable. The overview table shows the number of significant or non-significant relationships for each combination of medium, chemical, question, and citation in the relationship database. Two columns are included for each chemical or metabolite. The S column shows the number of relationships identified as significant; the

NS columns shows the number of relationships identified as not significant. Marginally significant relationships are included here under the S column, but are specifically identified as MS in the detail tables in Appendix C. Note that the relationships counted in any cell may represent different subpopulations compared or different types of analyses performed. Rows for alternating questions are shaded for ease of viewing.

B.2 Reference Information

To make the overview tables more compact, it was necessary to use abbreviations or codes in both the column name and contents. Table B.2.1 describes each column used in the overview tables. The column Reference Table identifies the number of a subsequent table containing information about the codes used. For example, the column (S, NS) includes codes described in Table B.2.3.

Table B.2.1 List of Columns and Associated Reference Tables in Overview Tables

Column Type or Name	Column Description	Column Applies to[a]	Reference Table[b]
Q#	Number assigned to an abbreviated question (Sec 4.2.2.2)	b	NA
Description	Abbreviated question	b	NA
Citation	Citation reference		Appendix A - Table A.1 and Table 4.2.1
(Chemical columns)	Chemical, metabolite, or molar-weighted sum	a	Appendix B – Table B.2.2
(S, NS)	Significance indicator		Appendix B – Table B.2.3

[a] The entry "a" is a dependent variable, in this case a chemical analytical measurement. The entry "b" is an independent variable or predictor, usually a question.
[b] NA – Not applicable

Table B.2.2 Chemical/Metabolite Reference Table

Grouping[a]	Code	Medium	Description
1-Non-DAP	1NAP	urine	1-Naphthol
1-Non-DAP	4NITR	urine	4-Nitrophenol
6-Chemical	ATZ	other[b]	Atrazine
1-Non-DAP	ATZM	urine	Atrazine mercapturate
6-Chemical	AZM	other	Azinphosmethyl
6-Chemical	AZMPH	other	Azinphosmethyl+Phosmet
6-Chemical	CHLR	other	Chlorpyrifos
3-DAP Sum[c]	DAP1	urine	DMP+DMTP+DMDTP+DEP+DETP+DEDTP
4-DAP Detect	DAP2	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
5-DAP High	DAP3	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement)[d]
2-DAP	DEDTP	urine	Diethyldithiophosphate (DEDTP)
2-DAP	DEP	urine	Diethylphosphate (DEP)
2-DAP	DETP	urine	Diethylthiophosphate (DETP)
2-DAP	DMDTP	urine	Dimethyldithiophosphate (DMDTP)
2-DAP	DMP	urine	Dimethylphosphate (DMP)
2-DAP	DMTP	urine	Dimethylthiophosphate (DMTP)
6-Chemical	EPAR	other	Ethyl parathion
3-DAP Sum	ETHL1	urine	DEP+DETP
3-DAP Sum	ETHL2	urine	DEP+DETP+DEDTP
4-DAP Detect	ETHL3	urine	DEP, DETP, DEDTP (at least one detectable measurement)
6-Chemical	MAL	other	Malathion

Grouping[a]	Code	Medium	Description
1-Non-DAP	MDA	urine	Malathion dicarboxylic acid
3-DAP Sum	MTHL1	urine	DMTP+DMDTP
3-DAP Sum	MTHL2	urine	DMP+DMTP+DMDTP
4-DAP Detect	MTHL3	urine	DMTP (detectable measurement)
4-DAP Detect	MTHL4	urine	DMP, DMTP (at least one detectable measurement)
5-DAP High	MTHL5	urine	DMP, DMTP (at least one high measurement) [d]
7-Metabolite NA	NA	urine	NA (not available or not specified)
6-Chemical	OPSUM	other	OP sum[e]
6-Chemical	PHSM	other	Phosmet
1-Non-DAP	TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] The number preceding the group name indicates the order of the group as it appears in the overview tables.
[b] Medium is urine and other (any other medium measured).
[c] Sums are molar-weighted unless otherwise specified.
[d] See definition of high measurement in Azaroff (1999).
[e] OP Sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet

Table B.2.3 Significance Indicator Reference Table

Code	Description
MS	Relationship is marginally significant based on critical value used in publication
NA	Significance level is not available in publication
NS	Relationship is not significant based on critical value used in publication
S	Relationship is significant based on critical value used in publication

Table B.2.4 provides a cross-reference between the relationship summary tables in the Results section and the tables in Appendices B, C, and D.

Table B.2.4 Table Numbers Cross-Referenced between Results Section and Appendices A, B, and C, by Category Group

Category			Section #	Table #[a]	Overview Table #	Detailed Table #	Comment Table #
Group	**#**	**Description**	**Results**	**Results**	**Appendix B**	**Appendix C**	**Appendix D**
Source	1	Residential pesticide use	4.2.4.1	4.2.6.x	B.3.1.1	C.3.1.1	D.3.1.1
Source	2	Household characteristics	4.2.4.2	4.2.7.x	B.3.1.2	C.3.1.2	D.3.1.2
Source	3	Residential sources (environmental measures)	4.2.4.3	4.2.8.x	B.3.1.3	C.3.1.3	D.3.1.3
Source	4	Household occupation	4.2.4.4	4.2.9.x	B.3.1.4	C.3.1.4	D.3.1.4
Source	5	Residential proximity to agricultural fields	4.2.4.5	4.2.10.x	B.3.1.5	C.3.1.5	D.3.1.5
Source	6	Residential location	4.2.4.6	4.2.11.x	B.3.1.6	C.3.1.6	D.3.1.6
Behavior	7	Subject's personal characteristics	4.2.5.1	4.2.13.x	B.3.2.1	C.3.2.1	D.3.2.1
Behavior	8	Child's behaviors	4.2.5.2	4.2.14.x	B.3.2.2	C.3.2.2	D.3.2.2
Behavior	9	Dietary behaviors	4.2.5.3	4.2.15.x	B.3.2.3	C.3.2.3	D.3.2.3
Behavior	10	Family hygiene practices	4.2.5.4	4.2.16.x	B.3.2.4	C.3.2.4	D.3.2.4
Behavior	11	Smoking-related activities	4.2.5.5	4.2.17.x	B.3.2.5	C.3.2.5	D.3.2.5
Behavior	12	Work exposure/practices	4.2.5.6	4.2.18.x	B.3.2.6	C.3.2.6	D.3.2.6
Other	13	Related exposure levels	4.2.6.1	4.2.20.x	B.3.3.1	C.3.3.1	D.3.3.1
Other	14	Health	4.2.6.2	4.2.21.x	B.3.3.2	C.3.3.2	D.3.3.2

[a] x in this column refers to the three table types, a, b, and c, described above.

B.3 Overview Tables

B.3.1 Source Relationships

B.3.1.1 Category 1: Residential Pesticide Use

Table B.3.1.1 Overview of Relationships for Questions in Category 1: Residential Pesticide Use – Grouped by Medium and Sorted by Question and Citation

- **a) Urine, part 1**
- **b) Urine, part 2**
- **c) Dust**
- **d) Indoor Air**
- **e) Outdoor Air**
- **f) Personal Air**
- **g) Solid Food**

Table B.3.1.1.a Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Urine Measurements, part 1

Q#	Description	Citation	1NAP		4NITR		ATZM		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
101	Pesticide Use	Krinsley 1998										1										
101	Pesticide Use	Royster 2002																				
102	Inside Treated	Krinsley 1998										1										
102	Inside Treated	Lu 2001																				
102	Inside Treated	Sexton 2003							1	1												
103	Inside Treated - Bathroom	Krinsley 1998										1										
104	Inside Treated - Bedroom	Krinsley 1998									3											

Q#	Description	Citation	1NAP		4NITR		ATZM		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
105	Inside Treated - Cabinets	Krinsley 1998										1										
106	Inside Treated - Closets	Krinsley 1998									1											
107	Inside Treated - Cupboards With Dishes	Krinsley 1998										1										
108	Inside Treated - Dining Room	Krinsley 1998									1											
109	Inside Treated - Family Room	Krinsley 1998										1										
110	Inside Treated - Kitchen	Krinsley 1998										1										
111	Inside Treated - Living Room	Krinsley 1998									1											
112	Inside Treated - on Baseboards	Krinsley 1998										1										
113	Inside Treated - on Ceiling	Krinsley 1998										1										
114	Inside Treated - on Floor	Krinsley 1998										1										
115	Inside Treated - on Lower Walls	Krinsley 1998										1										
116	Inside Treated - on Upper Walls	Krinsley 1998										1										
117	Inside Treated - Other Room	Krinsley 1998									2											

Q#	Description	Citation	1NAP		4NITR		ATZM		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
118	Pets Treated	Lu 2000																				
118	Pets Treated	Lu 2001																				
119	Outside Treated	Krinsley 1998									1											
119	Outside Treated	Sexton 2003							1		1											
120	Garden Treated	Fenske 2002				1					1											
120	Garden Treated	Lu 2000																				
120	Garden Treated	Lu 2001																				
121	Lawn/Yard Treated	Lu 2000																				
121	Lawn/Yard Treated	Lu 2001																				
121	Lawn/Yard Treated	Sexton 2003									1											
122	Inside or Outside Treated	Adgate 2001		1						1		1										
122	Inside or Outside Treated	Aprea 2000												2		1		2		2		1
123	Previous Treatment	Lu 2000																				
124	Level of Pesticide Use	Adgate 2001		1						1		1										
124	Level of Pesticide Use	Krinsley 1998									2											
124	Level of Pesticide Use	Sexton 2003							2													

Q#	Description	Citation	1NAP		4NITR		ATZM		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
125	Frequency Personal Application Inside	Krinsley 1998									1											
126	Frequency Personal Application Outside	Krinsley 1998									3											
127	Inside/Outside Treated by Family Member	Azaroff 1999																				
128	Frequency Professional Application Inside	Krinsley 1998										1										
129	Frequency Professional Application Outside	Krinsley 1998										1										
130	Personally Mixed Pesticide Inside	Krinsley 1998									1											
131	Personally Mixed Pesticide Outside	Krinsley 1998										1										
132	Presence During Mixing	Adgate 2001		1				1		1		1										

Table B.3.1.1.b Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Urine Measurements, part 2

Q#	Description	Citation	ETHL1		ETHL2		MTHL1		MTHL2		ETHL3		MTHL3		MTHL4		DAP2		DAP3	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
101	Pesticide Use	Krinsley 1998																		
101	Pesticide Use	Royster 2002				2				2										
102	Inside Treated	Krinsley 1998																		
102	Inside Treated	Lu 2001		1						1										
102	Inside Treated	Sexton 2003																		
103	Inside Treated - Bathroom	Krinsley 1998																		
104	Inside Treated - Bedroom	Krinsley 1998																		
105	Inside Treated - Cabinets	Krinsley 1998																		
106	Inside Treated - Closets	Krinsley 1998																		
107	Inside Treated - Cupboards With Dishes	Krinsley 1998																		
108	Inside Treated - Dining Room	Krinsley 1998																		
109	Inside Treated - Family Room	Krinsley 1998																		
110	Inside Treated - Kitchen	Krinsley 1998																		
111	Inside Treated - Living Room	Krinsley 1998																		
112	Inside Treated - on Baseboards	Krinsley 1998																		
113	Inside Treated - on Ceiling	Krinsley 1998																		

Q#	Description	Citation	ETHL1		ETHL2		MTHL1		MTHL2		ETHL3		MTHL3		MTHL4		DAP2		DAP3	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
114	Inside Treated - on Floor	Krinsley 1998																		
115	Inside Treated - on Lower Walls	Krinsley 1998																		
116	Inside Treated - on Upper Walls	Krinsley 1998																		
117	Inside Treated - Other Room	Krinsley 1998																		
118	Pets Treated	Lu 2000						1												
118	Pets Treated	Lu 2001		1						1										
119	Outside Treated	Krinsley 1998																		
119	Outside Treated	Sexton 2003																		
120	Garden Treated	Fenske 2002																		
120	Garden Treated	Lu 2000						1												
120	Garden Treated	Lu 2001	1						1											
121	Lawn/Yard Treated	Lu 2000						1												
121	Lawn/Yard Treated	Lu 2001		1						1										
121	Lawn/Yard Treated	Sexton 2003																		
122	Inside or Outside Treated	Adgate 2001																		
122	Inside or Outside Treated	Aprea 2000				2														
123	Previous Treatment	Lu 2000						1												
124	Level of Pesticide Use	Adgate 2001																		
124	Level of Pesticide Use	Krinsley 1998																		
124	Level of Pesticide Use	Sexton 2003																		

Q#	Description	Citation	ETHL1		ETHL2		MTHL1		MTHL2		ETHL3		MTHL3		MTHL4		DAP2		DAP3	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
125	Frequency Personal Application Inside	Krinsley 1998																		
126	Frequency Personal Application Outside	Krinsley 1998																		
127	Inside/Outside Treated By Family Member	Azaroff 1999									1		1		1		1		1	
128	Frequency Professional Application Inside	Krinsley 1998																		
129	Frequency Professional Application Outside	Krinsley 1998																		
130	Personally Mixed Pesticide Inside	Krinsley 1998																		
131	Personally Mixed Pesticide Outside	Krinsley 1998																		
132	Presence During Mixing	Adgate 2001																		

Table B.3.1.1.c Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Dust Measurements

Q#	Description	Citation	AZM		AZMPH		CHLR		OPSUM	
			S	NS	S	NS	S	NS	S	NS
101	Pesticide Use	McCauley 2001a		1						
101	Pesticide Use	McCauley 2003								1
102	Inside Treated	Sexton 2003						1		
118	Pets Treated	Lu 2000				1				
119	Outside Treated	Sexton 2003					1			
120	Garden Treated	Lu 2000				1				
121	Lawn/Yard Treated	Lu 2000				1				
123	Previous Treatment	Lu 2000				1				

Table B.3.1.1.d Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Indoor Air Measurements

Q#	Description	Citation	CHLR		MAL	
			S	NS	S	NS
102	Inside Treated	Sexton 2003		1		1

Table B.3.1.1.e Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Outdoor Air Measurements

Q#	Description	Citation	CHLR		MAL	
			S	NS	S	NS
102	Inside Treated	Sexton 2003		1		1

Table B.3.1.1.f Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Personal Air Measurements

Q#	Description	Citation	ATZ		CHLR		MAL	
			S	NS	S	NS	S	NS
102	Inside Treated	Sexton 2003			1			1
124	Level of Pesticide Use	Sexton 2003	2					

Table B.3.1.1.g Overview of Relationships for Questions in Category 1: Residential Pesticide Use with Solid Food Measurements

Q#	Description	Citation	CHLR		MAL	
			S	NS	S	NS
102	Inside Treated	Sexton 2003		1		1
119	Outside Treated	Sexton 2003	1			

B.3.1.2 Category 2: Household Characteristics

Table B.3.1.2 Overview of Relationships for Questions in Category 2: Household Characteristics – Grouped by Medium and Sorted by Question and Citation

a) Urine
b) Dust
c) Indoor Air

Table B.3.1.2.a Overview of Relationships for Questions in Category 2: Household Characteristics with Urine Measurements, part 1

Q#	Description	Citation	MDA		TCPY		DEP		DETP		DEDTP		DMP		DMTP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
201	Housing Type	Lu 2001																
203	Age of House > 10 Years	Krinsley 1998				1												
204	Age of House > 20 Years	Krinsley 1998				1												
205	Having Air Conditioning	Krinsley 1998				1												
206	Having Central Heating	Krinsley 1998				1												
207	Having Evaporative Cooling	Krinsley 1998				1												
208	Pets in House	Aprea 2000						2		2		2		2		1		1
208	Pets in House	Lu 2001																
209	Pets Inside/ Outside House	Sexton 2003	1															

Q#	Description	Citation	MDA		TCPY		DEP		DETP		DEDTP		DMP		DMTP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
211	Existence of Garden or Vegetable Garden	Aprea 2000						2		2		2		2		1		
211	Existence of Garden or Vegetable Garden	Lu 2001																
211	Existence of Garden or Vegetable Garden	Sexton 2003	1															
212	Ornamental Plants or Cut Flowers	Aprea 2000						2		2		2		2		1		1

Table B.3.1.2.b Overview of Relationships for Questions in Category 2: Household Characteristics with Urine Measurements, part 2

Q#	Description	Citation	ETHL1		ETHL2		MTHL2		DAP1	
			S	NS	S	NS	S	NS	S	NS
201	Housing Type	Lu 2001		1				1		
203	Age of House > 10 Years	Krinsley 1998								
204	Age of House > 20 Years	Krinsley 1998								
205	Having Air Conditioning	Krinsley 1998								
206	Having Central Heating	Krinsley 1998								
207	Having Evaporative Cooling	Krinsley 1998								

Q#	Description	Citation	ETHL1		ETHL2		MTHL2		DAP1	
			S	NS	S	NS	S	NS	S	NS
208	Pets in House	Aprea 2000				2		1		1
208	Pets in House	Lu 2001		1			1			
209	Pets Inside/Outside House	Sexton 2003								
211	Existence of Garden or Vegetable Garden	Aprea 2000				2		1		1
211	Existence of Garden or Vegetable Garden	Lu 2001	1					1		
211	Existence of Garden or Vegetable Garden	Sexton 2003								
212	Ornamental Plants or Cut Flowers	Aprea 2000				2		1		1

Table B.3.1.2.c Overview of Relationships for Questions in Category 2: Household Characteristics with Dust Measurements

Q#	Description	Citation	AZM		CHLR		EPAR		OPSUM		PHSM	
			S	NS	S	NS	S	NS	S	NS	S	NS
201	Housing Type	McCauley 2001a		1								
202	Property Used as a Farm	Sexton 2003			1							
210	Pet Inside to Outside	Simcox 1995		2		2		2				2
213	Size of Household	McCauley 2001a	1									
213	Size of Household	McCauley 2003								1		
214	Location of Play Area	McCauley 2003								1		
215	Age of House (Years)	McCauley 2003		1						1		

Q#	Description	Citation	AZM		CHLR		EPAR		OPSUM		PHSM	
			S	NS	S	NS	S	NS	S	NS	S	NS
216	Size of Home (Sq Ft)	McCauley 2003							1	1		
217	Number of Pets In House	McCauley 2003								1		

Table B.3.1.2.d Overview of Relationships for Questions in Category 2: Household Characteristics with Indoor Air Measurements

Q#	Description	Citation	CHLR	
			S	NS
202	Property Used as a Farm	Sexton 2003	1	

B.3.1.3 Category 3: Residential Sources (Environmental Measures)

Table B.3.1.3 Overview of Relationships for Questions in Category 3: Residential Sources (Environmental Measures) – Grouped by Medium and Sorted by Question and Citation

a) **Urine**
b) **Dust**

Table B.3.1.3.a Overview of Relationships for Questions in Category 3: Residential Sources (Environmental Measures) with Urine Measurements

Q#	Description	Citation	MTHL2		DAP1		NA	
			S	NS	S	NS	S	NS
301	Household Dust	Curl 2002	2					
301	Household Dust	Lu 2000					2	
302	Loading from Household Floor Dust	Shalat 2003				1		

Table B.3.1.3.b Overview of Relationships for Questions in Category 3: Residential Sources (Environmental Measures) with Dust Measurements

Q#	Description	Citation	AZM		CHLR		EPAR		PHSM	
			S	NS	S	NS	S	NS	S	NS
303	Outdoor Soil	Simcox 1995	1	1	1	1	2		1	1

B.3.1.4 Category 4: Household Occupation

Table B.3.1.4 Overview of Relationships for Questions in Category 4: Household Occupation – Grouped by Medium and Sorted by Question and Citation

a) **Urine, part 1**
b) **Urine, Part 2**
c) **Dust**
d) **Soil**

Table B.3.1.4.a Overview of Relationships for Questions in Category 4: Household Occupation with Urine Measurements, part 1

Q#	Description	Citation	4NITR		TCPY		DMTP		DMDTP		ETHL2		MTHL1		MTHL2	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
402	Household Member Spraying Fields	Azaroff 1999														
403	Recent Fieldwork	Azaroff 1999														
404	Applicator vs Farmworker	Fenske 2002		1		1										
404	Applicator vs Farmworker	Lu 2000						1		1				1		
406	Applicator vs Reference	Loewenherz 1997					5	3								
407	Applicator+Farmworker vs Reference	Fenske 2002		2		2										
407	Applicator+Farmworker vs Reference	Lu 2000					1			1			1			
411	Farmworker vs Others	Koch 2002										2				2
413	Expected Occupational Exposure	Koch 1999										3				3
414	Occupational Pesticide Exposure	Royster 2002										2				2

Table B.3.1.4.b Overview of Relationships for Questions in Category 4: Household Occupation with Urine Measurements, part 2

Q#	Description	Citation	ETHL3		MTHL3		MTHL4		DAP2		MTHL5		DAP3	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
402	Household Member Spraying Fields	Azaroff 1999	2		1		2		1		1		1	
403	Recent Fieldwork	Azaroff 1999		2			1		1		1		1	
404	Applicator vs Farmworker	Fenske 2002												
404	Applicator vs Farmworker	Lu 2000												
406	Applicator vs Reference	Loewenherz 1997												
407	Applicator+Farmworker vs Reference	Fenske 2002												
407	Applicator+Farmworker vs Reference	Lu 2000												
411	Farmworker vs Others	Koch 2002												
413	Expected Occupational Exposure	Koch 1999												
414	Occupational Pesticide Exposure	Royster 2002												

Table B.3.1.4.c Overview of Relationships for Questions in Category 4: Household Occupation with Dust Measurements

Q#	Description	Citation	AZM		AZMPH		CHLR		EPAR		OPSUM		PHSM	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
401	Agricultural Workers in Household	McCauley 2001a	2											
404	Applicator vs Farmworker	Fenske 2002						1	1					
404	Applicator vs Farmworker	Lu 2000		1	1									1
405	Applicator vs Non-Applicator	Simcox 1995		3			2	1	4	1				3
407	Applicator+Farmworker vs Reference	Fenske 2002					3		2	1				
407	Applicator+Farmworker vs Reference	Lu 2000	1		1								1	
408	Farmer vs Farmworker	Simcox 1995		3				3	2	3				3
409	Farmer+Farmworker vs Reference	Simcox 1995	1	1			1	1	1	1				2
410	Farmworker vs Grower	McCauley 2001a	1	1										
412	Field Worker vs Pesticide Handler	Grossman 2001	1											
413	Expected Occupational Exposure	Grossman 2001	1	1										
415	Tree Thinning	McCauley 2003									1			
416	Number in Household with High Pesticide Contact	McCauley 2003									1			

Table B.3.1.4.d Overview of Relationships for Questions in Category 4: Household Occupation with Soil Measurements

Q#	Description	Citation	AZM		CHLR		EPAR		PHSM	
			S	NS	S	NS	S	NS	S	NS
408	Farmer vs Farmworker	Simcox 1995		1		1		1		1
409	Farmer+Farmworker vs Reference	Simcox 1995	1			1		1		1

B.3.1.5 Category 5: Residential Proximity to Agricultural Fields

Table B.3.1.5 Overview of Relationships for Questions in Category 5: Residential Proximity to Agricultural Fields – Grouped by Medium and Sorted by Question and Citation

a) **Urine**
b) **Dust**

Table B.3.1.5.a Overview of Relationships for Questions in Category 5: Residential Proximity to Agricultural Fields with Urine Measurements

Q#	Description	Citation	4NITR		TCPY		DMTP		DMDTP		ETHL2		MTHL1		MTHL2	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Curl 2002														4
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Fenske 2002		1		1										
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Koch 2002										2				2
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Loewenherz 1997					2	1								
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Lu 2000					1			1			1	2		
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Royster 2002										4				4
502	Living near Multiple Fields	Royster 2002										2				2

Table B.3.1.5.b Overview of Relationships for Questions in Category 5: Residential Proximity to Agricultural Fields with Dust Measurements

Q#	Description	Citation	AZM		AZMPH		CHLR		EPAR		OPSUM		PHSM	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Curl 2002		2										
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Fenske 2002					2			1				
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Grossman 2001		2										
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Lu 2000	1		4									1
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	McCauley 2001a	1	1										
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	McCauley 2003										1		
501	Proximity of Home to Pesticide-Treated Farmland/Orchard	Simcox 1995	2	4			1	5	5	3				6

B.3.1.6 Category 6: Residential Location

Table B.3.1.6 Overview of Relationships for Questions in Category 6: Residential Location – Grouped by Medium and Sorted by Question and Citation

a) **Urine**
b) **Dust**

Table B.3.1.6.a Overview of Relationships for Questions in Category 6: Residential Location with Urine Measurements

Q#	Description	Citation	1NAP		MDA		TCPY		ETHL1		MTHL2	
			S	NS	S	NS	S	NS	S	NS	S	NS
601	Urban vs Non-Urban	Adgate 2001		3		3	3					
602	Urban vs Rural	Krinsley 1998						1				
603	Border vs. Non-Border	Krinsley 1998						1				
604	Community	Lu 2001								1		1

Table B.3.1.6.b Overview of Relationships for Questions in Category 6: Residential Location with Dust Measurements

Q#	Description	Citation	AZM	
			S	NS
605	Vehicle vs House	Curl 2002	1	

B.3.2 Behavior Relationships

B.3.2.1 Category 7: Subject's Personal Characteristics

Table B.3.2.1 Overview of Relationships for Questions in Category 7: Subject's Personal Characteristics – Grouped by Medium and Sorted by Question and Citation

a) **Urine, part 1**
b) **Urine, part 2**

Table B.3.2.1.a Overview of Relationships for Questions in Category 7: Subject's Personal Characteristics with Urine Measurements, part 1

Q#	Description	Citation	1NAP		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMTP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
701	Sex	Adgate 2001		1		1		1												
701	Sex	Aprea 2000								2		2		2		2		2		2
701	Sex	Koch 1999																		
701	Sex	Koch 2002																		
701	Sex	Krinsley 1998						1												
701	Sex	Lu 2001																		
701	Sex	Shalat 2003																		
702	Age	Adgate 2001		1		1		1												
702	Age	Curl 2002																		
702	Age	Koch 1999																		
702	Age	Koch 2002																		
702	Age	Krinsley 1998					1	1												
702	Age	Loewenherz 1997															4	10		
702	Age	Lu 2001																		

Q#	Description	Citation	1NAP		MDA		TCPY		DEP		DETP		DEDTP		DMP		DMTP		DMDTP	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
702	Age	Shalat 2003																		
703	Ethnicity	Adgate 2001	1		1															
703	Ethnicity	Krinsley 1998						1												
704	Education Level	Krinsley 1998						1												
705	Income	Adgate 2001	1		3		2													
705	Income	Krinsley 1998						1												
705	Income	Lu 2001																		
707[a]	Hand's Surface Area	Shalat 2003																		

[a] There is no question grouping for the number 706.

Table B.3.2.1.b Overview of Relationships for Questions in Category 7: Subject’s Personal Characteristics with Urine Measurements, part 2

Q#	Description	Citation	ETHL1		ETHL2		MTHL2		DAP1	
			S	NS	S	NS	S	NS	S	NS
701	Sex	Adgate 2001								
701	Sex	Aprea 2000				2		2		2
701	Sex	Koch 1999				1		1		
701	Sex	Koch 2002			1		1			
701	Sex	Krinsley 1998								
701	Sex	Lu 2001		1				1		

Q#	Description	Citation	ETHL1		ETHL2		MTHL2		DAP1	
			S	NS	S	NS	S	NS	S	NS
701	Sex	Shalat 2003								2
702	Age	Adgate 2001								
702	Age	Curl 2002		2			4			
702	Age	Koch 1999			1			1		
702	Age	Koch 2002				1		1		
702	Age	Krinsley 1998								
702	Age	Loewenherz 1997								
702	Age	Lu 2001		1				1		
702	Age	Shalat 2003							2	
703	Ethnicity	Adgate 2001								
703	Ethnicity	Krinsley 1998								
704	Education Level	Krinsley 1998								
705	Income	Adgate 2001								
705	Income	Krinsley 1998								
705	Income	Lu 2001		1				1		
707[a]	Hand's Surface Area	Shalat 2003								2

[a] There is no question grouping for the number 706.

B.3.2.2 Category 8: Child's Behaviors

Table B.3.2.2 Overview of Relationships for Questions in Category 8: Child's Behaviors – Grouped by Medium and Sorted by Question and Citation

a) Urine

Table B.3.2.2.a Overview of Relationships for Questions in Category 8: Child's Behaviors with Urine Measurements

Q#	Description	Citation	4NITR		TCPY		ETHL1		MTHL1		MTHL2		DAP1	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
801	Hand-to-Mouth Activity	Fenske 2002		1		1								
801	Hand-to-Mouth Activity	Lu 2000								1				
801	Hand-to-Mouth Activity	Lu 2001						1				1		
802	Thumb-Sucking	Fenske 2002		1		1								
802	Thumb-Sucking	Lu 2000								1				
802	Thumb-Sucking	Lu 2001						1				1		
803	Hand Washing Before Meals	Fenske 2002		1		1								
803	Hand Washing Before Meals	Lu 2000								1				
804	Frequency of Handwashing	Lu 2001						1				1		
805	Time Spent Outdoors	Fenske 2002		1		1								
805	Time Spent Outdoors	Lu 2000								1				
806	Loading From Hand Wipe	Shalat 2003											2	

B.3.2.3 Category 9: Dietary Behaviors

Table B.3.2.3 Overview of Relationships for Questions in Category 9: Dietary Behaviors – Grouped by Medium and Sorted by Question and Citation

a) Urine

Table B.3.2.3.a Overview of Relationships for Questions in Category 9: Dietary Behaviors with Urine Measurements

Q#	Description	Citation	TCPY		DEP		DETP		DEDTP		DMP		ETHL2		MTHL2	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
901	Type of Drinking Water	Krinsley 1998		1												
902	Consumption of Homegrown Fresh Vegetables	Krinsley 1998		1												
903	Ate Lunch at School	Aprea 2000				2		2		2		2		2		
904	Organic Diet	Curl 2003												2	2	

B.3.2.4 Category 10: Family Hygiene Practices

Table B.3.2.4 Overview of Relationships for Questions in Category 10: Family Hygiene Practices – Grouped by Medium and Sorted by Question and Citation

a) Urine
b) Dust

Table B.3.2.4.a Overview of Relationships for Questions in Category 10: Family Hygiene Practices with Urine Measurements

Q#	Description	Citation	4NITR		TCPY		DMTP		ETHL1		MTHL1		MTHL2	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
1001	Shoes Removed at Door	Carrel 1996					2	2						
1001	Shoes Removed at Door	Lu 2000										1		
1002	Presence of Doormats	Fenske 2002		1		1								
1002	Presence of Doormats	Lu 2000										1		
1003	Presence of Floor Mats	Lu 2001								1				1
1004	Vacuuming Frequency	Fenske 2002		1		1								
1004	Vacuuming Frequency	Lu 2000										1		
1004	Vacuuming Frequency	Lu 2001								1				1
1006	Work Clothes Worn Indoors	Carrel 1996						4						
1006	Work Clothes Worn Indoors	Fenske 2002		1		1								
1006	Work Clothes Worn Indoors	Lu 2000										1		
1007	Work Clothes Mixed with Laundry	Lu 2000										1		
1008	Laundering Practices	Fenske 2002		1		1								

Q#	Description	Citation	4NITR		TCPY		DMTP		ETHL1		MTHL1		MTHL2	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
1008	Laundering Practices	Carrel 1996						4						
1010	Shower Soon After Work	Carrel 1996						4						

Table B.3.2.4.b Overview of Relationships for Questions in Category 10: Family Hygiene Practices with Dust Measurements

Q#	Description	Citation	AZM		AZMPH		CHLR		EPAR		OPSUM		PHSM	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
1001	Shoes Removed at Door	Grossman 2001		1										
1001	Shoes Removed at Door	Lu 2000				1								
1001	Shoes Removed at Door	McCauley 2003		1								1		
1001	Shoes Removed at Door	Simcox 1995		2				2		2				2
1002	Presence of Doormats	Fenske 2002						1		1				
1002	Presence of Doormats	Lu 2000				1								
1002	Presence of Doormats	Simcox 1995		2				2		2				2
1004	Vacuuming Frequency	Fenske 2002						1		1				
1004	Vacuuming Frequency	Lu 2000				1								
1005	Vacuuming Indoor Play Areas	Simcox 1995		2				2		2				2
1006	Work Clothes Worn Indoors	Fenske 2002						1		1				
1006	Work Clothes Worn Indoors	Lu 2000				1								
1006	Work Clothes Worn Indoors	McCauley 2003	1								1			
1007	Work Clothes Mixed with Laundry	Lu 2000				1								

Q#	Description	Citation	AZM		AZMPH		CHLR		EPAR		OPSUM		PHSM	
			S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
1008	Laundering Practices	Fenske 2002						1		1				
1009	Number of Days Since Last Vacuuming	McCauley 2003									1			
1010	Shower Soon After Work	McCauley 2003		1								1		
1010	Shower Soon After Work	Grossman 2001		1										
1012	After Work Hygiene Index	McCauley 2003		1								1		

B.3.2.5 Category 11: Smoking-Related Activities

Table B.3.2.5 Overview of Relationships for Questions in Category 11: Smoking-Related Activities – Grouped by Medium and Sorted by Question and Citation
a) Urine

Table B.3.2.5.a Overview of Relationships for Questions in Category 11: Smoking-Related Activities with Urine Measurements

Q#	Description	Citation	TCPY	
			S	NS
1101	Current Smoker	Krinsley 1998	1	
1102	Subject Smoked	Krinsley 1998	2	
1103	Exposure to Second Hand Smoke	Krinsley 1998		1

B.3.2.6 Category 12: Work Exposure/Practices

Table B.3.2.6 Overview of Relationships for Questions in Category 12: Work Exposure/Practices – Grouped by Medium and Sorted by Question and Citation

a) **Urine**
b) **Dust**

Table B.3.2.6.a Overview of Relationships for Questions in Category 12: Work Exposure/Practices with Urine Measurements

Q#	Description	Citation	TCPY	
			S	NS
1201	Pesticide Exposure at Work in Past 6 Mo	Krinsley 1998		1

Table B.3.2.6.b Overview of Relationships for Questions in Category 12: Work Exposure/Practices with Dust Measurements

Q#	Description	Citation	AZM	
			S	NS
1202	Wear Boots While Doing Fieldwork?	Grossman 2001		1
1203	Wear Gloves While Doing Fieldwork?	Grossman 2001		1
1204	Wear Hat While Doing Fieldwork?	Grossman 2001		1

B.3.3 Other Relationships

B.3.3.1 Category 13: Related Exposure Levels

Table B.3.3.1 Overview of Relationships for Questions in Category 13: Related Exposure Levels – Grouped by Medium and Sorted by Question and Citation
a) Urine

Table B.3.3.1.a Overview of Relationships for Questions in Category 13: Related Exposure Levels with Urine Measurements

Q#	Description	Citation	MTHL4		DAP2		DAP3	
			S	NS	S	NS	S	NS
1301	Detectable Levels in Adult Household Members	Azaroff 1999			1	1		
1302	High Levels in Adult Household Members	Azaroff 1999	1		1		1	

B.3.3.2 Category 14: Health

Table B.3.3.2 Overview of Relationships for Questions in Category 14: Health – Grouped by Medium and Sorted by Question and Citation
a) Urine

Table B.3.3.2.a Overview of Relationships for Questions in Category 14: Health with Urine Measurements

Q#	Description	Citation	TCPY	
			S	NS
1401	Health Status	Krinsley 1998		1
1402	Asthma and Allergies	Krinsley 1998		1
1403	Bowel Disease	Krinsley 1998	1	
1404	Diabetes	Krinsley 1998		1
1405	Intestinal Disease	Krinsley 1998	3	
1406	Ulcer	Krinsley 1998	1	

Appendix C

Detail Tables for Relationships from Literature Review

Appendix C
Detail Tables for Relationships from Literature Review

Contents

Tables

Appendices B, C, and D provide specific information about the relationships extracted from the literature review and summarized in Results sections 4.2.4, 4.2.5, and 4.2.6. The information is presented as overview, detail, and comment tables. Each appendix includes one type of table for all the question categories and relationships. This appendix presents the detail tables.

C.1 Description

Table C.1 is an example of a detail table which provides the detailed statistical analysis and descriptive information for each relationship counted in the associated overview table (Table B.1 in Appendix B), and for each relationship in Table D.1 in Appendix D.

Table C.1 Example of Relationship Detail Table for Question Category: Residential Pesticide Use (Overview Table – Table B.1 Appendix B)

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q101--Pesticide Use																						
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	Y	N	yes vs no		ug/g Cre							166				0.0010
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	Y	N		yes	ug/g Cre				8.200	10.540		126				
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	Y	N		no	ug/g Cre				7.490	7.310		40				
814	urine	ETHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
815	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
812	urine	MTHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
813	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
633	dust	AZM	C	McCauley 2001a	TNR	> 0.05	N	N	Not Available		ppm											
848	dust	OPSUM	C	McCauley 2003	WTWS	0.39	N	N	yes vs no		ppm							24				

ID #	Me-dium	Chemi-cal	M T	Citation	Analy-sis	p-value	L G	P M	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q102--Inside Treated																						
563	urine	MDA	C	Sexton 2003	BSLR-5	0.1	Y	N	yes vs no		ug/L										-0.220	0.1200
557	urine	MDA	C	Sexton 2003	LGRG	0.174	N	N	high score vs not high score		ug/L								0.550	(0.23, 1.3)		
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	Y	N	yes vs no		ug/g Cre							166				0.0001
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	Y	N		yes	ug/g Cre				7.690	8.270		90				
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	Y	N		no	ug/g Cre				7.640	8.120		76				
164	urine	ETHL1	C	Lu 2001	MWU	0.27	N	N		yes	umol/L			0.030				23				
164	urine	ETHL1	C	Lu 2001	MWU	0.27	N	N		no	umol/L			0.040				73				
165	urine	MTHL2	C	Lu 2001	MWU	0.35	N	N		yes	umol/L			0.110				23				
165	urine	MTHL2	C	Lu 2001	MWU	0.35	N	N		no	umol/L			0.110				73				
561	dust	CHLR	L	Sexton 2003	LGRG	0.436	N	N	yes vs no		ng/cm^2								0.710	(0.30, 1.67)		
558	indair	CHLR	C	Sexton 2003	LGRG	0.296	N	N	yes vs no		ng/m^3								0.310	(0.04, 2.75)		
554	indair	MAL	C	Sexton 2003	LGRG	0.369	N	N	yes vs no		ng/m^3								0.641	(0.24, 1.69)		
559	outd-air	CHLR	C	Sexton 2003	LGRG	0.715	N	N	yes vs no		ng/m^3								0.700	(0.11, 4.66)		
555	outd-air	MAL	C	Sexton 2003	LGRG	0.373	N	N	yes vs no		ng/m^3								2.760	(0.30, 25.7)		
562	pers-air	CHLR	C	Sexton 2003	BSLR-1	0.04	Y	N	yes vs no		ng/m^3										-0.820	0.0700
553	pers-air	MAL	C	Sexton 2003	LGRG	0.073	N	N	yes vs no		ng/m^3								0.377	(0.13, 1.09)		
560	sldfood	CHLR	I	Sexton 2003	LGRG	0.38	N	N	yes vs no		ug/day								1.460	(0.63, 3.37)		

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
556	sldfood	MAL	I	Sexton 2003	LGRG	0.06	N	N	yes vs no		ug/day								0.442	(0.19, 1.04)		
Q103--Inside Treated--Bathroom																						
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	Y	N	yes vs no		ug/g Cre							167				0.0050
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	Y	N		yes	ug/g Cre				8.380	9.000		70				
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	Y	N		no	ug/g Cre				7.150	7.480		97				

Table C.1 includes all the relationships for the Residential Pesticide Use category counted in Table B.1 (Appendix B). The highest level of organization in this table is based on the Q# for the questions within the category (Appendix E) instead of the medium as in the Appendix B overview tables. Thus each section of the table describes the relationships for one of the questions appearing in the associated overview table, and each row describes one aspect of one of the relationships. The rows within a question's section are sorted by medium, chemical/metabolite, citation, and analysis type. The chemicals/metabolites are presented by the following groupings: (urinary metabolites) non-DAPs (dialkyl phosphates), single DAPs, DAP sums, detectable DAPs, high DAPs, and chemicals for other mediums (see Table C.2.2).

In the section of Table C.1 for "Q103 – Inside treated - bathroom," there are three rows for the urinary metabolite "TCPY," and the citation "Krinsley 1998." Each relationship described in a detail table has at least one row, and each row shows the ID number assigned to the relationship as described in section 4.2.2.2. Two types of rows are used to describe relationships: analysis level and group level rows. In most cases, a relationship is described by one type of row or the other. If there is more than one row for a relationship, the columns ID# through PM, and UNITS, have the same values for all of the relationships.

Several types of relationship situations can be found in the detail tables:

(1) If a relationship is described by only one row, the information included in the row is at the analysis level. In addition to the header information (columns ID# through PM), the row contains information in columns N through R^2 as available in the publication. These relationships are either for an analysis that is not a group comparison like a regression analysis, or for an analysis comparing groups, where no group level

statistics are provided. In the latter case, a description of the groups compared is included in the Groups Compared column, e.g., "yes vs no" for Q101 and ID# 814.

(2) When statistical information was available for the groups compared in the analysis, a relationship is described by more than one row. In addition to the header information, these rows include information in columns GMEAN through N as available, and there is a row for each group compared in the analysis. Rows with names in the Group Name column are group level rows, e.g., Q102 and ID# 164.

(3) In a few relationships, analysis level and group level information is provided, e.g., Q101 and ID# 484. In this case group level statistics (mean and standard deviation) were included, but the analysis was a regression analysis, not a test of the means.

C.2 Reference Information

To make the detail tables more compact, it was necessary to use abbreviations or codes in both the column names and contents. Table C.2.1 describes each column name used in the detail tables. The column Reference Table identifies the number of a subsequent table containing information about the codes used. For example, the column LG includes codes described in Table C.2.6.

Table C.2.1 List of Columns and Associated Reference Tables in Detail Tables

Column Type or Name	Description	Applies to[a]	Reference Table[b]
ID #	Number assigned to each relationship		NA
Medium	Sample medium		Appendix C - Table C.2.3
Chemical	Chemical, metabolite, or molar-weighted sum	a	Appendix C - Table C.2.2
MT	Type of measurement	a	Appendix C - Table C.2.4
Citation	Citation reference		Appendix A - Table A.1
Analysis	Type of statistical analysis performed	a	Appendix C - Table C.2.5
p-value	Probability value associated with statistical analysis		NA
LG	Log transformation	a	Appendix C - Table C.2.6
PM	p-value is associated with model rather than predictor		Appendix C - Table C.2.7
Groups Compared	Predictor groups compared in analysis separated by "vs"; otherwise assume predictor is continuous	b	NA
Group Name	Name of analyzed group described by group statistics	b	NA
Units	Units for chemical measurement	a	NA
GMean	Group geometric mean	a	Appendix C - Table C.2.8
GSD	Group geometric standard deviation	a	Appendix C - Table C.2.8
Median	Group median	a	Appendix C - Table C.2.8
Mean	Group mean	a	Appendix C - Table C.2.8
StDev	Group standard deviation	a	Appendix C - Table C.2.8
PctD	Group percent of measurements above LOD (limit of detection)	a	NA
N	Number of participants in group or analysis	a,b	NA
OR	Odds ratio for predictor (logistic regression)	b	Appendix C - Table C.2.9

Column Type or Name	Description	Applies to[a]	Reference Table[b]
CI	Confidence interval (95% assumed) for OR or Beta depending on which is included	a	NA
Beta	Regression coefficient for predictor	b	Appendix C - Table C.2.9
R^2	R^2 from regression analysis of one or more predictors	b	NA

[a] The entry "a" is a dependent variable, in this case a chemical analytical measurement. The entry "b" is an independent variable or predictor, usually a question.
[b] NA – Not applicable

Table C.2.2 Chemical/Metabolite Reference Table

Grouping[a]	Code	Medium	Description
1-Non-DAP	1NAP	urine	1-Naphthol
1-Non-DAP	4NITR	urine	4-Nitrophenol
6-Chemical	ATZ	other[b]	Atrazine
1-Non-DAP	ATZM	urine	Atrazine mercapturate
6-Chemical	AZM	other	Azinphosmethyl
6-Chemical	AZMPH	other	Azinphosmethyl+Phosmet
6-Chemical	CHLR	other	Chlorpyrifos
3-DAP Sum[c]	DAP1	urine	DMP+DMTP+DMDTP+DEP+DETP+DEDTP
4-DAP Detect	DAP2	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
5-DAP High	DAP3	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement)[d]
2-DAP	DEDTP	urine	Diethyldithiophosphate (DEDTP)
2-DAP	DEP	urine	Diethylphosphate (DEP)

Grouping[a]	Code	Medium	Description
2-DAP	DETP	urine	Diethylthiophosphate (DETP)
2-DAP	DMDTP	urine	Dimethyldithiophosphate (DMDTP)
2-DAP	DMP	urine	Dimethylphosphate (DMP)
2-DAP	DMTP	urine	Dimethylthiophosphate (DMTP)
6-Chemical	EPAR	other	Ethyl parathion
3-DAP Sum	ETHL1	urine	DEP+DETP
3-DAP Sum	ETHL2	urine	DEP+DETP+DEDTP
4-DAP Detect	ETHL3	urine	DEP, DETP, DEDTP (at least one detectable measurement)
6-Chemical	MAL	other	Malathion
1-Non-DAP	MDA	urine	Malathion dicarboxylic acid
3-DAP Sum	MTHL1	urine	DMTP+DMDTP
3-DAP Sum	MTHL2	urine	DMP+DMTP+DMDTP
4-DAP Detect	MTHL3	urine	DMTP (detectable measurement)
4-DAP Detect	MTHL4	urine	DMP, DMTP (at least one detectable measurement)
5-DAP High	MTHL5	urine	DMP, DMTP (at least one high measurement) [d]
7-Metabolite NA	NA	urine	NA (not available or not specified)
6-Chemical	OPSUM	other	OP sum[e]
6-Chemical	PHSM	other	Phosmet
1-Non-DAP	TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] The number preceding the group name indicates the order of the group as it appears in the overview tables.
[b] Medium is urine or other (any other medium measured).
[c] Sums are molar-weighted unless otherwise specified.

[d] See definition of high measurement in Azaroff (1999).
[e] OP Sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet.

Table C.2.3 Medium Reference Table

Code	Description
dust	dust
indair	indoor air
outdair	outdoor air
persair	personal air
sldfood	solid food
soil	soil
urine	urine

Table C.2.4 Type of Measurement Reference Table

Code	Description
A	Adjusted concentration (urine concentration adjusted by creatinine)
C	Concentration
I	Daily intake (food)
L	Loading (dust or dermal)

Table C.2.5 Statistical Analysis Reference Table

Code	Description
BSLR-#x[a]	Backwards Stepwise Linear Regression #x
BDPH	Bonferroni/Dunn Post Hoc Test
CHSQ	Chi-Square Test
CORR	Correlation
FISH	Fisher Exact Test
FSLR	Forward Selection Linear Regression
GLM	General Linear Model ANOVA
GLM-#x	General Linear Model ANOVA #x
KWAN	Kruskal-Wallis One-Way ANOVA
LGRG	Logistic Regression
MWU	Mann-Whitney U Test
MLR	Multiple Linear Regression
MLR-#x[a]	Multiple Linear Regression #x
MLGR-#x[a]	Multiple Logistic Regression #x
MVRG-#x[a]	Multivariate Regression #x
NAN	Not analyzed
OWAN	One-Way ANOVA
SLR	Simple Linear Regression
SLGR	Simple Logistic Regression
SPCR	Spearman Rank Correlation
TTST	t-test
TWAN-#x[a]	Two-Way ANOVA #x

Code	Description
TNR	Type of Analysis Not Reported
WTAN	Weighted ANOVA
WSRK	Wilcoxon Signed Rank Test
WTWS	Wilcoxon Two-Sample Test

[a] In some analyses where more than one predictor was analyzed in a relationship, the predictor questions will likely appear in different question category sections. The user can identify the predictors that were analyzed in the same relationship by looking for the same analysis code for the citation. For example, if a multiple linear regression was performed with three predictors on two metabolites, there would be two analysis types: < MLR-#1 and MLR-#2. The analysis type MLR-#1 would be used as the analysis type for the three relationships describing the three predictor questions. Aprea 2000 contains examples of this type of analysis code.

Table C.2.6 Log Transformation Reference Table

Code	Description
Y	Measurements were log-transformed before analysis.
N	Original measurement values were used in the analysis.

Table C.2.7 Probability for Model Reference Table

Code	Description
Y	p-value applies to a model which includes more than one predictor (e.g., regression analysis F-test).
N	p-value applies to one predictor in a single-predictor or multi-predictor analysis (e.g., coefficient in regression analysis).

Table C.2.8 Group Statistics Reference Table

Code[a]	Description
>	Group has statistic with higher value (e.g., Gmean, Median).
<	Group has statistic with lower value (e.g., Gmean, Median).

[a] Codes appear when publication provides only relative indicators for group statistics.

Table C.2.9 Analysis Statistics Reference Table

Code[a]	Description
↑	Statistic (e.g. regression coefficient) > 0, that is, there is a positive association between the measurement and predictor.
↓	Statistic (e.g. regression coefficient) < 0, that is, there is an inverse association between the measurement and predictor.

[a] Codes appear when publication provides only the direction of relationship.

Table C.2.10 provides a cross-reference between the relationship summary tables in the Results section and the tables in Appendices B, C, D.

Table C.2.10. Table Numbers Cross-Referenced between Results Section and Appendices A, B, and C, by Category Group

Category			Section #	Table #[a]	Overview Table #	Detailed Table #	Comment Table #
Group	**#**	**Description**	**Results**	**Results**	**Appendix B**	**Appendix C**	**Appendix D**
Source	1	Residential pesticide use	4.2.4.1	4.2.6.x	B.3.1.1	C.3.1.1	D.3.1.1
Source	2	Household characteristics	4.2.4.2	4.2.7.x	B.3.1.2	C.3.1.2	D.3.1.2

Category			Section #	Table #[a]	Overview Table #	Detailed Table #	Comment Table #
Group	**#**	**Description**	**Results**	**Results**	**Appendix B**	**Appendix C**	**Appendix D**
Source	3	Residential sources (environmental measures)	4.2.4.3	4.2.8.x	B.3.1.3	C.3.1.3	D.3.1.3
Source	4	Household occupation	4.2.4.4	4.2.9.x	B.3.1.4	C.3.1.4	D.3.1.4
Source	5	Residential proximity to agricultural fields	4.2.4.5	4.2.10.x	B.3.1.5	C.3.1.5	D.3.1.5
Source	6	Residential location	4.2.4.6	4.2.11.x	B.3.1.6	C.3.1.6	D.3.1.6
Behavior	7	Subject's personal characteristics	4.2.5.1	4.2.13.x	B.3.2.1	C.3.2.1	D.3.2.1
Behavior	8	Child's behaviors	4.2.5.2	4.2.14.x	B.3.2.2	C.3.2.2	D.3.2.2
Behavior	9	Dietary behaviors	4.2.5.3	4.2.15.x	B.3.2.3	C.3.2.3	D.3.2.3
Behavior	10	Family hygiene practices	4.2.5.4	4.2.16.x	B.3.2.4	C.3.2.4	D.3.2.4
Behavior	11	Smoking-related activities	4.2.5.5	4.2.17.x	B.3.2.5	C.3.2.5	D.3.2.5
Behavior	12	Work exposure/practices	4.2.5.6	4.2.18.x	B.3.2.6	C.3.2.6	D.3.2.6
Other	13	Related exposure levels	4.2.6.1	4.2.20.x	B.3.3.1	C.3.3.1	D.3.3.1
Other	14	Health	4.2.6.2	4.2.21.x	B.3.3.2	C.3.3.2	D.3.3.2

[a] x in this column refers to the three table types, a, b, and c, described above.

C.3 Detail Tables

C.3.1 Source Relationships

C.3.1.1 Category 1 - Residential Pesticide Use

Table C.3.1.1 Relationship Details for Questions in Category 1: Residential Pesticide Use – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q101--Pesticide Use																						
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	Y	N	yes vs no		ug/g Cre							166				0.0010
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	Y	N		yes	ug/g Cre				8.200	10.540		126				
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	Y	N		no	ug/g Cre				7.490	7.310		40				
814	urine	ETHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
815	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
812	urine	MTHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
813	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
633	dust	AZM	C	McCauley 2001a	TNR	> 0.05	N	N	Not Available		ppm											
848	dust	OPSUM	C	McCauley 2003	WTWS	0.39	N	N	yes vs no		ppm							24				
Q102--Inside Treated																						
563	urine	MDA	C	Sexton 2003	BSLR-5	0.1	Y	N	yes vs no		ug/L										-0.220	0.1200

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
557	urine	MDA	C	Sexton 2003	LGRG	0.174	N	N	high score vs not high score		ug/L								0.550	(0.23, 1.3)		
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	Y	N	yes vs no		ug/g Cre							166				0.0001
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	Y	N		yes	ug/g Cre				7.690	8.270		90				
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	Y	N		no	ug/g Cre				7.640	8.120		76				
164	urine	ETHL1	C	Lu 2001	MWU	0.27	N	N		yes	umol/L			0.030				23				
164	urine	ETHL1	C	Lu 2001	MWU	0.27	N	N		no	umol/L			0.040				73				
165	urine	MTHL2	C	Lu 2001	MWU	0.35	N	N		yes	umol/L			0.110				23				
165	urine	MTHL2	C	Lu 2001	MWU	0.35	N	N		no	umol/L			0.110				73				
561	dust	CHLR	L	Sexton 2003	LGRG	0.436	N	N	yes vs no		ng/cm^2								0.710	(0.30, 1.67)		
558	indair	CHLR	C	Sexton 2003	LGRG	0.296	N	N	yes vs no		ng/m^3								0.310	(0.04, 2.75)		
554	indair	MAL	C	Sexton 2003	LGRG	0.369	N	N	yes vs no		ng/m^3								0.641	(0.24, 1.69)		
559	outd-air	CHLR	C	Sexton 2003	LGRG	0.715	N	N	yes vs no		ng/m^3								0.700	(0.11, 4.66)		
555	outd-air	MAL	C	Sexton 2003	LGRG	0.373	N	N	yes vs no		ng/m^3								2.760	(0.30, 25.7)		
562	pers-air	CHLR	C	Sexton 2003	BSLR-1	0.04	Y	N	yes vs no		ng/m^3										-0.820	0.0700
553	pers-air	MAL	C	Sexton 2003	LGRG	0.073	N	N	yes vs no		ng/m^3								0.377	(0.13, 1.09)		
560	sldfood	CHLR	I	Sexton 2003	LGRG	0.38	N	N	yes vs no		ug/day								1.460	(0.63, 3.37)		
556	sldfood	MAL	I	Sexton 2003	LGRG	0.06	N	N	yes vs no		ug/day								0.442	(0.19, 1.04)		

ID #	Medium	Chemical	MT	Citation[a]	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q103--Inside Treated--Bathroom																						
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	Y	N	yes vs no		ug/g Cre							167				0.0050
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	Y	N		yes	ug/g Cre				8.380	9.000		70				
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	Y	N		no	ug/g Cre				7.150	7.480		97				
Q104--Inside Treated--Bedroom																						
767	urine	TCPY	A	Krinsley 1998	FSLR#2	< 0.001	Y	Y	yes vs no		ug/g Cre							166			0.125	0.2100
772	urine	TCPY	A	Krinsley 1998	FSLR#3	< 0.001	Y	Y	yes vs no		ug/g Cre										0.246	0.3500
497	urine	TCPY	A	Krinsley 1998	SLR	0.02	Y	N	yes vs no		ug/g Cre							167				0.0300
497	urine	TCPY	A	Krinsley 1998	SLR	0.02	Y	N		yes	ug/g Cre				9.080	9.180		65				
497	urine	TCPY	A	Krinsley 1998	SLR	0.02	Y	N		no	ug/g Cre				6.760	7.320		102				
Q105--Inside Treated--Cabinets																						
506	urine	TCPY	A	Krinsley 1998	SLR	0.15	Y	N	yes vs no		ug/g Cre							167				0.0100
506	urine	TCPY	A	Krinsley 1998	SLR	0.15	Y	N		yes	ug/g Cre				10.560	12.210		21				
506	urine	TCPY	A	Krinsley 1998	SLR	0.15	Y	N		no	ug/g Cre				7.250	7.350		146				
Q106--Inside Treated--Closets																						
507	urine	TCPY	A	Krinsley 1998	SLR	0.04	Y	N	yes vs no		ug/g Cre							167				0.0300
507	urine	TCPY	A	Krinsley 1998	SLR	0.04	Y	N		yes	ug/g Cre				11.710	13.000		26				
507	urine	TCPY	A	Krinsley 1998	SLR	0.04	Y	N		no	ug/g Cre				6.920	6.700		141				

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q107--Inside Treated--Cupboards with Dishes																						
505	urine	TCPY	A	Krinsley 1998	SLR	0.52	Y	N	yes vs no		ug/g Cre							167				0.0100
505	urine	TCPY	A	Krinsley 1998	SLR	0.52	Y	N		yes	ug/g Cre				9.210	11.800		11				
505	urine	TCPY	A	Krinsley 1998	SLR	0.52	Y	N		no	ug/g Cre				7.560	7.870		156				
Q108--Inside Treated--Dining Room																						
496	urine	TCPY	A	Krinsley 1998	SLR	0.12	Y	N	yes vs no		ug/g Cre							167				0.0200
496	urine	TCPY	A	Krinsley 1998	SLR	0.12	Y	N		yes	ug/g Cre				8.500	8.370		57				
496	urine	TCPY	A	Krinsley 1998	SLR	0.12	Y	N		no	ug/g Cre				7.230	8.040		110				
Q109--Inside Treated--Family Room																						
494	urine	TCPY	A	Krinsley 1998	SLR	0.38	Y	N	yes vs no		ug/g Cre							167				0.0050
494	urine	TCPY	A	Krinsley 1998	SLR	0.38	Y	N		yes	ug/g Cre				7.780	7.510						
494	urine	TCPY	A	Krinsley 1998	SLR	0.38	Y	N		no	ug/g Cre				7.630	8.370						
Q110--Inside Treated--Kitchen																						
493	urine	TCPY	A	Krinsley 1998	SLR	0.89	Y	N	yes vs no		ug/g Cre							167				0.0010
493	urine	TCPY	A	Krinsley 1998	SLR	0.89	Y	N		yes	ug/g Cre				7.820	8.580		80				
493	urine	TCPY	A	Krinsley 1998	SLR	0.89	Y	N		no	ug/g Cre				7.520	7.780		87				
Q111--Inside Treated--Living Room																						
495	urine	TCPY	A	Krinsley 1998	SLR	0.08	Y	N	yes vs no		ug/g Cre							167				0.0200
495	urine	TCPY	A	Krinsley 1998	SLR	0.08	Y	N		yes	ug/g Cre				8.700	9.140		66				

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
495	urine	TCPY	A	Krinsley 1998	SLR	0.08	Y	N		no	ug/g Cre				6.990	7.400		101				
Q112--Inside Treated--On Baseboards																						
501	urine	TCPY	A	Krinsley 1998	SLR	0.51	Y	N	yes vs no		ug/g Cre							167				0.0030
501	urine	TCPY	A	Krinsley 1998	SLR	0.51	Y	N		yes	ug/g Cre				8.300	9.060		69				
501	urine	TCPY	A	Krinsley 1998	SLR	0.51	Y	N		no	ug/g Cre				7.220	7.450		98				
Q113--Inside Treated--On Ceiling																						
504	urine	TCPY	A	Krinsley 1998	SLR	0.58	Y	N	yes vs no		ug/g Cre							167				0.0020
504	urine	TCPY	A	Krinsley 1998	SLR	0.58	Y	N		yes	ug/g Cre				9.030	8.090		8				
504	urine	TCPY	A	Krinsley 1998	SLR	0.58	Y	N		no	ug/g Cre				7.600	8.170		159				
Q114--Inside Treated--On Floor																						
500	urine	TCPY	A	Krinsley 1998	SLR	0.27	Y	N	yes vs no		ug/g Cre							167				0.0070
500	urine	TCPY	A	Krinsley 1998	SLR	0.27	Y	N		yes	ug/g Cre				6.850	7.700		38				
500	urine	TCPY	A	Krinsley 1998	SLR	0.27	Y	N		no	ug/g Cre				7.900	8.290		129				
Q115--Inside Treated--On Lower Walls																						
502	urine	TCPY	A	Krinsley 1998	SLR	0.65	Y	N	yes vs no		ug/g Cre							167				0.0010
502	urine	TCPY	A	Krinsley 1998	SLR	0.65	Y	N		yes	ug/g Cre				9.710	11.230		16				
502	urine	TCPY	A	Krinsley 1998	SLR	0.65	Y	N		no	ug/g Cre				7.430	7.770		151				
Q116--Inside Treated--On Upper Walls																						
503	urine	TCPY	A	Krinsley 1998	SLR	0.2	Y	N	yes vs no		ug/g Cre							167				0.0100

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
503	urine	TCPY	A	Krinsley 1998	SLR	0.2	Y	N		yes	ug/g Cre				13.100	14.820		8				
503	urine	TCPY	A	Krinsley 1998	SLR	0.2	Y	N		no	ug/g Cre				7.390	7.650		159				
Q117--Inside Treated--Other Room																						
773	urine	TCPY	A	Krinsley 1998	FSLR#3	< 0.001	Y	Y	yes vs no		ug/g Cre										0.172	0.3500
499	urine	TCPY	A	Krinsley 1998	SLR	0.05	Y	N	yes vs no		ug/g Cre							167				0.0200
499	urine	TCPY	A	Krinsley 1998	SLR	0.05	Y	N		yes	ug/g Cre				12.630	14.190		21				
499	urine	TCPY	A	Krinsley 1998	SLR	0.05	Y	N		no	ug/g Cre				6.950	6.640		146				
Q118--Pets Treated																						
160	urine	ETHL1	C	Lu 2001	MWU	0.14	N	N		yes	umol/L			0.040				18				
160	urine	ETHL1	C	Lu 2001	MWU	0.14	N	N		no	umol/L			0.030				18				
335	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		yes	ug/ml			0.070								
335	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		no	ug/ml			0.050								
161	urine	MTHL2	C	Lu 2001	MWU	0.8	N	N		yes	umol/L			0.150				18				
161	urine	MTHL2	C	Lu 2001	MWU	0.8	N	N		no	umol/L			0.180				18				
331	dust	AZMPH	C	Lu 2000	MWU	0.1	N	N		yes	ug/g			0.700								
331	dust	AZMPH	C	Lu 2000	MWU	0.1	N	N		no	ug/g			2.100								
Q119--Outside Treated																						
567	urine	MDA	C	Sexton 2003	BSLR-5	0.03	Y	N	yes vs no		ug/L										-0.330	0.1200
489	urine	TCPY	A	Krinsley 1998	SLR	0.11	Y	N	yes vs no		ug/g Cre							166				0.0200
489	urine	TCPY	A	Krinsley 1998	SLR	0.11	Y	N		yes	ug/g Cre				7.960	7.690		107				
489	urine	TCPY	A	Krinsley 1998	SLR	0.11	Y	N		no	ug/g Cre				7.130	9.020		59				

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
570	urine	TCPY	C	Sexton 2003	BSLR-6	0.09	Y	N	yes vs no		ug/L										-0.290	0.0800
566	dust	CHLR	L	Sexton 2003	BSLR-4	0.01	Y	N	yes vs no		ng/cm^2										-0.028	0.0800
565	sld-food	CHLR	I	Sexton 2003	BSLR-3	0.06	Y	N	yes vs no		ug/day										-0.800	0.0400
Q120--Garden Treated																						
249	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
248	urine	TCPY	C	Fenske 2002	MWU	0.02	N	N		yes	ug/L				8.300							
248	urine	TCPY	C	Fenske 2002	MWU	0.02	N	N		no	ug/L				2.400							
156	urine	ETHL1	C	Lu 2001	MWU	0.02	N	N		yes	umol/L			0.040				27				
156	urine	ETHL1	C	Lu 2001	MWU	0.02	N	N		no	umol/L			0.030				22				
338	urine	MTHL1	C	Lu 2000	MWU	0.9	N	N		yes	ug/ml			0.080								
338	urine	MTHL1	C	Lu 2000	MWU	0.9	N	N		no	ug/ml			0.050								
157	urine	MTHL2	C	Lu 2001	MWU	0.05	N	N		yes	umol/L			0.190				27				
157	urine	MTHL2	C	Lu 2001	MWU	0.05	N	N		no	umol/L			0.090				22				
334	dust	AZMPH	C	Lu 2000	MWU	0.8	N	N		yes	ug/g			2.100								
334	dust	AZMPH	C	Lu 2000	MWU	0.8	N	N		no	ug/g			1.900								
Q121--Lawn/Yard Treated																						
571	urine	TCPY	C	Sexton 2003	BSLR-6	0.09	Y	N	yes vs no		ug/L										-0.260	0.0800
162	urine	ETHL1	C	Lu 2001	MWU	0.68	N	N		yes	umol/L			0.040				45				
162	urine	ETHL1	C	Lu 2001	MWU	0.68	N	N		no	umol/L			0.040				48				
337	urine	MTHL1	C	Lu 2000	MWU	0.7	N	N		yes	ug/ml			0.060								
337	urine	MTHL1	C	Lu 2000	MWU	0.7	N	N		no	ug/ml			0.050								
163	urine	MTHL2	C	Lu 2001	MWU	0.13	N	N		yes	umol/L			0.140				45				
163	urine	MTHL2	C	Lu 2001	MWU	0.13	N	N		no	umol/L			0.090				48				

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
333	dust	AZMPH	C	Lu 2000	MWU	0.7	N	N		yes	ug/g			2.600								
333	dust	AZMPH	C	Lu 2000	MWU	0.7	N	N		no	ug/g			1.800								
Q122--Inside or Outside Treated																						
132	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											
133	urine	MDA	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											
134	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											
71	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	36.400	2.400				79	166				
71	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	32.700	2.400				75	29				
62	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0490
72	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	24.300	2.700				62	166				
72	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	14.900	2.900				46	29				
73	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	9.900	2.400				21	166				
73	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	7.400	2.100				10	29				
64	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0620
70	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	136.900	3.000				96	166				
70	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	113.500	2.500				96	29				
61	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0440
67	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	19.700	3.800				41	166				

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
67	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	13.300	2.800				33	29				
74	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	81.500	2.200				90	166				
74	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	62.200	2.200				82	29				
65	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0560
Q123--Previous Treatment																						
336	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		yes	ug/ml			0.050								
336	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		no	ug/ml			0.050								
332	dust	AZMPH	C	Lu 2000	MWU	0.3	N	N		no	ug/g			2.100								
332	dust	AZMPH	C	Lu 2000	MWU	0.3	N	N		yes	ug/g			1.100								
Q124--Level of Pesticide Use																						
136	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	Y	N	high score vs not high score		ug/L											
137	urine	MDA	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											
551	urine	MDA	C	Sexton 2003	SLR	0.033	Y	N	high score vs not high score		ug/L											
549	urine	MDA	C	Sexton 2003	WTWS	0.04	N	N	high score vs not high score		ug/L									(1.06, 5.8)		
138	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	Y	N	high score vs not high score		ug/L											
762	urine	TCPY	A	Krinsley 1998	FSLR#1	< 0.001	Y	Y	PUI index scores		ug/g Cre										0.003	0.1800
476	urine	TCPY	A	Krinsley 1998	SLR	< 0.004	Y	N	PUI index scores		ug/g Cre											0.0500

ID #	Medium	Chemical	MT	Citation[a]	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
550	pers-air	ATZ	C	Sexton 2003	LGRG	0.028	N	N	high score vs not high score		ng/m^3								1.220	(1.05, 1.45)		
552	pers-air	ATZ	C	Sexton 2003	LGRG	0.02	Y	N	high score vs not high score		ng/m^3											
Q125--Frequency Personal Application Inside																						
486	urine	TCPY	A	Krinsley 1998	SLR	0.07	Y	N	number of times		ug/g Cre							90				0.0360
486	urine	TCPY	A	Krinsley 1998	SLR	0.07	Y	N		yes	ug/g Cre				9.060	11.070		42				
486	urine	TCPY	A	Krinsley 1998	SLR	0.07	Y	N		no	ug/g Cre				6.490	4.400		48				
Q126--Frequency Personal Application Outside																						
766	urine	TCPY	A	Krinsley 1998	FSLR#2	< 0.001	Y	Y	number of times		ug/g Cre							166			0.270	0.2100
771	urine	TCPY	A	Krinsley 1998	FSLR#3	< 0.001	Y	Y	number of times		ug/g Cre										0.020	0.3500
490	urine	TCPY	A	Krinsley 1998	SLR	0.003	Y	N	number of times		ug/g Cre							107				0.0800
490	urine	TCPY	A	Krinsley 1998	SLR	0.003	Y	N		yes	ug/g Cre				6.860	4.180		76				
490	urine	TCPY	A	Krinsley 1998	SLR	0.003	Y	N		no	ug/g Cre				10.660	12.440		31				
Q127--Inside/Outside Treated by Family Member																						
275	urine	ETHL3	C	Azaroff 1999	MLGR-6	< 0.05	N	N	yes vs no		ug/L							273	3.000	(1.2, 8.2)		
591	urine	MTHL3	C	Azaroff 1999	MLGR-7	< 0.01	N	N	yes vs no		ug/L							274	12.000	(3.8, 4.1)		
276	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.01	N	N	yes vs no		ug/L							274	6.700	(2.0, 2.6)		
273	urine	DAP2	C	Azaroff 1999	MLGR-1	< 0.05	N	N	yes vs no		ug/L							274	1.800	(1.0, 3.0)		

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
274	urine	DAP3	C	Azaroff 1999	MLGR-2	< 0.10	N	N	yes vs no		ug/L							274	2.000	(1.0, 4.6)		
Q128--Frequency Professional Application Inside																						
487	urine	TCPY	A	Krinsley 1998	SLR	0.62	Y	N	yes vs no		ug/g Cre							88				0.0030
Q129--Frequency Professional Application Outside																						
491	urine	TCPY	A	Krinsley 1998	SLR	0.96	Y	N	number of times		ug/g Cre							107				0.0003
491	urine	TCPY	A	Krinsley 1998	SLR	0.96	Y	N		yes	ug/g Cre				6.860	4.180		76				
491	urine	TCPY	A	Krinsley 1998	SLR	0.96	Y	N		no	ug/g Cre				10.660	12.440		31				
Q130--Personally Mixed Pesticide Inside																						
488	urine	TCPY	A	Krinsley 1998	SLR	0.18	Y	N	yes vs no		ug/g Cre							23				0.0840
488	urine	TCPY	A	Krinsley 1998	SLR	0.18	Y	N		yes	ug/g Cre				14.900	20.090		4				
488	urine	TCPY	A	Krinsley 1998	SLR	0.18	Y	N		no	ug/g Cre				5.600	3.960		19				
Q131--Personally Mixed Pesticide Outside																						
492	urine	TCPY	A	Krinsley 1998	SLR	0.46	Y	N	yes vs no		ug/g Cre							30				0.0190
492	urine	TCPY	A	Krinsley 1998	SLR	0.46	Y	N		yes	ug/g Cre				9.430	12.160		11				
492	urine	TCPY	A	Krinsley 1998	SLR	0.46	Y	N		no	ug/g Cre				6.630	4.960		19				
Q132--Presence During Mixing																						
680	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											
683	urine	ATZM	C	Adgate 2001	NAN	> 0.05	Y	N	yes vs no		ug/L											
681	urine	MDA	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
682	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	Y	N	yes vs no		ug/L											

[a] See section 4.2.2.2 and the paragraph immediately following Table 4.2.3 regarding relationships from Sexton (2003).

C.3.1.2 Category 2 - Household Characteristics

Table C.3.1.2 Relationship Details for Questions in Category 2: Household Characteristics – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q201--Housing Type																						
168	urine	ETHL1	C	Lu 2001	TNR	> 0.05	N	N	single-family home vs multiunit building		umol/L											
169	urine	MTHL2	C	Lu 2001	TNR	> 0.05	N	N	single-family home vs multiunit building		umol/L											
632	dust	AZM	C	McCauley 2001a	TNR	> 0.05	N	N	Not Available		ppm											
Q202--Property Used as a Farm																						
690	dust	CHLR	L	Sexton 2003	BSLR-4	0.06	Y	N	yes vs no		ng/cm^2										-0.660	0.0800
564	indair	CHLR	C	Sexton 2003	BSLR-2	0.01	Y	N	yes vs no		ng/m^3										-1.410	0.1200
Q203--Age of House >10 Years																						
483	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											
Q204--Age of House >20 Years																						
670	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											
Q205--Having Air Conditioning																						
480	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	Y	yes vs no		ug/g Cre											
Q206--Having Central Heating																						
482	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q207--Having Evaporative Cooling																						
481	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											
Q208--Pets in House																						
53	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	25.100	2.400									
53	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	36.200	2.400									
44	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0490
54	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	15.800	2.800									
54	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	16.100	2.900									
45	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0550
55	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	6.600	1.900									
55	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	8.100	2.200									
46	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0620
52	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	99.700	2.400									
52	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	122.600	2.600									
43	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0440
48	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	98.900	2.700									
48	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	106.000	2.800									
49	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	11.900	3.100									

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
49	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	14.900	2.600									
158	urine	ETHL1	C	Lu 2001	MWU	0.4	N	N		yes	umol/L			0.040				40				
158	urine	ETHL1	C	Lu 2001	MWU	0.4	N	N		no	umol/L			0.040				56				
56	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	54.400	2.100									
56	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	68.400	2.200									
47	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0560
50	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	238.800	2.100									
50	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	276.600	2.300									
159	urine	MTHL2	C	Lu 2001	MWU	0.04	N	N		yes	umol/L			0.160				40				
159	urine	MTHL2	C	Lu 2001	MWU	0.04	N	N		no	umol/L			0.090				56				
51	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	301.900	2.000									
51	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	359.300	2.200									
Q209--Pets Inside/Outside House																						
569	urine	MDA	C	Sexton 2003	BSLR-5	0.08	Y	N	yes vs no		ug/L										-0.260	0.1200
Q210--Pet Inside to Outside																						
736	dust	AZM	L	Simcox 1995	MLR-3	> 0.05	N	N	yes vs no		ug/m^2											
436	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
438	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
738	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
439	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
739	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
737	dust	PHSM	L	Simcox 1995	MLR-4	> 0.05	N	N	yes vs no		ug/m^2											
437	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
Q211--Existence of Garden or Vegetable Garden																						
568	urine	MDA	C	Sexton 2003	BSLR-5	0.04	Y	N	yes vs no		ug/L										0.310	0.1200
17	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	33.300	2.500									
17	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	33.000	2.300									
8	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0490
9	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0550
18	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	15.700	2.700									
18	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	16.300	3.000									
19	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	8.100	2.200									
19	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	7.300	2.000									
10	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0620
16	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	115.500	2.300									
16	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	118.500	2.700									

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
7	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0440
12	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	114.200	2.800									
12	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	91.500	2.800									
154	urine	ETHL1	C	Lu 2001	MWU	0.04	N	N		yes	umol/L			0.040				49				
154	urine	ETHL1	C	Lu 2001	MWU	0.04	N	N		no	umol/L			0.030				46				
20	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	66.600	2.300									
20	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	62.200	2.100									
11	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0560
14	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	247.800	2.100									
14	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	281.500	2.400									
155	urine	MTHL2	C	Lu 2001	MWU	0.11	N	N		yes	umol/L			0.140				49				
155	urine	MTHL2	C	Lu 2001	MWU	0.11	N	N		no	umol/L			0.080				46				
15	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	362.100	2.200									
15	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	321.400	2.000									
Q212--Ornamental Plants or Cut Flowers																						
35	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	32.800	2.400									
35	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	35.700	2.300									
26	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0490
36	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	16.300	2.900									

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
36	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	14.500	2.700									
27	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0550
37	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	7.900	2.200									
37	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	6.800	1.800									
28	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0620
34	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	121.100	2.600									
34	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	90.600	2.400									
25	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0440
30	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	103.500	2.800									
30	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	109.700	2.700									
31	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	14.000	3.000									
31	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	14.900	2.900									
38	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	64.600	2.300									
38	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	66.100	1.900									
29	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0560
32	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	270.000	2.300									
32	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	248.700	2.100									

ID #	Me-dium	Chemi-cal	MT	Citation[a]	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
33	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	327.900	1.900									
33	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	347.400	2.200									
Q213--Size of Household																						
631	dust	AZM	C	McCauley 2001a	SLR	> 0.05	Y	N			ppm							22			↑	
847	dust	OPSUM	C	McCauley 2003	CORR	0.29	Y	N	number of individuals		ppm							24				0.0480
Q214--Location of Play Area																						
832	dust	OPSUM	C	McCauley 2003	WTWS	0.66	N	N		common	ppm			1.190								
832	dust	OPSUM	C	McCauley 2003	WTWS	0.66	N	N		isolated	ppm			0.840								
Q215--Age of House (Years)																						
843	dust	AZM	C	McCauley 2003	CORR	0.22	Y	N	years		ppm							24				0.0676
842	dust	OPSUM	C	McCauley 2003	CORR	0.25	Y	N	years		ppm							24				0.0625
Q216--Size of Home (sq ft)																						
844	dust	OPSUM	C	McCauley 2003	CORR	0.08	Y	N	size in sq ft		ppm							24				0.0160
845	dust	OPSUM	C	McCauley 2003	MLR	0.16	Y	N	size in sq ft		ppm							24				
Q217--Number of Pets in House																						
849	dust	OPSUM	C	McCauley 2003	CORR	0.95	Y	N	number of animals		ppm							24				0.0004

[a] See section 4.2.2.2 and the paragraph immediately following Table 4.2.3 regarding relationships from Sexton (2003).

C.3.1.3 Category 3 - Residential Sources (Environmental Measures)

Table C.3.1.3 Relationship Details for Questions in Category 3: Residential Sources (Environmental Measures) – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q301--Household Dust																						
147	urine	MTHL2	C	Curl 2002	SLR	< 0.001	Y	N	measure-ment		umol/L											0.1400
586	urine	MTHL2	A	Curl 2002	SLR	< 0.001	Y	N	measure-ment		umol/g Cre											0.1500
328	urine	NA	C	Lu 2000	SPCR	< 0.10	N	N	measure-ment		ug/ml											
329	urine	NA	C	Lu 2000	SPCR	0.09	N	N	measure-ment		ug/ml											0.0120
Q302--Loading from Household Floor Dust																						
644	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	N	Y	measure-ment		nmol/ mol Cre							41				0.2600
Q303--Outdoor Soil																						
403	dust	AZM	C	Simcox 1995	SPCR	0.001	N	N	indoor HH dust vs outdoor surf soil		ng/g							48				
407	dust	AZM	C	Simcox 1995	SPCR	0.87	N	N	indoor HH dust vs outdoor surf soil		ng/g							11				
405	dust	CHLR	C	Simcox 1995	SPCR	< 0.001	N	N	indoor HH dust vs outdoor surf soil		ng/g							48				
409	dust	CHLR	C	Simcox 1995	SPCR	0.21	N	N	indoor HH dust vs outdoor surf soil		ng/g							11				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
406	dust	EPAR	C	Simcox 1995	SPCR	0.02	N	N	indoor HH dust vs outdoor surf soil		ng/g							48				
410	dust	EPAR	C	Simcox 1995	SPCR	0.01	N	N	indoor HH dust vs outdoor surf soil		ng/g							11				
404	dust	PHSM	C	Simcox 1995	SPCR	< 0.001	N	N	indoor HH dust vs outdoor surf soil		ng/g							48				
408	dust	PHSM	C	Simcox 1995	SPCR	0.48	N	N	indoor HH dust vs outdoor surf soil		ng/g							11				

C.3.1.4 Category 4 - Household Occupation

Table C.3.1.4 Relationship Details for Questions in Category 4: Household Occupation – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q401--Agricultural Workers in Household																						
572	dust	AZM	C	McCauley 2001a	SLR	0.002	Y	N	number of workers		ppm							25			↑	
634	dust	AZM	C	McCauley 2001a	SLR	< 0.05	Y	N	number of workers		ppm							25				
Q402--Household Member Spraying Fields																						
282	urine	ETHL3	C	Azaroff 1999	MLGR-5	< 0.05	N	N	yes vs no		ug/L							273	2.500	(1.2, 5.3)		
283	urine	ETHL3	C	Azaroff 1999	MLGR-6	< 0.10	N	N	yes vs no		ug/L							273	2.100	(0.9, 4.4)		
590	urine	MTHL3	C	Azaroff 1999	MLGR-7	< 0.01	N	N	yes vs no		ug/L							274	2.800	(1.4, 5.8)		
279	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.01	N	N	yes vs no		ug/L							274	3.200	(1.8, 5.7)		
281	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.05	N	N	yes vs no		ug/L							274	3.200	(1.2, 9.6)		
277	urine	DAP2	C	Azaroff 1999	MLGR-1	< 0.05	N	N	yes vs no		ug/L							274	1.900	(1.1, 3.3)		
280	urine	MTHL5	C	Azaroff 1999	MLGR-4	< 0.01	N	N	yes vs no		ug/L							274	3.900	(1.9, 8.0)		
278	urine	DAP3	C	Azaroff 1999	MLGR-2	< 0.10	N	N	yes vs no		ug/L							274	2.100	(1.0, 4.9)		
Q403--Recent Fieldwork																						
271	urine	ETHL3	C	Azaroff 1999	MLGR-5	> 0.10	N	N	yes vs no		ug/L							273	1.700	(0.8, 3.9)		
272	urine	ETHL3	C	Azaroff 1999	MLGR-6	> 0.10	N	N	yes vs no		ug/L							273	1.800	(0.8, 3.9)		

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
269	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.01	N	N	yes vs no		ug/L							274	3.100	(1.8, 5.5)		
267	urine	DAP2	C	Azaroff 1999	MLGR-1	< 0.01	N	N	yes vs no		ug/L							274	3.100	(1.8, 5.2)		
270	urine	MTHL5	C	Azaroff 1999	MLGR-4	< 0.05	N	N	yes vs no		ug/L							274	2.600	(1.2, 6.1)		
268	urine	DAP3	C	Azaroff 1999	MLGR-2	< 0.05	N	N	yes vs no		ug/L							274	2.400	(1.1, 5.3)		
Q404--Applicator vs Farmworker																						
239	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N		applicator	ug/L			0.000	1.100	5.100		49				
239	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N		farm-worker	ug/L			0.000	121.000	419.000		12				
238	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N		applicator	ug/L			0.000	4.500	15.000		49				
238	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N		farm-worker	ug/L			0.000	6.400	15.000		12				
319	urine	DMTP	C	Lu 2000	MWU	≥ 0.10	N	N		applicator	ug/ml			0.030	0.040	0.050		49				
319	urine	DMTP	C	Lu 2000	MWU	≥ 0.10	N	N		farm-worker	ug/ml			0.020	0.030	0.040		13				
320	urine	DMDTP	C	Lu 2000	MWU	≥ 0.10	N	N		applicator	ug/ml			0.000	0.005	0.010		49				
320	urine	DMDTP	C	Lu 2000	MWU	≥ 0.10	N	N		farm-worker	ug/ml			0.000	0.002	0.003		13				
321	urine	MTHL1	C	Lu 2000	MWU	≥ 0.10	N	N		applicator	ug/ml			0.060	0.100	0.100		49				
321	urine	MTHL1	C	Lu 2000	MWU	≥ 0.10	N	N		farm-worker	ug/ml			0.050	0.070	0.080		13				
316	dust	AZM	C	Lu 2000	MWU	≥ 0.10	N	N		applicator	ug/g			1.060	2.060	2.300		49				
316	dust	AZM	C	Lu 2000	MWU	≥ 0.10	N	N		farm-worker	ug/g			0.750	1.470	1.500		13				
318	dust	AZMPH	C	Lu 2000	MWU	0.07	N	N		applicator	ug/g			2.360	3.290	3.200		49				
318	dust	AZMPH	C	Lu 2000	MWU	0.07	N	N		farm-worker	ug/g			0.920	1.610	1.600		13				
232	dust	CHLR	C	Fenske 2002	MWU	> 0.05	N	N		applicator	ug/g			0.370	0.550	0.580		49				
232	dust	CHLR	C	Fenske 2002	MWU	> 0.05	N	N		farm-worker	ug/g			0.250	0.270	0.180		12				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
235	dust	EPAR	C	Fenske 2002	MWU	0.03	N	N		applicator	ug/g			0.010	0.070	0.160		49				
235	dust	EPAR	C	Fenske 2002	MWU	0.03	N	N		farm-worker	ug/g			0.000	0.020	0.080		12				
317	dust	PHSM	C	Lu 2000	MWU	$\geq$ 0.10	N	N		applicator	ug/g			0.150	1.230	2.500		49				
317	dust	PHSM	C	Lu 2000	MWU	$\geq$ 0.10	N	N		farm-worker	ug/g			0.110	0.140	0.100		13				
Q405--Applicator vs Non-applicator																						
387	dust	AZM	C	Simcox 1995	MWU	> 0.05	N	N		applicator	ng/g			1225.000	1955.000			28				
387	dust	AZM	C	Simcox 1995	MWU	> 0.05	N	N		non-applicator	ng/g			769.000	1758.000			20				
391	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N		non-applicator	ug/m^2			5.800	13.700			20				
391	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N		applicator	ug/m^2			14.400	19.300			28				
425	dust	AZM	C	Simcox 1995	OWAN	> 0.05	Y	N	applicator vs non-applicator		ng/g											
389	dust	CHLR	C	Simcox 1995	MWU	0.02	N	N		applicator	ng/g			395.000	514.000			28				
389	dust	CHLR	C	Simcox 1995	MWU	0.02	N	N		non-applicator	ng/g			156.000	318.000			20				
393	dust	CHLR	L	Simcox 1995	MWU	0.04	N	N		applicator	ug/m^2			2.700	5.700			28				
393	dust	CHLR	L	Simcox 1995	MWU	0.04	N	N		non-applicator	ug/m^2			1.200	3.500			20				
427	dust	CHLR	C	Simcox 1995	OWAN	> 0.05	Y	N	applicator vs non-applicator		ng/g											
390	dust	EPAR	C	Simcox 1995	MWU	< 0.001	N	N		applicator	ng/g			273.000	516.000			28				
390	dust	EPAR	C	Simcox 1995	MWU	< 0.001	N	N		non-applicator	ng/g			<11	161.000			20				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
394	dust	EPAR	L	Simcox 1995	MWU	0.002	N	N		applicator	ug/m^2			2.700	5.100			28				
394	dust	EPAR	L	Simcox 1995	MWU	0.002	N	N		non-applicator	ug/m^2			0.050	2.200			20				
428	dust	EPAR	C	Simcox 1995	OWAN	0.001	Y	N	applicator vs non-applicator		ng/g											
429	dust	EPAR	C	Simcox 1995	TWAN-1	0.002	Y	N	applicator vs non-applicator		ng/g											
430	dust	EPAR	C	Simcox 1995	TWAN-2	> 0.05	Y	N	applicator vs non-applicator		ng/g											
388	dust	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		applicator	ng/g			523.000	2108.000			28				
388	dust	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		non-applicator	ng/g			523.000	2137.000			20				
392	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N		applicator	ug/m^2			5.200	28.000			28				
392	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N		non-applicator	ug/m^2			2.500	27.500			20				
426	dust	PHSM	C	Simcox 1995	OWAN	> 0.05	Y	N	applicator vs non-applicator		ng/g											
Q406--Applicator vs Reference																						
201	urine	DMTP	C	Loewen-herz 1997	CHSQ	> 0.10	N	N	applicator vs reference		ug/ml											
202	urine	DMTP	C	Loewen-herz 1997	CHSQ	0.022	N	N		applicator	ug/ml						67					
202	urine	DMTP	C	Loewen-herz 1997	CHSQ	0.022	N	N		reference	ug/ml						40					
176	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		applicator	ug/ml			0.015	0.033			46				
176	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		reference	ug/ml			0.000	0.016			13				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
177	urine	DMTP	C	Loewen-herz 1997	MWU	0.036	N	N		applicator	ug/ml			0.019	0.049			46				
177	urine	DMTP	C	Loewen-herz 1997	MWU	0.036	N	N		reference	ug/ml			0.000	0.015			13				
178	urine	DMTP	C	Loewen-herz 1997	MWU	0.015	N	N		applicator	ug/ml			0.021	0.042			90				
178	urine	DMTP	C	Loewen-herz 1997	MWU	0.015	N	N		reference	ug/ml			0.005	0.016			25				
198	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		applicator	ug/ml			0.035	0.096		46	46				
198	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		reference	ug/ml			0.000	0.016		23	13				
199	urine	DMTP	C	Loewen-herz 1997	MWU	0.022	N	N		applicator	ug/ml			0.019	0.049		56	43				
199	urine	DMTP	C	Loewen-herz 1997	MWU	0.022	N	N		reference	ug/ml			0.000	0.015		33	12				
200	urine	DMTP	A	Loewen-herz 1997	MWU	0.011	N	N		applicator	ug/g Cre			0.037	0.094		51	89				
200	urine	DMTP	A	Loewen-herz 1997	MWU	0.011	N	N		reference	ug/g Cre			0.000	0.040		28	27				
Q407--Applicator+Farmworker vs Reference																						
241	urine	4NITR	C	Fenske 2002	KWAN	> 0.05	N	N		applicator	ug/L			0.000	1.100	5.100		49				
241	urine	4NITR	C	Fenske 2002	KWAN	> 0.05	N	N		farm-worker	ug/L			0.000	121.000	419.000		12				
241	urine	4NITR	C	Fenske 2002	KWAN	> 0.05	N	N		reference	ug/L			0.000	0.460	1.700		14				
231	urine	4NITR	C	Fenske 2002	TNR	> 0.05	N	N		agricultural	ug/L			0.000	25.000	190.000		61				
231	urine	4NITR	C	Fenske 2002	TNR	> 0.05	N	N		reference	ug/L			0.000	0.460	1.700		14				
240	urine	TCPY	C	Fenske 2002	KWAN	> 0.05	N	N		applicator	ug/L			0.000	4.500	15.000		49				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
240	urine	TCPY	C	Fenske 2002	KWAN	> 0.05	N	N		farm-worker	ug/L			0.000	6.400	15.000		12				
240	urine	TCPY	C	Fenske 2002	KWAN	> 0.05	N	N		reference	ug/L			0.000	4.600	9.200		14				
230	urine	TCPY	C	Fenske 2002	TNR	> 0.05	N	N		agricultural	ug/L			0.000	4.900	15.000		61				
230	urine	TCPY	C	Fenske 2002	TNR	> 0.05	N	N		reference	ug/L			0.000	4.600	9.200		14				
325	urine	DMTP	C	Lu 2000	MWU	0.07	N	N		agricultural	ug/ml			0.020	0.040	0.040		62				
325	urine	DMTP	C	Lu 2000	MWU	0.07	N	N		reference	ug/ml			0.005	0.020	0.040		14				
326	urine	DMDTP	C	Lu 2000	MWU	≥ 0.10	N	N		agricultural	ug/ml			0.000	0.004	0.009		62				
326	urine	DMDTP	C	Lu 2000	MWU	≥ 0.10	N	N		reference	ug/ml			0.000	0.003	0.005		14				
327	urine	MTHL1	C	Lu 2000	MWU	0.09	N	N		agricultural	ug/ml			0.050	0.090	0.110		62				
327	urine	MTHL1	C	Lu 2000	MWU	0.09	N	N		reference	ug/ml			0.010	0.060	0.090		14				
322	dust	AZM	C	Lu 2000	MWU	< 0.001	N	N		agricultural	ug/g			1.000	1.940	2.190		62				
322	dust	AZM	C	Lu 2000	MWU	< 0.001	N	N		reference	ug/g			0.150	0.290	0.350		14				
324	dust	AZMPH	C	Lu 2000	MWU	< 0.001	N	N		agricultural	ug/g			1.920	2.950	3.000		62				
324	dust	AZMPH	C	Lu 2000	MWU	< 0.001	N	N		reference	ug/g			0.270	0.370	0.370		14				
233	dust	CHLR	C	Fenske 2002	KWAN	< 0.001	N	N		applicator	ug/g			0.370	0.550	0.580		49				
233	dust	CHLR	C	Fenske 2002	KWAN	< 0.001	N	N		farm-worker	ug/g			0.250	0.270	0.180		12				
233	dust	CHLR	C	Fenske 2002	KWAN	< 0.001	N	N		reference	ug/g			0.070	0.090	0.090		14				
234	dust	CHLR	C	Fenske 2002	MWU	< 0.001	N	N		agricultural	ug/g			0.340	0.500	0.540		61				
234	dust	CHLR	C	Fenske 2002	MWU	< 0.001	N	N		reference	ug/g			0.070	0.090	0.090		14				
244	dust	CHLR	C	Fenske 2002	MWU	< 0.01	N	N	(applicator + farm-worker) vs reference		ug/g											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
236	dust	EPAR	C	Fenske 2002	KWAN	< 0.01	N	N		applicator	ug/g			0.010	0.070	0.160		49				
236	dust	EPAR	C	Fenske 2002	KWAN	< 0.01	N	N		farm-worker	ug/g			0.000	0.020	0.080		12				
236	dust	EPAR	C	Fenske 2002	KWAN	< 0.01	N	N		reference	ug/g			0.000	0.003	0.010		14				
237	dust	EPAR	C	Fenske 2002	MWU	0.02	N	N		agricultural	ug/g			0.000	0.060	0.140		61				
237	dust	EPAR	C	Fenske 2002	MWU	0.02	N	N		reference	ug/g			0.000	0.003	0.010		14				
245	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N	(applicator + farm-worker) vs reference		ug/g											
323	dust	PHSM	C	Lu 2000	MWU	0.02	N	N		agricultural	ug/g			0.140	1.010	2.270		62				
323	dust	PHSM	C	Lu 2000	MWU	0.02	N	N		reference	ug/g			0.090	0.090	0.040		14				
Q408--Farmer vs Farmworker																						
379	dust	AZM	C	Simcox 1995	MWU	> 0.05	N	N	farmer vs farm-worker		ng/g											
383	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N		farmer	ug/m^2			10.700	16.600			26				
383	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ug/m^2			8.000	16.700			22				
650	dust	AZM	C	Simcox 1995	OWAN	> 0.05	Y	N	farmer vs farm-worker		ng/g											
381	dust	CHLR	C	Simcox 1995	MWU	> 0.05	N	N	farmer vs farm-worker		ng/g											
385	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N		farmer	ug/m^2			1.620	4.100			26				
385	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ug/m^2			2.000	5.400			22				
654	dust	CHLR	C	Simcox 1995	OWAN	> 0.05	Y	N	farmer vs farm-worker		ng/g											
382	dust	EPAR	C	Simcox 1995	MWU	< 0.001	N	N	farmer vs farm-worker		ng/g											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
386	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N		farmer	ug/m^2			2.500	5.200			26				
386	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ug/m^2			0.570	2.400			22				
656	dust	EPAR	C	Simcox 1995	OWAN	0.001	Y	N	farmer vs farm-worker		ng/g											
659	dust	EPAR	C	Simcox 1995	TWAN-2	> 0.05	Y	N	farmer vs farm-worker		ng/g											
431	dust	EPAR	C	Simcox 1995	TWAN-3	> 0.05	Y	N	farmer vs farm-worker		ng/g											
380	dust	PHSM	C	Simcox 1995	MWU	> 0.05	N	N	farmer vs farm-worker		ng/g											
384	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N		farmer	ug/m^2			2.100	18.400			26				
384	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ug/m^2			8.400	36.100			22				
652	dust	PHSM	C	Simcox 1995	OWAN	> 0.05	Y	N	farmer vs farm-worker		ng/g											
367	soil	AZM	C	Simcox 1995	MWU	> 0.05	N	N		farmer	ng/g			<32	84.000		50	26				
367	soil	AZM	C	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ng/g			<32	<32		32	22				
369	soil	CHLR	C	Simcox 1995	MWU	> 0.05	N	N		farmer	ng/g			<11	18.000		23	26				
369	soil	CHLR	C	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ng/g			<11	14.000		23	22				
370	soil	EPAR	C	Simcox 1995	MWU	> 0.05	N	N		farmer	ng/g			<34	46.000		4	26				
370	soil	EPAR	C	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ng/g			<34	<34		0	22				
368	soil	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		farmer	ng/g			<7	38.000		19	26				
368	soil	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		farm-worker	ng/g			<7	11.000		14	22				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q409--Farmer+Farmworker vs Reference																						
371	dust	AZM	C	Simcox 1995	MWU	0.001	N	N		agricultural	ng/g			1100.000	1870.000		100	48				
371	dust	AZM	C	Simcox 1995	MWU	0.001	N	N		reference	ng/g			283.000	330.000		100	11				
375	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N		agricultural	ug/m^2			9.900	16.600			48				
375	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N		reference	ug/m^2			0.830	14.000			11				
373	dust	CHLR	C	Simcox 1995	MWU	0.01	N	N		agricultural	ng/g			267.000	429.000		98	48				
373	dust	CHLR	C	Simcox 1995	MWU	0.01	N	N		reference	ng/g			53.000	168.000		82	11				
377	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N		agricultural	ug/m^2			1.900	4.800			48				
377	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N		reference	ug/m^2			0.470	0.590			11				
374	dust	EPAR	C	Simcox 1995	MWU	0.02	N	N		agricultural	ng/g			154.000	365.000		69	48				
374	dust	EPAR	C	Simcox 1995	MWU	0.02	N	N		reference	ng/g			<11	76.000		27	11				
378	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N		agricultural	ug/m^2			1.200	3.900			48				
378	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N		reference	ug/m^2			<MLOQ	0.350			11				
372	dust	PHSM	C	Simcox 1995	MWU	0.07	N	N		agricultural	ng/g			519.000	2080.000		96	48				
372	dust	PHSM	C	Simcox 1995	MWU	0.07	N	N		reference	ng/g			185.000	227.000		100	11				
376	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N		agricultural	ug/m^2			3.000	27.100			48				
376	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N		reference	ug/m^2			0.940	0.910			11				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
363	soil	AZM	C	Simcox 1995	MWU	0.04	N	N		agricultural	ng/g			<32	60.000		42	48				
363	soil	AZM	C	Simcox 1995	MWU	0.04	N	N		reference	ng/g			<32	<32		0	11				
365	soil	CHLR	C	Simcox 1995	MWU	> 0.05	N	N		agricultural	ng/g			<11	17.000		23	48				
365	soil	CHLR	C	Simcox 1995	MWU	> 0.05	N	N		reference	ng/g			<11	11.000		18	11				
366	soil	EPAR	C	Simcox 1995	MWU	> 0.05	N	N		agricultural	ng/g			<34	<34		2	48				
366	soil	EPAR	C	Simcox 1995	MWU	> 0.05	N	N		reference	ng/g			<34	<34		0	11				
364	soil	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		agricultural	ng/g			<7	26.000		17	48				
364	soil	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		reference	ng/g			<7	<7		0	11				
Q410--Farmworker vs Grower																						
575	dust	AZM	C	McCauley 2001a	WTWS	0.02	N	N		farm-worker homes	ppm			0.710				25				
575	dust	AZM	C	McCauley 2001a	WTWS	0.02	N	N		grower homes	ppm			1.450				24				
630	dust	AZM	C	McCauley 2001a	WTWS	> 0.05	N	N		farm-worker homes	ppm			1.450				25				
630	dust	AZM	C	McCauley 2001a	WTWS	> 0.05	N	N		grower homes	ppm			1.640				24				
Q411--Farmworker vs Others																						
289	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		agricultural	umol/L	0.036	1.570					621				
289	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		non-agricultural	umol/L	0.036	1.550					351				
291	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		agricultural	umol/L	0.052	1.950					74				
291	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		non-agricultural	umol/L	0.051	1.950					33				
288	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		agricultural	umol/L	0.079	2.490					621				

ID #	Me-dium	Chemi-cal	M T	Citation	Analy-sis	p-value	L G	P M	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
288	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		non-agricultural	umol/L	0.081	2.510					351				
290	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		agricultural	umol/L	0.108	2.980					117				
290	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		non-agricultural	umol/L	0.124	3.150					56				
Q412--Field Worker vs Pesticide Handler																						
453	dust	AZM	L	Grossman 2001	MLR-7	0.011	Y	N	field worker vs pesticide handler		ug/m^2									(0.162, 0.804)	0.361	
453	dust	AZM	L	Grossman 2001	MLR-7	0.011	Y	N		field worker	ug/m^2	9.630	5.370					89				
453	dust	AZM	L	Grossman 2001	MLR-7	0.011	Y	N		pesticide handler	ug/m^2	3.880	6.730					23				
Q413--Expected Occupational Exposure																						
605	urine	ETHL2	C	Koch 1999	KWAN	0.878	N	N	low vs medium vs high		umol/L											
607	urine	ETHL2	C	Koch 1999	KWAN	0.351	N	N	low vs medium vs high		umol/L											
609	urine	ETHL2	C	Koch 1999	KWAN	0.85	N	N	low vs medium vs high		umol/L											
604	urine	MTHL2	C	Koch 1999	KWAN	0.93	N	N	low vs medium vs high		umol/L											
606	urine	MTHL2	C	Koch 1999	KWAN	0.851	N	N	low vs medium vs high		umol/L											
608	urine	MTHL2	C	Koch 1999	KWAN	0.387	N	N	low vs medium vs high		umol/L											
448	dust	AZM	L	Grossman 2001	MLR-6	< 0.001	Y	N	low vs high		ug/m^2									(3.53, 20.1)	8.410	
448	dust	AZM	L	Grossman 2001	MLR-6	< 0.001	Y	N		low	ug/m^2	0.984	6.670					20				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
448	dust	AZM	L	Grossman 2001	MLR-6	< 0.001	Y	N		high	ug/m^2	8.000	5.810					112				
449	dust	AZM	L	Grossman 2001	MLR-6	0.084	Y	N	low vs moderate		ug/m^2									(0.862, 10.2)	2.970	
449	dust	AZM	L	Grossman 2001	MLR-6	0.084	Y	N		low	ug/m^2	0.984	6.670					20				
449	dust	AZM	L	Grossman 2001	MLR-6	0.084	Y	N		moderate	ug/m^2	2.320	7.310					16				
Q414--Occupational Pesticide Exposure																						
810	urine	ETHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
811	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
808	urine	MTHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
809	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
Q415--Tree Thinning																						
831	dust	OPSUM	C	McCauley 2003	WTWS	0.06	N	N		yes	ppm			<								
831	dust	OPSUM	C	McCauley 2003	WTWS	0.06	N	N		no	ppm			>								
Q416--Number in Household with High Pesticide Contact																						
830	dust	OPSUM	C	McCauley 2003	WTWS	0.007	N	N		1 HH member	ppm			<								
830	dust	OPSUM	C	McCauley 2003	WTWS	0.007	N	N		2 HH members	ppm			>								

C.3.1.5 Category 5 - Residential Proximity to Agricultural Fields

Table C.3.1.5 Relationship Details for Questions in Category 5: Residential Proximity to Agricultural Fields – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q501--Proximity of Home to Pesticide-Treated Farmland/Orchard																						
257	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N		≤ 200 ft	ug/L			0.000	33.000	210.000		46				
257	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N		> 200 ft	ug/L			0.000	0.000	0.000		15				
256	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N		≤ 200 ft	ug/L			0.000	6.000	17.000		46				
256	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N		> 200 ft	ug/L			0.000	1.300	4.900		15				
204	urine	DMTP	C	Loewenherz 1997	FISH	0.036	N	N		< 200 ft	ug/ml						-999					
204	urine	DMTP	C	Loewenherz 1997	FISH	0.036	N	N		> 200 ft	ug/ml						-888					
193	urine	DMTP	C	Loewenherz 1997	MWU	> 0.10	N	N		< 200 ft	ug/ml			0.015	0.034		44	36				
193	urine	DMTP	C	Loewenherz 1997	MWU	> 0.10	N	N		> 200 ft	ug/ml			0.019	0.029		40	10				
194	urine	DMTP	C	Loewenherz 1997	MWU	0.062	N	N		< 200 ft	ug/ml			0.023	0.056		58	36				
194	urine	DMTP	C	Loewenherz 1997	MWU	0.062	N	N		> 200 ft	ug/ml			0.000	0.022		67	9				
342	urine	DMTP	C	Lu 2000	MWU	0.009	N	N		≤ 200 ft	ug/ml			0.030	0.040	0.050		47				
342	urine	DMTP	C	Lu 2000	MWU	0.009	N	N		> 200 ft	ug/ml			0.010	0.020	0.030		15				
343	urine	DMDTP	C	Lu 2000	MWU	≥ 0.10	N	N		≤ 200 ft	ug/ml			0.000	0.005	0.010		47				
343	urine	DMDTP	C	Lu 2000	MWU	≥ 0.10	N	N		> 200 ft	ug/ml			0.000	0.002	0.004		15				
299	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		≤ 200 ft	umol/L	0.033	1.440					104				
299	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		> 200 ft	umol/L	0.036	1.570					868				

ID #	Me-dium	Chemi-cal	M T	Citation	Analy-sis	p-value	L G	P M	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
301	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		$\leq$ 200 ft	umol/L	0.035	1.460					8				
301	urine	ETHL2	C	Koch 2002	GLM	> 0.05	Y	N		> 200 ft	umol/L	0.051	2.010					109				
804	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.25 mile	ug/g Cre			12.860	18.880	14.550		5				
804	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.25 mile	ug/g Cre			10.150	27.020	41.110		9				
805	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.50 mile	ug/g Cre			12.840	30.100	44.140		8				
805	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.50 mile	ug/g Cre			15.420	16.110	7.370		6				
806	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.25 mile	ug/g Cre			11.250	14.970	13.030		7				
806	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.25 mile	ug/g Cre			11.790	19.090	20.010		10				
807	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.50 mile	ug/g Cre			11.990	17.650	19.000		12				
807	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.50 mile	ug/g Cre			10.860	16.790	13.390		5				
344	urine	MTHL1	C	Lu 2000	MWU	0.01	N	N		$\leq$ 200 ft	ug/ml			0.070	0.100	0.110		47				
344	urine	MTHL1	C	Lu 2000	MWU	0.01	N	N		> 200 ft	ug/ml			0.020	0.040	0.070		15				
346	urine	MTHL1	C	Lu 2000	SLR	0.1	N	N	4 distance categories		ug/ml										-0.200	
348	urine	MTHL1	C	Lu 2000	SLR	0.06	N	N	5 distance categories		ug/ml										↓	
140	urine	MTHL2	C	Curl 2002	OWAN	0.34	Y	N	6 distance categories		umol/L							216				
142	urine	MTHL2	C	Curl 2002	OWAN	0.3	Y	N	$\leq$ 200 ft vs > 200 ft		umol/L							216				
584	urine	MTHL2	A	Curl 2002	OWAN	0.3	Y	N	6 distance categories		umol/g Cre							216				
585	urine	MTHL2	A	Curl 2002	OWAN	0.4	Y	N	$\leq$ 200 ft vs > 200 ft		umol/g Cre							216				
298	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		$\leq$ 200 ft	umol/L	0.079	2.450					104				

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
298	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		> 200 ft	umol/L	0.080	2.510					868				
300	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		≤ 200 ft	umol/L	0.137	3.560					21				
300	urine	MTHL2	C	Koch 2002	GLM	> 0.05	Y	N		> 200 ft	umol/L	0.110	2.970					152				
800	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.25 mile	ug/g Cre			22.200	122.900	220.850		5				
800	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.25 mile	ug/g Cre			31.700	44.130	48.620		9				
801	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.50 mile	ug/g Cre			41.600	105.710	172.620		8				
801	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.50 mile	ug/g Cre			19.600	27.670	29.970		6				
802	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.25 mile	ug/g Cre			34.750	68.770	90.260		7				
802	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.25 mile	ug/g Cre			33.250	99.860	149.190		10				
803	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		< 0.50 mile	ug/g Cre			40.800	73.730	90.550		12				
803	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N		> 0.50 mile	ug/g Cre			9.500	120.040	197.050		5				
141	dust	AZM	C	Curl 2002	OWAN	0.58	Y	N	6 distance categories		ug/g											
143	dust	AZM	C	Curl 2002	OWAN	0.58	Y	N	≤ 200 ft vs > 200 ft		ug/g							216				
454	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	Y	N	< 2 blocks vs 2-8 blocks		ug/m^2									(0.282, 2.12)	0.773	
454	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	Y	N		< 2 blocks	ug/m^2	4.640	7.070					72				
454	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	Y	N		2-8 blocks	ug/m^2	3.590	6.350					18				
455	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	Y	N	< 2 blocks vs > 8 blocks		ug/m^2									(0.801, 3.11)	1.580	
455	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	Y	N		< 2 blocks	ug/m^2	4.640	7.070					72				

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
455	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	Y	N		> 8 blocks	ug/m^2	7.330	6.960					57				
339	dust	AZM	C	Lu 2000	MWU	0.008	N	N		≤ 200 ft	ug/g			1.300	2.200	2.200		45				
339	dust	AZM	C	Lu 2000	MWU	0.008	N	N		> 200 ft	ug/g			0.490	1.300	2.100		15				
573	dust	AZM	C	McCauley 2001a	SLR	0.32	Y	N	distance (meters)		ppm							25				
574	dust	AZM	C	McCauley 2001a	SLR	0.04	Y	N	distance (meters)		ppm							22			↓	
411	dust	AZM	C	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ng/g											
419	dust	AZM	C	Simcox 1995	KWAN	< 0.001	N	N	< 50 ft vs ≥ 50 ft vs > 0.25 mi		ng/g											
432	dust	AZM	L	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
732	dust	AZM	L	Simcox 1995	MLR-2	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
415	dust	AZM	C	Simcox 1995	MWU	0.04	N	N		< 50 ft	ng/g			>								
415	dust	AZM	C	Simcox 1995	MWU	0.04	N	N		≥ 50 ft	ng/g			<								
651	dust	AZM	C	Simcox 1995	OWAN	> 0.05	Y	N	< 50 ft vs ≥ 50 ft		ng/g											
341	dust	AZMPH	C	Lu 2000	MWU	0.014	N	N		≤ 200 ft	ug/g			2.600	3.400	3.100		45				
341	dust	AZMPH	C	Lu 2000	MWU	0.014	N	N		> 200 ft	ug/g			0.870	1.700	2.200		15				
349	dust	AZMPH	C	Lu 2000	MWU	0.02	N	N		agricultural	ug/g			>				11				
349	dust	AZMPH	C	Lu 2000	MWU	0.02	N	N		reference	ug/g			<				14				
345	dust	AZMPH	C	Lu 2000	SLR	0.04	N	N	4 distance categories		ug/g										-0.680	
347	dust	AZMPH	C	Lu 2000	SLR	< 0.01	N	N	5 distance categories		ug/g										↓	

Relationship Between Questionnaire Responses and Children's Pesticide Exposure Measurements

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
254	dust	CHLR	C	Fenske 2002	MWU	< 0.01	N	N		≤ 200 ft	ug/g			0.400	0.590	0.590		46				
254	dust	CHLR	C	Fenske 2002	MWU	< 0.01	N	N		> 200 ft	ug/g			0.150	0.220	0.180		15				
258	dust	CHLR	C	Fenske 2002	SLR	< 0.001	N	N	4 distance categories		ug/g							61			-0.160	
413	dust	CHLR	C	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ng/g											
421	dust	CHLR	C	Simcox 1995	KWAN	0.02	N	N	< 50 ft vs ≥ 50 ft vs > 0.25 mi		ng/g											
434	dust	CHLR	L	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
734	dust	CHLR	L	Simcox 1995	MLR-1	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
417	dust	CHLR	C	Simcox 1995	MWU	> 0.05	N	N		≥ 50 ft	ng/g			<								
417	dust	CHLR	C	Simcox 1995	MWU	> 0.05	N	N		< 50 ft	ng/g			>								
655	dust	CHLR	C	Simcox 1995	OWAN	> 0.05	Y	N	< 50 ft vs ≥ 50 ft		ng/g											
255	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N		≤ 200 ft	ug/g			0.010	0.050	0.100		46				
255	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N		> 200 ft	ug/g			0.000	0.080	0.240		15				
414	dust	EPAR	C	Simcox 1995	KWAN	0.005	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ng/g											
422	dust	EPAR	C	Simcox 1995	KWAN	0.001	N	N	< 50 ft vs ≥ 50 ft vs > 0.25 mi		ng/g											

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
435	dust	EPAR	L	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
735	dust	EPAR	L	Simcox 1995	MLR-2	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
418	dust	EPAR	C	Simcox 1995	MWU	0.005	N	N		≥ 50 ft	ng/g			<								
418	dust	EPAR	C	Simcox 1995	MWU	0.005	N	N		< 50 ft	ng/g			>								
657	dust	EPAR	C	Simcox 1995	OWAN	0.001	Y	N	< 50 ft vs ≥ 50 ft		ng/g											
658	dust	EPAR	C	Simcox 1995	TWAN-1	0.004	Y	N	< 50 ft vs ≥ 50 ft		ng/g											
660	dust	EPAR	C	Simcox 1995	TWAN-3	> 0.05	Y	N	< 50 ft vs ≥ 50 ft		ng/g											
340	dust	PHSM	C	Lu 2000	MWU	≥ 0.10	N	N		≤ 200 ft	ug/g			1.140	1.200	2.600		45				
340	dust	PHSM	C	Lu 2000	MWU	≥ 0.10	N	N		> 200 ft	ug/g			0.120	0.450	0.600		15				
412	dust	PHSM	C	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ng/g											
420	dust	PHSM	C	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs ≥ 50 ft vs > 0.25 mi		ng/g											
433	dust	PHSM	L	Simcox 1995	KWAN	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
733	dust	PHSM	L	Simcox 1995	MLR-3	> 0.05	N	N	< 50 ft vs 50-200 ft vs > 200 ft		ug/m^2											
416	dust	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		< 50 ft	ng/g			>								
416	dust	PHSM	C	Simcox 1995	MWU	> 0.05	N	N		≥ 50 ft	ng/g			<								
653	dust	PHSM	C	Simcox 1995	OWAN	> 0.05	Y	N	< 50 ft vs ≥ 50 ft		ng/g											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
846	dust	OPSUM	C	McCauley 2003	CORR	0.5	Y	N	distance (feet)		ppm							24				0.0080
Q502--Living Near Multiple Fields																						
818	urine	ETHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
819	urine	ETHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											
816	urine	MTHL2	C	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
817	urine	MTHL2	A	Royster 2002	MWU	> 0.05	N	N	yes vs no		ug/g Cre											

C.3.1.6 Category 6 - Residential Location

Table C.3.1.6 Relationship Details for Questions in Category 6: Residential Location – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q601--Urban vs Non-Urban																						
684	urine	1NAP	A	Adgate 2001	WTAN	0.097	Y	N		urban	ug/g Cre	<						58				
684	urine	1NAP	A	Adgate 2001	WTAN	0.097	Y	N		non-urban	ug/g Cre	>						22				
750	urine	1NAP	C	Adgate 2001	WTAN	0.13	Y	N		urban	ug/L	1.700						58				
750	urine	1NAP	C	Adgate 2001	WTAN	0.13	Y	N		non-urban	ug/L	1.200						22				
751	urine	1NAP	C	Adgate 2001	WTAN	0.1	Y	N		urban	ug/L	1.700						58				
751	urine	1NAP	C	Adgate 2001	WTAN	0.1	Y	N		non-urban	ug/L	1.200						22				
685	urine	MDA	A	Adgate 2001	WTAN	0.16	Y	N		urban	ug/g Cre	>						58				
685	urine	MDA	A	Adgate 2001	WTAN	0.16	Y	N		non-urban	ug/g Cre	<						25				
752	urine	MDA	C	Adgate 2001	WTAN	0.099	Y	N		urban	ug/L	0.770						58				
752	urine	MDA	C	Adgate 2001	WTAN	0.099	Y	N		non-urban	ug/L	0.610						25				
753	urine	MDA	C	Adgate 2001	WTAN	0.16	Y	N		urban	ug/L	0.770						58				
753	urine	MDA	C	Adgate 2001	WTAN	0.16	Y	N		non-urban	ug/L	0.610						25				
686	urine	TCPY	A	Adgate 2001	WTAN	0.019	Y	N		urban	ug/g Cre	>						60				
686	urine	TCPY	A	Adgate 2001	WTAN	0.019	Y	N		non-urban	ug/g Cre	<						23				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
754	urine	TCPY	C	Adgate 2001	WTAN	0.036	Y	N		urban	ug/L	7.200						60				
754	urine	TCPY	C	Adgate 2001	WTAN	0.036	Y	N		non-urban	ug/L	4.700						23				
755	urine	TCPY	C	Adgate 2001	WTAN	0.02	Y	N		urban	ug/L	7.200						60				
755	urine	TCPY	C	Adgate 2001	WTAN	0.02	Y	N		non-urban	ug/L	4.700						23				
Q602--Urban vs Rural																						
464	urine	TCPY	A	Krinsley 1998	SLR	0.62	Y	Y	rural vs urban		ug/g Cre							170				0.0014
464	urine	TCPY	A	Krinsley 1998	SLR	0.62	Y	Y		rural	ug/g Cre				7.360	8.900		24				
464	urine	TCPY	A	Krinsley 1998	SLR	0.62	Y	Y		urban	ug/g Cre				7.780	8.050		144				
Q603--Border vs Non-Border																						
463	urine	TCPY	A	Krinsley 1998	SLR	0.86	Y	Y	border vs non-border		ug/g Cre							167				0.0002
463	urine	TCPY	A	Krinsley 1998	SLR	0.86	Y	Y		border	ug/g Cre				7.810	8.970		22				
463	urine	TCPY	A	Krinsley 1998	SLR	0.86	Y	Y		non-border	ug/g Cre				7.680	8.030		149				
Q604--Community																						
150	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N		community 1	umol/L			0.030	0.040			50				
150	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N		community 2	umol/L			0.040	0.050			46				
151	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N		community 1	umol/L			0.100	0.170			50				
151	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N		community 2	umol/L			0.110	0.200			46				
Q605--Vehicle vs House																						
145	dust	AZM	C	Curl 2002	SLR	< 0.001	Y	N	vehicle vs house		ug/g							145				0.4100

C.3.2 Behavior Relationships

C.3.2.1 Category 7 – Subject's Personal Characteristics

Table C.3.2.1 Relationship Details for Questions in Category 7: Subject's Personal Characteristics – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q701--Sex																						
112	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	Y	N	male vs female		ug/L											
113	urine	MDA	C	Adgate 2001	WTAN	> 0.05	Y	N	male vs female		ug/L											
114	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	Y	N	male vs female		ug/L											
460	urine	TCPY	A	Krinsley 1998	SLR	0.59	Y	Y	male vs female		ug/g Cre							167				0.0017
460	urine	TCPY	A	Krinsley 1998	SLR	0.59	Y	Y		male	ug/g Cre				7.060	7.760		66				
460	urine	TCPY	A	Krinsley 1998	SLR	0.59	Y	Y		female	ug/g Cre				8.110	8.430		100				
108	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	32.600	2.600									
108	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	33.800	2.200									
99	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	Y	Y	male vs female		nmol/g Cre											0.0490
109	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	17.300	2.900									
109	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	15.000	2.800									
100	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	Y	Y	male vs female		nmol/g Cre											0.0550

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
110	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	7.800	2.300									
110	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	7.700	2.100									
101	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	Y	Y	male vs female		nmol/g Cre											0.0620
107	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	111.100	2.700									
107	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	122.000	2.400									
98	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	Y	Y	male vs female		nmol/g Cre											0.0440
103	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	111.700	3.000									
103	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	98.100	2.500									
94	urine	DMTP	A	Aprea 2000	MLR-2	< 0.05	Y	Y	male vs female		nmol/g Cre											0.0790
104	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	16.400	3.400									
104	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	12.300	2.500									
95	urine	DMDTP	A	Aprea 2000	MLR-3	< 0.05	Y	Y	male vs female		nmol/g Cre											0.0800
152	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N		male	umol/L			0.040	0.050			49				
152	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N		female	umol/L			0.040	0.040			47				
111	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	66.300	2.300									
111	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	63.500	2.100									
102	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	Y	Y	male vs female		nmol/g Cre											0.0560
601	urine	ETHL2	C	Koch 1999	MWU	0.411	N	N	male vs female		umol/L											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
285	urine	ETHL2	C	Koch 2002	GLM-2	0.046	Y	N		male	umol/L	0.037	1.590					351				
285	urine	ETHL2	C	Koch 2002	GLM-2	0.046	Y	N		female	umol/L	0.036	1.470					621				
105	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	277.000	2.500									
105	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	258.600	2.100									
96	urine	MTHL2	A	Aprea 2000	MLR-4	< 0.05	Y	Y	male vs female		nmol/g Cre											0.0670
600	urine	MTHL2	C	Koch 1999	MWU	0.097	N	N	male vs female		umol/L											
284	urine	MTHL2	C	Koch 2002	GLM-1	0.005	Y	N		male	umol/L	0.085	2.450					351				
284	urine	MTHL2	C	Koch 2002	GLM-1	0.005	Y	N		female	umol/L	0.078	2.290					621				
153	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N		male	umol/L			0.100	0.190			49				
153	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N		female	umol/L			0.110	0.180			47				
106	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		male	nmol/g Cre	356.400	2.300									
106	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	Y	N		female	nmol/g Cre	334.800	2.000									
97	urine	DAP1	A	Aprea 2000	MLR-9	< 0.05	Y	Y	male vs female		nmol/g Cre											0.0720
533	urine	DAP1	A	Shalat 2003	MVRG-1	0.310	N	N	male vs female		nmol/mol Cre							41		(-44.02, 14.38)	-14.820	0.2800
641	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	N	Y	male vs female		nmol/mol Cre							41				0.2600
Q702--Age																						
116	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	Y	N	< 6 years old vs > 6 years old		ug/L											
117	urine	MDA	C	Adgate 2001	WTAN	> 0.05	Y	N	< 6 years old vs > 6 years old		ug/L											

Relationship Between Questionnaire Responses and Children's Pesticide Exposure Measurements

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
118	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	Y	N	< 6 years old vs > 6 years old		ug/L											
461	urine	TCPY	A	Krinsley 1998	SLR	0.75	Y	Y	< 18 years old vs 18-59 years old vs ≥ 60 years old		ug/g Cre							166				0.0006
461	urine	TCPY	A	Krinsley 1998	SLR	0.75	Y	Y		< 18 years old	ug/g Cre				7.130	4.670		31				
461	urine	TCPY	A	Krinsley 1998	SLR	0.75	Y	Y		18-59 years old	ug/g Cre				7.820	9.060		101				
461	urine	TCPY	A	Krinsley 1998	SLR	0.75	Y	Y		≥ 60 years old	ug/g Cre				7.680	7.940		35				
671	urine	TCPY	C	Krinsley 1998	SLR	< 0.05	Y	N	< 18 years old vs 18-59 years old vs ≥ 60 years old		ug/L							166				0.0006
671	urine	TCPY	C	Krinsley 1998	SLR	< 0.05	Y	N		< 18 years old	ug/L				11.530			31				
671	urine	TCPY	C	Krinsley 1998	SLR	< 0.05	Y	N		18-59 years old	ug/L				7.600			101				
671	urine	TCPY	C	Krinsley 1998	SLR	< 0.05	Y	N		≥ 60 years old	ug/L				7.270			35				
181	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/ml			0.015	0.028			19				
181	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		3-4 years old	ug/ml			0.009	0.029			25				
182	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/ml			0.015	0.028			19				
182	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		5-6 years old	ug/ml			0.009	0.025			19				
183	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		3-4 years old	ug/ml			0.009	0.029			25				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
183	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		5-6 years old	ug/ml			0.009	0.025			19				
184	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/ml			0.045	0.034			20				
184	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		3-4 years old	ug/ml			0.033	0.059			25				
185	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/ml			0.034	0.045			20				
185	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	N	N		5-6 years old	ug/ml			0.009	0.035			20				
186	urine	DMTP	C	Loewen-herz 1997	MWU	0.06	N	N		3-4 years old	ug/ml			0.033	0.059			25				
186	urine	DMTP	C	Loewen-herz 1997	MWU	0.06	N	N		5-6 years old	ug/ml			0.009	0.035			20				
187	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/g Cre			0.042	0.099		41	17				
187	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		3-4 years old	ug/g Cre			0.013	0.089		36	25				
188	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/g Cre			0.042	0.099		41	17				
188	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		5-6 years old	ug/g Cre			0.011	0.037		37	19				
189	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		3-4 years old	ug/g Cre			0.013	0.089		36	25				
189	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		5-6 years old	ug/g Cre			0.011	0.037		37	19				
190	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		0-2 years old	ug/g Cre			0.061	0.223		63	19				
190	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	N	N		3-4 years old	ug/g Cre			0.062	0.088		63	24				
191	urine	DMTP	A	Loewen-herz 1997	MWU	0.038	N	N		0-2 years old	ug/g Cre			0.061	0.223		63	19				
191	urine	DMTP	A	Loewen-herz 1997	MWU	0.038	N	N		5-6 years old	ug/g Cre			0.012	0.043		47	17				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
192	urine	DMTP	A	Loewen-herz 1997	MWU	0.083	N	N		3-4 years old	ug/g Cre			0.062	0.088		63	24				
192	urine	DMTP	A	Loewen-herz 1997	MWU	0.083	N	N		5-6 years old	ug/g Cre			0.012	0.043		47	17				
179	urine	DMTP	C	Loewen-herz 1997	WSRK	> 0.10	N	N	younger vs older		ug/ml							21				
180	urine	DMTP	C	Loewen-herz 1997	WSRK	0.04	N	N		younger	ug/ml			>								
180	urine	DMTP	C	Loewen-herz 1997	WSRK	0.04	N	N		older	ug/ml			<								
581	urine	ETHL1	C	Curl 2002	OWAN	> 0.05	Y	N	adult vs child		umol/L											
582	urine	ETHL1	A	Curl 2002	OWAN	> 0.05	Y	N	adult vs child		umol/g Cre											
170	urine	ETHL1	C	Lu 2001	KWAN	0.64	N	N	2, 3, 4, 5 years old		umol/L											
603	urine	ETHL2	C	Koch 1999	MWU	0.014	N	N		2-4 years old	umol/L			>				25				
603	urine	ETHL2	C	Koch 1999	MWU	0.014	N	N		5-6 years old	umol/L			<				13				
287	urine	ETHL2	C	Koch 2002	GLM-2	0.27	Y	N	5 age categories		umol/L											
144	urine	MTHL2	A	Curl 2002	OWAN	0.001	Y	N		adult	umol/g Cre	0.090	7.200					213				
144	urine	MTHL2	A	Curl 2002	OWAN	0.001	Y	N		child	umol/g Cre	0.140	3.200					211				
580	urine	MTHL2	C	Curl 2002	OWAN	0.01	Y	N		adult	umol/L	>										
580	urine	MTHL2	C	Curl 2002	OWAN	0.01	Y	N		child	umol/L	<										
146	urine	MTHL2	C	Curl 2002	SLR	< 0.001	Y	N	adult vs child		umol/L							206				0.1800
583	urine	MTHL2	A	Curl 2002	SLR	< 0.001	Y	N	adult vs child		umol/g Cre							206				0.1500
602	urine	MTHL2	C	Koch 1999	MWU	0.295	N	N	2-4 years old vs 5-6 years old		umol/L											
286	urine	MTHL2	C	Koch 2002	GLM-1	0.16	Y	N	5 age categories		umol/L											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
171	urine	MTHL2	C	Lu 2001	KWAN	0.36	N	N	2, 3, 4, 5 years old		umol/L											
532	urine	DAP1	A	Shalat 2003	MVRG-1	0.007	N	N	age in months		nmol/ mol Cre							41		(-3.6, -0.61)	-2.110	0.2800
640	urine	DAP1	A	Shalat 2003	MVRG-2	< 0.05	N	Y	age in months		nmol/ mol Cre							41				0.2600
Q703--Ethnicity																						
124	urine	1NAP	C	Adgate 2001	WTAN	0.009	Y	N		white	ug/L	>										
124	urine	1NAP	C	Adgate 2001	WTAN	0.009	Y	N		non-white	ug/L	<										
125	urine	MDA	C	Adgate 2001	WTAN	0.035	Y	N		white	ug/L	<										
125	urine	MDA	C	Adgate 2001	WTAN	0.035	Y	N		non-white	ug/L	>										
462	urine	TCPY	A	Krinsley 1998	SLR	0.99	Y	Y	Hispanic vs non-Hispanic		ug/g Cre							168				0.0003
462	urine	TCPY	A	Krinsley 1998	SLR	0.99	Y	Y		Hispanic	ug/g Cre				8.470	10.510		52				
462	urine	TCPY	A	Krinsley 1998	SLR	0.99	Y	Y		non-Hispanic	ug/g Cre				7.390	6.870		116				
Q704--Education Level																						
466	urine	TCPY	A	Krinsley 1998	SLR	0.44	Y	Y	no HS diploma vs HS diploma +		ug/g Cre							167				0.0036
466	urine	TCPY	A	Krinsley 1998	SLR	0.44	Y	Y		no HS diploma	ug/g Cre				9.340	7.510		53				
466	urine	TCPY	A	Krinsley 1998	SLR	0.44	Y	Y		HS diploma+	ug/g Cre				7.760	5.680		114				
Q705--Income																						
128	urine	1NAP	C	Adgate 2001	WTAN	0.025	Y	N		$30K-50K	ug/L	>										

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
128	urine	1NAP	C	Adgate 2001	WTAN	0.025	Y	N		> $75K	ug/L	<										
756	urine	MDA	C	Adgate 2001	WTAN	0.047	Y	N		$30K-50K	ug/L	<										
756	urine	MDA	C	Adgate 2001	WTAN	0.047	Y	N		< $30K	ug/L	>										
757	urine	MDA	C	Adgate 2001	WTAN	0.07	Y	N		$30K-50K	ug/L	<										
757	urine	MDA	C	Adgate 2001	WTAN	0.07	Y	N		$50K-75K	ug/L	>										
758	urine	MDA	C	Adgate 2001	WTAN	0.009	Y	N		$30K-50K	ug/L	<										
758	urine	MDA	C	Adgate 2001	WTAN	0.009	Y	N		< $30K	ug/L	>										
759	urine	TCPY	C	Adgate 2001	WTAN	0.012	Y	N		$50K-75K	ug/L	<										
759	urine	TCPY	C	Adgate 2001	WTAN	0.012	Y	N		< $30K	ug/L	>										
760	urine	TCPY	C	Adgate 2001	WTAN	0.012	Y	N		$50K-75K	ug/L	<										
760	urine	TCPY	C	Adgate 2001	WTAN	0.012	Y	N		$30K-50K	ug/L	>										
465	urine	TCPY	A	Krinsley 1998	SLR	0.32	Y	Y	< $20K vs ≥ $20K		ug/g Cre							162				0.0062
465	urine	TCPY	A	Krinsley 1998	SLR	0.32	Y	Y		< $20K	ug/g Cre				10.240	13.500		35				
465	urine	TCPY	A	Krinsley 1998	SLR	0.32	Y	Y		≥ $20K	ug/g Cre				6.940	5.970		127				
166	urine	ETHL1	C	Lu 2001	TNR	> 0.05	N	N	> $35K vs < $35K		umol/L											
167	urine	MTHL2	C	Lu 2001	TNR	> 0.05	N	N	> $35K vs < $35K		umol/L											
Q706--Loading From Hand Wipes[a]																						

ID #	Me-dium	Chemi-cal	M T	Citation	Analy-sis	p-value	L G	P M	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q707--Hand's Surface Area																						
534	urine	DAP1	A	Shalat 2003	MVRG-1	0.49	N	N	measure-ment		nmol/mol Cre							41		(0.28, 2.28)	1.270	0.2800
642	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	N	Y	measure-ment		nmol/mol Cre							41				0.2600

[a] There is no question grouping for number 706.

C.3.2.2 Category 8 – Child's Behaviors

Table C.3.2.2 Relationship Details for Questions in Category 8: Child's Behaviors – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q801--Hand-to-Mouth Activity																						
212	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
208	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
624	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
304	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		yes	ug/ml			0.050								
304	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		no	ug/ml			0.060								
625	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
Q802--Thumb Sucking																						
213	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
209	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
626	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
305	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		yes	ug/ml			0.090								
305	urine	MTHL1	C	Lu 2000	MWU	0.6	N	N		no	ug/ml			0.050								
627	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
Q803--Hand Washing before Meals																						
211	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
207	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
303	urine	MTHL1	C	Lu 2000	MWU	0.2	N	N		yes	ug/ml			0.090								
303	urine	MTHL1	C	Lu 2000	MWU	0.2	N	N		no	ug/ml			0.050								
Q804--Frequency of Handwashing																						

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
172	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
173	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
Q805--Time Spent Outdoors																						
210	urine	4NITR	C	Fenske 2002	KWAN	> 0.05	N	N	3 time categories		ug/L											
206	urine	TCPY	C	Fenske 2002	KWAN	> 0.05	N	N	3 time categories		ug/L											
302	urine	MTHL1	C	Lu 2000	KWAN	0.8	N	N		< 1 hr	ug/ml			0.050								
302	urine	MTHL1	C	Lu 2000	KWAN	0.8	N	N		1-4 hr	ug/ml			0.050								
302	urine	MTHL1	C	Lu 2000	KWAN	0.8	N	N		> 4 hr	ug/ml			0.060								
Q806--Loading from Hand Wipe																						
535	urine	DAP1	A	Shalat 2003	MVRG-1	0.022	N	N	measure-ment		nmol/mol Cre							41		(0.98, 11.80)	6.390	0.2800
643	urine	DAP1	A	Shalat 2003	MVRG-2	< 0.05	N	Y	measure-ment		nmol/mol Cre							41				0.2600

C.3.2.3 Category 9 – Dietary Behaviors

Table C.3.2.3 Relationship Details for Questions in Category 9: Dietary Behaviors – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q901--Type of Drinking Water																						
459	urine	TCPY	A	Krinsley 1998	SLR	< 0.19	Y	N		tap	ug/g Cre				<							
459	urine	TCPY	A	Krinsley 1998	SLR	< 0.19	Y	N		bottled	ug/g Cre				>							
Q902--Consumption of Homegrown Fresh Vegetables																						
457	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											
Q903--Ate Lunch at School																						
90	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	32.900	2.400									
90	urine	DEP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	33.400	2.400									
81	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0490
91	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	18.700	3.300									
91	urine	DETP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	14.700	2.600									
82	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0550
92	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	7.000	2.100									
92	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	8.200	2.200									
83	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0620
89	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	125.400	2.700									

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
89	urine	DMP	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	111.900	2.500									
80	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0440
93	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		yes	nmol/g Cre	67.400	2.300									
93	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	Y	N		no	nmol/g Cre	63.300	2.200									
84	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	Y	Y	yes vs no		nmol/g Cre											0.0560
Q904--Organic Diet																						
822	urine	ETHL2	C	Curl 2003	MWU	0.13	N	N	conventional vs organic		umol/L							39				
823	urine	ETHL2	C	Curl 2003	MWU	> 0.05	N	N	conventional vs organic		umol/L							39				
820	urine	MTHL2	C	Curl 2003	MWU	< 0.001	N	N		conventional	umol/L			0.170	0.340			21				
820	urine	MTHL2	C	Curl 2003	MWU	< 0.001	N	N		organic	umol/L			0.030	0.040			18				
821	urine	MTHL2	C	Curl 2003	MWU	< 0.05	N	N	conventional vs organic		umol/L							39				

C.3.2.4 Category 10 – Family Hygiene Practices

Table C.3.2.4 Relationship Details for Questions in Category 10: Family Hygiene Practices – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1001--Shoes Removed at Door																						
616	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N		yes	ug/ml						40	20				
616	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N		no	ug/ml						36	31				
617	urine	DMTP	C	Carrel 1996	CHSQ	0.083	N	N		yes	ug/ml						45	20				
617	urine	DMTP	C	Carrel 1996	CHSQ	0.083	N	N		no	ug/ml						74	31				
612	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N		yes	ug/ml			0.015	0.033			20				
612	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N		no	ug/ml			0.009	0.025			31				
613	urine	DMTP	C	Carrel 1996	MWU	0.096	N	N		yes	ug/ml			0.015	0.037			20				
613	urine	DMTP	C	Carrel 1996	MWU	0.096	N	N		no	ug/ml			0.037	0.063			31				
311	urine	MTHL1	C	Lu 2000	MWU	0.2	N	N		yes	ug/ml			0.040								
311	urine	MTHL1	C	Lu 2000	MWU	0.2	N	N		no	ug/ml			0.070								
440	dust	AZM	L	Grossman 2001	MLR-1	> 0.05	Y	N	always/ usually vs sometimes/ rarely/never		ug/m^2									(0.605, 2.66)	1.670	
440	dust	AZM	L	Grossman 2001	MLR-1	> 0.05	Y	N		always/ usually	ug/m^2	9.860	4.970					52				
440	dust	AZM	L	Grossman 2001	MLR-1	> 0.05	Y	N		sometimes to never	ug/m^2	9.320	6.090					37				
835	dust	AZM	C	McCauley 2003	WTWS	0.46	N	N	yes vs no		ppm											
720	dust	AZM	L	Simcox 1995	MLR-1	> 0.05	N	N	yes vs no		ug/m^2											
351	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
306	dust	AZMPH	C	Lu 2000	MWU	0.8	N	N		yes	ug/g			1.500								

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
306	dust	AZMPH	C	Lu 2000	MWU	0.8	N	N		no	ug/g			2.100								
722	dust	CHLR	L	Simcox 1995	MLR-3	> 0.05	N	N	yes vs no		ug/m^2											
353	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
723	dust	EPAR	L	Simcox 1995	MLR-4	> 0.05	N	N	yes vs no		ug/m^2											
354	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
721	dust	PHSM	L	Simcox 1995	MLR-2	> 0.05	N	N	yes vs no		ug/m^2											
352	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
834	dust	OPSUM	C	McCauley 2003	WTWS	0.36	N	N	yes vs no		ppm											
Q1002--Presence of Doormats																						
218	urine	4NITR	C	Fenske 2002	TNR	> 0.05	N	N	yes vs no		ug/L											
214	urine	TCPY	C	Fenske 2002	TNR	> 0.05	N	N	yes vs no		ug/L											
312	urine	MTHL1	C	Lu 2000	MWU	0.3	N	N		yes	ug/ml			0.070								
312	urine	MTHL1	C	Lu 2000	MWU	0.3	N	N		no	ug/ml			0.030								
724	dust	AZM	L	Simcox 1995	MLR-1	> 0.05	N	N	yes vs no		ug/m^2											
355	dust	AZM	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
307	dust	AZMPH	C	Lu 2000	MWU	0.6	N	N		yes	ug/g			1.800								
307	dust	AZMPH	C	Lu 2000	MWU	0.6	N	N		no	ug/g			2.900								
222	dust	CHLR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/g											
726	dust	CHLR	L	Simcox 1995	MLR-3	> 0.05	N	N	yes vs no		ug/m^2											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
357	dust	CHLR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
226	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/g											
727	dust	EPAR	L	Simcox 1995	MLR-4	> 0.05	N	N	yes vs no		ug/m^2											
358	dust	EPAR	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
725	dust	PHSM	L	Simcox 1995	MLR-2	> 0.05	N	N	yes vs no		ug/m^2											
356	dust	PHSM	L	Simcox 1995	MWU	> 0.05	N	N	yes vs no		ug/m^2											
Q1003--Presence of Floor Mats																						
174	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
175	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N	yes vs no		umol/L											
Q1004--Vacuuming Frequency																						
221	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	< 1/week vs > 1/week		ug/L											
217	urine	TCPY	C	Fenske 2002	MWU	> 0.05	N	N	< 1/week vs > 1/week		ug/L											
622	urine	ETHL1	C	Lu 2001	MWU	> 0.05	N	N	< 1/week vs > 1/week		umol/L											
315	urine	MTHL1	C	Lu 2000	MWU	0.3	N	N		> 1/week	ug/ml			0.070								
315	urine	MTHL1	C	Lu 2000	MWU	0.3	N	N		≤ 1/week	ug/ml			0.050								
315	urine	MTHL1	C	Lu 2000	MWU	0.3	N	N		no answer	ug/ml			0.080								
623	urine	MTHL2	C	Lu 2001	MWU	> 0.05	N	N	< 1/week vs > 1/week		umol/L											
310	dust	AZMPH	C	Lu 2000	MWU	0.6	N	N		> 1/week	ug/g			1.500								
310	dust	AZMPH	C	Lu 2000	MWU	0.6	N	N		≤ 1/week	ug/g			2.600								
310	dust	AZMPH	C	Lu 2000	MWU	0.6	N	N		no answer	ug/g			2.300								
225	dust	CHLR	C	Fenske 2002	MWU	> 0.05	N	N	< 1/week vs > 1/week		ug/g											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
229	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N	< 1/week vs > 1/week		ug/g											
Q1005--Vacuuming Indoor Play Areas																						
359	dust	AZM	L	Simcox 1995	KWAN	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
728	dust	AZM	L	Simcox 1995	MLR-1	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
361	dust	CHLR	L	Simcox 1995	KWAN	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
730	dust	CHLR	L	Simcox 1995	MLR-3	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
362	dust	EPAR	L	Simcox 1995	KWAN	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
731	dust	EPAR	L	Simcox 1995	MLR-1	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
360	dust	PHSM	L	Simcox 1995	KWAN	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
729	dust	PHSM	L	Simcox 1995	MLR-2	> 0.05	N	N	< weekly vs weekly vs > weekly		ug/m^2											
Q1006--Work Clothes Worn Indoors																						
219	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
215	urine	TCPY	C	Fenske 2002	TNR	> 0.05	N	N	yes vs no		ug/L											
716	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N	yes vs no		ug/ml											
717	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N	yes vs no		ug/ml											
712	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N	yes vs no		ug/ml											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
713	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N	yes vs no		ug/ml											
313	urine	MTHL1	C	Lu 2000	MWU	0.2	N	N		yes	ug/ml			0.070								
313	urine	MTHL1	C	Lu 2000	MWU	0.2	N	N		no	ug/ml			0.050								
837	dust	AZM	C	McCauley 2003	TTST	< 0.01	Y	N		< 2 hours	ppm			0.530	0.920			18				
837	dust	AZM	C	McCauley 2003	TTST	< 0.01	Y	N		> 2 hours	ppm			5.900	3.960			5				
308	dust	AZMPH	C	Lu 2000	MWU	0.2	N	N		yes	ug/g			2.700								
308	dust	AZMPH	C	Lu 2000	MWU	0.2	N	N		no	ug/g			1.500								
223	dust	CHLR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/g											
227	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/g											
836	dust	OPSUM	C	McCauley 2003	TTST	< 0.01	Y	N		< 2 hours	ppm			0.950	1.140			18				
836	dust	OPSUM	C	McCauley 2003	TTST	< 0.01	Y	N		> 2 hours	ppm			6.180	4.950			5				
Q1007--Work Clothes Mixed with Laundry																						
314	urine	MTHL1	C	Lu 2000	MWU	0.8	N	N		yes	ug/ml			0.050								
314	urine	MTHL1	C	Lu 2000	MWU	0.8	N	N		no	ug/ml			0.080								
309	dust	AZMPH	C	Lu 2000	MWU	0.4	N	N		yes	ug/g			1.400								
309	dust	AZMPH	C	Lu 2000	MWU	0.4	N	N		no	ug/g			3.100								
Q1008--Laundering Practices																						
220	urine	4NITR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/L											
216	urine	TCPY	C	Fenske 2002	TNR	> 0.05	N	N	yes vs no		ug/L											
706	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N	yes vs no		ug/ml											
707	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N	yes vs no		ug/ml											
702	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N	yes vs no		ug/ml											
703	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N	yes vs no		ug/ml											

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
224	dust	CHLR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/g											
228	dust	EPAR	C	Fenske 2002	MWU	> 0.05	N	N	yes vs no		ug/g											
Q1009--Number of Weeks Since Last Vacuuming																						
833	dust	OPSUM	C	McCauley 2003	MLR	0.03	Y	N	# weeks since last cleaning		ppm									(0.1, 2.2)	1.200	
Q1010--Shower Soon After Work																						
866	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N	yes vs no		ug/ml											
867	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	N	N	yes vs no		ug/ml											
862	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N	yes vs no		ug/ml											
863	urine	DMTP	C	Carrel 1996	MWU	> 0.10	N	N	yes vs no		ug/ml											
441	dust	AZM	L	Grossman 2001	MLR-2	> 0.05	Y	N	$\leq$ hr vs > 1 hr		ug/m^2									(0.559, 2.39)	1.160	
441	dust	AZM	L	Grossman 2001	MLR-2	> 0.05	Y	N		$\leq$ 1 hr	ug/m^2	10.400	7.310					41				
441	dust	AZM	L	Grossman 2001	MLR-2	> 0.05	Y	N		> 1 hr	ug/m^2	9.170	3.990					48				
839	dust	AZM	C	McCauley 2003	TTST	0.89	Y	N	< 30 minutes vs > 30 minutes		ppm											
838	dust	OPSUM	C	McCauley 2003	TTST	0.63	Y	N	< 30 minutes vs > 30 minutes		ppm											
Q1011[a]																						

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1012--After Work Hygiene Index																						
841	dust	AZM	C	McCauley 2003	CORR	0.43	Y	N	5 index categories		ppm							24				0.0290
840	dust	OPSUM	C	McCauley 2003	CORR	0.8	Y	N	5 index categories		ppm							24				0.0025

[a] No questions associated with this Q#.

C.3.2.5 Category 11 – Smoking-Related Activities

Table C.3.2.5 Relationship Details for Questions in Category 11: Smoking-Related Activities – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1101--Current Smoker																						
467	urine	TCPY	A	Krinsley 1998	SLR	0.009	Y	N	yes vs no		ug/g Cre							167				0.0400
467	urine	TCPY	A	Krinsley 1998	SLR	0.009	Y	N		yes	ug/g Cre				5.700	7.460		35				
467	urine	TCPY	A	Krinsley 1998	SLR	0.009	Y	N		no	ug/g Cre				8.190	8.270		132				
Q1102--Subject Smoked																						
764	urine	TCPY	A	Krinsley 1998	FSLR#1	< 0.001	Y	Y	yes vs no		ug/g Cre										-0.170	0.1800
769	urine	TCPY	A	Krinsley 1998	FSLR#2	< 0.001	Y	Y	yes vs no		ug/g Cre							166			0.169	0.2100
Q1103--Exposure to Second Hand Smoke																						
474	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											

C.3.2.6 Category 12 – Work Exposure/Practices

Table C.3.2.6 Relationship Details for Questions in Category 12: Work Exposure/Practices – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1201--Pesticide Exposure at Work in Past 6 Mo																						
531	urine	TCPY	A	Krinsley 1998	SLR	0.37	Y	N	yes vs no		ug/g Cre											0.0050
531	urine	TCPY	A	Krinsley 1998	SLR	0.37	Y	N		yes	ug/g Cre				5.420	3.410		11				
531	urine	TCPY	A	Krinsley 1998	SLR	0.37	Y	N		no	ug/g Cre				7.020	5.740		65				
Q1202--Wear Boots While Doing Fieldwork?																						
446	dust	AZM	L	Grossman 2001	MLR-4	> 0.05	Y	N	always /usually vs sometimes/ rarely/never		ug/m^2									(0.423, 1.83)	0.880	
446	dust	AZM	L	Grossman 2001	MLR-4	> 0.05	Y	N		always/ usually	ug/m^2	8.960	5.510					36				
446	dust	AZM	L	Grossman 2001	MLR-4	> 0.05	Y	N		sometimes to never	ug/m^2	10.100	5.360					53				
Q1203--Wear Gloves While Doing Fieldwork?																						
447	dust	AZM	L	Grossman 2001	MLR-5	> 0.05	Y	N	always/ usually vs sometimes/ rarely/never		ug/m^2									(0.313, 1.64)	0.717	
447	dust	AZM	L	Grossman 2001	MLR-5	> 0.05	Y	N		always/ usually	ug/m^2	6.690	4.840					25				
447	dust	AZM	L	Grossman 2001	MLR-5	> 0.05	Y	N		sometimes to never	ug/m^2	11.100	5.540					64				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1204--Wear Hat While Doing Fieldwork?																						
445	dust	AZM	L	Grossman 2001	MLR-3	> 0.05	Y	N	always/ usually vs sometimes/ rarely/never		ug/m^2									(0.651, 4.20)	1.650	
445	dust	AZM	L	Grossman 2001	MLR-3	> 0.05	Y	N		always/ usually	ug/m^2	10.200	5.280					74				
445	dust	AZM	L	Grossman 2001	MLR-3	> 0.05	Y	N		sometimes to never	ug/m^2	7.340	6.030					15				

C.3.3 Other Relationships

C.3.3.1 Category 13 – Related Exposure Levels

Table C.3.3.1 Relationship Details for Questions in Category 13: Related Exposure Levels – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1301--Detectable Levels in Adult Household Members																						
262	urine	DAP2	C	Azaroff 1999	SLGR	< 0.01	N	N	number of adults		ug/L							135	2.000	(1.4, 3.0)		
265	urine	DAP2	C	Azaroff 1999	SLGR	0.1	N	N	yes vs no		ug/L								4.400	(0.9, 2.2)		
Q1302--High Levels in Adult Household Members																						
266	urine	MTHL4	C	Azaroff 1999	SLGR	< 0.01	N	N		yes	ug/L				>			12				
266	urine	MTHL4	C	Azaroff 1999	SLGR	< 0.01	N	N		no	ug/L				<			30				
263	urine	DAP2	C	Azaroff 1999	SLGR	< 0.01	N	N	number of adults		ug/L							135	2.100	(1.3, 3.6)		
264	urine	DAP3	C	Azaroff 1999	SLGR	< 0.01	N	N	number of adults		ug/L							135	2.200	(1.2, 4.0)		

C.3.3.2 Category 14 – Health

Table C.3.3.2 Relationship Details for Questions in Category 14: Health – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemical	MT	Citation	Analysis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
Q1401--Health Status																						
472	urine	TCPY	A	Krinsley 1998	SLR	< 0.66	Y	N	good vs fair-poor		ug/g Cre											
Q1402--Asthma and Allergies																						
470	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											
Q1403--Bowel Disease																						
761	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	Y	Y	yes vs no		ug/g Cre										-0.380	0.1800
Q1404--Diabetes																						
471	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	Y	N	yes vs no		ug/g Cre											
Q1405--Intestinal Disease																						
765	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	Y	Y	yes vs no		ug/g Cre							166			0.326	0.2100
770	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	Y	Y	yes vs no		ug/g Cre							71			-0.305	0.3500
469	urine	TCPY	A	Krinsley 1998	SLR	0.004	Y	N	yes vs no		ug/g Cre							166				0.0500
469	urine	TCPY	A	Krinsley 1998	SLR	0.004	Y	N		yes	ug/g Cre				4.470	4.400		13				
469	urine	TCPY	A	Krinsley 1998	SLR	0.004	Y	N		no	ug/g Cre				7.950	8.370		153				
Q1406--Ulcer																						
468	urine	TCPY	A	Krinsley 1998	SLR	0.02	Y	N	yes vs no		ug/g Cre							167				0.0300
468	urine	TCPY	A	Krinsley 1998	SLR	0.02	Y	N		yes	ug/g Cre				5.380	4.520		22				

ID #	Me-dium	Chemi-cal	MT	Citation	Analy-sis	p-value	LG	PM	Groups Compared	Group Name	Units	Gmean	GSD	Median	Mean	StDev	PctD	N	OR	CI	Beta	R^2
468	urine	TCPY	A	Krinsley 1998	SLR	0.02	Y	N		no	ug/g Cre				8.010	8.520		145				

Appendix D

Comment Tables for Relationships from Literature Review

Appendix D
Comment Tables for Relationship from Literature Review

Contents

Tables

Appendices B, C, and D provide specific information about the relationships extracted from the literature review and summarized in Results sections 4.2.4, 4.2.5, and 4.2.6. The information is presented as overview, detail, and comment tables. Each appendix includes one type of table for all the question categories and relationships. This appendix presents the comment tables.

D.1 Description

Information about each relationship with respect to the subpopulation analyzed, the chemical measurement, and the analysis are included in the comment tables. Table D.1 is an example of the comment table associated with Table C.1 in Appendix C. The sections in Table D.1 are organized by question as in Table C.1, and the rows within each question section are sorted by medium, chemical groupings (Table D.2.2), citation, and analysis type. The comment tables, however, contain only one row for each relationship, and the information for the relationship can be matched to the information in the detail table by the relationship ID number in the first column. The columns ID through MT match in both tables for a particular ID#. The Original Question phrasing is the description provided in the publication. In most cases the full phrasing was not provided.

Table D.1 Example of Relationship Comment Table for Question Category: Residential Pesticide Use (Detail Table – Table C.1 Appendix C)

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q101--Pesticide Use										
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	any pesticide use			
814	urine	ETHL2	C	Royster 2002	MWU	> 0.05	pesticide use			
815	urine	ETHL2	A	Royster 2002	MWU	> 0.05	pesticide use			
812	urine	MTHL2	C	Royster 2002	MWU	> 0.05	pesticide use			
813	urine	MTHL2	A	Royster 2002	MWU	> 0.05	pesticide use			
633	dust	AZM	C	McCauley 2001a	TNR	> 0.05	family use of pesticide control products	farmworker and grower homes in Hood River County		

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
848	dust	OPSUM	C	McCauley 2003	WTWS	0.39	family use of pesticide control products			
Q102--Inside Treated										
563	urine	MDA	C	Sexton 2003	BSLR-5	0.1	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used inside this house/apartment?			unexpected direction of coefficient
557	urine	MDA	C	Sexton 2003	LGRG	0.174	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	pesticide use inside in past 6 mo			
164	urine	ETHL1	C	Lu 2001	MWU	0.27	pesticide use inside	focus children: communities combined	average urine samples per child	
165	urine	MTHL2	C	Lu 2001	MWU	0.35	pesticide use inside	focus children: communities combined	average urine samples per child	
561	dust	CHLR	L	Sexton 2003	LGRG	0.436	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable) ; child's play area	
558	indair	CHLR	C	Sexton 2003	LGRG	0.296	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
554	indair	MAL	C	Sexton 2003	LGRG	0.369	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
559	outdair	CHLR	C	Sexton 2003	LGRG	0.715	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
555	outdair	MAL	C	Sexton 2003	LGRG	0.373	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
562	persair	CHLR	C	Sexton 2003	BSLR-1	0.04	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used inside this house/apartment?		child's breathing zone	unexpected direction of coefficient
553	persair	MAL	C	Sexton 2003	LGRG	0.073	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable); child's breathing zone	
560	sldfood	CHLR	I	Sexton 2003	LGRG	0.38	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
556	sldfood	MAL	I	Sexton 2003	LGRG	0.06	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
Q103--Inside Treated--Bathroom										
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	pesticide used in bathroom in past 6 mo			

D.2 Reference Information

To make the comment tables more compact, it was necessary to use abbreviations or codes in both the column names and contents. Table D.2.1 describes each column used in the comment tables. The column Reference Table identifies the number of a subsequent table with information about the codes used. For example, the column MT includes codes described in Table D.2.5.

Table D.2.1 List of Columns and Associated Reference Tables for Comment Tables

Column Type or Name	Description	Applies to[a]	Reference Table[b]
ID #	Number assigned to each relationship		NA

Column Type or Name	Description	Applies to[a]	Reference Table[b]
Medium	Sample medium		Appendix D - Table D.2.3
Chemical	Chemical, metabolite, or molar-weighted sum	a	Appendix D - Table D.2.2
MT	Type of measurement	a	Appendix D - Table D.2.4
Citation	Citation reference		App A - Table A.1
Analysis	Type of statistical analysis performed	a	Appendix D - Table D.2.5
p-value	Probability value associated with statistical analysis		NA
Original Question	Question description as included in the publication	b	NA
Subpopulation Analyzed	Description of particular study's subpopulation included in this analysis		NA
Notes on Measurement	Additional information on analytical measurements used in the analysis	a, b	NA
Notes on Analysis	Additional information regarding the statistical analysis		NA

[a] The entry "a" is a dependent variable, in this case a chemical analytical measurement. The entry "b" is an independent variable or predictor, usually a question.
[b] NA – Not applicable

Table D.2.2 Chemical/Metabolite Reference Table

Grouping[a]	Code	Medium	Description
1-Non-DAP	1NAP	urine	1-Naphthol
1-Non-DAP	4NITR	urine	4-Nitrophenol
6-Chemical	ATZ	other[b]	Atrazine
1-Non-DAP	ATZM	urine	Atrazine mercapturate

Grouping[a]	Code	Medium	Description
6-Chemical	AZM	other	Azinphosmethyl
6-Chemical	AZMPH	other	Azinphosmethyl+Phosmet
6-Chemical	CHLR	other	Chlorpyrifos
3-DAP Sum[c]	DAP1	urine	DMP+DMTP+DMDTP+DEP+DETP+DEDTP
4-DAP Detect	DAP2	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one detectable measurement)
5-DAP High	DAP3	urine	DEP, DETP, DEDTP, DMP, DMTP (at least one high measurement) [d]
2-DAP	DEDTP	urine	Diethyldithiophosphate (DEDTP)
2-DAP	DEP	urine	Diethylphosphate (DEP)
2-DAP	DETP	urine	Diethylthiophosphate (DETP)
2-DAP	DMDTP	urine	Dimethyldithiophosphate (DMDTP)
2-DAP	DMP	urine	Dimethylphosphate (DMP)
2-DAP	DMTP	urine	Dimethylthiophosphate (DMTP)
6-Chemical	EPAR	other	Ethyl parathion
3-DAP Sum	ETHL1	urine	DEP+DETP
3-DAP Sum	ETHL2	urine	DEP+DETP+DEDTP
4-DAP Detect	ETHL3	urine	DEP, DETP, DEDTP (at least one detectable measurement)
6-Chemical	MAL	other	Malathion
1-Non-DAP	MDA	urine	Malathion dicarboxylic acid
3-DAP Sum	MTHL1	urine	DMTP+DMDTP
3-DAP Sum	MTHL2	urine	DMP+DMTP+DMDTP
4-DAP Detect	MTHL3	urine	DMTP (detectable measurement)

Grouping[a]	Code	Medium	Description
4-DAP Detect	MTHL4	urine	DMP, DMTP (at least one detectable measurement)
5-DAP High	MTHL5	urine	DMP, DMTP (at least one high measurement)[d]
7-Metabolite NA	NA	urine	NA (not available or not specified)
6-Chemical	OPSUM	other	OP sum[e]
6-Chemical	PHSM	other	Phosmet
1-Non-DAP	TCPY	urine	3,5,6-Trichloro-2-pyridinol

[a] The number preceding the group name indicates the order of the group as it appears in the overview tables.
[b] Medium is other than urine, e.g., air, dermal
[c] Sums are molar-weighted unless otherwise specified.
[d] See definition of high measurement in Azaroff (1999).
[e] OP Sum = azinphosmethyl, chlorpyrifos, malathion, and phosmet

Table D.2.3 Medium Reference Table

Code	Description
dust	dust
indair	indoor air
outdair	outdoor air
persair	personal air
sldfood	solid food
soil	soil
urine	urine

Table D.2.4 Type of Measurement Reference Table

Code	Description
A	Adjusted concentration (urine concentration adjusted by creatinine)
C	Concentration
I	Daily intake (food)
L	Loading (dust or dermal)

Table D.2.5 Statistical Analysis Reference Table

Code	Description
BSLR-#x[a]	Backwards Stepwise Linear Regression #x
BDPH	Bonferroni/Dunn Post Hoc Test
CHSQ	Chi-square Test
CORR	Correlation
FISH	Fisher Exact Test
FSLR	Forward Selection Linear Regression
GLM	General Linear Model ANOVA
GLM-#x	General Linear Model ANOVA #x
KWAN	Kruskal-Wallis One-Way ANOVA
LGRG	Logistic Regression
MWU	Mann-Whitney U Test
MLR	Multiple Linear Regression
MLR-#x[a]	Multiple Linear Regression #x

MLGR-#x[a]	Multiple Logistic Regression #x
MVRG-#x[a]	Multivariate Regression #x
NAN	Not analyzed
OWAN	One-Way ANOVA
SLR	Simple Linear Regression
SLGR	Simple Logistic Regression
SPCR	Spearman Rank Correlation
TTST	t-test
TWAN-#x[a]	Two-Way ANOVA #x
TNR	Type of Analysis Not Reported
WTAN	Weighted ANOVA
WSRK	Wilcoxon Signed Rank Test
WTWS	Wilcoxon Two-Sample Test

[a] In some analyses where more than one predictor was analyzed in a relationship, the predictor questions will likely appear in different question category sections. The user can identify the predictors that were analyzed in the same relationship by looking for the same analysis code for the citation. For example, if a multiple linear regression was performed with three predictors on two metabolites, there would be two analysis types: < MLR-#1 and MLR-#2. The analysis type MLR-#1 would be used as the analysis type for the three relationships describing the three predictor questions. Aprea 2000 contains examples of this type of analysis code.

Table D.2.6 provides a cross-reference between the relationship summary tables in the Results section and the tables in Appendices B, C, and D.

Table D.2.6 Table Numbers Cross-Referenced between Results Section and Appendices A, B, and C, by Category Group

Category			Section #	Table #[a]	Overview Table #	Detailed Table #	Comment Table #
Group	**#**	**Description**	**Results**	**Results**	**Appendix B**	**Appendix C**	**Appendix D**
Source	1	Residential pesticide use	4.2.4.1	4.2.6.x	B.3.1.1	C.3.1.1	D.3.1.1
Source	2	Household characteristics	4.2.4.2	4.2.7.x	B.3.1.2	C.3.1.2	D.3.1.2
Source	3	Residential sources (environmental measures)	4.2.4.3	4.2.8.x	B.3.1.3	C.3.1.3	D.3.1.3
Source	4	Household occupation	4.2.4.4	4.2.9.x	B.3.1.4	C.3.1.4	D.3.1.4
Source	5	Residential proximity to agricultural fields	4.2.4.5	4.2.10.x	B.3.1.5	C.3.1.5	D.3.1.5
Source	6	Residential location	4.2.4.6	4.2.11.x	B.3.1.6	C.3.1.6	D.3.1.6
Behavior	7	Subject's personal characteristics	4.2.5.1	4.2.13.x	B.3.2.1	C.3.2.1	D.3.2.1
Behavior	8	Child's behaviors	4.2.5.2	4.2.14.x	B.3.2.2	C.3.2.2	D.3.2.2
Behavior	9	Dietary behaviors	4.2.5.3	4.2.15.x	B.3.2.3	C.3.2.3	D.3.2.3
Behavior	10	Family hygiene practices	4.2.5.4	4.2.16.x	B.3.2.4	C.3.2.4	D.3.2.4
Behavior	11	Smoking-related activities	4.2.5.5	4.2.17.x	B.3.2.5	C.3.2.5	D.3.2.5
Behavior	12	Work exposure/practices	4.2.5.6	4.2.18.x	B.3.2.6	C.3.2.6	D.3.2.6
Other	13	Related exposure levels	4.2.6.1	4.2.20.x	B.3.3.1	C.3.3.1	D.3.3.1
Other	14	Health	4.2.6.2	4.2.21.x	B.3.3.2	C.3.3.2	D.3.3.2

[a] x in this column refers to the three table types, a, b, and c, described above.

D.3 Comment Tables

D.3.1 Source Relationships

D.3.1.1 Category 1: Residential Pesticide Use

Table D.3.1.1 Relationship Comments for Questions in Category 1: Residential Pesticide Use – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q101--Pesticide Use										
484	urine	TCPY	A	Krinsley 1998	SLR	0.77	any pesticide use			
814	urine	ETHL2	C	Royster 2002	MWU	> 0.05	pesticide use			
815	urine	ETHL2	A	Royster 2002	MWU	> 0.05	pesticide use			
812	urine	MTHL2	C	Royster 2002	MWU	> 0.05	pesticide use			
813	urine	MTHL2	A	Royster 2002	MWU	> 0.05	pesticide use			
633	dust	AZM	C	McCauley 2001a	TNR	> 0.05	family use of pesticide control products	farmworker and grower homes in Hood River County		
848	dust	OPSUM	C	McCauley 2003	WTWS	0.39	family use of pesticide control products			

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q102--Inside Treated										
563	urine	MDA	C	Sexton 2003	BSLR-5	0.1	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used inside this house/apartment?			unexpected direction of coefficient
557	urine	MDA	C	Sexton 2003	LGRG	0.174	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
485	urine	TCPY	A	Krinsley 1998	SLR	0.93	pesticide use inside in past 6 mo			
164	urine	ETHL1	C	Lu 2001	MWU	0.27	pesticide use inside	focus children: communities combined	average urine samples per child	
165	urine	MTHL2	C	Lu 2001	MWU	0.35	pesticide use inside	focus children: communities combined	average urine samples per child	
561	dust	CHLR	L	Sexton 2003	LGRG	0.436	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable) ; child's play area	
558	indair	CHLR	C	Sexton 2003	LGRG	0.296	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
554	indair	MAL	C	Sexton 2003	LGRG	0.369	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
559	outdair	CHLR	C	Sexton 2003	LGRG	0.715	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
555	outdair	MAL	C	Sexton 2003	LGRG	0.373	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
562	persair	CHLR	C	Sexton 2003	BSLR-1	0.04	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used inside this house/apartment?		child's breathing zone	unexpected direction of coefficient
553	persair	MAL	C	Sexton 2003	LGRG	0.073	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable); child's breathing zone	
560	sldfood	CHLR	I	Sexton 2003	LGRG	0.38	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
556	sldfood	MAL	I	Sexton 2003	LGRG	0.06	Was there indoor pesticide application in past 6 months?		concentration (detectable / nondetectable)	
Q103--Inside Treated--Bathroom										
498	urine	TCPY	A	Krinsley 1998	SLR	0.36	pesticide used in bathroom in past 6 mo			
Q104--Inside Treated--Bedroom										
767	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether subject applied pesticides in the bedroom			p < 0.00001
772	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether subject applied pesticides in the bedroom	used pesticides both inside and outside, personally or professionally applied		p < 0.00001
497	urine	TCPY	A	Krinsley 1998	SLR	0.02	pesticide used in bedroom in past 6 mo			
Q105--Inside Treated--Cabinets										
506	urine	TCPY	A	Krinsley 1998	SLR	0.15	pesticide used in cabinets in past 6 mo			

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q106--Inside Treated--Closets										
507	urine	TCPY	A	Krinsley 1998	SLR	0.04	pesticide used in closets in past 6 mo			
Q107--Inside Treated--Cupboards with Dishes										
505	urine	TCPY	A	Krinsley 1998	SLR	0.52	pesticide used in cupboards with dishes in past 6 mo			
Q108--Inside Treated--Dining Room										
496	urine	TCPY	A	Krinsley 1998	SLR	0.12	pesticide used in dining room in past 6 mo			
Q109--Inside Treated--Family Room										
494	urine	TCPY	A	Krinsley 1998	SLR	0.38	pesticide used in family room in past 6 mo			
Q110--Inside Treated--Kitchen										
493	urine	TCPY	A	Krinsley 1998	SLR	0.89	pesticide used in kitchen in past 6 mo			
Q111--Inside Treated--Living Room										
495	urine	TCPY	A	Krinsley 1998	SLR	0.08	pesticide used in living room in past 6 mo			
Q112--Inside Treated--On Baseboards										
501	urine	TCPY	A	Krinsley 1998	SLR	0.51	pesticide used on baseboards in past 6 mo			
Q113--Inside Treated--On Ceiling										
504	urine	TCPY	A	Krinsley 1998	SLR	0.58	pesticide used on ceiling in past 6 mo			
Q114--Inside Treated--On Floor										
500	urine	TCPY	A	Krinsley 1998	SLR	0.27	pesticide used on floor in past 6 mo			

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q115--Inside Treated--On Lower Walls										
502	urine	TCPY	A	Krinsley 1998	SLR	0.65	pesticide used on lower walls in past 6 mo			
Q116--Inside Treated--On Upper Walls										
503	urine	TCPY	A	Krinsley 1998	SLR	0.2	pesticide used on upper walls in past 6 mo			
Q117--Inside Treated--Other Room										
773	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether the subject used pesticides in other room	used pesticides both inside and outside, personally or professionally applied		p < 0.00001
499	urine	TCPY	A	Krinsley 1998	SLR	0.05	pesticide used in other room in past 6 mo			
Q118--Pets Treated										
160	urine	ETHL1	C	Lu 2001	MWU	0.14	pesticide used on household pets	focus children: communities combined	average urine samples per child	
335	urine	MTHL1	C	Lu 2000	MWU	0.6	Are household pets treated with pesticides?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
161	urine	MTHL2	C	Lu 2001	MWU	0.8	pesticide used on household pets	focus children: communities combined	average urine samples per child	
331	dust	AZMPH	C	Lu 2000	MWU	0.1	Are household pets treated with pesticides?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
Q119--Outside Treated										
567	urine	MDA	C	Sexton 2003	BSLR-5	0.03	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used on the exterior of this house/apartment?			unexpected direction of coefficient

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
489	urine	TCPY	A	Krinsley 1998	SLR	0.11	pesticide use outside in past 6 mo			
570	urine	TCPY	C	Sexton 2003	BSLR-6	0.09	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used on the exterior of this house/apartment?			unexpected direction of coefficient
566	dust	CHLR	L	Sexton 2003	BSLR-4	0.01	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used on the exterior of this house/apartment?		from child's play area	unexpected direction of coefficient
565	sldfood	CHLR	I	Sexton 2003	BSLR-3	0.06	In the past six months were any chemicals for the control of fleas, roaches, ants, or other insects used on the exterior of this house/apartment?			unexpected direction of coefficient
Q120--Garden Treated										
249	urine	4NITR	C	Fenske 2002	MWU	> 0.05	OP pesticide use in garden	focus children	average of visit 1 and visit 2 values	
248	urine	TCPY	C	Fenske 2002	MWU	0.02	OP pesticide use in garden	focus children	average of visit 1 and visit 2 values	
156	urine	ETHL1	C	Lu 2001	MWU	0.02	garden pesticide used	focus children: communities combined	average urine samples per child	
338	urine	MTHL1	C	Lu 2000	MWU	0.9	Have you ever used OPs in your garden?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
157	urine	MTHL2	C	Lu 2001	MWU	0.05	garden pesticide used	focus children: communities combined	average urine samples per child	

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
334	dust	AZMPH	C	Lu 2000	MWU	0.8	Have you ever used OPs in your garden?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
Q121--Lawn/Yard Treated										
571	urine	TCPY	C	Sexton 2003	BSLR-6	0.09	In the past six months have there been any regular treatments by anyone on the lawn or yard outside of this house/apartment?			unexpected direction of coefficient
162	urine	ETHL1	C	Lu 2001	MWU	0.68	pesticide use on lawn	focus children: communities combined	average urine samples per child	
337	urine	MTHL1	C	Lu 2000	MWU	0.7	Has your lawn ever been treated with OPs?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
163	urine	MTHL2	C	Lu 2001	MWU	0.13	pesticide use on lawn	focus children: communities combined	average urine samples per child	
333	dust	AZMPH	C	Lu 2000	MWU	0.7	Has your lawn ever been treated with OPs?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
Q122--Inside or Outside Treated										
132	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	recent pesticide use indoor or outdoor		weighted intra-child means	
133	urine	MDA	C	Adgate 2001	WTAN	> 0.05	recent pesticide use indoor or outdoor		weighted intra-child means	
134	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	recent pesticide use indoor or outdoor		weighted intra-child means	
71	urine	DEP	A	Aprea 2000	BDPH	> 0.05	use of pesticides inside or outside			multiple comparison test w/ 1 independent variable
62	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	use of pesticides inside or outside			
72	urine	DETP	A	Aprea 2000	BDPH	> 0.05	use of pesticides inside or outside			multiple comparison test w/ 1 independent variable

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
73	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	use of pesticides inside or outside			multiple comparison test w/ 1 independent variable
64	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	use of pesticides inside or outside			
70	urine	DMP	A	Aprea 2000	BDPH	> 0.05	use of pesticides inside or outside			multiple comparison test w/ 1 independent variable
61	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	use of pesticides inside or outside			
67	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	use of pesticides inside or outside			multiple comparison test w/ 1 independent variable
74	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	use of pesticides inside or outside			multiple comparison test w/ 1 independent variable
65	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	use of pesticides inside or outside			
Q123--Previous Treatment										
336	urine	MTHL1	C	Lu 2000	MWU	0.6	Has your house been treated with OPs since January 1995?(within 6 months)	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
332	dust	AZMPH	C	Lu 2000	MWU	0.3	Has your house been treated with OPs since January 1995?(within 6 months)	(applicator + farm-worker) families	adjusted by extraction efficiencies	
Q124--Level of Pesticide Use										
136	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	level of pesticide use		weighted intra-child means	
137	urine	MDA	C	Adgate 2001	WTAN	> 0.05	level of pesticide use		weighted intra-child means	

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
551	urine	MDA	C	Sexton 2003	SLR	0.033	level of pesticide use			household pesticide-use screening score was subjectively assigned, to reflect the household's potential for pesticide exposure and was based on questionnaire responses and a pesticide inventory
549	urine	MDA	C	Sexton 2003	WTWS	0.04	level of pesticide use			household pesticide-use screening score was subjectively assigned, to reflect the household's potential for pesticide exposure and was based on questionnaire responses and a pesticide inventory
138	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	level of pesticide use		weighted intra-child means	
762	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	pesticide use index (PUI)			PUI was constructed from pesticide use variables: p < 0.00001
476	urine	TCPY	A	Krinsley 1998	SLR	< 0.004	pesticide use index (PUI)			PUI was constructed from pesticide use variables: p < 0.0042
550	persair	ATZ	C	Sexton 2003	LGRG	0.028	level of pesticide use		concentration (detectable / nondetectable); child's breathing zone	household pesticide-use screening score was subjectively assigned, to reflect the household's potential for pesticide exposure and was based on questionnaire responses and a pesticide inventory

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
552	persair	ATZ	C	Sexton 2003	LGRG	0.02	level of pesticide use		child's breathing zone	household pesticide-use screening score was subjectively assigned, to reflect the household's potential for pesticide exposure and was based on questionnaire responses and a pesticide inventory
Q125--Frequency Personal Application Inside										
486	urine	TCPY	A	Krinsley 1998	SLR	0.07	number of times personally applied pesticide inside in past 6 mo	pesticide users		
Q126--Frequency Personal Application Outside										
766	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	number of times the subject personally applied pesticides outside in past 6 mo			p < 0.00001
771	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	number of times the subject personally applied pesticides outside in past 6 mo	used pesticides both inside and outside, personally or professionally applied		p < 0.00001
490	urine	TCPY	A	Krinsley 1998	SLR	0.003	number of times personally applied pesticide outside in past 6 mo	pesticide users		
Q127--Inside/Outside Treated by Family Member										
275	urine	ETHL3	C	Azaroff 1999	MLGR-6	< 0.05	OP applied in house or yard by household mother		detectable ethylated AP metabolites - 3 samples combined - second model	
591	urine	MTHL3	C	Azaroff 1999	MLGR-7	< 0.01	methamidophos applied in house or yard by household mother		detectable levels of DMTP -- 3 samples combined	controlled for fieldwork -- variable included as predictor

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
276	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.01	methamidophos applied in house or yard by household mother		detectable methylated AP metabolites - 3 samples combined	
273	urine	DAP2	C	Azaroff 1999	MLGR-1	< 0.05	OP applied in house or yard by household mother		detectable AP metabolites - 3 samples combined	
274	urine	DAP3	C	Azaroff 1999	MLGR-2	< 0.10	OP applied in house or yard by household mother		high or very high level of an AP metabolite - 3 samples combined	
Q128--Frequency Professional Application Inside										
487	urine	TCPY	A	Krinsley 1998	SLR	0.62	number of times professionally applied pesticide inside in past 6 mo	pesticide users		
Q129--Frequency Professional Application Outside										
491	urine	TCPY	A	Krinsley 1998	SLR	0.96	number of times professionally applied pesticide outside in past 6 mo	pesticide users		
Q130--Personally Mixed Pesticide Inside										
488	urine	TCPY	A	Krinsley 1998	SLR	0.18	personally mixed inside pesticide in past 6 mo	pesticide users		
Q131--Personally Mixed Pesticide Outside										
492	urine	TCPY	A	Krinsley 1998	SLR	0.46	personally mixed outside pesticide in past 6 mo			
Q132--Presence During Mixing										
680	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	child present during pesticide mixing	children with 3 urine samples	weighted intra-child means	
683	urine	ATZM	C	Adgate 2001	NAN	> 0.05	child present during pesticide mixing	children with 3 urine samples	weighted intra-child means	

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
681	urine	MDA	C	Adgate 2001	WTAN	> 0.05	child present during pesticide mixing	children with 3 urine samples	weighted intra-child means	
682	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	child present during pesticide mixing	children with 3 urine samples	weighted intra-child means	

[a] See section 4.2.2.2 and the paragraph immediately following Table 4.2.3 regarding relationships from Sexton (2003).

D.3.1.2 Category 2: Household Characteristics

Table D.3.1.2 Relationship Comments for Questions in Category 2: Household Characteristics – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q201--Housing Type										
168	urine	ETHL1	C	Lu 2001	TNR	> 0.05	type of housing	focus children: communities combined	average urine samples per child	
169	urine	MTHL2	C	Lu 2001	TNR	> 0.05	type of housing	focus children: communities combined	average urine samples per child	
632	dust	AZM	C	McCauley 2001a	TNR	> 0.05	housing type	farmworker and grower homes in Hood River County		
Q202--Property Used as a Farm										
690	dust	CHLR	L	Sexton 2003	BSLR-4	0.06	Is this property used as a farm?			unexpected direction of coefficient
564	indair	CHLR	C	Sexton 2003	BSLR-2	0.01	Is this property used as a farm?			unexpected direction of coefficient
Q203--Age of House > 10 Years										
483	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	age of house			
Q204--Age of House > 20 Years										
670	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	age of house			
Q205--Having Air Conditioning										
480	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	having air conditioning			

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q206--Having Central Heating										
482	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	having central heating			
Q207--Having Evaporative Cooling										
481	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	having evaporative cooling			
Q208--Pets in House										
53	urine	DEP	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
44	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	domestic animals in house			
54	urine	DETP	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
45	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	domestic animals in house			
55	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
46	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	domestic animals in house			
52	urine	DMP	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
43	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	domestic animals in house			
48	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
49	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
158	urine	ETHL1	C	Lu 2001	MWU	0.4	pets in household	focus children: communities combined	average urine samples per child	

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
56	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
47	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	domestic animals in house			
50	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
159	urine	MTHL2	C	Lu 2001	MWU	0.04	pets in household	focus children: communities combined	average urine samples per child	
51	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	domestic animals in house			multiple comparison test w/ 1 independent variable
Q209--Pets Inside/Outside House										
569	urine	MDA	C	Sexton 2003	BSLR-5	0.08	Do you have pets such as dogs, cats, gerbils, hamsters, rabbits, guinea pigs, birds, or horses?			unexpected direction of coefficient
Q210--Pet Inside to Outside										
736	dust	AZM	L	Simcox 1995	MLR-3	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
436	dust	AZM	L	Simcox 1995	MWU	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
438	dust	CHLR	L	Simcox 1995	MWU	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
738	dust	CHLR	L	Simcox 1995	MWU	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
439	dust	EPAR	L	Simcox 1995	MWU	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
739	dust	EPAR	L	Simcox 1995	MWU	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
737	dust	PHSM	L	Simcox 1995	MLR-4	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
437	dust	PHSM	L	Simcox 1995	MWU	> 0.05	Is there a pet that goes in and out of the house?		dust: 2 samples pooled	
Q211--Existence of Garden or Vegetable Garden										
568	urine	MDA	C	Sexton 2003	BSLR-5	0.04	Do you have a flower, vegetable, or fruit garden to which you apply chemicals?			
17	urine	DEP	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
8	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	existence of garden or vegetable garden			
18	urine	DETP	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
9	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	existence of garden or vegetable garden			
19	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
10	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	existence of garden or vegetable garden			
16	urine	DMP	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
7	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	existence of garden or vegetable garden			
12	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
154	urine	ETHL1	C	Lu 2001	MWU	0.04	garden exists	focus children: communities combined	average urine samples per child	
20	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
11	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	existence of garden or vegetable garden			
14	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
155	urine	MTHL2	C	Lu 2001	MWU	0.11	garden exists	focus children: communities combined	average urine samples per child	
15	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	existence of garden or vegetable garden			multiple comparison test w/ 1 independent variable
Q212--Ornamental Plants or Cut Flowers										
35	urine	DEP	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
26	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	ornamental plants or cut flowers in house			
36	urine	DETP	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
27	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	ornamental plants or cut flowers in house			
37	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
28	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	ornamental plants or cut flowers in house			
34	urine	DMP	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
25	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	ornamental plants or cut flowers in house			
30	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable

ID #	Medium	Chemi-cal	MT	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
31	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
38	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
29	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	ornamental plants or cut flowers in house			
32	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
33	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	ornamental plants or cut flowers in house			multiple comparison test w/ 1 independent variable
Q213--Size of Household										
631	dust	AZM	C	McCauley 2001a	SLR	> 0.05	number of persons living in household	homes in Hood River County with detectable dust samples		assumed not significant based on comments in article
847	dust	OPSUM	C	McCauley 2003	CORR	0.29	number of individuals in household			r = 0.22
Q214--Location of Play Area										
832	dust	OPSUM	C	McCauley 2003	WTWS	0.66	location of child's play area			
Q215--Age of House (years)										
843	dust	AZM	C	McCauley 2003	CORR	0.22	age of house (years)			r = 0.26
842	dust	OPSUM	C	McCauley 2003	CORR	0.25	age of house (years)			r = 0.25
Q216--Size of House (sq ft)										
844	dust	OPSUM	C	McCauley 2003	CORR	0.08	size of house (sq ft)			r = 0.40
845	dust	OPSUM	C	McCauley 2003	MLR	0.16	size of house (sq ft)			partial correlation = 0.31; analysis adjusted for age of house

ID #	Medium	Chemi-cal	M T	Citation[a]	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q217--Number of Pets in House										
849	dust	OPSUM	C	McCauley 2003	CORR	0.95	number of cats and dogs living in house			r = 0.02

[a] See section 4.2.2.2 and the paragraph immediately following Table 4.2.3 regarding relationships from Sexton (2003).

D.3.1.3 Category 3: Residential Sources (Environmental Measures)

Table D.3.1.3 Relationship Comments for Questions in Category 3: Residential Sources (Environmental Measures) – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q301--Household Dust										
147	urine	MTHL2	C	Curl 2002	SLR	< 0.001	household dust level of azinphosmethyl			p < 0.0001
586	urine	MTHL2	A	Curl 2002	SLR	< 0.001	household dust level of azinphosmethyl			
328	urine	NA	C	Lu 2000	SPCR	< 0.10	measurement	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values for urine; dust and urine adjusted by extraction efficiencies	dust: azinophosmethyl+phosmet
329	urine	NA	C	Lu 2000	SPCR	0.09	measurement	all families' children	average of visit 1 and visit 2 values for urine; dust and urine adjusted by extraction efficiencies	dust: azinophosmethyl+phosmet
Q302--Loading from Household Floor Dust										
644	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	household dust load			p = 0.076 for model; significance level assumed based on MVRG-1and comments in article
Q303--Outdoor Soil										
403	dust	AZM	C	Simcox 1995	SPCR	0.001	measurement	(farmer + farm-worker) families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.49
407	dust	AZM	C	Simcox 1995	SPCR	0.87	measurement	reference families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.05
405	dust	CHLR	C	Simcox 1995	SPCR	< 0.001	measurement	(farmer + farm-worker) families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.52: p = 0.0003

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
409	dust	CHLR	C	Simcox 1995	SPCR	0.21	measurement	reference families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.4
406	dust	EPAR	C	Simcox 1995	SPCR	0.02	measurement	(farmer + farm-worker) families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.35
410	dust	EPAR	C	Simcox 1995	SPCR	0.01	measurement	reference families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.81
404	dust	PHSM	C	Simcox 1995	SPCR	< 0.001	measurement	(farmer + farm-worker) families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.67; p < 0.0001
408	dust	PHSM	C	Simcox 1995	SPCR	0.48	measurement	reference families	dust: 2 samples pooled; soil: 5 sample composite	r = 0.23

D.3.1.4 Category 4: Household Occupation

Table D.3.1.4 Relationship Comments for Questions in Category 4: Household Occupation – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q401--Agricultural Workers in Household										
572	dust	AZM	C	McCauley 2001a	SLR	0.002	number of agricultural workers residing in home	homes in Hood River County with detectable dust samples		
634	dust	AZM	C	McCauley 2001a	SLR	< 0.05	number of agricultural workers residing in home	homes in Hood River County		assumed significant based on comments in article in comparison to analysis with only detectable samples
Q402--Household Member Spraying Fields										
282	urine	ETHL3	C	Azaroff 1999	MLGR-5	< 0.05	OP other than parathion, methamidophos, phoxim applied to fields during past year by head household farmer		detectable ethylated AP metabolites - 3 samples combined	
283	urine	ETHL3	C	Azaroff 1999	MLGR-6	< 0.10	OP other than parathion, methamidophos, phoxim applied to fields during past year by head household farmer		detectable ethylated AP metabolites - 3 samples combined	
590	urine	MTHL3	C	Azaroff 1999	MLGR-7	< 0.01	methyl parathion applied to fields within past year by head household farmer		detectable levels of DMTP -- 3 samples combined	controlled for fieldwork -- variable included as predictor
279	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.01	methyl parathion applied to fields within past year by head household farmer		detectable methylated AP metabolites - 3 samples combined	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
281	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.05	malathion or omethoate applied to fields within past year by head household farmer		detectable methylated AP metabolites - 3 samples combined	
277	urine	DAP2	C	Azaroff 1999	MLGR-1	< 0.05	OP applied to fields within past year by head household farmer		detectable AP metabolites - 3 samples combined	
280	urine	MTHL5	C	Azaroff 1999	MLGR-4	< 0.01	methyl parathion applied to fields within past year by head household farmer		high or very high level of a methylated AP metabolite - 3 samples combined	
278	urine	DAP3	C	Azaroff 1999	MLGR-2	< 0.10	OP applied to fields within past year by head household farmer		high or very high level of an AP metabolite - 3 samples combined	
Q403--Recent Fieldwork										
271	urine	ETHL3	C	Azaroff 1999	MLGR-5	> 0.10	reporting fieldwork within past 2 weeks		detectable ethylated AP metabolites - 3 samples combined	
272	urine	ETHL3	C	Azaroff 1999	MLGR-6	> 0.10	reporting fieldwork within past 2 weeks		detectable ethylated AP metabolites - 3 samples combined	
269	urine	MTHL4	C	Azaroff 1999	MLGR-3	< 0.01	reporting fieldwork within past 2 weeks		detectable methylated AP metabolites - 3 samples combined	
267	urine	DAP2	C	Azaroff 1999	MLGR-1	< 0.01	reporting fieldwork within past 2 weeks		detectable AP metabolites - 3 samples combined	
270	urine	MTHL5	C	Azaroff 1999	MLGR-4	< 0.05	reporting fieldwork within past 2 weeks		high or very high level of a methylated AP metabolite - 3 samples combined	
268	urine	DAP3	C	Azaroff 1999	MLGR-2	< 0.05	reporting fieldwork within past 2 weeks		high or very high level of an AP metabolite - 3 samples combined	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q404--Applicator vs Farmworker										
239	urine	4NITR	C	Fenske 2002	MWU	> 0.05	household occupation	focus children	average of visit 1 and visit 2 values	
238	urine	TCPY	C	Fenske 2002	MWU	> 0.05	household occupation	focus children	average of visit 1 and visit 2 values	
319	urine	DMTP	C	Lu 2000	MWU	>= 0.10	household occupation	focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
320	urine	DMDTP	C	Lu 2000	MWU	>= 0.10	household occupation	focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
321	urine	MTHL1	C	Lu 2000	MWU	>= 0.10	household occupation	focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
316	dust	AZM	C	Lu 2000	MWU	>= 0.10	household occupation		adjusted by extraction efficiencies	
318	dust	AZMPH	C	Lu 2000	MWU	0.07	household occupation		adjusted by extraction efficiencies	
232	dust	CHLR	C	Fenske 2002	MWU	> 0.05	household occupation		adjusted by extraction efficiencies	
235	dust	EPAR	C	Fenske 2002	MWU	0.03	household occupation		adjusted by extraction efficiencies	
317	dust	PHSM	C	Lu 2000	MWU	>= 0.10	household occupation		adjusted by extraction efficiencies	
Q405--Applicator vs Non-applicator										
387	dust	AZM	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
391	dust	AZM	L	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
425	dust	AZM	C	Simcox 1995	OWAN	> 0.05	pesticide application activity classification	(farmer + farm-worker) families	dust: 2 samples pooled	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
389	dust	CHLR	C	Simcox 1995	MWU	0.02	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
393	dust	CHLR	L	Simcox 1995	MWU	0.04	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
427	dust	CHLR	C	Simcox 1995	OWAN	> 0.05	pesticide application activity classification	(farmer + farm-worker) families	dust: 2 samples pooled	
390	dust	EPAR	C	Simcox 1995	MWU	< 0.001	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	p = 0.0003
394	dust	EPAR	L	Simcox 1995	MWU	0.002	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
428	dust	EPAR	C	Simcox 1995	OWAN	0.001	pesticide application activity classification	(farmer + farm-worker) families	dust: 2 samples pooled	
429	dust	EPAR	C	Simcox 1995	TWAN-1	0.002	pesticide application activity classification	(farmer + farm-worker) families	dust: 2 samples pooled	no significant interaction between proximity to orchards and applicator status
430	dust	EPAR	C	Simcox 1995	TWAN-2	> 0.05	pesticide application activity classification	(farmer + farm-worker) families	dust: 2 samples pooled	significant interaction between occupation (farmer vs farmworker) and applicator status, thus signficance level for applicator status assigned as NS
388	dust	PHSM	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
392	dust	PHSM	L	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
426	dust	PHSM	C	Simcox 1995	OWAN	> 0.05	pesticide application activity classification	(farmer + farm-worker) families	dust: 2 samples pooled	
Q406--Applicator vs Reference										
201	urine	DMTP	C	Loewen-herz 1997	CHSQ	> 0.10	household occupation	focus applicator children; visit 1	frequency of detectability	
202	urine	DMTP	C	Loewen-herz 1997	CHSQ	0.022	household occupation	focus applicator children; visit 2	frequency of detectability	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
176	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	household occupation	focus applicator children; visit 1		
177	urine	DMTP	C	Loewen-herz 1997	MWU	0.036	household occupation	focus applicator children; visit 2		
178	urine	DMTP	C	Loewen-herz 1997	MWU	0.015	household occupation	focus applicator children; visits combined		
198	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	household occupation	focus applicator children; visit 1		
199	urine	DMTP	C	Loewen-herz 1997	MWU	0.022	household occupation	focus applicator children; visit 2		
200	urine	DMTP	A	Loewen-herz 1997	MWU	0.011	household occupation	focus applicator children; visits combined		
Q407--Applicator+Farmworker vs Reference										
241	urine	4NITR	C	Fenske 2002	KWAN	> 0.05	household occupation	focus children	average of visit 1 and visit 2 values	
231	urine	4NITR	C	Fenske 2002	TNR	> 0.05	household occupations	focus children	average of visit 1 and visit 2 values	
240	urine	TCPY	C	Fenske 2002	KWAN	> 0.05	household occupation	focus children	average of visit 1 and visit 2 values	
230	urine	TCPY	C	Fenske 2002	TNR	> 0.05	household occupations	focus children	average of visit 1 and visit 2 values	
325	urine	DMTP	C	Lu 2000	MWU	0.07	household occupation	focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
326	urine	DMDTP	C	Lu 2000	MWU	>= 0.10	household occupation	focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
327	urine	MTHL1	C	Lu 2000	MWU	0.09	household occupation	focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
322	dust	AZM	C	Lu 2000	MWU	< 0.001	household occupation		household dust, adjusted by extraction efficiencies	
324	dust	AZMPH	C	Lu 2000	MWU	< 0.001	household occupation		household dust, adjusted by extraction efficiencies	
233	dust	CHLR	C	Fenske 2002	KWAN	< 0.001	household occupation		adjusted by extraction efficiencies	
234	dust	CHLR	C	Fenske 2002	MWU	< 0.001	household occupation		adjusted by extraction efficiencies	
244	dust	CHLR	C	Fenske 2002	MWU	< 0.01	household occupation	all reference families, and applicator and farworker families with distance > 0.25 mi - home to pesticide-treated farmland	adjusted by extraction efficiencies	
236	dust	EPAR	C	Fenske 2002	KWAN	< 0.01	household occupation		adjusted by extraction efficiencies	
237	dust	EPAR	C	Fenske 2002	MWU	0.02	household occupation		adjusted by extraction efficiencies	
245	dust	EPAR	C	Fenske 2002	MWU	> 0.05	household occupation	all reference families, and applicator and farworker families with distance > 0.25 mi - home to pesticide-treated farmland	adjusted by extraction efficiencies	
323	dust	PHSM	C	Lu 2000	MWU	0.02	household occupation		household dust, adjusted by extraction efficiencies	
Q408--Farmer vs Farmworker										
379	dust	AZM	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
383	dust	AZM	L	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
650	dust	AZM	C	Simcox 1995	OWAN	> 0.05	occupational classification	(farmer + farm-worker) families	dust: 2 samples pooled	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
381	dust	CHLR	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
385	dust	CHLR	L	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
654	dust	CHLR	C	Simcox 1995	OWAN	> 0.05	occupational classification	(farmer + farm-worker) families	dust: 2 samples pooled	
382	dust	EPAR	C	Simcox 1995	MWU	< 0.001	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	p = 0.0007
386	dust	EPAR	L	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
656	dust	EPAR	C	Simcox 1995	OWAN	0.001	occupational classification	(farmer + farm-worker) families	dust: 2 samples pooled	
659	dust	EPAR	C	Simcox 1995	TWAN-2	> 0.05	farm occupation	(farmer + farm-worker) families	dust: 2 samples pooled	significant interaction between occupation (farmer vs farmworker) and applicator status thus signficance level for occupation assigned as NS
431	dust	EPAR	C	Simcox 1995	TWAN-3	> 0.05	farm occupation	(farmer + farm-worker) families	dust: 2 samples pooled	significant interaction between occupation (farmer vs farmworker) and proximity to orchards thus significance level for occupation assigned as NS
380	dust	PHSM	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
384	dust	PHSM	L	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	dust: 2 samples pooled	
652	dust	PHSM	C	Simcox 1995	OWAN	> 0.05	occupational classification	(farmer + farm-worker) families	dust: 2 samples pooled	
367	soil	AZM	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	soil: 5 sample composite	
369	soil	CHLR	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	soil: 5 sample composite	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
370	soil	EPAR	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	soil: 5 sample composite	
368	soil	PHSM	C	Simcox 1995	MWU	> 0.05	household occupation	(farmer + farm-worker) families	soil: 5 sample composite	
Q409--Farmer+Farmworker vs Reference										
371	dust	AZM	C	Simcox 1995	MWU	0.001	household occupation		dust: 2 samples pooled	
375	dust	AZM	L	Simcox 1995	MWU	> 0.05	household occupation		dust: 2 samples pooled	
373	dust	CHLR	C	Simcox 1995	MWU	0.01	household occupation		dust: 2 samples pooled	
377	dust	CHLR	L	Simcox 1995	MWU	> 0.05	household occupation		dust: 2 samples pooled	
374	dust	EPAR	C	Simcox 1995	MWU	0.02	household occupation		dust: 2 samples pooled	
378	dust	EPAR	L	Simcox 1995	MWU	> 0.05	household occupation		dust: 2 samples pooled	
372	dust	PHSM	C	Simcox 1995	MWU	0.07	household occupation		dust: 2 samples pooled	
376	dust	PHSM	L	Simcox 1995	MWU	> 0.05	household occupation		dust: 2 samples pooled	
363	soil	AZM	C	Simcox 1995	MWU	0.04	household occupation		soil: 5 sample composite	
365	soil	CHLR	C	Simcox 1995	MWU	> 0.05	household occupation		soil: 5 sample composite	
366	soil	EPAR	C	Simcox 1995	MWU	> 0.05	household occupation		soil: 5 sample composite	
364	soil	PHSM	C	Simcox 1995	MWU	> 0.05	household occupation		soil: 5 sample composite	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q410--Farmworker vs Grower										
575	dust	AZM	C	McCauley 2001a	WTWS	0.02	open areas in farmworker homes vs. play areas in grower homes	farmworker and grower homes in Hood River County		
630	dust	AZM	C	McCauley 2001a	WTWS	> 0.05	open areas in farmworker homes vs. entry areas in grower homes	farmworker and grower homes in Hood River County		
Q411--Farmworker vs Others										
289	urine	ETHL2	C	Koch 2002	GLM	> 0.05	household occupations		Includes multiple samples per child	
291	urine	ETHL2	C	Koch 2002	GLM	> 0.05	household occupations	samples from spray months in 1998	Includes multiple samples per child	
288	urine	MTHL2	C	Koch 2002	GLM	> 0.05	household occupations		Includes multiple samples per child	
290	urine	MTHL2	C	Koch 2002	GLM	> 0.05	household occupations	samples from spray months in 1998	Includes multiple samples per child	
Q412--Field Worker vs Pesticide Handler										
453	dust	AZM	L	Grossman 2001	MLR-7	0.011	occupational category	farm-worker with high expected exposure		analysis adjusted for respondents' residential proximity to treated field or orchard
Q413--Expected Occupational Exposure										
605	urine	ETHL2	C	Koch 1999	KWAN	0.878	expected occupational exposure		median excretion value per child	
607	urine	ETHL2	C	Koch 1999	KWAN	0.351	expected occupational exposure	samples from spray months in 1988	median excretion value per child	
609	urine	ETHL2	C	Koch 1999	KWAN	0.85	expected occupational exposure	samples from non-spray months in 1988	median excretion value per child	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
604	urine	MTHL2	C	Koch 1999	KWAN	0.93	expected occupational exposure		median excretion value per child	
606	urine	MTHL2	C	Koch 1999	KWAN	0.851	expected occupational exposure	samples from spray months in 1988	median excretion value per child	
608	urine	MTHL2	C	Koch 1999	KWAN	0.387	expected occupational exposure	samples from non-spray months in 1988	median excretion value per child	
448	dust	AZM	L	Grossman 2001	MLR-6	< 0.001	expected occupational exposure	farm-worker		analyses adjusted for respondents' educational status; p < 0.0001
449	dust	AZM	L	Grossman 2001	MLR-6	0.084	expected occupational exposure	farm-worker		analyses adjusted for respondents' educational status
Q414--Occupational Pesticide Exposure										
810	urine	ETHL2	C	Royster 2002	MWU	> 0.05	occupational pesticide exposure			
811	urine	ETHL2	A	Royster 2002	MWU	> 0.05	occupational pesticide exposure			
808	urine	MTHL2	C	Royster 2002	MWU	> 0.05	occupational pesticide exposure			
809	urine	MTHL2	A	Royster 2002	MWU	> 0.05	occupational pesticide exposure			
Q415--Tree Thinning										
831	dust	OPSUM	C	McCauley 2003	WTWS	0.06	occupation as tree thinner		play area; carpet, rug covering or bare floor samples	
Q416--Number with High Contact Exposure in Household										
830	dust	OPSUM	C	McCauley 2003	WTWS	0.007	household members with high pesticide contact jobs	households where member(s) have high pesticide contact jobs	play area; carpet, rug covering or bare floor samples	

D.3.1.5 Category 5: Residential Proximity to Agricultural Fields

Table D.3.1.5 Relationship Comments for Questions in Category 5: Residential Proximity to Agricultural Fields – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q501--Proximity of Home to Pesticide-Treated Farmland/Orchard										
257	urine	4NITR	C	Fenske 2002	MWU	> 0.05	distance - home to pesticide-treated farmland	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values	
256	urine	TCPY	C	Fenske 2002	MWU	> 0.05	distance - home to pesticide-treated farmland	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values	
204	urine	DMTP	C	Loewen-herz 1997	FISH	0.036	distance - home to sprayed field	focus applicator children; visit 2	counts of detects, traces, or non-detects	
193	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	distance - home to sprayed field	focus applicator children; visit 1		
194	urine	DMTP	C	Loewen-herz 1997	MWU	0.062	distance - home to sprayed field	focus applicator children; visit 2		
342	urine	DMTP	C	Lu 2000	MWU	0.009	distance - home to pesticide-treated farmland	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
343	urine	DMDTP	C	Lu 2000	MWU	>= 0.10	distance - home to pesticide-treated farmland	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
299	urine	ETHL2	C	Koch 2002	GLM	> 0.05	residential proximity to a fruit tree orchard		Includes multiple samples per child	
301	urine	ETHL2	C	Koch 2002	GLM	> 0.05	residential proximity to a fruit tree orchard	samples from spray months in 1998	Includes multiple samples per child	
804	urine	ETHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 1, GPS/GIS measure of distance		

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
805	urine	ETHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 1, GPS/GIS measure of distance		
806	urine	ETHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 2, GPS/GIS measure of distance		
807	urine	ETHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 2, GPS/GIS measure of distance		
344	urine	MTHL1	C	Lu 2000	MWU	0.01	distance - home to pesticide-treated farmland	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
346	urine	MTHL1	C	Lu 2000	SLR	0.1	distance - home to pesticide-treated farmland	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	distance represented by categories: <50 ft, 50-200 ft, 200 ft-0.25 mi, >0.25 mi
348	urine	MTHL1	C	Lu 2000	SLR	0.06	distance - home to pesticide-treated farmland	all families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	distance represented by categories: <50 ft, 50-200 ft, 200 ft-0.25 mi, >0.25 mi, reference family
140	urine	MTHL2	C	Curl 2002	OWAN	0.34	distance - home to sprayed field-orig categories			
142	urine	MTHL2	C	Curl 2002	OWAN	0.3	distance - home to sprayed field-rev categories			
584	urine	MTHL2	A	Curl 2002	OWAN	0.3	distance - home to sprayed field-orig categories			
585	urine	MTHL2	A	Curl 2002	OWAN	0.4	distance - home to sprayed field-rev categories			
298	urine	MTHL2	C	Koch 2002	GLM	> 0.05	residential proximity to a fruit tree orchard		Includes multiple samples per child	
300	urine	MTHL2	C	Koch 2002	GLM	> 0.05	residential proximity to a fruit tree orchard	samples from spray months in 1998	Includes multiple samples per child	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
800	urine	MTHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 1, GPS/GIS measure of distance		
801	urine	MTHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 1, GPS/GIS measure of distance		
802	urine	MTHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 2, GPS/GIS measure of distance		
803	urine	MTHL2	A	Royster 2002	MWU	> 0.05	proximity of home to closest agricultural field	visit 2, GPS/GIS measure of distance		
141	dust	AZM	C	Curl 2002	OWAN	0.58	distance - home to sprayed field-orig categories			
143	dust	AZM	C	Curl 2002	OWAN	0.58	distance - home to sprayed field-rev categories			
454	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	distance - home to pesticide-treated farmland	farm-worker		
455	dust	AZM	L	Grossman 2001	MLR-8	> 0.05	distance - home to pesticide-treated farmland	farm-worker		
339	dust	AZM	C	Lu 2000	MWU	0.008	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	
573	dust	AZM	C	McCauley 2001a	SLR	0.32	distance - home to agricultural fields	homes in Hood River County with dust samples		
574	dust	AZM	C	McCauley 2001a	SLR	0.04	distance - home to agricultural fields	homes in Hood River County with detectable dust samples		
411	dust	AZM	C	Simcox 1995	KWAN	> 0.05	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	concentration decreases with increase in distance

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
419	dust	AZM	C	Simcox 1995	KWAN	< 0.001	distance - home to pesticide-treated farmland (orchard)		dust: 2 samples pooled	concentration decreases with increase in distance; p = 0.0001
432	dust	AZM	L	Simcox 1995	KWAN	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
732	dust	AZM	L	Simcox 1995	MLR-2	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
415	dust	AZM	C	Simcox 1995	MWU	0.04	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	
651	dust	AZM	C	Simcox 1995	OWAN	> 0.05	proximity to orchards	(farmer + farm-worker) families	dust: 2 samples pooled	
341	dust	AZMPH	C	Lu 2000	MWU	0.014	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	
349	dust	AZMPH	C	Lu 2000	MWU	0.02	distance - home to pesticide-treated farmland	distance > 0.25 mi - home to pesticide-treated farmland	adjusted by extraction efficiencies	
345	dust	AZMPH	C	Lu 2000	SLR	0.04	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	distance represented by categories: <50 ft, 50-200 ft, 200 ft-0.25 mi, >0.25 mi
347	dust	AZMPH	C	Lu 2000	SLR	< 0.01	distance - home to pesticide-treated farmland	all families	adjusted by extraction efficiencies	distance represented by categories: <50 ft, 50-200 ft, 200 ft-0.25 mi, >0.25 mi, reference family
254	dust	CHLR	C	Fenske 2002	MWU	< 0.01	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	
258	dust	CHLR	C	Fenske 2002	SLR	< 0.001	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	distance represented by categories: <50 ft, 50-200 ft, 200 ft-0.25 mi, >0.25 mi

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
413	dust	CHLR	C	Simcox 1995	KWAN	> 0.05	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	concentration decreases with increase in distance
421	dust	CHLR	C	Simcox 1995	KWAN	0.02	distance - home to pesticide-treated farmland (orchard)		dust: 2 samples pooled	concentration decreases with increase in distance
434	dust	CHLR	L	Simcox 1995	KWAN	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
734	dust	CHLR	L	Simcox 1995	MLR-1	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
417	dust	CHLR	C	Simcox 1995	MWU	> 0.05	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	
655	dust	CHLR	C	Simcox 1995	OWAN	> 0.05	proximity to orchards	(farmer + farm-worker) families	dust: 2 samples pooled	
255	dust	EPAR	C	Fenske 2002	MWU	> 0.05	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	
414	dust	EPAR	C	Simcox 1995	KWAN	0.005	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	concentration decreases with increase in distance
422	dust	EPAR	C	Simcox 1995	KWAN	0.001	distance - home to pesticide-treated farmland (orchard)		dust: 2 samples pooled	concentration decreases with increase in distance
435	dust	EPAR	L	Simcox 1995	KWAN	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
735	dust	EPAR	L	Simcox 1995	MLR-2	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
418	dust	EPAR	C	Simcox 1995	MWU	0.005	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	
657	dust	EPAR	C	Simcox 1995	OWAN	0.001	proximity to orchards	(farmer + farm-worker) families	dust: 2 samples pooled	
658	dust	EPAR	C	Simcox 1995	TWAN-1	0.004	proximity to orchards	(farmer + farm-worker) families	dust: 2 samples pooled	no significant interaction between proximity to orchards and applicator status
660	dust	EPAR	C	Simcox 1995	TWAN-3	> 0.05	proximity to orchards	(farmer + farm-worker) families	dust: 2 samples pooled	significant interaction between occupation (farmer vs farmworker) and proximity to orchards thus significance level for proximity assigned as NS
340	dust	PHSM	C	Lu 2000	MWU	>= 0.10	distance - home to pesticide-treated farmland	(applicator + farm-worker) families	adjusted by extraction efficiencies	
412	dust	PHSM	C	Simcox 1995	KWAN	> 0.05	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	concentration decreases with increase in distance
420	dust	PHSM	C	Simcox 1995	KWAN	> 0.05	distance - home to pesticide-treated farmland (orchard)		dust: 2 samples pooled	concentration decreases with increase in distance
433	dust	PHSM	L	Simcox 1995	KWAN	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
733	dust	PHSM	L	Simcox 1995	MLR-3	> 0.05	How far is the house from a commercial orchard?	(farmer + farm-worker) families	dust: 2 samples pooled	
416	dust	PHSM	C	Simcox 1995	MWU	> 0.05	distance - home to pesticide-treated farmland (orchard)	(farmer + farm-worker) families	dust: 2 samples pooled	
653	dust	PHSM	C	Simcox 1995	OWAN	> 0.05	proximity to orchards	(farmer + farm-worker) families	dust: 2 samples pooled	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
846	dust	OPSUM	C	McCauley 2003	CORR	0.5	distance from home to nearest active orchard			r = -0.09
Q502--Living near Multiple Fields										
818	urine	ETHL2	C	Royster 2002	MWU	> 0.05	living near multiple fields			
819	urine	ETHL2	A	Royster 2002	MWU	> 0.05	living near multiple fields			
816	urine	MTHL2	C	Royster 2002	MWU	> 0.05	living near multiple fields			
817	urine	MTHL2	A	Royster 2002	MWU	> 0.05	living near multiple fields			

D.3.1.6 Category 6: Residential Location

Table D.3.1.6 Relationship Comments for Questions in Category 6: Residential Location – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q601--Urban vs Non-urban										
684	urine	1NAP	A	Adgate 2001	WTAN	0.097	urban vs non-urban	children with 3 urine samples	weighted intra-child means	
750	urine	1NAP	C	Adgate 2001	WTAN	0.13	urban vs non-urban		weighted intra-child means	
751	urine	1NAP	C	Adgate 2001	WTAN	0.1	urban vs non-urban	children with 3 urine samples	weighted intra-child means	
685	urine	MDA	A	Adgate 2001	WTAN	0.16	urban vs non-urban	children with 3 urine samples	weighted intra-child means	
752	urine	MDA	C	Adgate 2001	WTAN	0.099	urban vs non-urban		weighted intra-child means	
753	urine	MDA	C	Adgate 2001	WTAN	0.16	urban vs non-urban	children with 3 urine samples	weighted intra-child means	
686	urine	TCPY	A	Adgate 2001	WTAN	0.019	urban vs non-urban	children with 3 urine samples	weighted intra-child means	
754	urine	TCPY	C	Adgate 2001	WTAN	0.036	urban vs non-urban		weighted intra-child means	
755	urine	TCPY	C	Adgate 2001	WTAN	0.02	urban vs non-urban	children with 3 urine samples	weighted intra-child means	
Q602--Urban vs Rural										
464	urine	TCPY	A	Krinsley 1998	SLR	0.62	rural residences vs. urban residences			
Q603--Border vs Non-border										
463	urine	TCPY	A	Krinsley 1998	SLR	0.86	border residences vs. non-border residences			

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q604--Community										
150	urine	ETHL1	C	Lu 2001	MWU	> 0.05	community	focus children: community 1	average urine samples per child	
151	urine	MTHL2	C	Lu 2001	MWU	> 0.05	community	focus children: community 1	average urine samples per child	
Q605--Vehicle vs House										
145	dust	AZM	C	Curl 2002	SLR	< 0.001	sampling location			measurements increase together, r >0

D.3.2 Behavior Relationships

D.3.2.1 Category 7: Subject's Personal Characteristics

Table D.3.2.1 Relationship Comments for Questions in Category 7: Subject's Personal Characteristics – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q701--Sex										
112	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	sex		weighted intra-child means	
113	urine	MDA	C	Adgate 2001	WTAN	> 0.05	sex		weighted intra-child means	
114	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	sex		weighted intra-child means	
460	urine	TCPY	A	Krinsley 1998	SLR	0.59	sex			n based on degrees of freedom specified for analysis
108	urine	DEP	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
99	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	sex			
109	urine	DETP	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
100	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	sex			
110	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
101	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	sex			
107	urine	DMP	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
98	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	sex			
103	urine	DMTP	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
94	urine	DMTP	A	Aprea 2000	MLR-2	< 0.05	sex			
104	urine	DMDTP	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
95	urine	DMDTP	A	Aprea 2000	MLR-3	< 0.05	sex			
152	urine	ETHL1	C	Lu 2001	MWU	> 0.05	sex of child	focus children: communities combined	average urine samples per child	
111	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
102	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	sex			
601	urine	ETHL2	C	Koch 1999	MWU	0.411	sex		median excretion value per child	
285	urine	ETHL2	C	Koch 2002	GLM-2	0.046	sex		Includes multiple samples per child	model adjusted for variables including residential pesticide use, proximity, and household occupations
105	urine	MTHL2	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
96	urine	MTHL2	A	Aprea 2000	MLR-4	< 0.05	sex			
600	urine	MTHL2	C	Koch 1999	MWU	0.097	sex		median excretion value per child	model adjusted for variables including residential pesticide use, proximity, and household occupations

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
284	urine	MTHL2	C	Koch 2002	GLM-1	0.005	sex		Includes multiple samples per child	model adjusted for variables including residential pesticide use, proximity, and household occupations
153	urine	MTHL2	C	Lu 2001	MWU	> 0.05	sex of child	focus children: communities combined	average urine samples per child	
106	urine	DAP1	A	Aprea 2000	BDPH	> 0.05	sex			multiple comparison test w/ 1 independent variable
97	urine	DAP1	A	Aprea 2000	MLR-9	< 0.05	sex			
533	urine	DAP1	A	Shalat 2003	MVRG-1	0.310	gender of child			p = 0.016 for model; male = 1, female = 0: p =0.3101
641	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	gender of child			p = 0.076 for model; male = 1, female = 0; significance level assumed based on MVRG-1
Q702--Age										
116	urine	1NAP	C	Adgate 2001	WTAN	> 0.05	age		weighted intra-child means	
117	urine	MDA	C	Adgate 2001	WTAN	> 0.05	age		weighted intra-child means	
118	urine	TCPY	C	Adgate 2001	WTAN	> 0.05	age		weighted intra-child means	
461	urine	TCPY	A	Krinsley 1998	SLR	0.75	age as continuous variable			n based on degrees of freedom specified for analysis
671	urine	TCPY	C	Krinsley 1998	SLR	< 0.05	age as continuous variable			
181	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 1		
182	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 1		

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
183	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 1		
184	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 2		
185	urine	DMTP	C	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 2		
186	urine	DMTP	C	Loewen-herz 1997	MWU	0.06	age	focus applicator children; visit 2		
187	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 1		
188	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 1		
189	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 1		
190	urine	DMTP	A	Loewen-herz 1997	MWU	> 0.10	age	focus applicator children; visit 2		
191	urine	DMTP	A	Loewen-herz 1997	MWU	0.038	age	focus applicator children; visit 2		
192	urine	DMTP	A	Loewen-herz 1997	MWU	0.083	age	focus applicator children; visit 2		
179	urine	DMTP	C	Loewen-herz 1997	WSRK	> 0.10	age - paired siblings	focus applicator children; visit 1		
180	urine	DMTP	C	Loewen-herz 1997	WSRK	0.04	age - paired siblings	focus applicator children; visit 2		
581	urine	ETHL1	C	Curl 2002	OWAN	> 0.05	age			
582	urine	ETHL1	A	Curl 2002	OWAN	> 0.05	age			
170	urine	ETHL1	C	Lu 2001	KWAN	0.64	age	focus children: communities combined	average urine samples per child	
603	urine	ETHL2	C	Koch 1999	MWU	0.014	age		median excretion value per child	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
287	urine	ETHL2	C	Koch 2002	GLM-2	0.27	age		Includes multiple samples per child	model adjusted for variables including residential pesticide use, proximity, and household occupations
144	urine	MTHL2	A	Curl 2002	OWAN	0.001	age			
580	urine	MTHL2	C	Curl 2002	OWAN	0.01	age			
146	urine	MTHL2	C	Curl 2002	SLR	< 0.001	age			
583	urine	MTHL2	A	Curl 2002	SLR	< 0.001	age			
602	urine	MTHL2	C	Koch 1999	MWU	0.295	age		median excretion value per child	
286	urine	MTHL2	C	Koch 2002	GLM-1	0.16	age		Includes multiple samples per child	model adjusted for variables including residential pesticide use, proximity, and household occupations
171	urine	MTHL2	C	Lu 2001	KWAN	0.36	age	focus children: communities combined	average urine samples per child	
532	urine	DAP1	A	Shalat 2003	MVRG-1	0.007	age of child in months			p = 0.016 for model
640	urine	DAP1	A	Shalat 2003	MVRG-2	< 0.05	age of child in months			p = 0.076 for model; significance level assumed based on MVRG-1
Q703--Ethnicity										
124	urine	1NAP	C	Adgate 2001	WTAN	0.009	race		weighted intra-child means	
125	urine	MDA	C	Adgate 2001	WTAN	0.035	race		weighted intra-child means	
462	urine	TCPY	A	Krinsley 1998	SLR	0.99	ethnicity			
Q704--Education Level										
466	urine	TCPY	A	Krinsley 1998	SLR	0.44	education level			

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q705--Income										
128	urine	1NAP	C	Adgate 2001	WTAN	0.025	income			p-values not adjusted for multiple comparisons
756	urine	MDA	C	Adgate 2001	WTAN	0.047	income			p-values not adjusted for multiple comparisons
757	urine	MDA	C	Adgate 2001	WTAN	0.07	income			p-values not adjusted for multiple comparisons
758	urine	MDA	C	Adgate 2001	WTAN	0.009	income			p-values not adjusted for multiple comparisons
759	urine	TCPY	C	Adgate 2001	WTAN	0.012	income			p-values not adjusted for multiple comparisons
760	urine	TCPY	C	Adgate 2001	WTAN	0.012	income			p-values not adjusted for multiple comparisons
465	urine	TCPY	A	Krinsley 1998	SLR	0.32	household income			
166	urine	ETHL1	C	Lu 2001	TNR	> 0.05	income level	focus children: communities combined	average urine samples per child	
167	urine	MTHL2	C	Lu 2001	TNR	> 0.05	income level	focus children: communities combined	average urine samples per child	
Q706--Loading from Hand Wipes[a]										
Q707--Hand's Surface Area										
534	urine	DAP1	A	Shalat 2003	MVRG-1	0.49	child's hand area			p = 0.016 for model
642	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	child's hand area			p = 0.076 for model; significance level assumed based on MVRG-1

[a] There is no question grouping for the number 706.

D.3.2.2 Category 8: Child's Behaviors

Table D.3.2.2 Relationship Comments for Questions in Category 8: Child's Behaviors – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q801--Hand-to-Mouth Activity										
212	urine	4NITR	C	Fenske 2002	MWU	> 0.05	child's hand-to-mouth activity	focus children	average of visit 1 and visit 2 values	
208	urine	TCPY	C	Fenske 2002	MWU	> 0.05	child's hand-to-mouth activity	focus children	average of visit 1 and visit 2 values	
624	urine	ETHL1	C	Lu 2001	MWU	> 0.05	hands in mouth	focus children: communities combined	average urine samples per child	
304	urine	MTHL1	C	Lu 2000	MWU	0.6	Do children have hand-to-mouth activity?	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
625	urine	MTHL2	C	Lu 2001	MWU	> 0.05	hands in mouth	focus children: communities combined	average urine samples per child	
Q802--Thumb-Sucking										
213	urine	4NITR	C	Fenske 2002	MWU	> 0.05	child's frequent thumb-sucking	focus children	average of visit 1 and visit 2 values	
209	urine	TCPY	C	Fenske 2002	MWU	> 0.05	child's frequent thumb-sucking	focus children	average of visit 1 and visit 2 values	
626	urine	ETHL1	C	Lu 2001	MWU	> 0.05	thumb sucking	focus children: communities combined	average urine samples per child	
305	urine	MTHL1	C	Lu 2000	MWU	0.6	Do children suck their thumbs?	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
627	urine	MTHL2	C	Lu 2001	MWU	> 0.05	thumb sucking	focus children: communities combined	average urine samples per child	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q803--Hand Washing before Meals										
211	urine	4NITR	C	Fenske 2002	MWU	> 0.05	child's hand washing before each meal	focus children	average of visit 1 and visit 2 values	
207	urine	TCPY	C	Fenske 2002	MWU	> 0.05	child's hand washing before each meal	focus children	average of visit 1 and visit 2 values	
303	urine	MTHL1	C	Lu 2000	MWU	0.2	Do children wash their hands before meals?	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
Q804--Frequency of Handwashing										
172	urine	ETHL1	C	Lu 2001	MWU	> 0.05	frequency of handwashing	focus children: communities combined	average urine samples per child	
173	urine	MTHL2	C	Lu 2001	MWU	> 0.05	frequency of handwashing	focus children: communities combined	average urine samples per child	
Q805--Time Spent Outdoors										
210	urine	4NITR	C	Fenske 2002	KWAN	> 0.05	child's time spent outdoors	focus children	average of visit 1 and visit 2 values	
206	urine	TCPY	C	Fenske 2002	KWAN	> 0.05	child's time spent outdoors	focus children	average of visit 1 and visit 2 values	
302	urine	MTHL1	C	Lu 2000	KWAN	0.8	How many hours/day are children outdoors?	(applicator + farm-worker) families - focus children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
Q806--Loading from Hand Wipe										
535	urine	DAP1	A	Shalat 2003	MVRG-1	0.022	child's hand load			p = 0.016 for model p = 0.0219
642	urine	DAP1	A	Shalat 2003	MVRG-2	> 0.05	child's hand area			p = 0.076 for model; significance level assumed based on MVRG-1

D.3.2.3 Category 9: Dietary Behaviors

Table D.3.2.3 Relationship Comments for Questions in Category 9: Dietary Behaviors – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q901--Type of Drinking Water										
459	urine	TCPY	A	Krinsley 1998	SLR	< 0.19	drinkers of bottled water			
Q902--Consumption of Homegrown Fresh Vegetables										
457	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	consumption of homegrown fresh vegetables			
Q903--Ate Lunch at School										
90	urine	DEP	A	Aprea 2000	BDPH	> 0.05	ate lunch at school			multiple comparison test w/ 1 independent variable
81	urine	DEP	A	Aprea 2000	MLR-5	> 0.05	ate lunch at school			
91	urine	DETP	A	Aprea 2000	BDPH	> 0.05	ate lunch at school			multiple comparison test w/ 1 independent variable
82	urine	DETP	A	Aprea 2000	MLR-6	> 0.05	ate lunch at school			
92	urine	DEDTP	A	Aprea 2000	BDPH	> 0.05	ate lunch at school			multiple comparison test w/ 1 independent variable
83	urine	DEDTP	A	Aprea 2000	MLR-7	> 0.05	ate lunch at school			
89	urine	DMP	A	Aprea 2000	BDPH	> 0.05	ate lunch at school			multiple comparison test w/ 1 independent variable
80	urine	DMP	A	Aprea 2000	MLR-1	> 0.05	ate lunch at school			

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
93	urine	ETHL2	A	Aprea 2000	BDPH	> 0.05	ate lunch at school			multiple comparison test w/ 1 independent variable
84	urine	ETHL2	A	Aprea 2000	MLR-8	> 0.05	ate lunch at school			
Q904--Organic Diet										
822	urine	ETHL2	C	Curl 2003	MWU	0.13	organic vs conventional diet			
823	urine	ETHL2	C	Curl 2003	MWU	> 0.05	organic vs conventional diet	no residential use of OP pesticides		
820	urine	MTHL2	C	Curl 2003	MWU	< 0.001	organic vs conventional diet			p = 0.0003
821	urine	MTHL2	C	Curl 2003	MWU	< 0.05	organic vs conventional diet	no residential use of OP pesticides		

D.3.2.4 Category 10: Family Hygiene Practices

Table D.3.2.4 Relationship Comments for Questions in Category 10: Family Hygiene Practices – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1001--Shoes Removed at Door										
616	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	Are work shoes worn inside house? (group names are reversed to fit Q1001)	focus applicator children; < 200 feet from orchard; visit 1		comparison of % detects, % trace, and % non-detects; group names reversed to fit question Q1001
617	urine	DMTP	C	Carrel 1996	CHSQ	0.083	Are work shoes worn inside house? (group names are reversed to fit Q1001)	focus applicator children; < 200 feet from orchard; visit 2		comparison of % detects, % trace, and % non-detects; group names reversed to fit question Q1001
612	urine	DMTP	C	Carrel 1996	MWU	> 0.10	Are work shoes worn inside house? (group names reversed to fit Q1001)	focus applicator children; < 200 feet from orchard; visit 1		group names reversed to fit question Q1001
613	urine	DMTP	C	Carrel 1996	MWU	0.096	Are work shoes worn inside house? (group names reversed to fit Q1001)	focus applicator children; < 200 feet from orchard: visit 2		group names reversed to fit question Q1001
311	urine	MTHL1	C	Lu 2000	MWU	0.2	Do household members remove shoes at the door?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
440	dust	AZM	L	Grossman 2001	MLR-1	> 0.05	Remove shoes outside home?	fieldworker		
835	dust	AZM	C	McCauley 2003	WTWS	0.46	shoes removed at door			
720	dust	AZM	L	Simcox 1995	MLR-1	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
351	dust	AZM	L	Simcox 1995	MWU	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
306	dust	AZMPH	C	Lu 2000	MWU	0.8	Do household members remove shoes at the door?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
722	dust	CHLR	L	Simcox 1995	MLR-3	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
353	dust	CHLR	L	Simcox 1995	MWU	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
723	dust	EPAR	L	Simcox 1995	MLR-4	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
354	dust	EPAR	L	Simcox 1995	MWU	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
721	dust	PHSM	L	Simcox 1995	MLR-2	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
352	dust	PHSM	L	Simcox 1995	MWU	> 0.05	Do familiy members remove shoes at the door?		dust: 2 samples pooled	
834	dust	OPSUM	C	McCauley 2003	WTWS	0.36	shoes removed at door			
Q1002--Presence of Doormats										
218	urine	4NITR	C	Fenske 2002	TNR	> 0.05	presence of doormats	focus children	average of visit 1 and visit 2 values	
214	urine	TCPY	C	Fenske 2002	TNR	> 0.05	presence of doormats	focus children	average of visit 1 and visit 2 values	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
312	urine	MTHL1	C	Lu 2000	MWU	0.3	Are there doormats outside the main entrance?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
724	dust	AZM	L	Simcox 1995	MLR-1	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
355	dust	AZM	L	Simcox 1995	MWU	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
307	dust	AZMPH	C	Lu 2000	MWU	0.6	Are there doormats outside the main entrance?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
222	dust	CHLR	C	Fenske 2002	MWU	> 0.05	presence of doormats		adjusted by extraction efficiencies	
726	dust	CHLR	L	Simcox 1995	MLR-3	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
357	dust	CHLR	L	Simcox 1995	MWU	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
226	dust	EPAR	C	Fenske 2002	MWU	> 0.05	presence of doormats		adjusted by extraction efficiencies	
727	dust	EPAR	L	Simcox 1995	MLR-4	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
358	dust	EPAR	L	Simcox 1995	MWU	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
725	dust	PHSM	L	Simcox 1995	MLR-2	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
356	dust	PHSM	L	Simcox 1995	MWU	> 0.05	Are there walk-off mats outside main entries?		dust: 2 samples pooled	
Q1003--Presence of Floor Mats										
174	urine	ETHL1	C	Lu 2001	MWU	> 0.05	presence of floor mats	focus children: communities combined	average urine samples per child	
175	urine	MTHL2	C	Lu 2001	MWU	> 0.05	presence of floor mats	focus children: communities combined	average urine samples per child	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1004--Vacuuming Frequency										
221	urine	4NITR	C	Fenske 2002	MWU	> 0.05	vacuuming frequency	focus children	average of visit 1 and visit 2 values	
217	urine	TCPY	C	Fenske 2002	MWU	> 0.05	vacuuming frequency	focus children	average of visit 1 and visit 2 values	
622	urine	ETHL1	C	Lu 2001	MWU	> 0.05	frequency of vacuuming	focus children: communities combined	average urine samples per child	
315	urine	MTHL1	C	Lu 2000	MWU	0.3	How frequently is the carpet vacuumed?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
623	urine	MTHL2	C	Lu 2001	MWU	> 0.05	frequency of vacuuming	focus children: communities combined	average urine samples per child	
310	dust	AZMPH	C	Lu 2000	MWU	0.6	How frequently is the carpet vacuumed?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
225	dust	CHLR	C	Fenske 2002	MWU	> 0.05	vacuuming frequency		adjusted by extraction efficiencies	
229	dust	EPAR	C	Fenske 2002	MWU	> 0.05	vacuuming frequency		adjusted by extraction efficiencies	
Q1005--Vacuuming Indoor Play Areas										
359	dust	AZM	L	Simcox 1995	KWAN	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
728	dust	AZM	L	Simcox 1995	MLR-1	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
361	dust	CHLR	L	Simcox 1995	KWAN	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
730	dust	CHLR	L	Simcox 1995	MLR-3	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
362	dust	EPAR	L	Simcox 1995	KWAN	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
731	dust	EPAR	L	Simcox 1995	MLR-1	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
360	dust	PHSM	L	Simcox 1995	KWAN	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
729	dust	PHSM	L	Simcox 1995	MLR-2	> 0.05	How frequently are children's indoor play areas vacuumed?		dust: 2 samples pooled	
Q1006--Work Clothes Worn Indoors										
219	urine	4NITR	C	Fenske 2002	MWU	> 0.05	wearing of work shoes and work clothes in the house	focus children	average of visit 1 and visit 2 values	
215	urine	TCPY	C	Fenske 2002	TNR	> 0.05	wearing of work shoes and work clothes in the house	focus children	average of visit 1 and visit 2 values	
716	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	clothes changing	focus applicator children; < 200 feet from orchard; visit 1		comparison of % detects, % trace, and % non-detects
717	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	clothes changing	focus applicator children; < 200 feet from orchard; visit 2		comparison of % detects, % trace, and % non-detects
712	urine	DMTP	C	Carrel 1996	MWU	> 0.10	clothes changing	focus applicator children; < 200 feet from orchard; visit 1		
713	urine	DMTP	C	Carrel 1996	MWU	> 0.10	clothes changing	focus applicator children; < 200 feet from orchard: visit 2		

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
313	urine	MTHL1	C	Lu 2000	MWU	0.2	Do household members wear work clothes in the house?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
837	dust	AZM	C	McCauley 2003	TTST	< 0.01	amount of time until work clothes are changed			
308	dust	AZMPH	C	Lu 2000	MWU	0.2	Do household members wear work clothes in the house?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
223	dust	CHLR	C	Fenske 2002	MWU	> 0.05	wearing of work shoes and work clothes in the house		adjusted by extraction efficiencies	
227	dust	EPAR	C	Fenske 2002	MWU	> 0.05	wearing of work shoes and work clothes in the house		adjusted by extraction efficiencies	
836	dust	OPSUM	C	McCauley 2003	TTST	< 0.01	amount of time until work clothes are changed			
Q1007--Work Clothes Mixed with Laundry										
314	urine	MTHL1	C	Lu 2000	MWU	0.8	Do work clothes mix with family laundry?	(applicator + farm-worker) families' children	average of visit 1 and visit 2 values, adjusted by extraction efficiencies	
309	dust	AZMPH	C	Lu 2000	MWU	0.4	Do work clothes mix with family laundry?	(applicator + farm-worker) families	adjusted by extraction efficiencies	
Q1008--Laundering Practices										
220	urine	4NITR	C	Fenske 2002	MWU	> 0.05	laundering practices (work clothes with laundry)	focus children	average of visit 1 and visit 2 values	
216	urine	TCPY	C	Fenske 2002	TNR	> 0.05	laundering practices (work clothes with laundry)	focus children	average of visit 1 and visit 2 values	

ID #	Medium	Chemi-cal	M T	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
706	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	washing practices	focus applicator children; < 200 feet from orchard; visit 1		comparison of % detects, % trace, and % non-detects
707	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	washing practices	focus applicator children; < 200 feet from orchard; visit 2		comparison of % detects, % trace, and % non-detects
702	urine	DMTP	C	Carrel 1996	MWU	> 0.10	washing practices	focus applicator children; < 200 feet from orchard; visit 1		
703	urine	DMTP	C	Carrel 1996	MWU	> 0.10	washing practices	focus applicator children; < 200 feet from orchard: visit 2		
224	dust	CHLR	C	Fenske 2002	MWU	> 0.05	laundering practices (work clothes with laundry)		adjusted by extraction efficiencies	
228	dust	EPAR	C	Fenske 2002	MWU	> 0.05	laundering practices (work clothes with laundry)		adjusted by extraction efficiencies	
Q1009--Number of Days Since Last Vacuuming										
833	dust	OPSUM	C	McCauley 2003	MLR	0.03	number of days since last cleaning of area where sample was taken			partial correlation = 0.45; analysis adjusted for location of sampled area
Q1010--Shower Soon After Work										
866	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	showering	focus applicator children; < 200 feet from orchard; visit 1		comparison of % detects, % trace, and % non-detects
867	urine	DMTP	C	Carrel 1996	CHSQ	> 0.10	showering	focus applicator children; < 200 feet from orchard; visit 2		comparison of % detects, % trace, and % non-detects
862	urine	DMTP	C	Carrel 1996	MWU	> 0.10	showering	focus applicator children; < 200 feet from orchard; visit 1		

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
863	urine	DMTP	C	Carrel 1996	MWU	> 0.10	showering	focus applicator children; < 200 feet from orchard: visit 2		
441	dust	AZM	L	Grossman 2001	MLR-2	> 0.05	Shower after work within 1 hour?	fieldworker		
839	dust	AZM	C	McCauley 2003	TTST	0.89	washed immediately upon arriving home (< 30 min)			
838	dust	OPSUM	C	McCauley 2003	TTST	0.63	washed immediately upon arriving home (< 30 min)			
Q1011[a]										
Q1012--After Work Hygiene Index										
841	dust	AZM	C	McCauley 2003	CORR	0.43	aggregate measure of after work hygiene practices (removing shoes, time before clothes change, wearing clothes indoors, time before washing)			r = 0.17
840	dust	OPSUM	C	McCauley 2003	CORR	0.8	aggregate measure of after work hygiene practices (removing shoes, time before clothes change, wearing clothes indoors, time before washing)			r = 0.05

[a] No questions associated with this Q#.

D.3.2.5 Category 11: Smoking-Related Activities

Table D.3.2.5 Relationship Comments for Questions in Category 11: Smoking-Related Activities – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1101--Current Smoker										
467	urine	TCPY	A	Krinsley 1998	SLR	0.009	current smoker			
Q1102--Subject Smoked										
764	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether subject smoked			PUI was constructed from pesticide use variables: p < 0.00001
769	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether subject smoked			p < 0.00001
Q1103--Exposure to Second Hand Smoke										
474	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	exposure to second hand smoke			

D.3.2.6 Category 12: Work Exposure/Practices

Table D.3.2.6 Relationship Comments for Questions in Category 12: Work Exposure/Practices – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1201--Pesticide Exposure at Work in Past 6 mo										
531	urine	TCPY	A	Krinsley 1998	SLR	0.37	pesticide exposure at work in past 6 mo			
Q1202--Wear Boots while Doing Fieldwork?										
446	dust	AZM	L	Grossman 2001	MLR-4	> 0.05	Wear boots while doing fieldwork?	fieldworker		
Q1203--Wear Gloves while Doing Fieldwork?										
447	dust	AZM	L	Grossman 2001	MLR-5	> 0.05	Wear gloves while doing fieldwork?	fieldworker		
Q1204--Wear Hat while Doing Fieldwork?										
445	dust	AZM	L	Grossman 2001	MLR-3	> 0.05	Wear hat while doing fieldwork?	fieldworker		

D.3.3 Other Relationships

D.3.3.1 Category 13: Related Exposure Levels

Table D.3.3.1 Relationship Comments for Questions in Category 13: Related Exposure Levels – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1301--Detectable Levels in Adult Household Members										
262	urine	DAP2	C	Azaroff 1999	SLGR	< 0.01	numbers of household members > 17 years old excreting detectable AP metabolites	children 8-17 years old	child's detectable AP metabolites - 3 samples combined	
265	urine	DAP2	C	Azaroff 1999	SLGR	0.1	numbers of household members > 17 years old excreting detectable AP metabolites	children 8-17 years old, reporting no fieldwork within past 2 weeks	child's detectable AP metabolites - 3 samples combined	
Q1302--High Levels in Adult Household Members										
266	urine	MTHL4	C	Azaroff 1999	SLGR	< 0.01	numbers of household members > 17 years old excreting high level AP metabolites	children 8-17 years old, reporting no fieldwork of any kind	child's detectable methylated AP metabolites - 3 samples combined	
263	urine	DAP2	C	Azaroff 1999	SLGR	< 0.01	numbers of household members > 17 years old excreting high or very high level AP metabolites	children 8-17 years old	child's detectable AP metabolites - 3 samples combined	
264	urine	DAP3	C	Azaroff 1999	SLGR	< 0.01	numbers of household members > 17 years old excreting high or very high level AP metabolites	children 8-17 years old	child's high or very high level of an AP metabolite - 3 samples combined	

D.3.3.2 Category 14: Health

Table D.3.3.2 Relationship Comments for Questions in Category 14: Health – Grouped by Question and Sorted by Medium, Chemical, Citation and Analysis

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1401--Health Status										
472	urine	TCPY	A	Krinsley 1998	SLR	< 0.66	self-reported health status			
Q1402--Asthma and Allergies										
470	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	ever having had asthma and allergies			
Q1403--Bowel Disease										
761	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	ever having had bowel disease			PUI was constructed from pesticide use variables: p < 0.00001
Q1404--Diabetes										
471	urine	TCPY	A	Krinsley 1998	SLR	> 0.20	ever having had diabetes			
Q1405--Intestinal Disease										
765	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether the subject ever had intestinal disease			p < 0.00001
770	urine	TCPY	A	Krinsley 1998	FSLR	< 0.001	whether the subject ever had intestinal disease	used pesticides both inside and outside, personally or professionally applied		p < 0.00001
469	urine	TCPY	A	Krinsley 1998	SLR	0.004	ever having had intestinal disease			

ID #	Medium	Chemi-cal	MT	Citation	Analysis	p-value	Original Question	Subpopulation Analyzed	Notes on Measurement	Notes on Analysis
Q1406--Ulcer										
468	urine	TCPY	A	Krinsley 1998	SLR	0.02	ever having had an ulcer			

Appendix E

Questions Tracked in the Literature Review

Contents

Tables

Appendix E
Questions Tracked in the Literature Review

E.1 Introduction

Sections 4.2.1 and 4.2.2 describe the process for extracting relationship information from publications identified in the literature review. Sections 4.2.4, 4.2.5, 4.2.6, and Appendices B, C, and D describe the relationships of pesticide or pesticide metabolite concentrations in various medium measurements with questions regarding environment or behavior. This Appendix describes the breadth of the questions extracted from the literature review (section 4.2).

E.2 Questions Tracked for Relationships

As the publications were reviewed for relationships, a level of organization for the relationships was introduced at the question level. As described in section 4.2.2.2, individual question phrasings found in the publications that implied the same question were grouped together. The group of questions was then assigned an abbreviated question phrasing or description. For example, the abbreviated question phrasing or description "inside treated" includes the following questions:

- pesticide use inside
- pesticide used inside in past 6 months
- Was there indoor pesticide application in past 6 months?
- In the past 6 months were any chemicals for the control of fleas, roaches, ants or other insects used inside this house/apartment?

A question #, e.g., Q102, is assigned to each question phrasing for ease of refernce in other tables. The question groupings were then organized into 14 question categories under three risk factors for presentation and discussion purposes. Table E.1 shows the risk factors and question categories used and the number of different abbreviated question descriptions or question groupings included in each.

Table E.1 Distribution of Questions Tracked in Literature Review by Risk Factor and Question Category

Risk Factor		Category		# Question Groupings
#	**Name**	**#**	**Name**	
1	Source	1	Residential pesticide use	32
1	Source	2	Household characteristics	17
1	Source	3	Residential sources (environmental measurements)	3
1	Source	4	Household occupation	16
1	Source	5	Residential proximity to agricultural fields	2
1	Source	6	Residential location	5

Risk Factor		Category		# Question Groupings
2	Behavior	7	Subject's personal characteristics	6
2	Behavior	8	Child's behaviors	6
2	Behavior	9	Dietary behaviors	4
2	Behavior	10	Family hygienic practices	11
2	Behavior	11	Smoking-related activities	3
2	Behavior	12	Work exposure/practices	4
3	Other	13	Related exposure levels	2
3	Other	14	Health	5

Table E.2 shows the abbreviated question phrasing or description for each of the question groupings by risk factor and question category. The detailed question phrasing for a specific relationship, as noted in its publication, can be found in Appendix D.

Table E.2 Questions Tracked in Literature Review by Risk Factor and Question Category

Risk Factor		Category		Question Grouping	
#	**Name**	**#**	**Name**	**#**	**Name**
1	Source	1	Residential pesticide use		
				101	pesticide use
				102	inside treated
				103	inside treated - bathroom
				104	inside treated - bedroom
				105	inside treated - cabinets
				106	inside treated - closets
				107	inside treated - cupboards with dishes
				108	inside treated - dining room
				109	inside treated - family room
				110	inside treated - kitchen
				111	inside treated - living room
				112	inside treated - on baseboards
				113	inside treated - on ceiling
				114	inside treated - on floor
				115	inside treated - on lower walls

Risk Factor		Category		Question Grouping	
#	Name	#	Name	#	Name
				116	inside treated - on upper walls
				117	inside treated - other room
				118	pets treated
				119	outside treated
				120	garden treated
				121	lawn/yard treated
				122	inside or outside treated
				123	previous treatment
				124	level of pesticide use
				125	frequency personal application inside
				126	frequency personal application outside
				127	inside/outside treated by family member
				128	frequency professional application inside
				129	frequency professional application outside
				130	personally mixed pesticide inside
				131	personally mixed pesticide outside
				132	presence during mixing
1	Source	2	Household characteristics		
				201	housing type
				202	property used as a farm
				203	age of house > 10 years
				204	age of house > 20 years
				205	having air conditioning
				206	having central heating
				207	having evaporative cooling
				208	pets in house
				209	pets inside/outside house
				210	pet inside to outside
				211	existence of garden or vegetable garden
				212	ornamental plants or cut flowers
				213	size of household

Risk Factor		Category		Question Grouping	
#	Name	#	Name	#	Name
				214	location of play area
				215	age of house (years)
				216	size of home (sq ft)
				217	number of pets in house
1	Source	3	Residential sources (environmental measurements)		
				301	household dust
				302	loading from household floor dust
				303	outdoor soil
1	Source	4	Household occupation		
				401	agricultural workers in household
				402	household member spraying fields
				403	recent fieldwork
				404	applicator vs farmworker
				405	applicator vs non-applicator
				406	applicator vs reference
				407	applicator+farmworker vs reference
				408	farmer vs farmworker
				409	farmer+farmworker vs reference
				410	farmworker vs grower
				411	farmworker vs others
				412	field worker vs pesticide handler
				413	expected occupational pesticide exposure
				414	occupational pesticide exposure
				415	tree thinning
				416	number in household with high pesticide contact
1	Source	5	Residential proximity to agricultural fields		
				501	proximity of home to pesticide-treated farmland/orchard
				502	living near multiple fields

Risk Factor		Category		Question Grouping	
#	**Name**	**#**	**Name**	**#**	**Name**
1	Source	6	Residential location		
				601	urban vs non-urban
				602	urban vs rural
				603	border vs. non-border
				604	community
				605	vehicle vs house
2	Behavior	7	Subject's personal characteristics		
				701	sex
				702	age
				703	ethnicity
				704	education level
				705	income
				707[a]	hand's surface area
2	Behavior	8	Child's behaviors		
				801	hand-to-mouth activity
				802	thumb-sucking
				803	hand washing before meals
				804	frequency of handwashing
				805	time spent outdoors
				806	loading from hand wipe
2	Behavior	9	Dietary behaviors		
				901	type of drinking water
				902	consumption of homegrown fresh vegetables
				903	ate lunch at school
				904	organic diet
2	Behavior	10	Family hygienic practices		
				1001	shoes removed at door
				1002	presence of doormats
				1003	presence of floor mats
				1004	vacuuming frequency
				1005	vacuuming indoor play areas

Risk Factor		Category		Question Grouping	
#	Name	#	Name	#	Name
				1006	work clothes worn indoors
				1007	work clothes mixed with laundry
				1008	laundering practices
				1009	number of weeks since last vacuuming
				1010	shower soon after work
				1012[b]	after work hygiene index
2	Behavior	11	Smoking-related activities		
				1101	current smoker
				1102	subject smoked
				1103	exposure to second hand smoke
2	Behavior	12	Work exposure/practices		
				1201	pesticide exposure at work in past 6 mo
				1202	wear boots while doing fieldwork
				1203	wear gloves while doing fieldwork
				1204	wear hat while doing fieldwork
3	Other	13	Related exposure levels		
				1301	detectable levels in adult household members
				1302	high levels in adult household members
3	Other	14	Health		
				1401	health status
				1402	asthma and allergies
				1403	bowel disease
				1404	diabetes
				1405	intestinal disease
				1406	ulcer

[a] There is no question grouping with the number 706.
[b] There is no question grouping with the number 1011.

Appendix F

Definition of Chemical Measurement Variables Used in the Analysis of the Yuma Study

Contents

Tables

Appendix F
Definition of Chemical Measurement Variables Used in the Analysis of the Yuma Study

F.1 Introduction

The Children's Pesticide Exposure Study (Yuma Study) described in Section 4.3 included measurements of pesticide and pesticide metabolite concentrations in samples of household and school dust, and children's urine, respectively. The statistical analyses of the Yuma Study data were performed on molar-weighted sums of the concentrations because the levels of individual chemicals/metabolites were very small or below detection level (BLD). This appendix describes the chemicals/metabolites measured in the study and the molar-weighted sums used in the statistical analyses.

F.2 Chemicals/Metabolites Measured

The urine samples were analyzed for the dialkylphosphates (DAPs) shown in Table F.1.

Table F.1 Metabolites Measured in Yuma Study Urine Samples

Name	Description
DEP	diethylphosphate
DETP	diethylthiophosphate
DEDTP	diethyldithiophosphate
DMP	dimethylphosphate
DMTP	dimethylthiophosphate
DMDTP	dimethyldithiophosphate

The household dust and school dust samples were analyzed for pesticides in the classes organophoshates, organochlorines, permethrins, and miscellaneous (Table F.2).

Table F.2 Pesticides Measured in Yuma Study Household and School Dust Samples

atrazine	4,4-' DDT	methyl parathion[a]
azinphos-methyl[a]	diazinon[a]	methoxychlor
bendiocarb	dichlorvos[a]	metolachlor
bensulide	dicofol	pendimethalin
benzamide	dieldrin	cis-permethrin
captan	disulfoton[a]	trans-permethrin
carbaryl	endosulfan 1	o-phenylphenol
carbofuran	endosulfan 2	phorate[a]
alpha-chlordane	ethyl parathion[a]	prometryn

gamma-chlordane	folpet	propoxur
chlorpyrifos[a]	fonophos[a]	simazine
chlorthal-dimethyl	heptachlor	terbufos[a]
cypermethrin	hexachlorobenzene	trifluralin
4,4-' DDD	lindane	
4,4-' DDE	malathion[a]	

[a] Organophosphorous (OP) pesticides

F.3 Chemicals/Metabolites Used in Statistical Analyses

In many cases, the concentration of the pesticides and/or metabolites found in the samples was BLD. Also, it was not as important for this study to identify relationships with the individual pesticides. Thus, for comparability of results across DAPs and to identify trends by categories of pesticides, two types of additional measurement variables were created for the statistical analyses: the molar equivalent of the chemical or metabolite concentration, and molar-weighted sums of chemical or metabolite concentrations.

F.3.1 Molar-Equivalent Concentrations

A molar-equivalent concentration (MEC) is the ratio of the concentration to the molecular weight of the chemical or metabolite. For example,

$$DEP_{MEC}\text{(nmoles/L)} = \text{DEP concentration (ng/L)/154.103 g/mole DEP or}$$

$$Carbaryl_{MEC}\text{(nmoles/g)} = \text{Carbaryl concentration (ng/g) /201.22 g/mole carbaryl,}$$

depending on the units involved.

F.3.2 Molar-Weighted Concentration Sums

Molar-weighted sums were created for the ethylated and methylated DAPs under both approaches (sections 4.3.2 and 4.3.3). Examples of these sums for the concentrations follow.

$$\text{Ethylated DAP Sum}_{MEC}\text{(nmoles/L)} = DEP_{MEC} + DETP_{MEC} + DEDTP_{MEC}.$$

$$\text{Methylated DAP Sum}_{MEC}\text{(nmoles/L)} = DMP_{MEC} + DMTP_{MEC} + DMDTP_{MEC}.$$

Sums were created for the concentrations adjusted, and not adjusted, for creatinine. The Yuma Study report (CDC 2002) identified the sums of the ethylated and methylated DAPs as DEOP and DMOP, respectively. For the data mining approach, the log of each sum was used for the analyses. The sums of the ethylated and methylated DAPs were identified as LWETHSUM and LWMETHSM, respectively.

Under the data mining approach, sums were also created for the concentrations measured in the household and school dust samples (Tables F.3 and F.4). Pesticides that had large numbers of non-detectable measurements or that were similar (e.g., chlordanes) were grouped together into sums.

Table F.3 Molar-Weighted Sums in the Yuma Study Data Mining Analyses

Name	Description[a]
Household Dust	
WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane
WCHLPYRF	Weighted chlorpyrifos
WCYPERMET[b]	Weighted cypermethrin
WDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT
WDIAZNON	Weighted diazonin
WDUSTBAL	Weighted sum of dust analytes except OP pesticides
WDUSTSUM	Weighted sum of all dust analytes
WOPBAL	Weighted sum of OP pesticides except chlorpyrifos and diazinon
WOPHNYLP[b]	Weighted o-phenylphenol
WOPSUM	Weighted sum of OP pesticides
WPERMSUM	Weighted sum of cispermethrin and transpermethrin
School Dust	
SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane
SWCHLPYR	Weighted chlorpyrifos
SWCYPRME[b]	Weighted cypermethrin
SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT
SWDIAZNO	Weighted diazonin
SWDSTBAL	Weighted sum of dust analytes except OP pesticides
SWDUSTSM	Weighted sum of all dust analytes
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos and diazinon
SWOPHNYL[b]	Weighted o-phenylphenol
SWOPSUM	Weighted sum of OP pesticides
SWPERMSM	Weighted sum of cispermethrin and transpermethrin

[a] See Table F.4 for chemicals/metabolites included in sums.
[b] Weighted sums included in Principal Component analyses, but not in CART analyses.

Table F.4 Pesticides Included in Molar-Weighted Dust Sums for the Yuma Study Data Mining Analyses

Pesticide	Household Dust											School Dust										
	WCHDNSUM	WCHLPYRF	WCYPERMET	WDDSUM	WDIAZNON	WDUSTBAL	WDUSTSUM	WOPBAL	WOPHNYLP	WOPSUM[a]	WPERMSUM	SWCHDNSUM	SWCHLPYR	SWCYPRME	SWDDSUM	SWDIAZNO	SWDSTBAL	SWDUSTSUM	SWOPBAL	SWOPHNYL	SWOPSUM[a]	SWPERMSM
atrazine						X	X										X	X				
azinphos-methyl						X	X	X		X							X	X	X		X	
bendiocarb						X	X										X	X				
bensulide						X	X										X	X				
benzamide						X	X										X	X				
captan						X	X										X	X				
carbaryl						X	X										X	X				
carbofuran						X	X										X	X				
alpha-chlordane	X					X	X					X					X	X				
gamma-chlordane	X					X	X					X					X	X				
chlorpyrifos		X					X			X			X					X			X	
chlorthal-dimethyl						X	X										X	X				
cypermethrin			X				X							X				X				
4,4-' DDD				X		X	X								X		X	X				
4,4-' DDE				X		X	X								X		X	X				
4,4-' DDT				X		X	X								X		X	X				
diazinon					X		X			X						X		X			X	
dichlorvos						X	X	X		X							X	X	X		X	

Pesticide	Household Dust											School Dust									
	WCHDNSUM	WCHLPYRF	WCYPERMET	WDDSUM	WDIAZNON	WDUSTBAL	WDUSTSUM	WOPBAL	WOPHNYLP	WOPSUM[a]	WPERMSUM	SWCHDNSUM	SWCHLPYR	SWCYPRME	SWDDSUM	SWDIAZNO	SWDSTBAL	SWDUSTSUM	SWOPBAL	SWOPHNYL	SWOPSUM[a]	SWPERMSM
dicofol						X	X										X	X				
dieldrin						X	X										X	X				
disulfoton						X	X	X		X							X	X	X		X	
endosulfan 1						X	X										X	X				
endosulfan 2						X	X										X	X				
ethyl parathion						X	X	X		X							X	X	X		X	
folpet						X	X										X	X				
fonophos						X	X	X									X	X	X			
heptachlor						X	X										X	X				
hexachlorobenzene						X	X										X	X				
lindane						X	X										X	X				
malathion						X	X	X		X							X	X	X		X	
methyl parathion						X	X	X		X							X	X	X		X	
methoxychlor						X	X										X	X				
metolachlor						X	X										X	X				
pendimethalin						X	X										X	X				
cis-permethrin							X				X							X				X
trans-permethrin							X				X							X				X
o-phenylphenol							X		X									X		X		
phorate						X	X	X		X							X	X	X		X	

Pesticide	Household Dust											School Dust										
	WCHDNSUM	WCHLPYRF	WCYPERMET	WDDSUM	WDIAZNON	WDUSTBAL	WDUSTSUM	WOPBAL	WOPHNYLP	WOPSUM[a]	WPERMSUM	SWCHDNSUM	SWCHLPYR	SWCYPRME	SWDDSUM	SWDIAZNO	SWDSTBAL	SWDUSTSUM	SWOPBAL	SWOPHNYL	SWOPSUM[a]	SWPERMSM
prometryn						X	X										X	X				
propoxur						X	X										X	X				
simazine						X	X										X	X				
terbufos						X	X	X		X							X	X	X		X	
trifluralin						X	X										X	X				

[a] Fonophos was inadvertently excluded from the OP sum for household and school dust samples; however, most of its measurements were below detection limit. Thus, analysis results should not have been significantly affected.
X indicates that molar-weighted pesticide concentration was included in sum.

Appendix G

Data Mining Methodology and Results for the Yuma Study

Appendix G
Data Mining Methodology and Results for the Yuma Study

Contents

Tables

Figures

G.1 Introduction

The second approach performed to evaluate the effectiveness of questions for predicting a child's pesticide exposure level was an analysis of a recent children's pesticide exposure study in Yuma, Arizona, which included questionnaires and measurements. Some aspects of the Yuma Study are described in section 4.3.1, and a report evaluating relationships that address a priori hypotheses has been published (CDC 2002).

As a supplement to the initial findings in the Yuma Study report, the study's data were also evaluated using data mining. Data mining describes an analysis approach that searches through data for relationships that may or may not be defined a priori. This technique is exploratory in nature, in comparison to a confirmatory analysis that is interested in determining whether a proposed relationship adequately explains the observed set of data (Hand 1999). In this appendix the methodology for processing and analyzing the Yuma Study data under the data mining approach is described, and detailed results from the analyses which are summarized in section 4.3.2 are presented.

G.2 Methodology for the Data Mining Approach

The data mining approach focused on identifying relationships that would be useful in classifying children by their organophosphate (OP) pesticide exposure level, and would at least have a higher likelihood of being able to identify children with high or low exposure levels. The first stage of this approach prepared the data for analysis, the second stage reviewed basic relationships in the data, and the third stage performed classification type analyses. The data manipulation and analysis steps were carried out with SPSS versions 11.5 and 12.0 (SPSS, Inc., Chicago, IL), and S-Plus version 6 (Insightful, Inc., Seattle WA).

G.2.1 Stage 1 – Data Preparation

Data from the Yuma Study were reviewed to determine the types of analyses to be performed. Adjustments were made to the data only to facilitate analyses, and not to change the intent of any responses. These adjustments included changes in data formats, the addition of code values to describe certain situations, the creation of additional variables based on the original data, and the identification of subgroups within the study to be used for the analyses. Steps were taken to ensure the quality of any changes made to the data and for any additional variables created.

G.2.1.1 Data Format and Code Value Assignment

Questionnaires usually include questions with defined sets of responses, such as Yes and No, and questions with no predefined set of responses (open-ended responses), such as brands of pesticide used. Several questions from the Yuma Study allowed for the latter type of responses. The unique responses given for these questions were assigned code values in new variables, although subsequently these questions were not included in the analyses. For all questions, code values were also assigned when some form of a no-response was given (e.g., don't know or response missing). The code value assigned in the Yuma Study to identify urine and dust analytical measurements below the detection limit (BDL) was changed to better fit with the types of data analyses performed for this report. A measurement value of 0.01was assigned for a BDL dust concentration, and a value of 0.001 was assigned for a BDL urinary metabolite concentration. These values were assigned before creating the molar-weighted concentrations described in Appendix F.

G.2.1.2 Additional Changes in Questionnaire Variables

To facilitate the analyses in Stages 2 and 3, additional variables based on the original data in the study were created (Table G.2.1). For example, questions about where the child routinely spent their time, and where medical care was received, allowed for multiple responses to be selected from a predefined list. In these check-all-that-apply questions, each response checked was included in a separate variable. For example, if a person checked responses B and D, response B would be noted under the first variable, and response D under the second. If a person checked responses A, B, and E, response A would be noted under the first variable, response B under the second variable, and response E under the third. Based on these two examples, response B could be found under more than one variable, a situation that did not allow for an easy analysis of the responses based on this project's objectives. Thus an additional set of variables was created where each option in the predefined list was associated with one variable. A value of 1 was assigned if the response was selected by the household, and a value of 0 was assigned if the response was not selected. For example, the set of variables CHLDTM1 to CHLDTM7 was created to capture the seven possible responses to where the child routinely spent their time.

In some instances, summaries or revised definitions of the original variables were created. For example, a variable was created to describe the number of rooms sprayed or treated with pesticides (NRMSPRYD) based on the rooms included in the questionnaire. Questions relating to the mother's and father's occupation and whether pesticides were used on the job were reviewed, and additional variables, DADCON2 and MOMCON2, were created to describe whether the parent's job was indoors with or without pesticide use, or outdoors with or without pesticide use.

Table G.2.1 Questionnaire Variables from the Yuma Study Used in Data Mining Analyses, Sorted Alphabetically

Type[a]	Name	Brief Description	Extended Description
Original	ADLTPEST	Non-parent in home works where pesticides used?	Is there another person living in the house (other than parent) who works in a place where pesticides are used?
Additional	ADTPSWK[b]	Any adult works where pesticide used?	Any adult in household works where pesticides used?
Original	AGE[b]	Age of principal child	Age of principal child calculated from date of birth
Original	BASEMENT	Basement treated with pesticides?	Was basement treated with pesticides?
Original	BATHROOM	Bathroom treated with pesticides?	Was bathroom treated with pesticides?
Original	BEDROOM	Bedroom treated with pesticides?	Was bedroom treated with pesticides?

Type[a]	Name	Brief Description	Extended Description
Original	CHEMINHS	Pesticides used inside home last month?	Were chemicals to control insects used inside the house during the last month?
Original	CHEMOUTH	Pesticides used outside home last month?	Were chemicals to control insects used on the exterior or foundation of the house during the last month?
Original	CHILDBED	Child's bedroom treated with pesticides?	Was child's bedroom treated with pesticides?
Original	CHILDFLD	Child worked in fields last month?	Has principal child been to the work field(s) during past month?
Additional	CHLDTM1	Child spends time in another home?	Principal child routinely spends time away from home – in another home
Additional	CHLDTM2	Child spends time at day care center?	Principal child routinely spends time away from home – at day care center
Additional	CHLDTM3	Child spends time at school?	Principal child routinely spends time away from home – at school
Additional	CHLDTM4	Child spends time at sport event?	Principal child routinely spends time away from home – at sport event
Additional	CHLDTM5	Child spends time playing in field?	Principal child routinely spends time away from home – playing in field
Additional	CHLDTM6	Child spends time playing in irrigation water?	Principal child routinely spends time away from home – playing in irrigation water
Additional	CHLDTM7	Child spends time playing outside?	Principal child routinely spends time away from home – playing outside
Original	CLOSEAPP	Distance between home and nearest application of pesticides	In past month, how close to participant's home was the nearest application of agricultural or gardening chemicals?
Additional	DADCON2	Father's occupation -- location and pesticide use	Does father work indoors or outdoors and with or without pesticides?
Additional	DADPEST[c]	Are pesticides used where father works?	Are pesticides used where father works? -- categories
Original	DADWORK[c]	Is the father currently employed?	Is the father currently employed?
Original	DININGRM	Dining room treated with pesticides?	Was dining room treated with pesticides?
Original	ETHNIC	Child's ethnic and racial background	Child's ethnic and racial background
Original	FAMILYRM	Family room treated with pesticides?	Was family room treated with pesticides?
Original	FARFIELD	Distance between home and agricultural field	How far is participant's home from a field where crops are grown?
Original	GPS[b]	Distance between home and field using GPS	Distance from home to field using GPS measurement categories
Original	GRADE	Child's grade	What grade is the principal child in?
Original	HEIGHT	Child's height (inches)	Measurement of principal child's height without shoes (inches)
Original	HOURAWAY	Number hours/wk child not at home	During school year, about how many hours per week does principal child spend away from home?
Original	HOWCHEMO	How pesticides were applied to fields	How were agricultural chemicals applied to field close to participant's home?
Original	HOWCHILD	Child's health in general	Description of principal child's health in general
Original	INSURED	Is child covered by medical insurance?	Is principal child covered by medical

Type[a]	Name	Brief Description	Extended Description
			insurance?
Original	KITCHEN	Kitchen treated with pesticides?	Was kitchen treated with pesticides?
Original	LICE	Child treated for head lice past six months?	Has principal child been treated for head lice in past six months?
Original	LIVEAREA[b]	Children/respondent live in area part-time	Children/respondent live in area < 10 months/year
Original	LIVEYEAR[b]	Number of years child lived at this address	Number of years child lived at this address
Original	LIVINGRM	Living room treated with pesticides?	Was living room treated with pesticides?
Additional	MOMCON2	Mother's occupation -- location and pesticide use	Does mother work indoors or outdoors and with or without pesticides?
Additional	MOMPEST[c]	Are pesticides used where mother works?	Are pesticides used where mother works? -- categories
Original	MOMWORK[c]	Mother now employed (not as housewife)?	Is the mother currently employed?
Original	NCATWRKD	Father's occupation -- categories	Father's occupation -- categories
Original	NCATWRKM	Mother's occupation -- categories	Mother's occupation -- categories
Additional	NRMSPRYD	Number of rooms sprayed last month	Number of rooms in house sprayed with pesticides in past month
Original	NUMADLTS[b]	Number of additional adults in home	Number of non-parent adults in home working with pesticides
Original	OFTCHEMI	How often is home treated for pests?	How often is participant's home treated for pests?
Original	OTHERRM	Other rooms treated with pesticides?	Were other rooms in the house treated with pesticide?
Original	PEOPLIVE[b]	Number people in household including participant	Number people in household including participant
Original	POISON	Anyone treated for pesticide poison?	Has anyone in the household been treated for pesticide poisoning in past year?
Original	SCHOOL	Child's school	School where principal child attends
Original	SEX	Child's gender	Gender of principal child
Original	SPRAYFLD	Child in yard when fields sprayed or dusted?	Does principal child play outside in the yard when the fields are sprayed or dusted?
Original	VEGGIES	How often child eats local fresh fruit/veg?	During the year, how often does principal child eat locally grown fresh fruits or vegetables?
Original	WASHVEGI	How often wash local fresh fruit/veg before eating?	How often are the locally grown fresh fruits and vegetables washed before they are eaten?
Original	WATERSR1	Drinking water source - public/commercial	Source of drinking water in participant's home is public/commercial
Original	WATERSR2	Drinking water source - private well	Source of drinking water in participant's home is private well
Original	WATERSR3	Drinking water source - cistern	Source of drinking water in participant's home is cistern
Original	WEIGHT	Child's weight (lbs)	Measurement of principal child's weight without shoes or other heavy articles (lbs)
Original	WHEEL	Distance between home and field -	Distance from home to field measured with

Type[a]	Name	Brief Description	Extended Description
		rotary wheel	rotary wheel - categories
Original	WHENFILD	Last time child was in work field	When was the last time principal child was in the work field?
Additional	WHERMD1	Family med care at private medical clinic	Where principal child's family receives medical care – private medical clinic
Additional	WHERMD2	Family med care at health dept clinic	Where principal child's family receives medical care – local health department clinic
Additional	WHERMD3	Family med care at other med clinic	Where principal child's family receives medical care – other medical clinic
Additional	WHERMD4	Family med care in Mexico	Where principal child's family receives medical care – Mexico
Additional	WHERMD5	No access to medical care	Where principal child's family receives medical care – no access
Additional	WHERMD6	Family med care at other place	Where principal child's family receives medical care – at other facility
Additional	WHERMD7	Family med care - do not know	Where principal child's family receives medical care – do not know
Original	WHERTIME	Room where child spends most awake time	Room where principal child spends most of their awake time
Original	WHNCHEMO	Last time field treated with pesticides?	When was the last time the field was sprayed or treated with pesticides?
Original	WHOCHEMI	Who applied pesticides inside the house?	Who applied chemicals inside the house?
Original	WHOCHEMO	Who applied pesticides outside house?	Who applied chemicals outside house?
Original	YOUNGSIB[a]	Number of children in household $\leq$ 11 years old	Number of additional children in household $\leq$ 11 years old

[a] Original variables existed in the data set provided from the Yuma Study. Additional variables were created based on the original variables.
[b] Questionnaire variable included in the Principal Component Analysis (section G.2.2.2) but not in the CART analyses (section G.2.4.1).
[b] Questionnaire variable included in the CART analyses (section G.2.4.1) but not in the Principal Component Analysis (section G.2.2.2).

G.2.1.3 Conditional Questions

Most questionnaires use conditional questions, that is, questions that are or are not asked of participants based on their response to a previous question. These questions are part of skip patterns in a questionnaire's administration. An example of a conditional pairing in the Yuma Study is the question CHILDFLD, *Has the child been to work in the fields in the past month?* and WHENFILD, *When was the last time your child was in the work field?* If the response to CHILDFLD (the condition question) is "No", then WHENFILD (the conditional question) was not asked. To ensure that responses on conditional questions accurately and consistently reflected the response to the condition question, responses to the conditional questions that were skipped were coded with a "Not Applicable (NA)" response. The consistent coding between the condition and conditional questions maintains the relatedness between the paired questions: however, for condition questions with a large number of "No" responses, the distribution for the conditional question will be heavily weighted with NA responses. This type of recoding has an impact on the analysis that needs to be recognized.

G.2.1.4 Non-Response Categories

Questionnaires usually include non-response categories to handle response outcomes such as "Missing," "Refused," "Not Applicable," and "Don't Know." The Yuma Study allowed for Don't Know, Refused-to-Answer, and Missing as non-response categories. The very small number of Refused-to-Answer responses was combined with the Missing responses into a No Response category. Even though the distinctions are somewhat gray, the Don't Know and No Response categories were assigned distinct code values in order to evaluate whether they represented groups with different exposure levels.

Data with non-responses offer analysis challenges. When analyzing one questionnaire variable with non-responses, the cases with No Response can be excluded from the analysis, or the cases with responses can be compared to those with No Response to determine if they have different measurement values. The chosen solution becomes more complex when the analysis includes several questionnaire variables simultaneously. If only the cases with responses to all questions are analyzed, the number of cases can decrease to levels that are not necessarily representative of the population measured. If variables with some non-responses are excluded from the analysis, potentially useful information from the responses is discarded. Imputation is sometimes used as a solution for analyzing such incomplete data sets; however, because these methods usually require an a priori knowledge of relationships between the variables, it was not considered a feasible option for this project.

An approach for handling non-responses in the statistical analyses was designed. Numeric codes were assigned to the non-response categories to preserve the sample size in the analysis, and to allow the investigation of differences between respondents and non-respondents, if desired. Variables that had nominal categories were assigned numeric codes for analysis (e.g., 1=yes, 2=no). The basis for the coding approach considers a variable's categories or values as a continuum of relative impact to exposure. This continuum could be applied to categories with an underlying ordinality, or to numeric values. Code values for the "Not Applicable," "Don't Know," and "No Response" categories were assigned to be consistent with the question's continuum of exposure impact as follows:

- category with most impact on exposure level
- . . .
- . . .
- category with least impact on exposure level
- Don't Know (assumes no potential impact)
- Not Applicable (implies no potential impact)
- No Response (assumes no potential impact).

The values assigned to the non-response categories depended on which categories actually had responses and the values already assigned to the response categories. Tables G.2.2 and G.2.3 illustrate this coding scheme with two examples.

Table G.2.2 Example of Questionnaire Variable CHEMINHS with Code Values Assigned for "No Response" and "Not Applicable" Where Exposure Impact Is Less Likely with the "No" Response than with the "Yes" Response

Code	Description
1	Yes
2	No
3	Not Applicable
4	No Response

Table G.2.3 Example of Questionnaire Variable VEGGIES with Code Values Assigned for "No Response" and "Do Not Know" Where Exposure Impact Is Less Likely When Child Eats Locally Grown Fresh Fruit Fewer Times Per Year

Code	Description
-1	No Response
0	Do Not Know
1	Never
2	About once a year
3	About once a month
4	About once a week
5	About once a day

The number of non-responses in the Yuma Study was small for the variables analyzed. Thus analysis comparing differences between respondents and non-respondents on a particular question was not pursued. The coding scheme for non-responses has limitations; however, it provided an underlying ordinality for the variables, where needed, and facilitated subsequent analyses.

G.2.1.5 Changes in Analytical Measurement Variables

The analytical measurement (AM) data were reviewed with preliminary analyses, and additional AM variables were created based on the original measurement variables. Variables were created for each chemical to indicate if the concentration value was above or below predefined cut-points. The cut-point used for the urinary metabolites was the 90th percentile, based on EPA's definition of a high-exposure level (USEPA 1992). Many pesticides in the dust samples had a large proportion of concentrations that were below the limit of detection (BLD). The 80th percentile was used as the cutpoint for all dust chemicals to broaden the range of higher concentration values.

The low number of detectable measurements for many of the dust chemicals and urine metabolites suggested the need for a second type of variable, the sum of molar-weighted measurements for groups of related chemicals or metabolites. Several chemicals with more detectable measurements such as chlorpyrifos, diazonin, cypermet, and o-phenylphenol were included in some of the weighted sums and were defined as individual molar-weighted variables. Appendix F describes the molar-weighting process and the chemicals/metabolites included in the molar-weighted sums. Some examples of the summed measurements are the sum of ethylated DAPs (DEP + DETP + DEDTP), all dust chemicals, and all available OP dust chemicals. Table G.2.4 shows the list of AM variables used in the Stage 2 and Stage 3 analyses. Based on their distributions, the AM data were log-transformed, where appropriate for the statistical analysis performed.

Table G.2.4 Analytical Measurement Variables Used in the Yuma Study Data Mining Analyses

Name	Description[a]
Urine from Child	
LWETHSUM	Log of weighted sum of DEP, DETP, and DEDTP (adjusted for creatinine)[b]
LWMETHSM	Log of weighted sum of DMP, DMTP, and DMDTP (adjusted for creatinine)[c]
Household Dust	
WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane
WCHLPYRF	Weighted chlorpyrifos
WCYPERMET[d]	Weighted cy-permethrin
WDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT
WDIAZNON	Weighted diazinon
WDUSTBAL	Weighted sum of dust analytes except OP pesticides
WDUSTSUM	Weighted sum of all dust analytes
WOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol
WOPHNYLP[d]	Weighted o-phenylphenol
WOPSUM	Weighted sum of OP pesticides
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin
School Dust	
SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane
SWCHLPYR	Weighted chlorpyrifos
SWCYPRME[d]	Weighted cy-permethrin
SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT
SWDIAZNO	Weighted diazinon

Name	Description[a]
SWDSTBAL	Weighted sum of dust analytes except OP pesticides
SWDUSTSM	Weighted sum of all dust analytes
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol
SWOPHNYL[d]	Weighted o-phenylphenol
SWOPSUM	Weighted sum of OP pesticides
SWPERMSM	Weighted sum of cis-permethrin and trans-permethrin

[a] See Appendix F for detailed descriptions.
[b] DEP = diethylphosphate, DETP = diethylthiophosphate, DEDTP = diethyldithiophosphate
[c] DMP = dimethylphosphate, DMTP = dimethylthiophosphate, DMDTP = dimethyldithiophosphate.
[d] Measurement variable included in Principal Component Analysis (section G.2.2.2) but not in CART analyses (section G.2.4.1).

Twenty-five school dust samples were taken at six of the participating schools. These measurements from a specific school and grade were added to the records of all principal participants in that school and grade. If more than one room was sampled within a school for a particular grade level, the school dust measurements for the school/grade combination were averaged before being merged with the principal participant's information.

G.2.2 Stage 2 – Review of Basic Relationships

G.2.2.1 Simple Indicators of Exposure Levels

As an initial evaluation of potential predictors of high exposure levels, three types of analyses were performed between the chemicals/metabolites and the questionnaire or grouping variables: contingency table analysis, Kruskal-Wallis (non-parametric one-way analysis of variance), and the median test. The two-level AM variables (section G.2.1.5) used in the contingency table analyses described the concentrations that were "high" and not high. The actual AM measurement values were used for the other analyses. Forty-nine of the original questionnaire variables in the categories of demographics, residential pesticide use, local pesticide use, activities of the principal participant, drinking water, parents' work environment, and medical care, were used as grouping variables for the analyses. An example of a grouping variable in the Kruskal-Wallis analysis is the variable that divides the data into the subgroups (e.g., male and female) whose measurements are compared in the analysis. Since house dust measurements are potential indicators of exposure, rank correlations between the dust measurements and the urine measurements were also calculated. These analyses were performed using the questionnaire responses and available measurements from the 152 principal participants/households. Results from these analyses are summarized in section G.3.1.

G.2.2.2 An Underlying Structure

Within a set of variables like the questionnaire data, the questions usually cluster into groups by subject matter. The groups may be predefined based on the questionnaire design, or based on the relationships that exist between the actual responses. Principal Component Analysis (PCA) was performed on the Yuma Study data to look at the type of question groupings, or dimensions, existing in the data set. Looking at this underlying structure in the data helps to understand relationships that appear or do not appear in the Stage 3 analyses. Knowing which questions may be measuring similar information can also help reduce the number of questions used in future studies, or may offer options for surrogate questions to be used.. Note that no one question in a PCA dimension represents the dimension.

PCA is one of the oldest and best known of the multivariate analysis techniques (Hotelling 1933, Jackson 1991, Jolliffe 1986, and Jolliffe 2002). Its central idea is "to reduce the dimensionality of a data set in which there are a large number of interrelated variables, while retaining as much as possible of the variation present in the data set" (Jolliffe 1986). PCA determines principal components (PCs) as linear combinations of the questionnaire variables that maximally discriminate among the cases. PCs are also known as latent or underlying variables or dimensions.

PCA derives the PCs in an order based on the magnitude of the eigenvalue, a measure of the variability accounted for by a PC. The PCs are designed to account for as high a percentage of variation among the questionnaire variables with as few PCs as possible. The dimensions in the data described by the PCs are orthogonal to, or uncorrelated with, each other. The result of a PCA is a matrix of loading values for each variable, with respect to each PC that has been identified. If the data are standardized, that is, the PCA is generated from a correlation matrix of the variables (as in these analyses) rather than a covariance matrix, the loading value represents the variable's relative weight in, or importance to, that PC. Subsequently the loading values range from -1.0 to 1.0, and represents a variable's correlation with the PC.

Traditionally PCA is performed on continuous or at least ordinal type variables; however, most of the questionnaire variables in the Yuma Study are categorical. Jolliffe (1986, 2002) confirms that when using PCA as a descriptive, rather than inferential, technique, assumptions about the type of data included are not required. He also notes that although linear functions of nominal or non-continuous variables may be harder to interpret, "the basic objective of PCA, to summarize most of the 'variation' which is present in the original set of *p* variables, using a smaller number of composite variables (i.e., PC scores) can be achieved regardless of the nature of the original variables."

A varimax rotation is used with the PCA to produce PCs which are more parsimonious, and PCs with eigenvalues $\geq$ 0.7 rather than $\geq$ 1.0 (Jolliffe 1986) are reviewed. Variables are associated with a specific rotated PC based on their correlation with it. Loading values from the PCAs range from -1.0 to 1.0, and variables with an absolute loading value $\geq$ 0.6 for a PC were considered descriptive of that component, that is, having a medium range of correlation with the PC. Additional details for a similar use of PCA can be found in USEPA (2004a).

G.2.3 Subpopulations Selected for Analysis

The analyses planned for Stages 2 and 3 were different than those performed in CDC (2002), because these analysis techniques were not amenable to handling within-household variability, and the objectives of the analyses were different. The Yuma Study included principal participants and siblings, however, questionnaire responses were collected only for the principal participants, and only demographic data, such as gender, age, height, and weight, were collected for the siblings. Although certain household questionnaire responses would apply to both principal participants and siblings (e.g.., questions analyzed in CDC(2002)), the responses for other household questions might not be the same for all of its participating children. Since several questionnaire responses and the school dust measurements were not collected for siblings, the analyses reported here were performed only on data from principal participants. To further limit the impact of factors relating to children not defined in the initial study design, the principal participants from kindergarten and first grade, and from the initial eight schools, were selected as the core set of participants for the data mining analysis (Stage 3). This approach reduced potential confounding factors that might affect the analysis results. Additionally, only those principal participants (130) with available and non-suspect urine measurement data were included.

G.2.4 Stage 3 – Classification Approach

In order for future study designs to be able to produce either an enriched population (i.e., a larger percentage of individuals with higher exposure levels), or to eliminate from further processing individuals with lower exposure levels, a screening tool must be able to identify the characteristics of potential study participants that classify them into one category of interest or the other. The tool does not, however, need to predict the participant's exposure measurement, as much as an exposure level.

The selected data mining approach creates groups of participants, described by questionnaire responses and/or measurements, with indicators of the likelihood of their group's exposure level. Researchers can then identify the groups from the data mining analysis that best fit their population of interest, and can then compare potential participants to the groups' descriptors in the screening process. The accuracy of the classification of potential participants depends on similarities in the populations, the number of respondents used in the data mining analysis, and the level of classification error in the data mining model. These caveats are similar to caveats put forth in any predictive modeling situation.

G.2.4.1 Classification Techniques

The data mining technique Classification and Regression Trees (CART) was selected as the primary type of analysis in this stage. CART is a method of defining subsets of the population of interest, in this case the Yuma Study principal participant children, where the between-subset variability of the target or dependent variable is maximized, and the within-subset variability is minimized. In these analyses, the target or dependent variables are LWETHSUM and LWMTHSM (Table G.2.4). The subsets are defined in terms of predictor or independent variables (questions or other concentrations) that can be nominal, ordinal or continuous in nature. One of the benefits of CART is that the distributional assumptions for the target and predictor variables are much less restrictive than for traditional types of analyses like regression or discriminant analysis that might be considered as analysis options. The output from CART describes the population subsets in terms of categories or ranges of values for the predictor variables.

Stage 3 looks at the relationships between a dependent variable and a set of independent variables to identify a model of predictors and their interactions that optimally classify the principal participants by their exposure level. The term exposure level is used generically here to describe the dependent variable of the model whether it is a concentration in household dust or a personal sample such as urine. A classification map or scheme defines subsets of the sampled population that have different levels of the dependent variable and provides characteristics of those subsets in terms of the predictors' values. An example of a classification map is included below. Data mining techniques like CART are used considerably, though not exclusively, in consumer preference and health studies (Magidson 1993, Weitlisbath 1999, The Measurement Group Website). Two examples of CART from the exposure assessment field are USEPA (2004a) and Roy (2003). The mapping or outcome from CART is called a tree and is similar to a decision tree diagram (Two Crows 1999). Breiman (1984) describes such mappings as classification trees or regression trees, depending on whether the dependent variable is categorical or continuous, respectively. The CART mapping partitions the data into subsets through an iterative and sequential process. Potential predictors are considered for each subset of the data locally, that is, independent of what fits for the other subsets. This aspect is different than interactions in traditional modeling analyses which are defined globally across the data set. The goal of the classification technique is to define the best set of rules or characteristics for identifying the class to which a case belongs (Breiman 1984).

CART performs the analysis in a sequential manner that results in the tree output. For a subset of participants or node of the tree, that is, being considered for further splitting or subdividing, CART looks across all the predictors, and at all categories or values in each predictor, to identify the predictor and values that create the next best split into two additional nodes. The best split is defined as the one producing the largest reduction in variance for the tree as a whole where variance for the tree is defined as the sum of the variance of the dependent variable within all of the nodes. Another technique, Chi-Square Automatic Interaction Detection, CHAID, (Magidson 1993), performs an analysis similar to CART, but can split each node into more than two subsets. The S-Plus version of CART was used for the results described below. Pruning and shrinking trees are refining techniques available for CART and are used to identify an overall "best" model for each target variable. These techniques, however, were not performed for this study.

G.2.4.2 Sample Classification Tree Output

The tree in Figure G.2.1 is an example of CART output from S-Plus. The tree is based on 131 principal participants with log measurements of the molar-weighted sum of ethylated DAPs, LWETHSUM. Note that this example is not one of the final analyses described in section G.3.3. Node 1 is the starting point and includes all 131 participants. Some of the node numbers in Figure G.2.1 are shown in a larger bolded font and correspond to the node numbers in Figure G.2.2. Figure G.2.2 lists the characteristics of the splits (predictors and values) at each node and the mean and standard deviation of the dependent variable for each node. More details on the tree output follow Figure G.2.2.

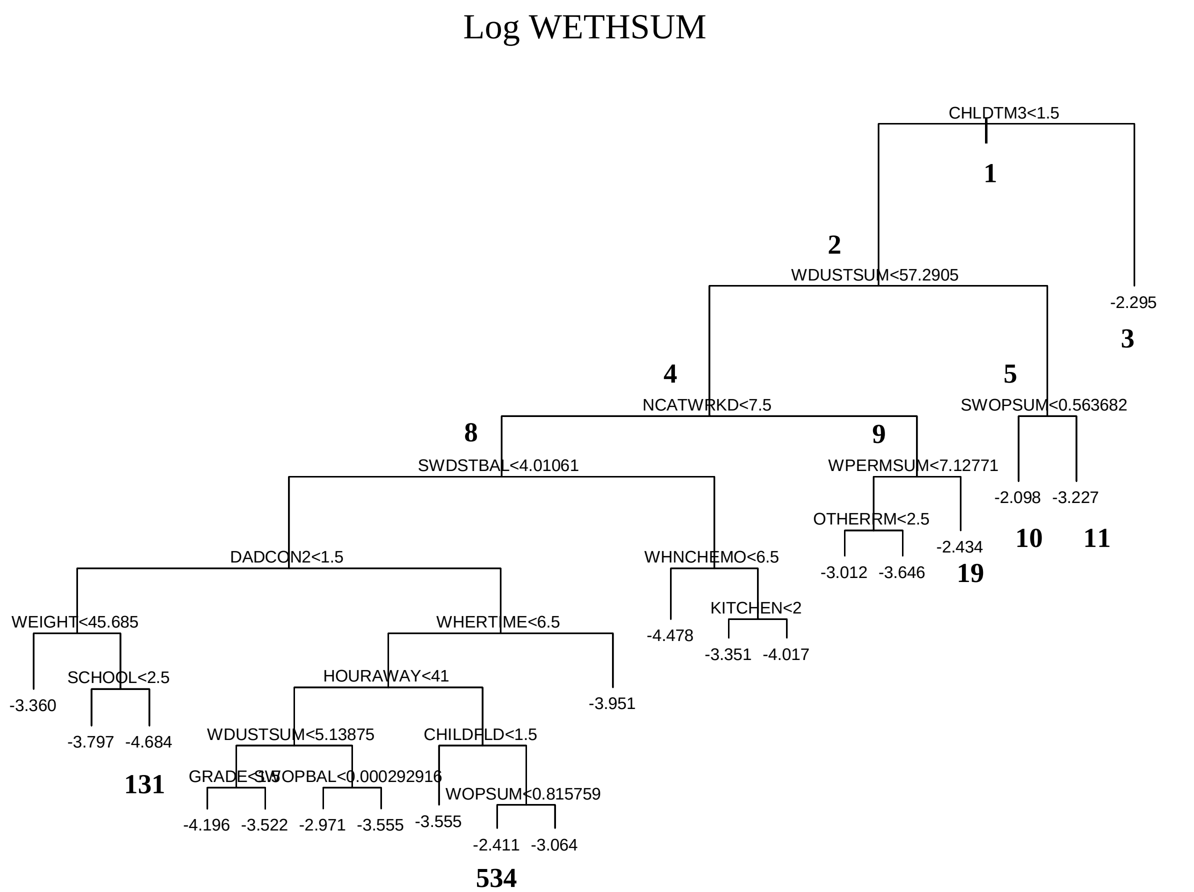

Figure G.2.1 Example CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions and House and School Dust Measurements for Yuma Study (131 participants): CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean

  1) root 131 91.37000 -3.352
    2) CHLDTM3<1.5 123 78.88000 -3.421
      4) WDUSTSUM<57.2905 111 63.72000 -3.503
        8) NCATWRKD<7.5 91 51.88000 -3.587
         16) SWDSTBAL<4.01061 72 37.41000 -3.462
           32) DADCON2<1.5 19  7.97400 -3.847
             64) WEIGHT<45.685 8  1.21300 -3.360 *
             65) WEIGHT>45.685 11  3.49400 -4.200
              130) SCHOOL<2.5 6  1.16900 -3.797 *
              131) SCHOOL>2.5 5  0.17690 -4.684 *
           33) DADCON2>1.5 53 25.62000 -3.324
             66) WHERTIME<6.5 46 21.38000 -3.229
              132) HOURAWAY<41 26  8.68300 -3.468
                264) WDUSTSUM<5.13875 11  2.24800 -3.828
                  528) GRADE<1.5 5  0.05032 -4.196 *
                  529) GRADE>1.5 6  0.96070 -3.522 *
                265) WDUSTSUM>5.13875 15  3.96500 -3.205
                  530) SWOPBAL<0.000292916 9  1.55700 -2.971 *
                  531) SWOPBAL>0.000292916 6  1.18200 -3.555 *
              133) HOURAWAY>41 20  9.26200 -2.918
                266) CHILDFLD<1.5 6  2.02800 -3.555 *
                267) CHILDFLD>1.5 14  3.75200 -2.644
                  534) WOPSUM<0.815759 9  1.04500 -2.411 *
                  535) WOPSUM>0.815759 5  1.33600 -3.064 *
             67) WHERTIME>6.5 7  1.07700 -3.951 *
         17) SWDSTBAL>4.01061 19  9.08600 -4.060
           34) WHNCHEMO<6.5 9  2.34400 -4.478 *
           35) WHNCHEMO>6.5 10  3.75400 -3.684
             70) KITCHEN<2 5  0.48550 -3.351 *
             71) KITCHEN>2 5  2.16000 -4.017 *
        9) NCATWRKD>7.5 20  8.28100 -3.121
         18) WPERMSUM<7.12771 15  4.09700 -3.350
           36) OTHERRM<2.5 7  0.17600 -3.012 *
           37) OTHERRM>2.5 8  2.41900 -3.646 *
         19) WPERMSUM>7.12771 5  1.04100 -2.434 *
      5) WDUSTSUM>57.2905 12  7.50400 -2.662
       10) SWOPSUM<0.563682 6  1.89600 -2.098 *
       11) SWOPSUM>0.563682 6  1.78500 -3.227 *
    3) CHLDTM3>1.5 8  2.97500 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 10, 3, 534, and 19. Node 131 has the lowest average level of Log(WETHSUM). The characteristics of participants in these nodes are described below. Table G.3.3 describes the code values for the questionnaire predictors. Table G.2.4 describes the dust measurement predictors. The nodes are numbered in bold on Figure G.2.1 and the final split characteristics are bolded in the above tree description.

- **Node 10** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM > 57.2905, and SWOPSUM < 0.563682. The average level of WETHSUM for these participants was 0.1227 nmoles/g (Log(WETHSUM) = -2.098).
- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child did not spend time in school. These cases had an average level of 0.1008 nmoles/g WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table 4.3.17 in Results.
- **Node 534** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD < 7.5, SWDSTBAL < 4.1061, DADCON2 > 1.5, WHERTIME < 6.5, HOURAWAY > 41, CHLDFLD > 1.5, and WOPSUM < 0.815759. The average level of WETHSUM for these participants was 0.0897 nmoles/g (Log(WETHSUM) = -2.411).
- **Node 19** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD > 7.5, and WPERMSUM > 7.12771. The average level of WETHSUM for these participants was 0.0877 nmoles/g (Log(WETHSUM) = -2.434).
- **Node 131** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD < 7.5, SWDSTBAL < 4.1061, DADCON2 < 1.5, WEIGHT < 45.685 (pounds), and SCHOOL > 2.5. The average level of WETHSUM for these participants was 0.0092 nmoles/g (Log(WETHSUM) = -4.684).

Figure G.2.2 Example CART Analysis of LWETHSUM[LOG(WETHSUM)] with All Questions and House and School Dust Measurements Yuma Study (131 Participants): Summary Statistics for Nodes in CART Tree (Figure G.2.1)

Sixty-three of the questions in Table G.2.1 and 18 of the measurements in Table G.2.4 were used as potential predictors for this analysis. The tree is grown at the first level by identifying the predictor (question or dust measurement) that splits the 131 cases into the two most distinct subsets of participants, that is, the subsets that have the largest mean difference for LWETHSUM. The first predictor selected is CHLDTM3, the child spends time at school. The groups are divided at the CHLDTM3 value of 1.5,as noted above the node's two branches (Figure G.3.3.a). If the case has a CHLDTM3 value < 1.5 (Node 2), it falls in the subset with the lower mean (-3.421) for LWETHSUM. If the case has a CHLDTM3 value > 1.5 (Node 3), it falls in the subset with the higher mean (-2.295) for LWETHSUM.

The process of identifying another predictor that creates the most "distinct" subsets is performed for each node, independent of the other nodes. Node 3 cannot be further subdivided given the available predictors, and the splitting options defined for the CART analysis. (Default options for the S-Plus implementation of CART (Venables 1994) were used. This node is an example of a terminal node or final subset of the tree. Node 2 is split by WDUSTSUM, the weighted sum of all dust analytes, at the value of 57.0295 nmoles/g. Nodes 10 and 11 split Node 5 by values of SWOPSUM, the weighted sum of OPs in school dust, at the value of 0.563682 nmoles/g. Nodes 8 and 9 split Node 4 by the categories of the father's occupation, NCATWRKD (Table G.3.3). The number of significant digits shown for the split points of the measurement variables is determined by the S-Plus program, and is not indicative of the precision available in the measurement data.

In some cases, a node may be split in an unexpected manner. For example, one might expect that lower levels of SWOPSUM (Node 10) would be associated with lower levels of LWETHSUM. But Node 11, with the higher level of SWOPSUM, has the lower mean value. This seeming inconsistency may be due to one of several factors: the level at which the tree's growth was stopped, whether the predictor is a surrogate for one that is not available in the list of questions or measurements, or whether this relationship applies only to this subset, and is not indicative of the relationship in other subsets. A node is considered terminal if the CART algorithms cannot split it further given the available predictors and the splitting rules selected. Nodes 3, 10, 11, 19, 534, and 131 are examples of terminal nodes.

Figure G.2.2 describes each intermediate and terminal node in Figure G.2.1 with additional information. The table in Figure G.2.2 shows levels of indentation for contiguous node splits. Each node in the tree (Figure G.2.1) is represented in the table (Figure G.2.2); however, not all of the node numbers in the tree are shown in larger bolded font. Node 1 is considered the root node in the table. At the bottom of Figure G.2.2, Node 10, for example, shows the splitting value from node 5 to be SWOPSUM < 0.563682 nmoles/g. Node 10 has six cases, a standard deviation for LWETHSUM of 1.896, and a mean value of LWETHSUM of -2.098. The * indicates that Node 10 is a terminal node. To identify the rest of Node 10's characteristics, follow the rows above node 10 with less indentation levels. Node 5 is the next left-most indentation, and indicates the participants had WDUSTSUM values > 57.2905 nmoles/g. The next left-most indentation from Node 5 is Node 2 (at the top of the list), which describes the characteristic that CHLDTM3 < 1.5 (YES). Thus the complete description of participants in Node 10 is: CHLDTM3 <1.5, WDUSTSUM > 57.2905 nmoles/g, and SWOPSUM < 0.563682 nmoles/g.

At this point, pruning or shrinking techniques could be used to define a best model since not every division of nodes makes a significantly better model. These techniques would be comparable to the deletion of predictors in a stepwise regression analysis after they have been included in the model: however, for this project, pruning and shrinking were not performed. The tree produced from the initial CART analysis was accepted as an indicator of the predictors useful in classifying a child's exposure level. Only the predictors selected and not the specific split points for the selected predictors were considered important for this project's broad objective which is to identify useful predictors rather than to create a predictive model.

Several factors impact how well the resulting tree is able to classify the subsets and which predictors are selected for classification. If the distribution of the dependent variable values covers a small range of close-knit measurements, it may be difficult for the technique to identify distinctions among the values. In this case, the technique may pick up minute distinctions, and the resulting predictors may seem inconsistent with expectations. The level of measurement values can also affect the interpretation or validity of the analysis. If the majority of values are not of a practical significance in measuring a child's pesticide exposure level, that is, they are BDL or less than some predefined threshold, the predictors resulting from the analysis may be spurious and not useful. The number of cases and the predictors included in an analysis can also impact the predictors selected for the tree. The smaller the number of cases analyzed, the less information is available to the algorithms to ground the relationships between predictors and the target or dependent variable.

When comparing predictors selected under different scenarios, it is also important to consider which predictors were available for the analysis. For example, the analyses of questions with LWETHSUM as the dependent variable will show differences because one scenario (ALL) uses 63 questions, and another scenario (LTD) uses only 29 of the 63 questions. Thus predictors selected under the LTD scenario may be replaced by other predictors in the ALL scenario. These exchangeable predictors can be considered potential surrogate questions. Some questions may appear under both scenarios, and can be considered more globally or universally useful.

The CART tree output will be used to identify questions or groups of questions that classify the principal participants by exposure level. They will not be used to predict exposure levels as with a regression equation. Instead a user might look at Figure G.2.2 and see that the node with the highest mean exposure level is node 10 (LWETHSUM = -2.098, WETHSUM =0.1227 nmoles/g). The group of participants with the second highest exposure level is node 3 (LWETHSUM = -2.295, WETHSUM = 0.1008 nmoles/g). Both nodes are based on a small number of measurements, because of the splitting rules used and the number of cases with higher LWETHSUM values out of the 131 cases. The characteristics of participants in Nodes 10 and 3 might be used as screening characteristics to identify children with higher pesticide exposure levels. The group with the lowest exposure level is node 131 (LWETHSUM = -4.684, WETHSUM = 0.0092 nmoles/g). The characteristics of participants in Node 131, 34, and 71, for example, might be used as screening characteristics to exclude children with lower pesticide exposure levels. It is important to recognize, however, that the splitting values for the predictors WDUSTSUM and SWOPSUM are particular to this study group, and the same values may not be as useful in splitting for other study populations. With a larger number of cases to analyze, a cross-validation could better substantiate the split values for the population of interest. This does not take away from the potential usefulness that household pesticide dust measurements and OP dust measurements in the school may have in the screening process.

Lastly, in comparing the means of the nodes, the researcher needs to consider whether the means of the higher exposure level nodes are high in terms of potential exposure impact, or whether they are not much different than the means in the other nodes. For example, the difference between the mean of Nodes 10 (highest mean) and 131 (lowest mean) is about than 0.1135 nmoles/g Creatinine. The researcher might question whether that is a practical difference for the adjusted concentration level, and whether the mean of 0.1227 nmoles/g Creatinine for Node 10 is the exposure level of interest, e.g., high enough for a potential health effect. Data mining techniques operate on mathematical relationships and judgments; the latter evaluation is a judgment of practical significance.

G.3 Results from Data Mining Approach – CART Analyses

The analyses of interest for the data mining approach on the Yuma Study data focused on identifying predictor questions or dust measurements that could be useful in classifying a child's pesticide exposure level as measured by the DAP urinary metabolites. A review of the available study questions from Table G.2.1 identified a subset of questions that were of higher interest or that were viewed as having a potentially stronger relationship with the exposure level. These questions are identified as the limited set of questions (LTD). The classification analyses were performed on two molar-weighted sums of DAP metabolites under several scenarios including questions (all or limited), and house and school dust measurements of pesticides.

G.3.1 Simple Indicators of Exposure Levels

The analyses in this stage were performed to help understand some of the basic relationships in the Yuma Study to potentially refine the analyses performed in Stage 3. Tests of bivariate relationships were conducted on the six individual DAPs (DMP, DMTP, DMDTP, DEP, DETP, and DEDTP) and the 51 original questionnaire variables in Table G.2.1. The questions covered demographics, residential pesticide use, local pesticide use, activities of the principal participant, source of drinking water, parents' work environment, and medical care.

The bivariate analyses were performed on the principal participants with usable urinary metabolite measurements (approximately 148 children) and before the recoding of conditional questions and non-responses. Because the questions were used as grouping variables (section G.2.2.1), the lack of recoding did not affect the evaluation of the relationships. Questionnaire variables that indicated some differences in levels for at least three of the six chemicals were:

Variable Name	Variable Description
cheminhs	Pesticides used inside home last month?
chemouth	Pesticides used outside home last month?
closeapp	Distance between home and nearest application of pesticides
washvegi	How often wash local fruit/veg before eating?
momwork	Mother now employed (not as housewife)?
insured	Is child covered by medical insurance?

Since house dust measurements are potential indicators of exposure, rank correlations between the dust measurements and the urine measurements were performed. Fourteen of the forty-four dust chemicals from Table 4.3.3 showed some correlation with the DAP measurements. Chlorpyrifos, diazinon, endosulfan I, endosulfan II, pendimethrin, trifuralin, and terbufos showed some correlation with more than one of the urinary metabolites.

G.3.2 Underlying Structure – Principal Component Analysis

Principal component analysis (PCA) was performed to help understand relationships between questions and to identify those that best described the most important dimensions in the data, that is, those explaining the most variability in the data. PCA was performed on data from 131 core participants after recoding for conditional questions and non-responses, and after creating the additional questionnaire variables included in Table G.2.1. Sixty-seven of the questions, as noted in the table and 22 of the house and school dust measurements from Table G.2.4 were used for the PCA runs. Three scenarios were run: questionnaires only, questionnaires and house dust measurements, and questionnaires and house and school dust measurements. These scenarios represent situations with increasing measurement burden which is a cost/effectiveness concern in study design. Because of the limited availability of school dust measurements, the PCA with the dust measurements was run with only 107 core participants.

Table G.3.1 shows the dimensions from two of the PCA runs, and the questionnaire variables most correlated with each dimension as described in section G.2.2.2. The two PCA scenarios include questionnaire responses only, and questionnaire responses and all dust measurements. Table G.3.1 shows the principal component (PC) number for each question or measurement under the two scenarios. The PC numbers indicate the order in which the PCs were extracted based on the amount of variability in the data explained, that is, low PC numbers explain more of the variability. Questions and measurements were assigned to the PC with which they were most correlated. Thus a question/measurement was assigned to a PC if the absolute value of the loading between the PC and variable was $\geq$ 0.6 (section G.2.3).

Table G.3.1 An Underlying Structure of the Yuma Study Questionnaire and Measurement Variables Based on Principal Component Analysis Under Two Scenarios

Principal Component Number[a]		Questions and Measurements	
Questions-only Scenario	Questions and Dust (House and School) Scenario	Name	Brief Description[b]
1	1	BASEMENT	Basement treated with pesticides?
1	1	BATHROOM	Bathroom treated with pesticides?
1	1	BEDROOM	Bedroom treated with pesticides?
1	1	CHEMINHS	Pesticides used inside home last month?
1	1	CHILDBED	Child's bedroom treated with pesticides?
1	1	DININGRM	Dining room treated with pesticides?
1	1	FAMILYRM	Family room treated with pesticides?
1	1	KITCHEN	Was kitchen treated with pesticides?
1	1	LIVINGRM	Living room treated with pesticides?
1	1	NRMSPRYD	Number of rooms sprayed last month
1	1	OTHERRM	Other rooms treated with pesticides?

Principal Component Number[a]		Questions and Measurements	
Questions-only Scenario	**Questions and Dust (House and School) Scenario**	**Name**	**Brief Description[b]**
1	1	WHOCHEMI	Who applied pesticides inside the house?
0	2	SCHOOL	Child's school
	2	SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane (School dust)
	2	SWCHLPYR	Weighted chlorpyrifos (School dust)
	2	SWDSTBAL	Weighted sum of dust analytes except OP pesticides (School dust)
	2	SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol (School dust)
	2	SWOPSUM	Weighted sum of OP pesticides (School dust)
2	3	CHILDFLD	Child worked in fields last month?
2	3	WHENFILD	Last time child was in work field
	4	WCHLPYRF	Weighted chlorpyrifos (Household dust)
	4	WDUSTBAL	Weighted sum of dust analytes except OP pesticides (Household dust)
	4	WOPSUM	Weighted sum of OP pesticides (Household dust)
11	5	AGE	Age of principal participant
11	5	GRADE	Child's grade
	5	SWDUSTSM	Weighted sum of all dust analytes (School dust)
	5	SWPERMSM	Weighted sum of cis-permethrin and trans-permethrin (School dust)
6	6	WATERSR1	Drinking water source - public/commercial
6	6	WATERSR3	Drinking water source - cistern
5	7	ADLTPEST	Non-parent in home works where pesticides used?
5	7	NUMADLTS	Number of additional adults in home
4	8	CLOSEAPP	Distance between home and nearest application of pesticides
4	8	HOWCHEMO	How pesticides were applied to fields
3	9	FARFIELD	Distance between home and agricultural field
3	9	GPS	Category distance of home from field - GPS measurement
3	9	WHEEL	Distance between home and field - rotary wheel
	10	WDUSTSUM	Weighted sum of all dust analytes (Household dust)
	10	WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin (Household dust)

Principal Component Number[a]		Questions and Measurements	
Questions-only Scenario	Questions and Dust (House and School) Scenario	Name	Brief Description[b]
8	11	CHEMOUTH	Pesticides used outside home last month?
8	11	WHOCHEMO	Who applied pesticides outside house?
10	12	HEIGHT	Child's height (inches)
10	12	WEIGHT	Child's weight (lbs)
9	13	MOMCON2	Mother's occupation -- location and pesticide use
9	13	NCATWRKM	Mother's occupation -- categories
	14	WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane (Household dust)
18	14	WHERMD3	Family med care at other med clinic
7	15	PEOPLIVE	Number people, including participating children, in household
7	15	YOUNGSIB	Number children $\leq$ 11 years old in household
0	16	WHERMD1	Family med care at private medical clinic
13	16	WHERMD4	Family med care in Mexico
17	17	DADCON2	Father's occupation -- location and pesticide use
17	17	NCATWRKD	Father's occupation -- categories
23	18	CHLDTM7	Child spends time playing outside?
22	19	CHLDTM3	Child spends time at school?
14	20	CHLDTM5	Child spends time playing in field?
14	20	WHERMD7	Family med care - do not know
	21	WDIAZNON	Weighted diazinon (Household dust)
26	22	WASHVEGI	How often wash local fresh fruit/veg before eating?
27	23	HOWCHILD	Child's health in general
15	24	WHERMD5	No access to medical care
0	25	LIVEYEAR	Number years child lived at this address?
16	26	CHLDTM1	Child spends time in another home?
21	27	LIVEAREA	Children, respondent live < 10 months/year in area?
28	28	CHLDTM2	Child spends time at day care center?
20	29	WATERSR2	Drinking water source - private well
0	30	CHLDTM6	Child spends time playing in irrigation water?
12	31	WHERMD6	Family med care at other place
	32	SWCYPRME	Weighted cy-permethrin (School dust)
	33	WDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and

Principal Component Number[a]		Questions and Measurements	
Questions-only Scenario	**Questions and Dust (House and School) Scenario**	**Name**	**Brief Description[b]**
			4,4'DDT(Household dust)
24	34	SPRAYFLD	Child in yard when fields sprayed or dusted?
29	35	WHERTIME	Room where child spends most awake time
0	0	ADTPSTWK	Any adult works where pesticides used?
19	0	CHLDTM4	Child spends time at sport event?
16	0	ETHNIC	Child's ethnic and racial background
0	0	HOURAWAY	Number hours/wk child not at home
0	0	INSURED	Is child covered by medical insurance?
0	0	LICE	Child treated for head lice past six months?
0	0	OFTCHEMI	How often is home treated for pests?
12	0	POISON	Anyone treated for pesticide poison?
0	0	SEX	Child's gender
	0	SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT (School dust)
	0	SWDIAZNO	Weighted diazinon (School dust)
	0	SWOPHNYL	Weighted o-phenylphenol (School dust)
0	0	VEGGIES	How often child eats local fresh fruit/veg?
	0	WCYPRMET	Weighted cy-permethrin (Household dust)
25	0	WHERMD2	Family med care at health dept clinic
0	0	WHNCHEMO	Last time field treated with pesticides?
	0	WOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol (Household dust)
	0	WOPHNYLP	Weighted o-phenylphenol (Household dust)

[a] 0 indicates the variable did not have an absolute loading value $\geq$ 0.6. Blank indicates the variable was not included in analysis scenario.
[b] See Table G.2.1 for extended descriptions

The 29 dimensions for the questions-only scenario accounted for 86% of the variability in the questionnaire responses with the first dimension accounting for 18%. The 35 dimensions for the question and dust measurement scenario accounted for 89% of the variability in the questionnaire responses with the first dimension accounting for 14%. The first dimension under both scenarios represents spraying of pesticides inside the home, in general and by room. Subsequent dimensions each account for a significantly smaller amount of the variability. Note that in many PCA analyses, only the first few dimensions are considered for further, and different, uses. In this instance, more dimensions were reviewed to look at the relationships between questions only.

Some items to note regarding the results from the PCA runs based on Table G.3.1:

1. The dimensions identified made sense. Condition and conditional questions (section G.2.1.3) grouped into the same PC.
2. The components of the PCs explaining the most variability did not change between the two scenarios, although the PC number (order of extraction) may have changed slightly.
3. The dimensions explaining the most variability across the two scenarios were:
    a. Pesticide sprayed inside house
    b. School and school dust measurements
    c. Child working in agricultural field
    d. Relationship of home to agricultural fields
    e. House dust measurements--OPs
    f. Adults in household working with pesticides

   Although these dimensions were not analyzed with respect to the urine measurements, they are consistent with the findings in Stage 3 which were so analyzed.
4. The results from the two PCAs showed a consistency of grouping questions into the same dimensions with slight variations in the later or smaller components. Although some of the correlations between the questionnaire variables and dimensions (PCs) are stronger because of the coding for conditional questions, the fact that other questions do not have strong correlations with the dimension speaks to cross-question consistency in the responses.
5. There were only a few instances where two different types of questions were correlated with the same dimension, e.g., CHLDTM1 (Child spends time in another home) and ETHNIC (Child's ethnic and racial background). This is an example of one question being a potential surrogate for the other.

G.3.3 Classification Approach – CART Analyses

The technique Classification and Regression Trees (CART) was selected as the primary type of data mining analysis. Details of the technique can be found in section G.2.4.1. The principal participants included in these analyses was limited to 130 children, those in kindergarten or first grade, from the initial eight study schools, and with available and non-suspect urine measurement data (section G.2.3). Twelve CART analyses were performed. As shown in Table G.3.2, six of the analyses were run for the log of the molar-weighted sum of ethylated DAPs (LWETHSUM), and six were run for the log of the molar-weighted sum of the methylated DAPs (LWMETHSM). These scenarios were run to understand the impact of increasing measurement burden which is often considered in the cost/effectiveness aspect of study design. CART analyses can handle independent variables with missing values; thus scenarios including school dust measurements did not have to be run with a smaller number of cases as for the PCA (section 4.3.2.3).

Table G.3.2 Description of and Cross-Reference for CART Analyses Performed on Yuma Study Data

	Predictors Included				
Dependent Variable[a]	**Question Group**[b]	**House Dust**	**School Dust**	**Summary Table**	**CART Details-- Figures in Appendix G**
LWETHSUM	ALL	No	No	G.3.4 [c]	G.2.1.a, G.2.1.b
LWETHSUM	LTD	No	No	G.3.4 [c]	G.2.2.a, G.2.2.b
LWETHSUM	ALL	Yes	No	G.3.4 [c]	G.2.3.a, G.2.3.b
LWETHSUM	LTD	Yes	No	G.3.4 [c]	G.2.4.a, G.2.4.b
LWETHSUM	ALL	Yes	Yes	G.3.4 [c]	G.2.5.a, G.2.5.b
LWETHSUM	LTD	Yes	Yes	G.3.4 [c]	G.2.6.a, G.2.6.b
LWMETHSM	ALL	No	No	G.3.5	G.2.7.a, G.2.7.b
LWMETHSM	LTD	No	No	G.3.5	G.2.8.a, G.2.8.b
LWMETHSM	ALL	Yes	No	G.3.5	G.2.9.a, G.2.9.b
LWMETHSM	LTD	Yes	No	G.3.5	G.2.10.a, G.2.10.b
LWMETHSM	ALL	Yes	Yes	G.3.5	G.2.11.a, G.2.11.b
LWMETHSM	LTD	Yes	Yes	G.3.5	G.2.12.a, G.2.12.b

[a] LWETHSUM is log (molar-weighted sum of ethylated DAPs adjusted for creatinine); LWMETHSM is log (molar-weighted sum of methylated DAPs adjusted for creatinine). See Appendix F for more details.
[b] ALL represents analyses with all 67 questions used with CART. LTD represents analyses with 29 of the 67 questions considered to be more likely predictors.
[c] See also Table G.3.6 for comparisons of CART analyses for LWETHSUM with and without CHLDTM3.

Section G.2.4.2 is an example of the output that will be provided for each of the scenarios noted above. The output references the characteristics of the subsets, based on split points for the variables, e.g., CHLDTM1 < 1.5, but does not describe what the subsets CHLDTM1 < 1.5 and CHLDTM1 > 1.5 represent. Table G.3.3 provides the translation between values and descriptions, and provides the variable description for the questionnaire variables included in the CART analyses, in alphabetical order by the variable names. By using Table G.3.3, the reader can see that CHLDTM1 < 1.5 represents a "Yes" response to whether the child spends time in another home. CHLDTM1 > 1.5 represents a "No" response. Five questionnaire variables are not included in Table G.3.3 because they are more continuous in nature, or as in the case of SCHOOL, is purely a way to anonymously labels the schools:

Variable Name	**Variable Description**
HEIGHT	Child's height (inches)
HOURAWAY	Number hours/wk child not at home
NRMSPRYD	Number of rooms sprayed last month
SCHOOL	Child's school
WEIGHT	Child's weight (lbs)

Table G.3.3 Code Values Assigned to Ordinal and Categorical Questionnaire Variables

Q Name	Q Description[a]	Value	Value Label
adltpest	Non-parent in home works where pesticides used?		
		1	Yes
		2	No
basement	Basement treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
bathroom	Bathroom treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
bedroom	Bedroom treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
cheminhs	Pesticides used inside home last month?		
		1	Yes
		2	No
chemouth	Pesticides used outside home last month?		
		1	Yes
		2	No
		3	Do not know
childbed	Child's bedroom treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
childfld	Child worked in fields in last month?		
		1	Yes
		2	No
		3	Do not know
		4	No Response
chldtm1	Child spends time in another home?		
		1	Yes
		2	No
chldtm2	Child spends time at day care center?		
		1	Yes
		2	No

Q Name	Q Description[a]	Value	Value Label
chldtm3	Child spends time at school?		
		1	Yes
		2	No
chldtm4	Child spends time at sport event?		
		1	Yes
		2	No
chldtm5	Child spends time playing in field?		
		1	Yes
		2	No
chldtm6	Child spends time playing in irrigation water?		
		1	Yes
		2	No
chldtm7	Child spends time playing outside?		
		1	Yes
		2	No
closeapp	Distance between home and nearest application of pesticides		
		1	In your yard/garden
		2	In neighbor's yard
		3	Further away
		4	Not used near home
		5	Do not know
		6	No Response
dadcon2	Father's occupation--location and pesticide use		
		1	Works Inside, no pesticides assumed
		2	Works Outside, no pesticides assumed
		3	Works Inside, pesticides assumed
		4	Works Outside, pesticides assumed
		5	Dad doesn't work
		6	No job response
dadpest	Are pesticides used where father works?		
		1	Yes
		2	No
		3	Not Applicable
		4	No Response
dadwork	Is the father currently employed?		

Q Name	Q Description[a]	Value	Value Label
		1	Yes
		2	No
		3	Not Applicable
diningrm	Dining room treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
ethnic	Child's ethnic and racial background		
		1	Hispanic
		2	Non-Hispanic white
		6	Other, specify
		7	No Response
familyrm	Family room treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
farfield	Distance between home and agricultural field		
		1	250 feet or less
		2	Over 250 feet
		3	Do not know
		4	No Response
grade	Child's grade		
		1	Kindergarden
		2	First Grade
howchemo	How pesticides were applied to fields		
		1	By airplane
		2	Mechanized spraying
		3	Hand application
		4	Other (Specify)
		5	Not used near home
		6	Do not know
		7	No Response
howchild	Child's health in general		
		1	Excellent
		2	Very Good
		3	Good
		4	Fair
insured	Is child covered by medical insurance?		
		1	Yes

Q Name	Q Description[a]	Value	Value Label
		2	No
		3	Do not know
		4	No Response
kitchen	Was kitchen treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
lice	Child treated for head lice past six months?		
		1	Yes
		2	No
		3	No Response
livingrm	Living room treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
momcon2	Mother's occupation--location and pesticide use		
		1	Works Inside, no pesticides assumed
		2	Works Outside, no pesticides assumed
		3	Works Inside, pesticides assumed
		4	Works Outside, pesticides assumed
		5	Mom doesn't work
		6	No job response
mompest	Are pesticides used where mother works?		
		1	Yes
		2	No
		3	Not Applicable
		4	No Response
momwork	Mother now employed (not as housewife)?		
		1	Yes
		2	No
		3	Not Applicable
ncatwrkd	Father's occupation--categories		
		1	Agriculture
		2	Laborer
		3	Repair

Q Name	Q Description[a]	Value	Value Label
		4	Service
		5	Sales
		6	Professional
		7	Other
		8	Dad doesn't work
		9	No response
ncatwrkm	Mother's occupation--categories		
		1	Agriculture
		4	Service
		5	Sales
		6	Professional
		7	Other
		8	Mom doesn't work
		9	No response
oftchemi	How often is home treated for pests?		
		1	About once a week
		2	About once a month
		3	Several times a year
		4	About once a year
		5	Infrequently
		6	Never or not yet
		7	Do not know
		8	No Response
otherrm	Other rooms treated with pesticides?		
		1	Yes
		2	No
		3	House not treated
poison	Anyone treated for pesticide poison?		
		1	Yes
		2	No
		3	Do not know
		4	No Response
sex	Child's gender		
		1	Female
		2	Male
sprayfld	Child in yard when fields sprayed or dusted?		
		1	Yes
		2	No
		3	Do not know

Q Name	Q Description[a]	Value	Value Label
		4	No Response
veggies	How often child eats local fruit/veg?		
		-1	No Response
		0	Do not know
		1	Never
		2	About once a year
		3	About once a month
		4	About once a week
		5	About once a day
washvegi	How often wash local fruit/veg before eating?		
		1	Always
		2	Usually
		3	Sometimes
		4	Never
watersr1	Drinking water source--public/commercial		
		1	Yes
		2	No
watersr2	Drinking water source--private well		
		1	Yes
		2	No
watersr3	Drinking water source--cistern		
		1	Yes
		2	No
wheel	Distance between home and field--rotary wheel		
		1	< 250 feet
		2	≥ 250 and < 500 ft
		3	≥ 500 feet
whenfild	Last time child was in work field		
		1	Today
		2	Yesterday
		3	> 2 days ago
		4	A week ago
		5	> a week ago
		6	Do not know
		7	Child not in field
		8	No Response
whermd1	Family med care at private medical clinic		
		1	Used

Q Name	Q Description[a]	Value	Value Label
		2	Not used or Not applicable
whermd2	Family med care at health department clinic		
		1	Used
		2	Not used or Not applicable
whermd3	Family med care at other med clinic		
		1	Used
		2	Not used or Not applicable
whermd4	Family med care in Mexico		
		1	Used
		2	Not used or Not applicable
whermd5	No access to medical care		
		1	Used
		2	Not used or Not applicable
whermd6	Family med care at other place		
		1	Used
		2	Not used or Not applicable
whermd7	Family med care - do not know		
		1	Used
		2	Not used or Not applicable
whertime	Room where child spend most awake time		
		1	Living room
		2	Family room
		3	Dining room
		6	Bedroom
		7	Other Location
whnchemo	Last time field treated with pesticides?		
		1	Today
		2	Yesterday
		3	> 2 days ago
		4	A week ago
		5	> a week ago
		6	Other
		7	Do not know
		8	Not applicable

Q Name	Q Description[a]	Value	Value Label
		9	No Response
whochemi	Who applied pesticides inside the house?		
		1	Self
		2	Professional service
		3	Family member+other
		4	House not treated-DK
whochemo	Who applied pesticides outside house?		
		1	Self
		2	Professional service
		3	Family member+other
		4	Outside not treated-DK

[a] See Table G.2.1 for extended descriptions

The scenarios for the following figures are described in Table G.3.2. The contents of the figures are described in the example CART output found in section G.2.4.2. Note that the target or dependent variables in the following CART output are logs of molar-weighted sums of DAPs, adjusted for creatinine.

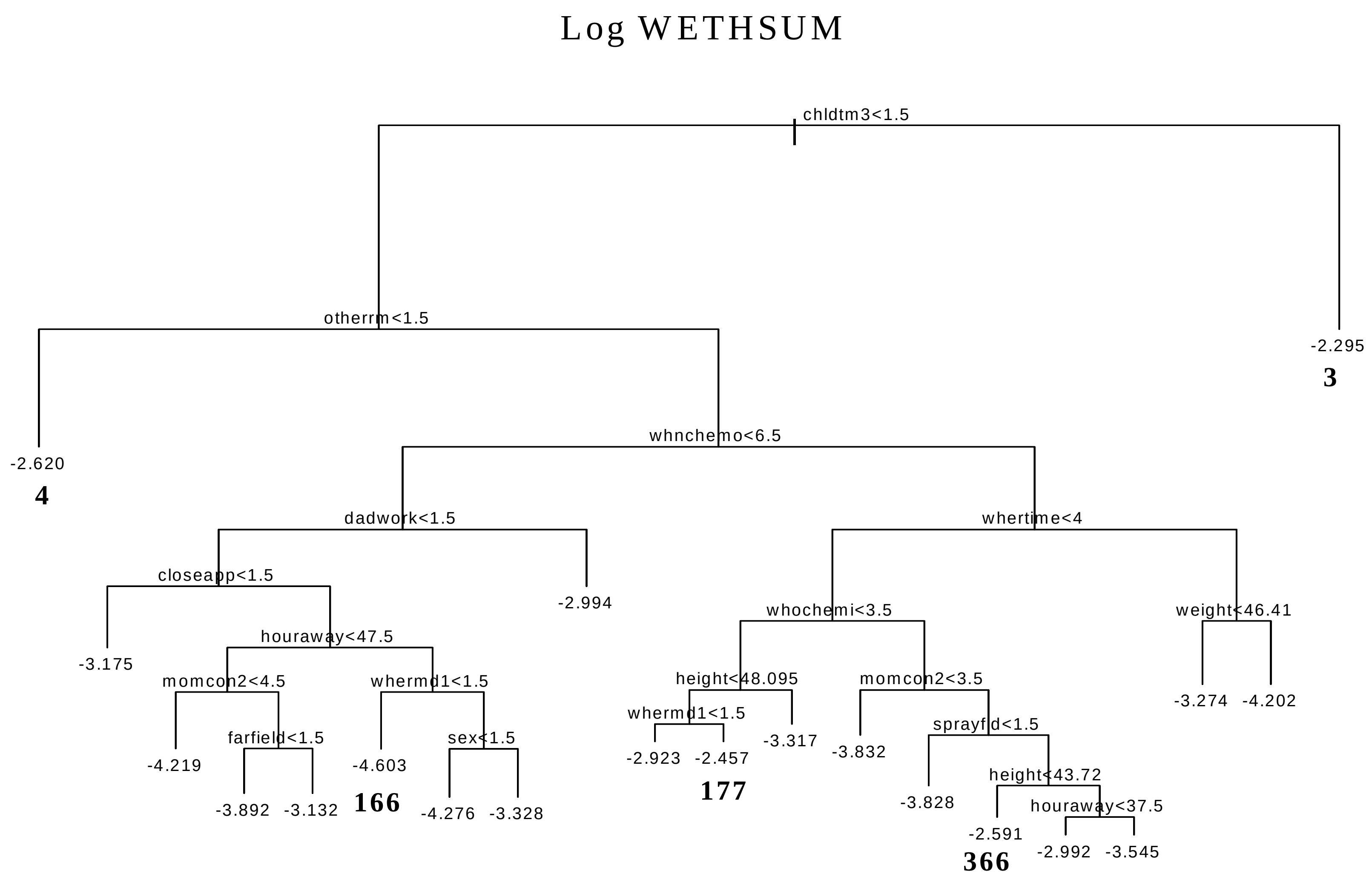

Figure G.3.1.a CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 91.3700 -3.352
    2) CHLDTM3<1.5 122 78.8700 -3.421
      4) OTHERRM<1.5 8  5.5200 -2.620 *
      5) OTHERRM>1.5 114 67.8500 -3.478
       10) WHNCHEMO<6.5 50 29.2300 -3.686
         20) DADWORK<1.5 45 26.3000 -3.763
           40) CLOSEAPP<1.5 7  4.6350 -3.175 *
           41) CLOSEAPP>1.5 38 18.8000 -3.871
             82) HOURAWAY<47.5 21  7.2790 -3.660
              164) MOMCON2<4.5 6  0.5516 -4.219 *
              165) MOMCON2>4.5 15  4.0970 -3.436
                330) FARFIELD<1.5 6  0.7633 -3.892 *
                331) FARFIELD>1.5 9  1.2510 -3.132 *
             83) HOURAWAY>47.5 17  9.4320 -4.132
              166) WHERMD1<1.5 7  2.4450 -4.603 *
              167) WHERMD1>1.5 10  4.3430 -3.802
                334) SEX<1.5 5  0.4823 -4.276 *
                335) SEX>1.5 5  1.6120 -3.328 *
         21) DADWORK>1.5 5  0.2675 -2.994 *
       11) WHNCHEMO>6.5 64 34.7700 -3.315
         22) WHERTIME<4 50 25.4300 -3.178
           44) WHOCHEMI<3.5 21  5.1600 -2.880
             88) HEIGHT<48.095 15  2.6180 -2.705
              176) WHERMD1<1.5 8  0.9439 -2.923 *
              177) WHERMD1>1.5 7  0.8653 -2.457 *
             89) HEIGHT>48.095 6  0.9392 -3.317 *
           45) WHOCHEMI>3.5 29 17.0500 -3.394
             90) MOMCON2<3.5 8  4.9110 -3.832 *
             91) MOMCON2>3.5 21 10.0200 -3.227
              182) SPRAYFLD<1.5 5  2.1590 -3.828 *
              183) SPRAYFLD>1.5 16  5.4960 -3.040
                366) HEIGHT<43.72 5  2.1700 -2.591 *
                367) HEIGHT>43.72 11  1.8630 -3.244
                  734) HOURAWAY<37.5 6  0.4431 -2.992 *
                  735) HOURAWAY>37.5 5  0.5861 -3.545 *
         23) WHERTIME>4 14  5.0550 -3.804
           46) WEIGHT<46.41 6  1.4650 -3.274 *
           47) WEIGHT>46.41 8  0.6442 -4.202 *
    3) CHLDTM3>1.5 8  2.9750 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 3, 177, 366, and 4. Node 166 has the lowest average level of Log(WETHSUM). The nodes are numbered in bold on Figure G.3.1.a and the final split characteristics are bolded in the above tree description.

- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child did not spend time in school. These cases had an average level of 0.1008 nmoles/g Creatinine WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table G.3.6.
- **Node 177** is characterized by participants with CHLDTM3 < 1.5, OTHERRM > 1.5, WHNCHEMO > 6.5, WHERTIME < 4, WHOCHEMI < 3.5, HEIGHT < 48.095 (inches), and WHERMD1 < 1.5. The average level of WETHSUM for these participants was 0.0857 nmoles/g Creatinine (Log(WETHSUM) = -2.457).
- **Node 366** is characterized by participants with CHLDTM3 < 1.5, OTHERRM > 1.5, WHNCHEMO > 6.5, WHERTIME < 4, WHOCHEMI < 3.5, MOMCON2 > 3.5, SPRAYFLD > 1.5, and HEIGHT < 43.72 (inches). The average level of WETHSUM for these participants was 0.0749 nmoles/g Creatinine (Log(WETHSUM) = -2.591).
- **Node 4** is characterized by participants with CHLDTM3 < 1.5, and OTHERRM < 1.5. The average level of WETHSUM for these participants was 0.0728 nmoles/g Creatinine (Log(WETHSUM) = -2.620).
- **Node 166** is characterized by participants with CHLDTM3 < 1.5, OTHERRM > 1.5, WHNCHEMO < 6.5, DADWORK < 1.5, CLOSEAPP > 1.5, HOURAWAY > 47.5, and WHERMD1 < 1.5. The average level of WETHSUM for these participants was 0.0100 nmoles/g Creatinine (Log(WETHSUM) = -4.603).

Figure G.3.1.b CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.1.a)

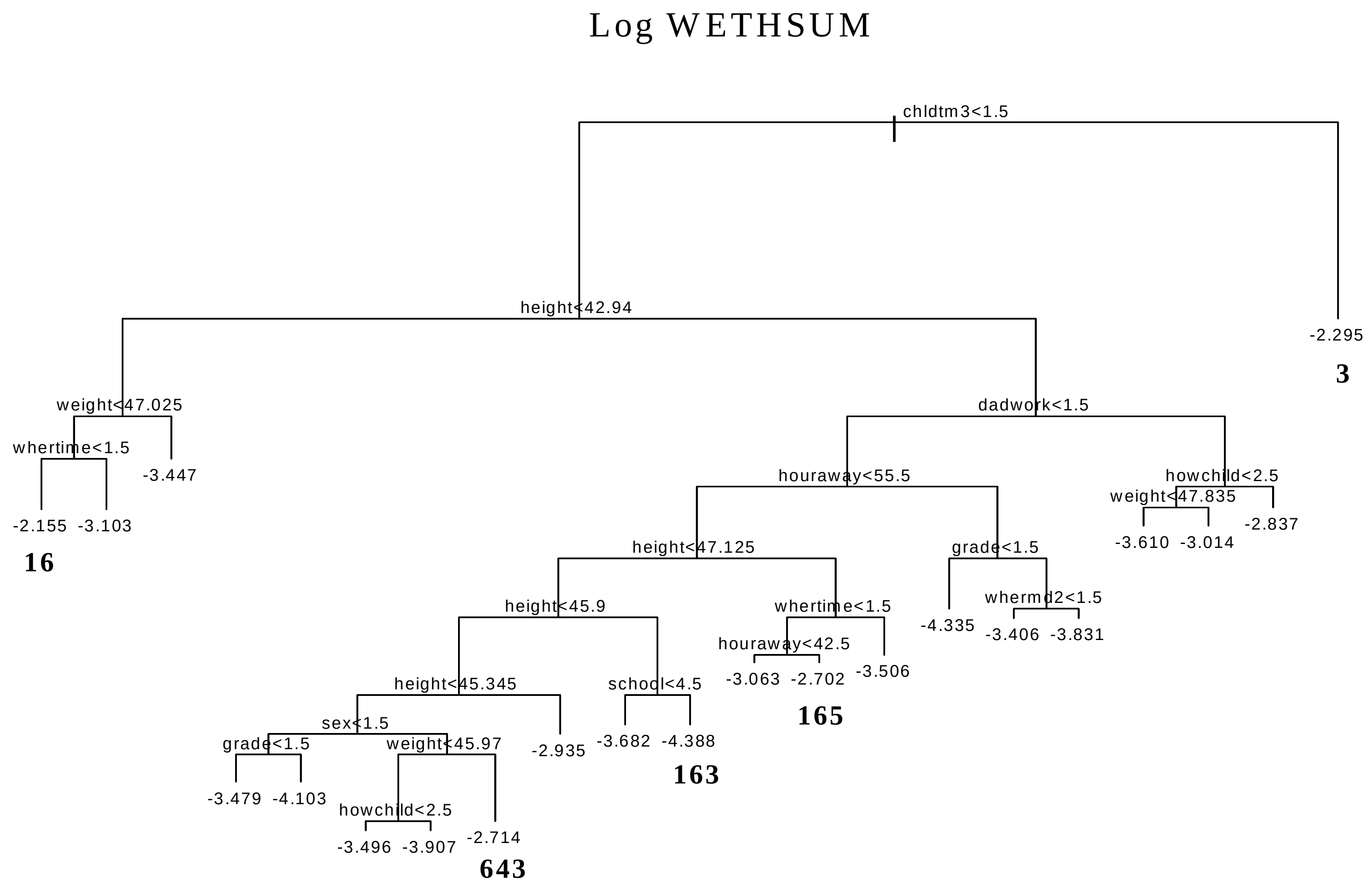

Figure G.3.2.a CART Analysis of LWETHSUM [LOG(WETHSUM)] with Limited Questions for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
        * denotes terminal node

      1) ROOT 130 91.3700 -3.352
     2) CHLDTM3<1.5 122 78.8700 -3.421
       4) HEIGHT<42.94 16 10.4700 -2.914
         8) WEIGHT<47.025 11  5.4890 -2.672
          16) WHERTIME<1.5 5  0.9163 -2.155 *
          17) WHERTIME>1.5 6  2.1230 -3.103 *
         9) WEIGHT>47.025 5  2.9150 -3.447 *
       5) HEIGHT>42.94 106 63.6700 -3.498
        10) DADWORK<1.5 88 52.7900 -3.579
          20) HOURAWAY<55.5 69 39.3300 -3.475
            40) HEIGHT<47.125 48 24.0100 -3.610
              80) HEIGHT<45.9 36 15.6900 -3.448
               160) HEIGHT<45.345 30 11.7100 -3.551
                 320) SEX<1.5 14  4.6710 -3.746
                   640) GRADE<1.5 8  3.0440 -3.479 *
                   641) GRADE>1.5 6  0.2934 -4.103 *
                 321) SEX>1.5 16  6.0410 -3.380
                   642) WEIGHT<45.97 11  1.9940 -3.683
                    1284) HOWCHILD<2.5 6  0.7926 -3.496 *
                    1285) HOWCHILD>2.5 5  0.7408 -3.907 *
                   643) WEIGHT>45.97 5  0.8216 -2.714 *
               161) HEIGHT>45.345 6  2.0860 -2.935 *
              81) HEIGHT>45.9 12  4.5690 -4.094
               162) SCHOOL<4.5 5  2.5550 -3.682 *
               163) SCHOOL>4.5 7  0.5605 -4.388 *
            41) HEIGHT>47.125 21 12.4500 -3.167
              82) WHERTIME<1.5 12  5.9120 -2.913
               164) HOURAWAY<42.5 7  4.9760 -3.063 *
               165) HOURAWAY>42.5 5  0.5563 -2.702 *
              83) WHERTIME>1.5 9  4.7270 -3.506 *
          21) HOURAWAY>55.5 19  9.9790 -3.958
            42) GRADE<1.5 9  6.2200 -4.335 *
            43) GRADE>1.5 10  1.3240 -3.619
              86) WHERMD2<1.5 5  0.2202 -3.406 *
              87) WHERMD2>1.5 5  0.6513 -3.831 *
        11) DADWORK>1.5 18  7.4670 -3.101
          22) HOWCHILD<2.5 10  2.7910 -3.312
            44) WEIGHT<47.835 5  0.7780 -3.610 *
            45) WEIGHT>47.835 5  1.1260 -3.014 *
          23) HOWCHILD>2.5 8  3.6720 -2.837 *
     3) CHLDTM3>1.5 8  2.9750 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 16, 3, 165, and 643. Node 163 has the lowest average level of Log(WETHSUM). The nodes are numbered in bold on Figure G.3.2.a and the final split characteristics are bolded in the above tree description.

- **Node 16** is characterized by participants with CHLDTM3 < 1.5, HEIGHT < 42.94 (inches), WEIGHT < 47.025 (pounds), and WHERTIME < 1.5. The average level of WETHSUM for these participants was 0.1159 nmoles/g Creatinine (Log(WETHSUM) = -2.155).
- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child did not spend time in school. These cases had an average level of 0.1008 nmoles/g Creatinine WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table G.3.6.
- **Node 165** is characterized by participants with CHLDTM3 < 1.5, HEIGHT > 42.94 (inches), DADWORK < 1.5, HOURAWAY < 55.5, HEIGHT > 47.125 (inches), WHERTIME < 1.5, and HOURAWAY > 42.5. The average level of WETHSUM for these participants was 0.0677 nmoles/g Creatinine (Log(WETHSUM) = -2.702).
- **Node 643** is characterized by participants with CHLDTM3 < 1.5, HEIGHT > 42.94 (inches), DADWORK < 1.5, HOURAWAY < 55.5, HEIGHT < 47.125 (inches), HEIGHT < 45.9 (inches), HEIGHT < 45.345 (inches), SEX > 1.5, and WEIGHT > 45.97 (pounds). The average level of WETHSUM for these participants was 0.0663 nmoles/g Creatinine (Log(WETHSUM) = -2.714).
- **Node 163** is characterized by participants with CHLDTM3 < 1.5, HEIGHT > 42.94 (inches), DADWORK < 1.5, HOURAWAY < 55.5, HEIGHT < 47.125 (inches), HEIGHT > 45.9 (inches), and SCHOOL < 4.5. The average level of WETHSUM for these participants was 0.0124 nmoles/g Creatinine (Log(WETHSUM) = -4.388).

Figure G.3.2.b CART Analysis of LWETHSUM [LOG(WETHSUM)] with Limited Questions for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.2.a)

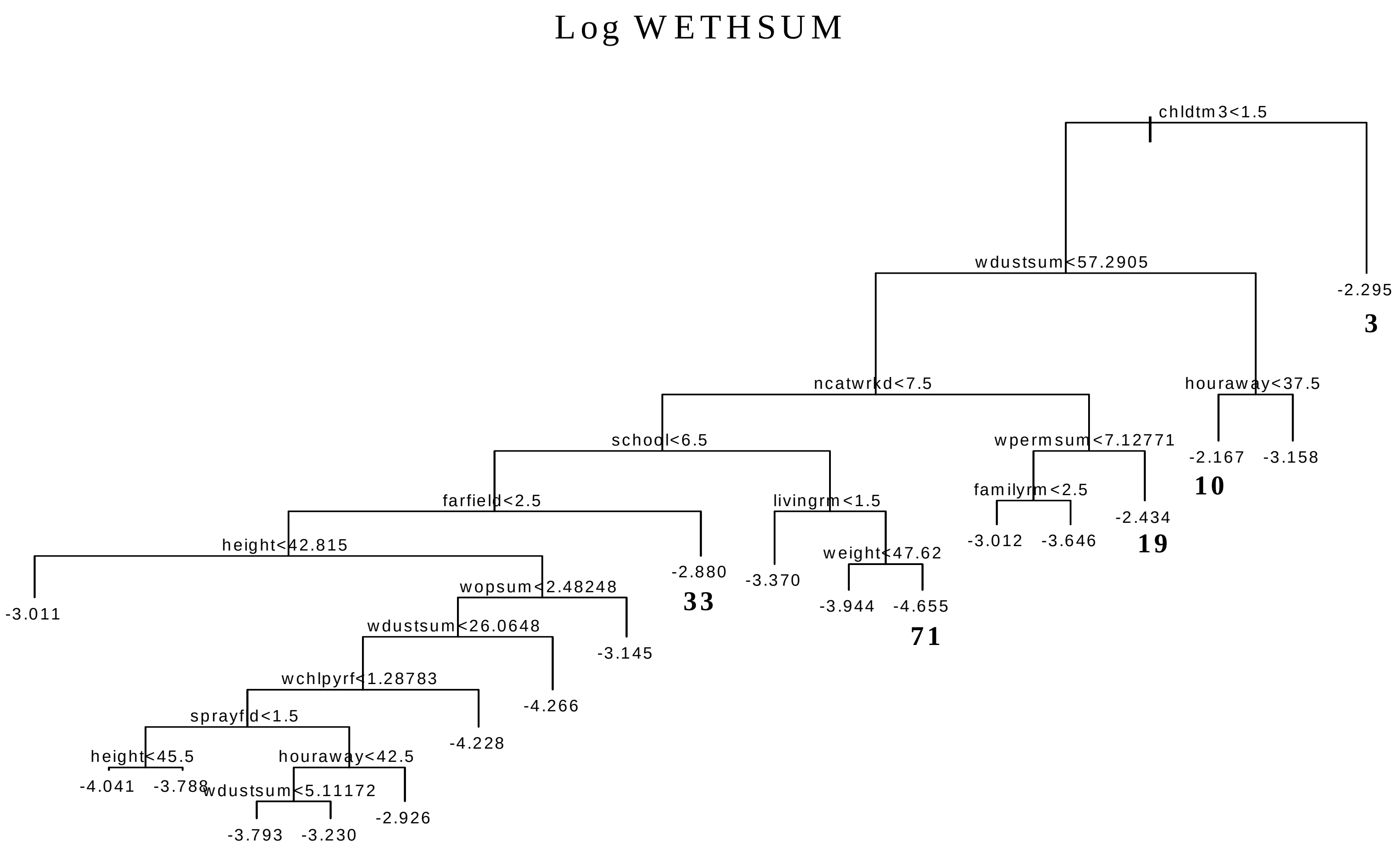

Figure G.3.3.a CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions and House Dust Measurements for 130 Yuma Study Particpants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

   1) ROOT 130 91.3700 -3.352
     2) CHLDTM3<1.5 122 78.8700 -3.421
       4) WDUSTSUM<57.2905 110 63.7000 -3.504
         8) NCATWRKD<7.5 90 51.8300 -3.589
          16) SCHOOL<6.5 71 39.8000 -3.483
            32) FARFIELD<2.5 64 36.1000 -3.549
              64) HEIGHT<42.815 8  5.8330 -3.011 *
              65) HEIGHT>42.815 56 27.6300 -3.626
               130) WOPSUM<2.48248 47 22.1100 -3.718
                 260) WDUSTSUM<26.0648 38 15.4000 -3.588
                   520) WCHLPYRF<1.28783 33 11.7900 -3.491
                    1040) SPRAYFLD<1.5 10  1.1690 -3.915
                      2080) HEIGHT<45.5 5  0.5299 -4.041 *
                      2081) HEIGHT>45.5 5  0.4783 -3.788 *
                    1041) SPRAYFLD>1.5 23  8.0480 -3.307
                      2082) HOURAWAY<42.5 14  2.9240 -3.552
                        4164) WDUSTSUM<5.11172 8  0.9874 -3.793 *
                        4165) WDUSTSUM>5.11172 6  0.8485 -3.230 *
                      2083) HOURAWAY>42.5 9  2.9810 -2.926 *
                   521) WCHLPYRF>1.28783 5  1.2500 -4.228 *
                 261) WDUSTSUM>26.0648 9  3.3650 -4.266 *
               131) WOPSUM>2.48248 9  3.0370 -3.145 *
            33) FARFIELD>2.5 7  0.8801 -2.880 *
          17) SCHOOL>6.5 19  8.2150 -3.987
            34) LIVINGRM<1.5 6  1.1600 -3.370 *
            35) LIVINGRM>1.5 13  3.7170 -4.272
              70) WEIGHT<47.62 7  1.7760 -3.944 *
              71) WEIGHT>47.62 6  0.3120 -4.655 *
         9) NCATWRKD>7.5 20  8.2810 -3.121
          18) WPERMSUM<7.12771 15  4.0970 -3.350
            36) FAMILYRM<2.5 7  0.1760 -3.012 *
            37) FAMILYRM>2.5 8  2.4190 -3.646 *
          19) WPERMSUM>7.12771 5  1.0410 -2.434 *
       5) WDUSTSUM>57.2905 12  7.5040 -2.662
        10) HOURAWAY<37.5 6  2.8740 -2.167 *
        11) HOURAWAY>37.5 6  1.6850 -3.158 *
     3) CHLDTM3>1.5 8  2.9750 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 10, 3, 19, and 33. Node 71 has the lowest average level of Log(WETHSUM). The nodes are numbered in bold on Figure G.3.3.a and the final split characteristics are bolded in the above tree description.

- **Node 10** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM > 57.2905, and HOURAWAY < 37.5. The average level of WETHSUM for these participants was 0.1145 nmoles/g Creatinine (Log(WETHSUM) = -2.167).
- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child does not spend time in school. These cases had an average level of 0.1008 nmoles/g Creatinine WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table G.3.6.
- **Node 19** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD > 7.5, and WPERMSUM > 7.12771. The average level of WETHSUM for these participants was 0.0877 nmoles/g Creatinine (Log(WETHSUM) = -2.434).
- **Node 33** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD < 7.5, SCHOOL < 6.5, and FARFIELD > 2.5. The average level of WETHSUM for these participants was 0.0561 nmoles/g Creatinine (Log(WETHSUM) = -2.880).
- **Node 71** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD < 7.5, SCHOOL > 6.5, LIVINGRM > 1.5, and WEIGHT > 47.62 (pounds). The average level of WETHSUM for these participants was 0.0095 nmoles/g Creatinine (Log(WETHSUM) = -4.655).

Figure G.3.3.b CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions and House Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.3.a)

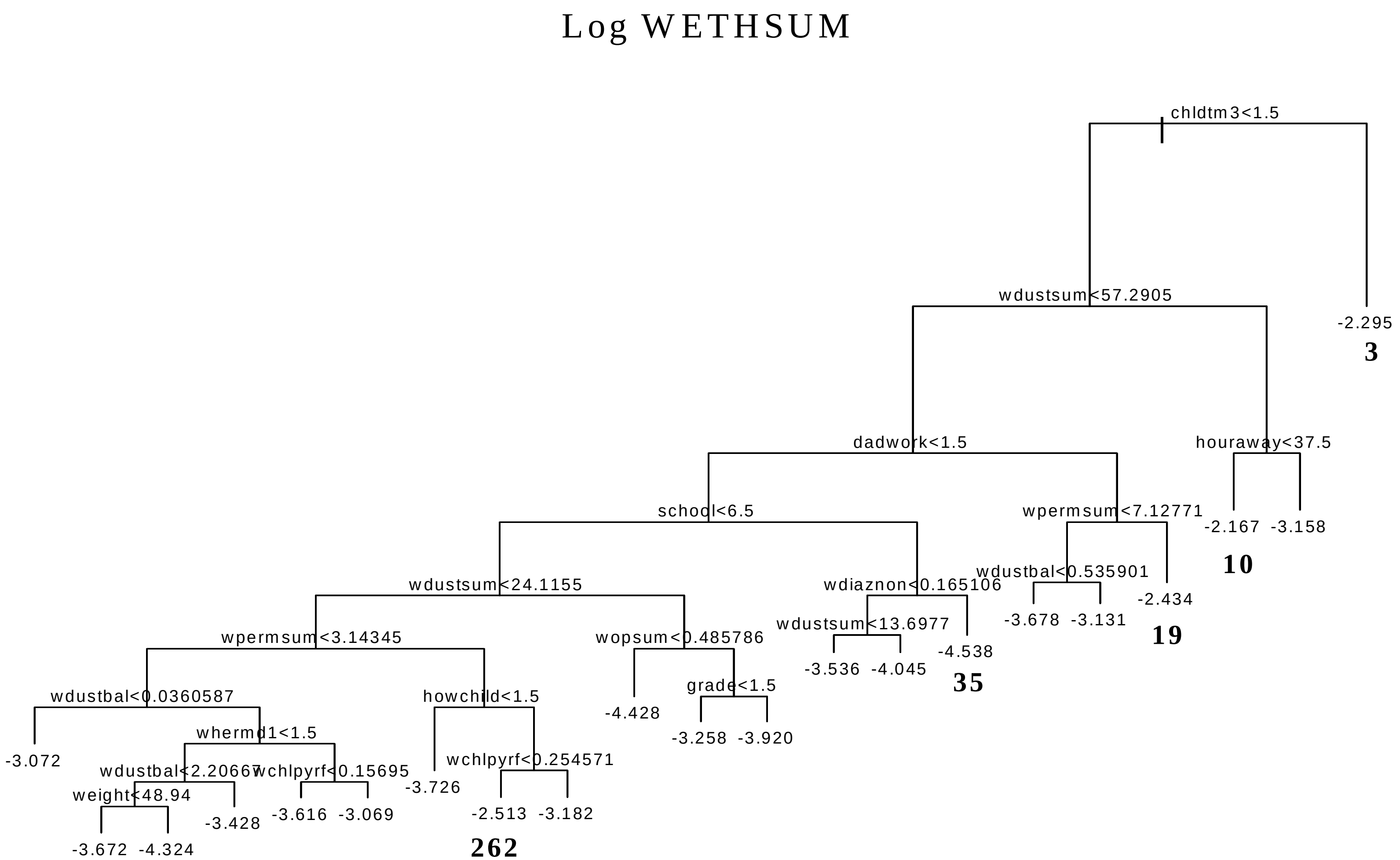

Figure G.3.4.a CART Analysis of LWETHSUM [LOG(WETHSUM)] with Limited Questions and House Dust Measurements for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 91.37000 -3.352
     2) CHLDTM3<1.5 122 78.87000 -3.421
       4) WDUSTSUM<57.2905 110 63.70000 -3.504
         8) DADWORK<1.5 90 51.83000 -3.589
          16) SCHOOL<6.5 71 39.80000 -3.483
            32) WDUSTSUM<24.1155 54 28.87000 -3.372
              64) WPERMSUM<3.14345 36 17.90000 -3.540
               128) WDUSTBAL<0.0360587 7  5.66100 -3.072 *
               129) WDUSTBAL>0.0360587 29 10.34000 -3.653
                 258) WHERMD1<1.5 18  5.98600 -3.858
                   516) WDUSTBAL<2.20667 13  3.13600 -4.023
                    1032) WEIGHT<48.94 6  1.29500 -3.672 *
                    1033) WEIGHT>48.94 7  0.46990 -4.324 *
                   517) WDUSTBAL>2.20667 5  1.57100 -3.428 *
                 259) WHERMD1>1.5 11  2.35900 -3.318
                   518) WCHLPYRF<0.15695 5  0.03282 -3.616 *
                   519) WCHLPYRF>0.15695 6  1.51000 -3.069 *
              65) WPERMSUM>3.14345 18  7.91800 -3.036
               130) HOWCHILD<1.5 5  1.39900 -3.726 *
               131) HOWCHILD>1.5 13  3.22200 -2.770
                 262) WCHLPYRF<0.254571 8  0.29330 -2.513 *
                 263) WCHLPYRF>0.254571 5  1.55000 -3.182 *
            33) WDUSTSUM>24.1155 17  8.15300 -3.835
              66) WOPSUM<0.485786 5  2.12000 -4.428 *
              67) WOPSUM>0.485786 12  3.54900 -3.589
               134) GRADE<1.5 6  0.88550 -3.258 *
               135) GRADE>1.5 6  1.35100 -3.920 *
          17) SCHOOL>6.5 19  8.21500 -3.987
            34) WDIAZNON<0.165106 14  5.55100 -3.791
              68) WDUSTSUM<13.6977 7  2.06700 -3.536 *
              69) WDUSTSUM>13.6977 7  2.57700 -4.045 *
            35) WDIAZNON>0.165106 5  0.60860 -4.538 *
         9) DADWORK>1.5 20  8.28100 -3.121
          18) WPERMSUM<7.12771 15  4.09700 -3.350
            36) WDUSTBAL<0.535901 6  0.75070 -3.678 *
            37) WDUSTBAL>0.535901 9  2.26700 -3.131 *
          19) WPERMSUM>7.12771 5  1.04100 -2.434 *
       5) WDUSTSUM>57.2905 12  7.50400 -2.662
        10) HOURAWAY<37.5 6  2.87400 -2.167 *
        11) HOURAWAY>37.5 6  1.68500 -3.158 *
     3) CHLDTM3>1.5 8  2.97500 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 10, 3, 19, and 262. Node 35 has the lowest average level of Log(WETHSUM). The nodes are numbered in bold on Figure G.3.4.a and the final split characteristics are bolded in the above tree description.

- **Node 10** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM > 57.2905, and HOURAWAY < 37.5. The average level of WETHSUM for these participants was 0.1145 nmoles/g Creatinine (Log(WETHSUM) = -2.167).
- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child did not spend time in school. These cases had an average level of 0.1008 nmoles/g Creatinine WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table G.3.6.
- **Node 19** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, DADWORK > 1.5, and, WPERMSUM > 7.12771. The average level of WETHSUM for these participants was 0.0877 nmoles/g Creatinine (Log(WETHSUM) = -2.434).
- **Node 262** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, DADWORK < 1.5, SCHOOL < 6.5, WDUSTSUM < 24.1555, WPERMSUM > 3.14345, HOWCHILD > 1.5, and WCHLPYRF < 0.254571. The average level of WETHSUM for these participants was 0.081 nmoles/g Creatinine (Log(WETHSUM) = -2.513).
- **Node 35** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, DADWORK < 1.5, SCHOOL > 6.5, and WDIAZNON > 0.165106. The average level of WETHSUM for these participants was 0.0107 nmoles/g Creatinine (Log(WETHSUM) = -4.538).

Figure G.3.4.b CART Analysis of LWETHSUM [LOG(WETHSUM)] with Limited Questions and House Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.4.a)

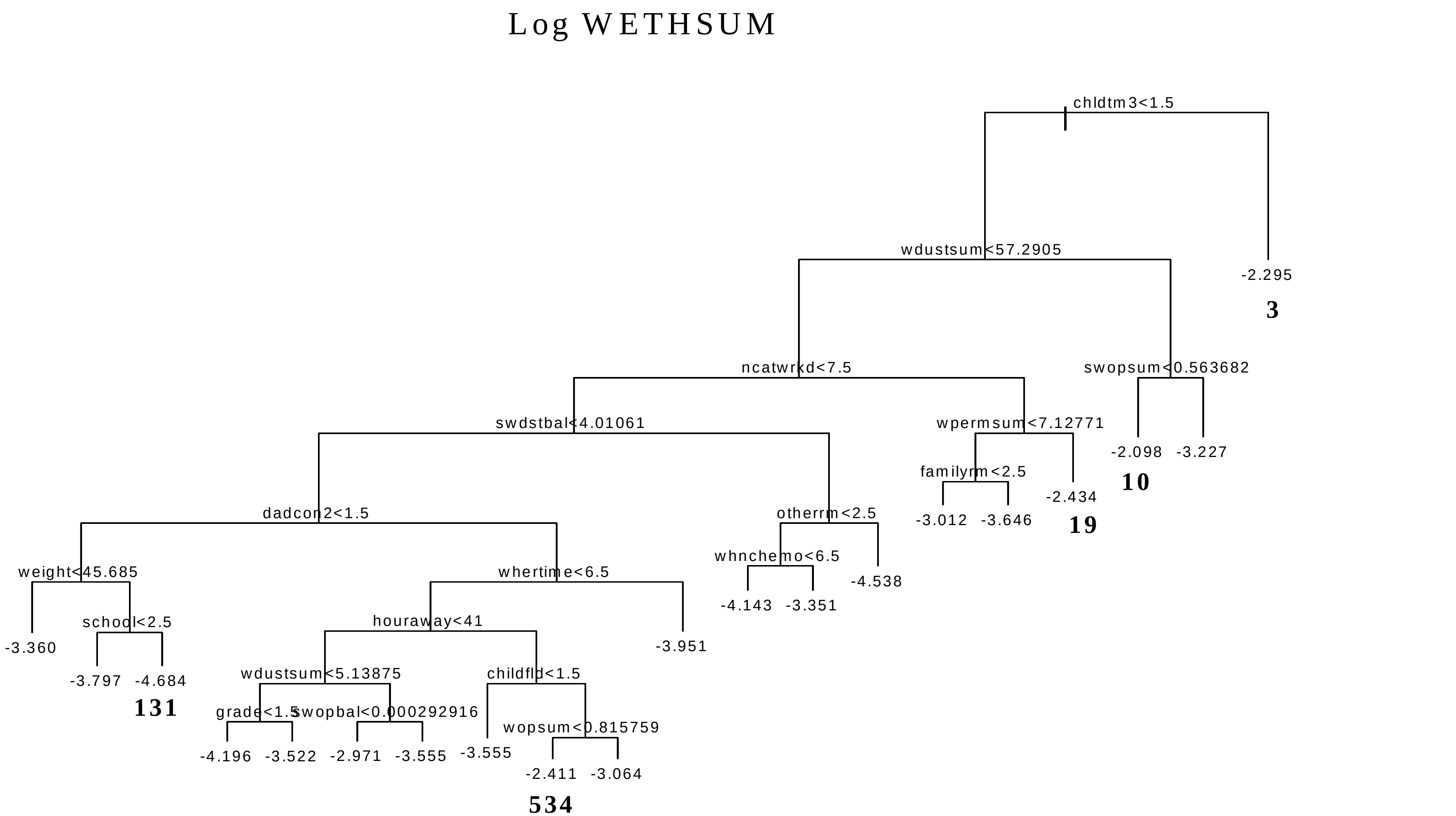

Figure G.3.5.a CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions and House and School Dust Measurements for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean

    1) ROOT 130 91.37000 -3.352
    2) CHLDTM3<1.5 122 78.87000 -3.421
      4) WDUSTSUM<57.2905 110 63.70000 -3.504
        8) NCATWRKD<7.5 90 51.83000 -3.589
         16) SWDSTBAL<4.01061 72 37.41000 -3.462
           32) DADCON2<1.5 19  7.97400 -3.847
             64) WEIGHT<45.685 8  1.21300 -3.360 *
             65) WEIGHT>45.685 11  3.49400 -4.200
              130) SCHOOL<2.5 6  1.16900 -3.797 *
              131) SCHOOL>2.5 5  0.17690 -4.684 *
           33) DADCON2>1.5 53 25.62000 -3.324
             66) WHERTIME<6.5 46 21.38000 -3.229
              132) HOURAWAY<41 26  8.68300 -3.468
                264) WDUSTSUM<5.13875 11  2.24800 -3.828
                  528) GRADE<1.5 5  0.05032 -4.196 *
                  529) GRADE>1.5 6  0.96070 -3.522 *
                265) WDUSTSUM>5.13875 15  3.96500 -3.205
                  530) SWOPBAL<0.000292916 9  1.55700 -2.971 *
                  531) SWOPBAL>0.000292916 6  1.18200 -3.555 *
              133) HOURAWAY>41 20  9.26200 -2.918
                266) CHILDFLD<1.5 6  2.02800 -3.555 *
                267) CHILDFLD>1.5 14  3.75200 -2.644
                  534) WOPSUM<0.815759 9  1.04500 -2.411 *
                  535) WOPSUM>0.815759 5  1.33600 -3.064 *
             67) WHERTIME>6.5 7  1.07700 -3.951 *
         17) SWDSTBAL>4.01061 18  8.59000 -4.098
           34) OTHERRM<2.5 10  2.32500 -3.747
             68) WHNCHEMO<6.5 5  0.27310 -4.143 *
             69) WHNCHEMO>6.5 5  0.48550 -3.351 *
           35) OTHERRM>2.5 8  3.48700 -4.538 *
        9) NCATWRKD>7.5 20  8.28100 -3.121
         18) WPERMSUM<7.12771 15  4.09700 -3.350
           36) FAMILYRM<2.5 7  0.17600 -3.012 *
           37) FAMILYRM>2.5 8  2.41900 -3.646 *
         19) WPERMSUM>7.12771 5  1.04100 -2.434 *
      5) WDUSTSUM>57.2905 12  7.50400 -2.662
       10) SWOPSUM<0.563682 6  1.89600 -2.098 *
       11) SWOPSUM>0.563682 6  1.78500 -3.227 *
    3) CHLDTM3>1.5 8  2.97500 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 10, 3, 534, and 19. Node 131 has the lowest average level of Log(WETHSUM). The nodes are numbered in bold on Figure G.3.5.a and the final split characteristics are bolded in the above tree description.

- **Node 10** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM > 57.2905, and SWOPSUM < 0.563682. The average level of WETHSUM for these participants was 0.1227 nmoles/g Creatinine (Log(WETHSUM) = -2.098).
- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child did not spend time in school. These cases had an average level of 0.1008 nmoles/g Creatinine WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table G.3.6.
- **Node 534** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD < 7.5, SWDSTBAL < 4.01061, DADCON2 > 1.5, WHERTIME < 6.5, HOURAWAY > 41, CHLDFLD > 1.5, and WOPSUM < 0.815759. The average level of WETHSUM for these participants was 0.0897 nmoles/g Creatinine (Log(WETHSUM) = -2.411).
- **Node 19** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD > 7.5, and WPERMSUM > 7.12771. The average level of WETHSUM for these participants was 0.0877 nmoles/g Creatinine (Log(WETHSUM) = -2.434).
- **Node 131** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, NCATWRKD < 7.5, SWDSTBAL < 4.01061, DADCON2 < 1.5, WEIGHT > 45.685 (pounds), and SCHOOL > 2.5. The average level of WETHSUM for these participants was 0.0092 nmoles/g Creatinine (Log(WETHSUM) = -4.684).

Figure G.3.5.b CART Analysis of LWETHSUM [LOG(WETHSUM)] with All Questions and House and School Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.5.a)

Log WETHSUM

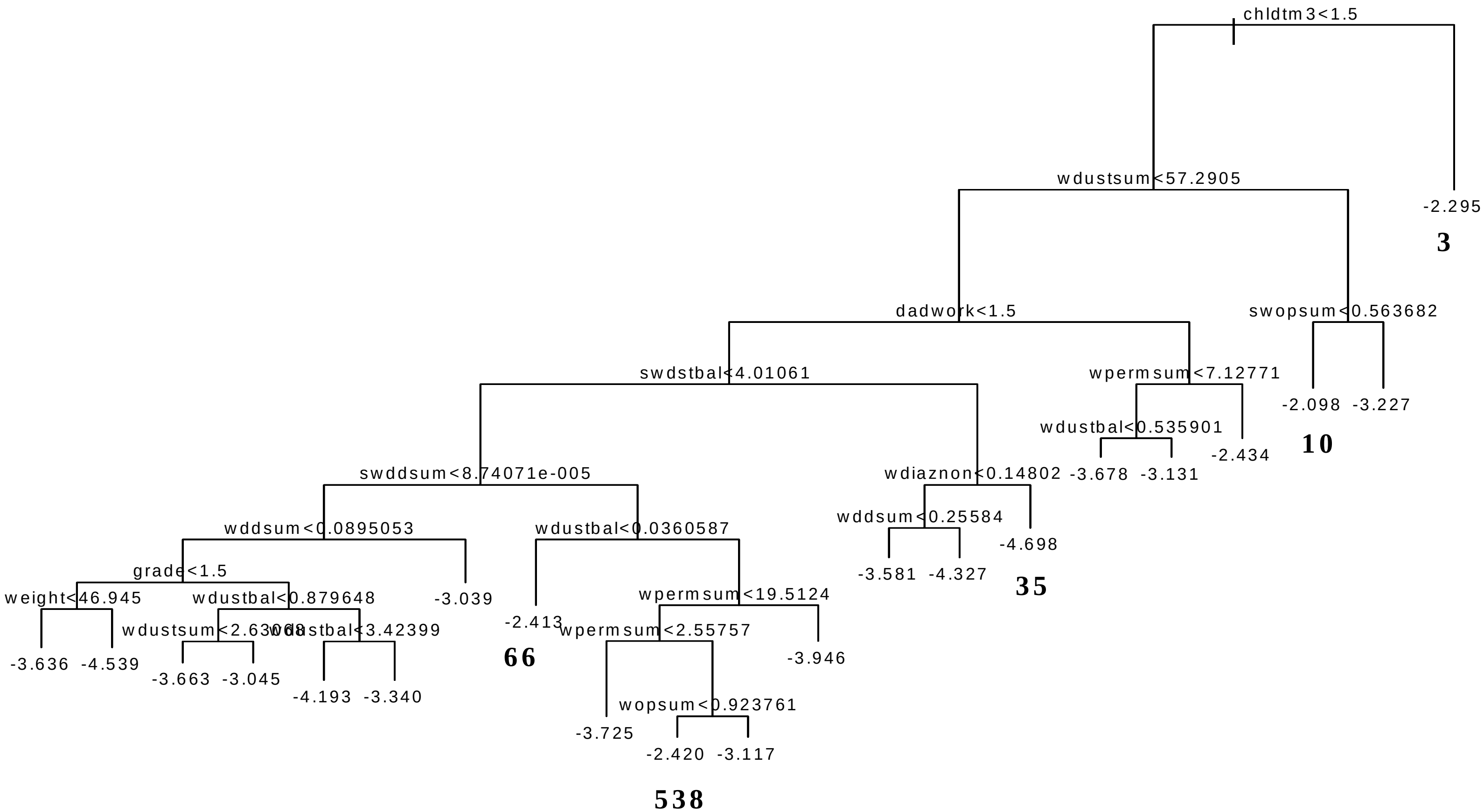

Figure G.3.6.a CART Analysis of LWETHSUM [LOG(WETHSUM)] with Limited Questions and House and School Dust Measurements for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 91.3700 -3.352
    2) CHLDTM3<1.5 122 78.8700 -3.421
      4) WDUSTSUM<57.2905 110 63.7000 -3.504
        8) DADWORK<1.5 90 51.8300 -3.589
         16) SWDSTBAL<4.01061 72 37.4100 -3.462
           32) SWDDSUM<8.74071E-005 43 19.0900 -3.634
             64) WDDSUM<0.0895053 37 14.8100 -3.731
              128) GRADE<1.5 11  4.3610 -4.046
                256) WEIGHT<46.945 6  1.8300 -3.636 *
                257) WEIGHT>46.945 5  0.3091 -4.539 *
              129) GRADE>1.5 26  8.8940 -3.597
                258) WDUSTBAL<0.879648 13  2.7320 -3.330
                  516) WDUSTSUM<2.63068 6  0.1600 -3.663 *
                  517) WDUSTSUM>2.63068 7  1.3390 -3.045 *
                259) WDUSTBAL>0.879648 13  4.3030 -3.865
                  518) WDUSTBAL<3.42399 8  0.6443 -4.193 *
                  519) WDUSTBAL>3.42399 5  1.4210 -3.340 *
             65) WDDSUM>0.0895053 6  1.7990 -3.039 *
           33) SWDDSUM>8.74071E-005 29 15.1600 -3.207
             66) WDUSTBAL<0.0360587 5  0.6672 -2.413 *
             67) WDUSTBAL>0.0360587 24 10.6800 -3.372
              134) WPERMSUM<19.5124 19  7.4790 -3.222
                268) WPERMSUM<2.55757 9  1.3840 -3.725 *
                269) WPERMSUM>2.55757 10  1.7570 -2.768
                  538) WOPSUM<0.923761 5  0.1611 -2.420 *
                  539) WOPSUM>0.923761 5  0.3797 -3.117 *
              135) WPERMSUM>19.5124 5  1.1300 -3.946 *
         17) SWDSTBAL>4.01061 18  8.5900 -4.098
           34) WDIAZNON<0.14802 13  4.4740 -3.868
             68) WDDSUM<0.25584 8  2.0210 -3.581 *
             69) WDDSUM>0.25584 5  0.7376 -4.327 *
           35) WDIAZNON>0.14802 5  1.6260 -4.698 *
        9) DADWORK>1.5 20  8.2810 -3.121
         18) WPERMSUM<7.12771 15  4.0970 -3.350
           36) WDUSTBAL<0.535901 6  0.7507 -3.678 *
           37) WDUSTBAL>0.535901 9  2.2670 -3.131 *
         19) WPERMSUM>7.12771 5  1.0410 -2.434 *
      5) WDUSTSUM>57.2905 12  7.5040 -2.662
       10) SWOPSUM<0.563682 6  1.8960 -2.098 *
       11) SWOPSUM>0.563682 6  1.7850 -3.227 *
    3) CHLDTM3>1.5 8  2.9750 -2.295 *
```

The four nodes with the highest average levels of Log(WETHSUM) are 10, 3, 66, and 538. Node 35 has the lowest average level of Log(WETHSUM). The nodes are numbered in bold on Figure G.3.6.a and the final split characteristics are bolded in the above tree description.

- **Node 10** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM > 57.2905, and SWOPSUM < 0.563682. The average level of WETHSUM for these participants was 0.1227 nmoles/g Creatinine (Log(WETHSUM) = -2.098).
- **Node 3** is characterized by participants with CHLDTM3 responses > 1.5, that is, the child did not spend time in school. These cases had an average level of 0.1008 nmoles/g Creatinine WETHSUM (Log(WETHSUM) = -2.295). These may be participants who spent "additional" time in school. See discussion surrounding Table G.3.6.
- **Node 66** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, DADWORK < 1.5, SWDSTBAL < 4.01061, SWDDSUM > 8.7E-05, and WDUSTBAL < 0.0360587. The average level of WETHSUM for these participants was 0.0895 nmoles/g Creatinine (Log(WETHSUM) = -2.413).
- **Node 538** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, DADWORK < 1.5, SWDSTBAL < 4.01061, SWDDSUM > 8.7E-05, WDUSTBAL > 0.0360587, WPERMSUM < 19.5124, WPERMSUM > 2.55757, and WOPSUM < 0.923761. The average level of WETHSUM for these participants was 0.0889 nmoles/g Creatinine (Log(WETHSUM) = -2.420).
- **Node 35** is characterized by participants with CHLDTM3 < 1.5, WDUSTSUM < 57.2905, DADWORK < 1.5, SWDSTBAL > 4.01061, and WDIAZNON < 0.14802. The average level of WETHSUM for these participants was 0.0091 nmoles/g Creatinine (Log(WETHSUM) = -4.698).

Figure G.3.6.b CART Analysis of LWETHSUM [LOG(WETHSUM)] with Limited Questions and House and School Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.6.a)

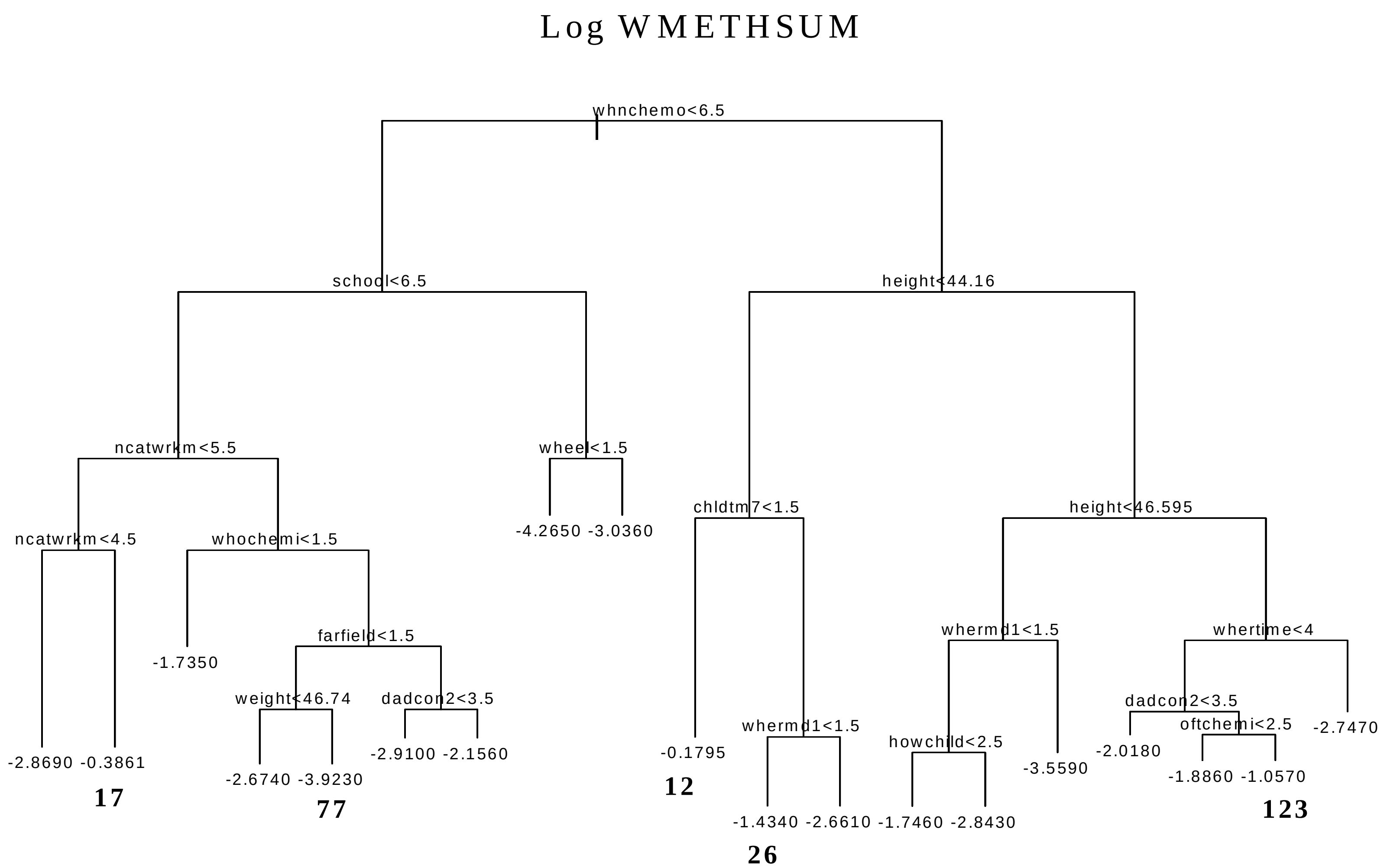

Figure G.3.7.a CART Analysis of LWMETHSM [LOG(WMETHSUM)] with All Questions for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 237.400 -2.2580
    2) WHNCHEMO<6.5 57 100.600 -2.6210
      4) SCHOOL<6.5 45  74.430 -2.3740
        8) NCATWRKM<5.5 10  25.250 -1.6280
         16) NCATWRKM<4.5 5   1.138 -2.8690 *
         17) NCATWRKM>4.5 5   8.700 -0.3861 *
        9) NCATWRKM>5.5 35  42.010 -2.5870
         18) WHOCHEMI<1.5 8  10.100 -1.7350 *
         19) WHOCHEMI>1.5 27  24.380 -2.8400
           38) FARFIELD<1.5 11  10.540 -3.3550
             76) WEIGHT<46.74 5   2.104 -2.6740 *
             77) WEIGHT>46.74 6   4.182 -3.9230 *
           39) FARFIELD>1.5 16   8.915 -2.4860
             78) DADCON2<3.5 7   4.271 -2.9100 *
             79) DADCON2>3.5 9   2.406 -2.1560 *
      5) SCHOOL>6.5 12  13.100 -3.5480
       10) WHEEL<1.5 5   4.465 -4.2650 *
       11) WHEEL>1.5 7   4.218 -3.0360 *
    3) WHNCHEMO>6.5 73 123.400 -1.9740
      6) HEIGHT<44.16 24  46.830 -1.2700
       12) CHLDTM7<1.5 9   3.500 -0.1795 *
       13) CHLDTM7>1.5 15  26.200 -1.9250
         26) WHERMD1<1.5 9  14.650 -1.4340 *
         27) WHERMD1>1.5 6   6.125 -2.6610 *
      7) HEIGHT>44.16 49  58.890 -2.3190
       14) HEIGHT<46.595 23  29.130 -2.7890
         28) WHERMD1<1.5 14  17.140 -2.2940
           56) HOWCHILD<2.5 7   6.467 -1.7460 *
           57) HOWCHILD>2.5 7   6.462 -2.8430 *
         29) WHERMD1>1.5 9   3.232 -3.5590 *
       15) HEIGHT>46.595 26  20.150 -1.9020
         30) WHERTIME<4 20  12.480 -1.6490
           60) DADCON2<3.5 8   3.190 -2.0180 *
           61) DADCON2>3.5 12   7.467 -1.4020
            122) OFTCHEMI<2.5 5   3.535 -1.8860 *
            123) OFTCHEMI>2.5 7   1.925 -1.0570 *
         31) WHERTIME>4 6   2.106 -2.7470 *
```

The four nodes with the highest average levels of Log(WMETHSUM) are 12, 17, 123, and 26. Node 77 has the lowest average level of Log(WMETHSUM). The nodes are numbered in bold on Figure G.3.7.a and the final split characteristics are bolded in the above tree description.

- **Node 12** is characterized by participants with WHNCHEMO > 6.5, HEIGHT < 44.16 (inches), and CHLDTM7 < 1.5. The average level of WMETHSUM for these participants was 0.8357 nmoles/g Creatinine (Log(WMETHSUM) = -0.1795).
- **Node 17** is characterized by participants with WHNCHEMO < 6.5, SCHOOL < 6.5, NCATWRKM < 5.5, and NCATWRKM > 4.5. The average level of WMETHSUM for these participants was 0.6797 nmoles/g Creatinine (Log(WMETHSUM) = -0.3861).
- **Node 123** is characterized by participants with WHNCHEMO > 6.5, HEIGHT > 44.16 (inches), HEIGHT > 46.595 (inches), WHERTIME < 4, DADCON2 > 3.5, and OFTCHEMI > 2.5. The average level of WMETHSUM for these participants was 0.3475 nmoles/g Creatinine (Log(WMETHSUM) = -1.0570).
- **Node 26** is characterized by participants with WHNCHEMO > 6.5, HEIGHT < 44.16 (inches), CHLDTM7 > 1.5, and WHERMD1 < 1.5. The average level of WMETHSUM for these participants was 0.2384 nmoles/g Creatinine (Log(WMETHSUM) = -1.4340).
- **Node 77** is characterized by participants with WHNCHEMO < 6.5, SCHOOL < 6.5, NCATWRKM < 5.5, WHOCHEMI > 1.5, FARFIELD < 1.5, and WEIGHT > 46.74 (pounds). The average level of WMETHSUM for these participants was 0.0196 nmoles/g Creatinine (Log(WMETHSUM) = -3.9320).

Figure G.3.7.b CART Analysis of LWMETHSM [LOG(WMETHSUM)] with All Questions for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.7.a)

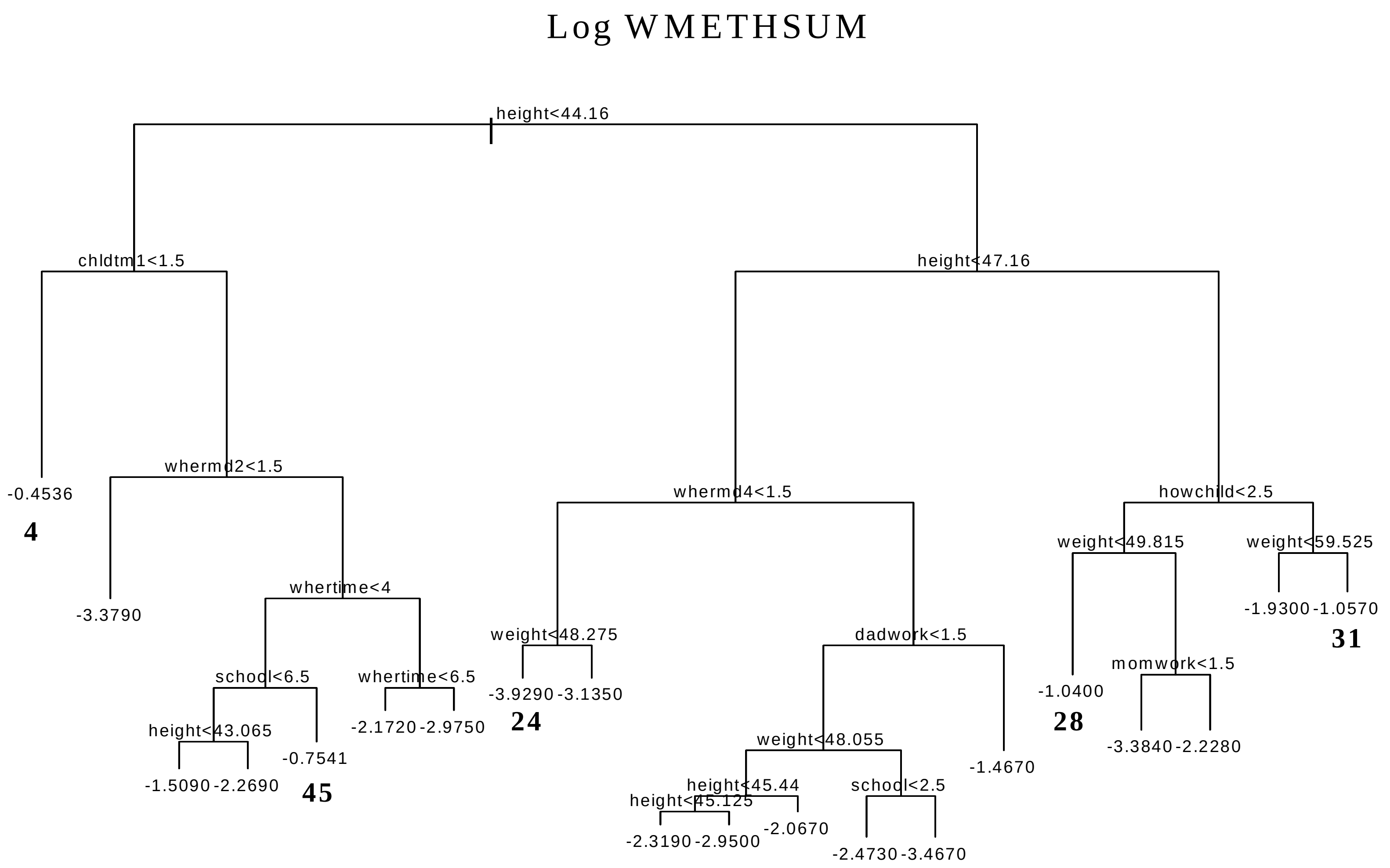

Figure G.3.8.a CART Analysis of LWMETHSM [LOG(WMETHSUM)] with Limited Questions for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 237.400 -2.2580
    2) HEIGHT<44.16 43 101.700 -1.8360
      4) CHLDTM1<1.5 7  15.870 -0.4536 *
      5) CHLDTM1>1.5 36  69.880 -2.1050
       10) WHERMD2<1.5 5  14.240 -3.3790 *
       11) WHERMD2>1.5 31  46.210 -1.8990
         22) WHERTIME<4 20  31.530 -1.5480
           44) SCHOOL<6.5 15  18.990 -1.8130
             88) HEIGHT<43.065 9  13.330 -1.5090 *
             89) HEIGHT>43.065 6   3.588 -2.2690 *
           45) SCHOOL>6.5 5   8.334 -0.7541 *
         23) WHERTIME>4 11   7.744 -2.5370
           46) WHERTIME<6.5 6   4.860 -2.1720 *
           47) WHERTIME>6.5 5   1.126 -2.9750 *
    3) HEIGHT>44.16 87 124.200 -2.4660
      6) HEIGHT<47.16 52  61.400 -2.8390
       12) WHERMD4<1.5 16  11.170 -3.5320
         24) WEIGHT<48.275 8   5.485 -3.9290 *
         25) WEIGHT>48.275 8   3.165 -3.1350 *
       13) WHERMD4>1.5 36  39.130 -2.5310
         26) DADWORK<1.5 30  26.760 -2.7440
           52) WEIGHT<48.055 16  10.820 -2.4220
            104) HEIGHT<45.44 10   6.004 -2.6340
              208) HEIGHT<45.125 5   3.425 -2.3190 *
              209) HEIGHT>45.125 5   1.584 -2.9500 *
            105) HEIGHT>45.44 6   3.607 -2.0670 *
           53) WEIGHT>48.055 14  12.370 -3.1120
            106) SCHOOL<2.5 5   7.099 -2.4730 *
            107) SCHOOL>2.5 9   2.099 -3.4670 *
         27) DADWORK>1.5 6   4.222 -1.4670 *
      7) HEIGHT>47.16 35  44.880 -1.9130
       14) HOWCHILD<2.5 19  25.660 -2.2190
         28) WEIGHT<49.815 5   1.886 -1.0400 *
         29) WEIGHT>49.815 14  14.330 -2.6410
           58) MOMWORK<1.5 5   1.741 -3.3840 *
           59) MOMWORK>1.5 9   8.297 -2.2280 *
       15) HOWCHILD>2.5 16  15.300 -1.5480
         30) WEIGHT<59.525 9   3.379 -1.9300 *
         31) WEIGHT>59.525 7   8.919 -1.0570 *
```

The four nodes with the highest average levels of Log(WMETHSUM) are 4, 45, 28, and 31. Node 24 has the lowest average level of Log(WMETHSUM). The nodes are numbered in bold on Figure G.3.8.a and the final split characteristics are bolded in the above tree description.

- **Node 4** is characterized by participants with HEIGHT < 44.16 (inches), and CHLDTM1 < 1.5. The average level of WMETHSUM for these participants was 0.6353 nmoles/g Creatinine (Log(WMETHSUM) = -0.4536).
- **Node 45** is characterized by participants with HEIGHT < 44.16 (inches), CHLDTM1 > 1.5, WHERMD2 > 1.5, WHERTIME < 4, and SCHOOL < 6.5. The average level of WMETHSUM for these participants was 0.4704 nmoles/g Creatinine (Log(WMETHSUM) = -0.7541).
- **Node 28** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT > 47.16 (inches), HOWCHILD < 2.5, and WEIGHT < 49.815 (pounds). The average level of WMETHSUM for these participants was 0.3535 nmoles/g Creatinine (Log(WMETHSUM) = -1.0400).
- **Node 31** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT > 47.16 (inches), HOWCHILD > 2.5, and WEIGHT > 59.525 (pounds). The average level of WMETHSUM for these participants was 0.3475 nmoles/g Creatinine (Log(WMETHSUM) = -1.0570).
- **Node 24** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT < 47.16 (inches), WHERMD4 < 1.5, and WEIGHT < 48.275 (inches). The average level of WMETHSUM for these participants was 0.0197 nmoles/g Creatinine (Log(WMETHSUM) = -3.9290).

Figure G.3.8.b CART Analysis of LWMETHSM [LOG(WMETHSUM)] with Limited Questions for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.8.a)

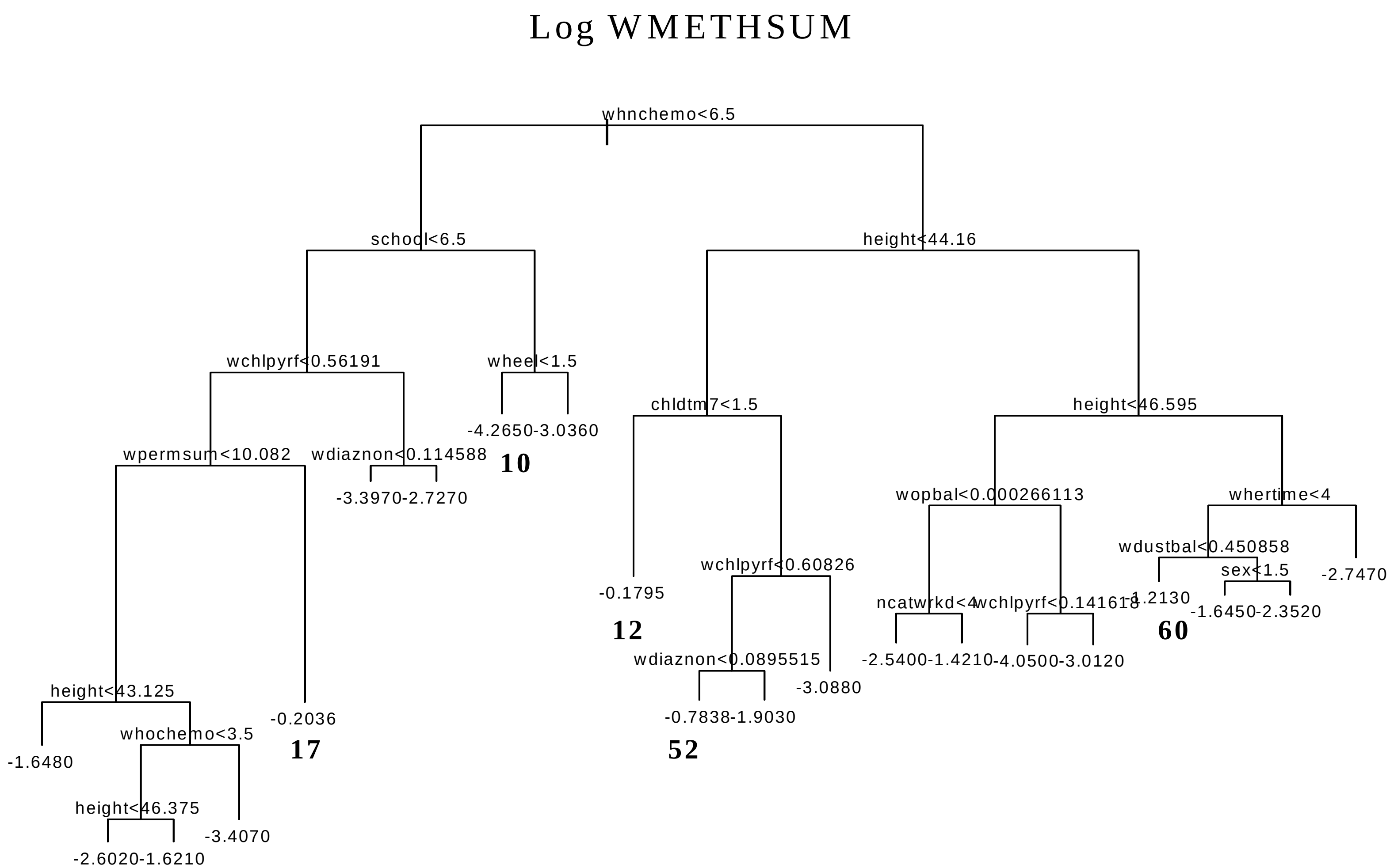

Figure G.3.9.a **CART Analysis of LWMETHSM [LOG(WMETHSUM)] with All Questions and House Dust Measurements for 130 Yuma Study Participants: CART Tree**

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 237.4000 -2.2580
    2) WHNCHEMO<6.5 57 100.6000 -2.6210
      4) SCHOOL<6.5 45  74.4300 -2.3740
        8) WCHLPYRF<0.56191 30  60.1000 -2.0410
         16) WPERMSUM<10.082 24  30.6800 -2.5010
           32) HEIGHT<43.125 5   3.0470 -1.6480 *
           33) HEIGHT>43.125 19  23.0500 -2.7250
             66) WHOCHEMO<3.5 10   4.9560 -2.1110
              132) HEIGHT<46.375 5   0.9366 -2.6020 *
              133) HEIGHT>46.375 5   1.6160 -1.6210 *
             67) WHOCHEMO>3.5 9  10.1400 -3.4070 *
         17) WPERMSUM>10.082 6   4.0920 -0.2036 *
        9) WCHLPYRF>0.56191 15   4.3590 -3.0400
         18) WDIAZNON<0.114588 7   1.4320 -3.3970 *
         19) WDIAZNON>0.114588 8   1.2560 -2.7270 *
      5) SCHOOL>6.5 12  13.1000 -3.5480
       10) WHEEL<1.5 5   4.4650 -4.2650 *
       11) WHEEL>1.5 7   4.2180 -3.0360 *
    3) WHNCHEMO>6.5 73 123.4000 -1.9740
      6) HEIGHT<44.16 24  46.8300 -1.2700
       12) CHLDTM7<1.5 9   3.5000 -0.1795 *
       13) CHLDTM7>1.5 15  26.2000 -1.9250
         26) WCHLPYRF<0.60826 10  13.5800 -1.3430
           52) WDIAZNON<0.0895515 5   6.0950 -0.7838 *
           53) WDIAZNON>0.0895515 5   4.3540 -1.9030 *
         27) WCHLPYRF>0.60826 5   2.4690 -3.0880 *
      7) HEIGHT>44.16 49  58.8900 -2.3190
       14) HEIGHT<46.595 23  29.1300 -2.7890
         28) WOPBAL<0.000266113 10   9.9560 -1.9810
           56) NCATWRKD<4 5   4.0880 -2.5400 *
           57) NCATWRKD>4 5   2.7380 -1.4210 *
         29) WOPBAL>0.000266113 13   7.6150 -3.4110
           58) WCHLPYRF<0.141618 5   1.5730 -4.0500 *
           59) WCHLPYRF>0.141618 8   2.7310 -3.0120 *
       15) HEIGHT>46.595 26  20.1500 -1.9020
         30) WHERTIME<4 20  12.4800 -1.6490
           60) WDUSTBAL<0.450858 8   3.2770 -1.2130 *
           61) WDUSTBAL>0.450858 12   6.6620 -1.9400
            122) SEX<1.5 7   2.0010 -1.6450 *
            123) SEX>1.5 5   3.2010 -2.3520 *
                31) WHERTIME>4 6   2.1060 -2.7470 *
```

The four nodes with the highest average levels of Log(WMETHSUM) are 12, 17, 52, and 60. Node 10 has the lowest average level of Log(WMETHSUM). The nodes are numbered in bold on Figure G.3.9.a and the final split characteristics are bolded in the above tree description.

- **Node 12** is characterized by participants with WHNCHEMO > 6.5, HEIGHT < 44.16 (inches), and CHLDTM7 < 1.5. The average level of WMETHSUM for these participants was 0.8357 nmoles/g Creatinine (Log(WMETHSUM) = -0.1795).
- **Node 17** is characterized by participants with WHNCHEMO < 6.5, SCHOOL < 6.5, WCHLPYRF < 0.56191, and WPERMSUM > 10.082. The average level of WMETHSUM for these participants was 0.8158 nmoles/g Creatinine (Log(WMETHSUM) = -0.2036).
- **Node 60** is characterized by participants with WHNCHEMO > 6.5, HEIGHT > 44.16 (inches), HEIGHT > 46.595 (inches), WHERTIME < 4, and WDUSTBAL < 0.450858. The average level of WMETHSUM for these participants was 0.2973 nmoles/g Creatinine (Log(WMETHSUM) = -1.2130).
- **Node 52** is characterized by participants with WHNCHEMO > 6.5, HEIGHT < 44.16 (inches), CHLDTM7 > 1.5, WCHLPYRF < 0.60826, and WDIAZNON < 0.0895515. The average level of WMETHSUM for these participants was 0.4567 nmoles/g Creatinine (Log(WMETHSUM) = -0.7838).
- **Node 10** is characterized by participants with WHNCHEMO < 6.5, SCHOOL > 6.5, and WHEEL < 1.5. The average level of WMETHSUM for these participants was 0.0141 nmoles/g Creatinine (Log(WMETHSUM) = -4.2650).

Figure G.3.9.b CART Analysis of LWMETHSM [LOG(WMETHSUM)] with All Questions and House Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.9.a)

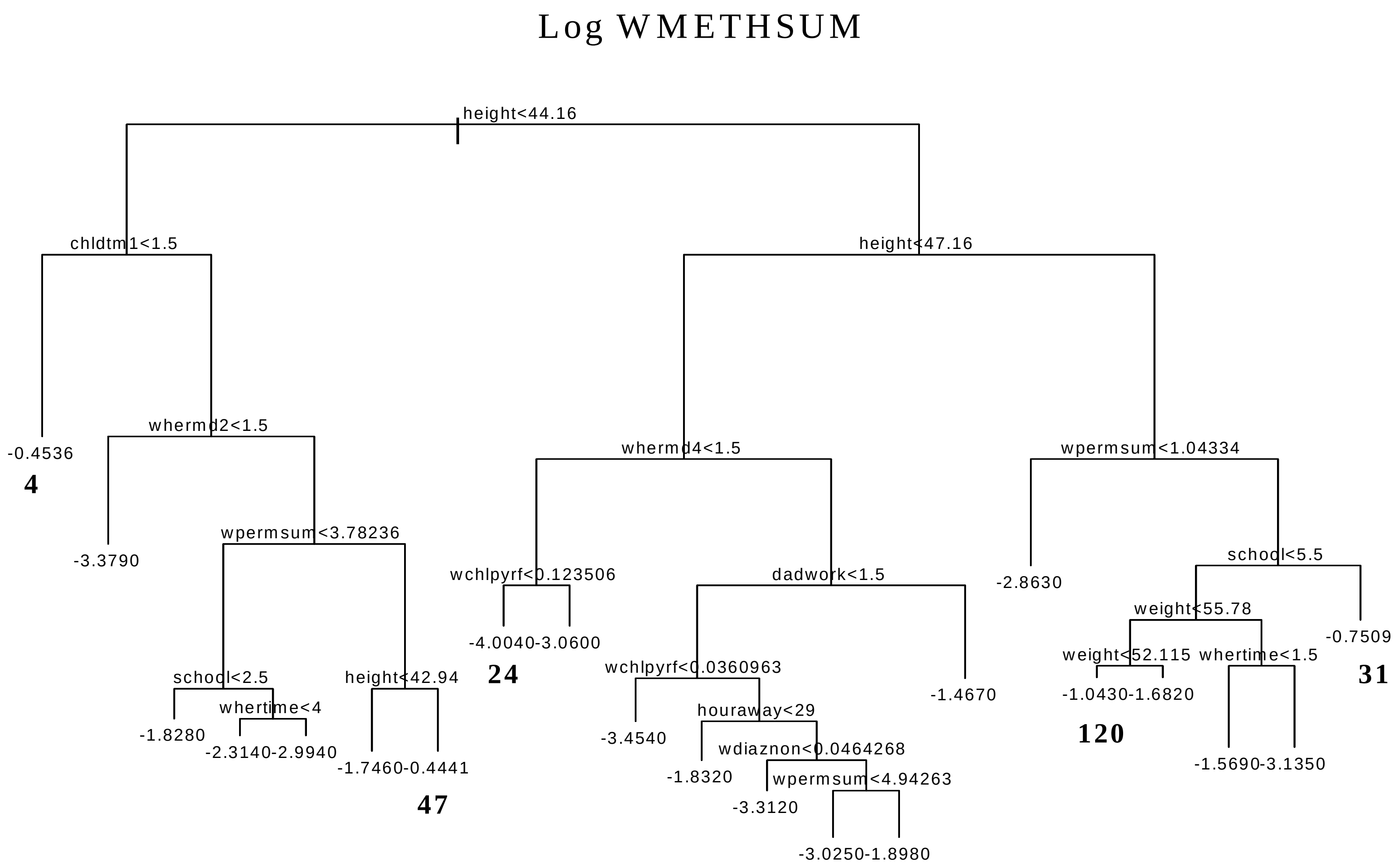

Figure G.3.10.a CART Analysis of LWMETHSM [LOG(WMETHSUM)] with Limited Questions and House Dust Measurements for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 237.4000 -2.2580
    2) HEIGHT<44.16 43 101.7000 -1.8360
      4) CHLDTM1<1.5 7  15.8700 -0.4536 *
      5) CHLDTM1>1.5 36  69.8800 -2.1050
       10) WHERMD2<1.5 5  14.2400 -3.3790 *
       11) WHERMD2>1.5 31  46.2100 -1.8990
         22) WPERMSUM<3.78236 18  15.5900 -2.4440
           44) SCHOOL<2.5 5   6.7420 -1.8280 *
           45) SCHOOL>2.5 13   6.2240 -2.6800
             90) WHERTIME<4 6   3.2790 -2.3140 *
             91) WHERTIME>4 7   1.4510 -2.9940 *
         23) WPERMSUM>3.78236 13  17.9000 -1.1450
           46) HEIGHT<42.94 7   6.4150 -1.7460 *
           47) HEIGHT>42.94 6   6.0080 -0.4441 *
    3) HEIGHT>44.16 87 124.2000 -2.4660
      6) HEIGHT<47.16 52  61.4000 -2.8390
       12) WHERMD4<1.5 16  11.1700 -3.5320
         24) WCHLPYRF<0.123506 8   5.6550 -4.0040 *
         25) WCHLPYRF>0.123506 8   1.9540 -3.0600 *
       13) WHERMD4>1.5 36  39.1300 -2.5310
         26) DADWORK<1.5 30  26.7600 -2.7440
           52) WCHLPYRF<0.0360963 6   3.0510 -3.4540 *
           53) WCHLPYRF>0.0360963 24  19.9200 -2.5660
            106) HOURAWAY<29 5   2.0940 -1.8320 *
            107) HOURAWAY>29 19  14.4200 -2.7600
              214) WDIAZNON<0.0464268 6   2.3920 -3.3120 *
              215) WDIAZNON>0.0464268 13   9.3600 -2.5050
                430) WPERMSUM<4.94263 7   1.4000 -3.0250 *
                431) WPERMSUM>4.94263 6   3.8570 -1.8980 *
         27) DADWORK>1.5 6   4.2220 -1.4670 *
      7) HEIGHT>47.16 35  44.8800 -1.9130
       14) WPERMSUM<1.04334 8   6.1140 -2.8630 *
       15) WPERMSUM>1.04334 27  29.4000 -1.6310
         30) SCHOOL<5.5 22  19.4500 -1.8310
           60) WEIGHT<55.78 10   3.3010 -1.3620
            120) WEIGHT<52.115 5   1.3320 -1.0430 *
            121) WEIGHT>52.115 5   0.9485 -1.6820 *
           61) WEIGHT>55.78 12  12.1200 -2.2220
            122) WHERTIME<1.5 7   2.9680 -1.5690 *
            123) WHERTIME>1.5 5   1.9990 -3.1350 *
         31) SCHOOL>5.5 5   5.1990 -0.7509 *
```

The four nodes with the highest average levels of Log(WMETHSUM) are 47, 4, 31, and 120. Node 24 has the lowest average level of Log(WMETHSUM). The nodes are numbered in bold on Figure G.3.10.a and the final split characteristics are bolded in the above tree description.

- **Node 47** is characterized by participants with HEIGHT < 44.16 (inches), CHLDTM1 > 1.5, WHERMD2 > 1.5, WPERMSUM > 3.78236, and HEIGHT > 42.94 (inches). The average level of WMETHSUM for these participants was 0.6414 nmoles/g Creatinine (Log(WMETHSUM) = -0.4441).
- **Node 4** is characterized by participants with HEIGHT < 44.16 (inches), and CHLDTM1 < 1.5. The average level of WMETHSUM for these participants was 0.6353 nmoles/g Creatinine (Log(WMETHSUM) = -0.4536).
- **Node 31** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT > 47.16 (inches), WPERMSUM > 1.04334, and SCHOOL > 5.5. The average level of WMETHSUM for these participants was 0.4719 nmoles/g Creatinine (Log(WMETHSUM) = -0.7509).
- **Node 120** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT > 47.16 (inches), WPERMSUM > 1.04334, SCHOOL < 5.5, WEIGHT < 55.78 (pounds) and WEIGHT < 52.115 (pounds). The average level of WMETHSUM for these participants was 0.3524 nmoles/g Creatinine (Log(WMETHSUM) = -1.0430).
- **Node 24** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT < 47.16 (inches), WHERMD4 < 1.5, and WCHLPYRF < 0.123506. The average level of WMETHSUM for these participants was 0.0182 nmoles/g Creatinine (Log(WMETHSUM) = -4.0040).

Figure G.3.10.b CART Analysis of LWMETHSM [LOG(WMETHSUM)] with Limited Questions and House Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.10.a)

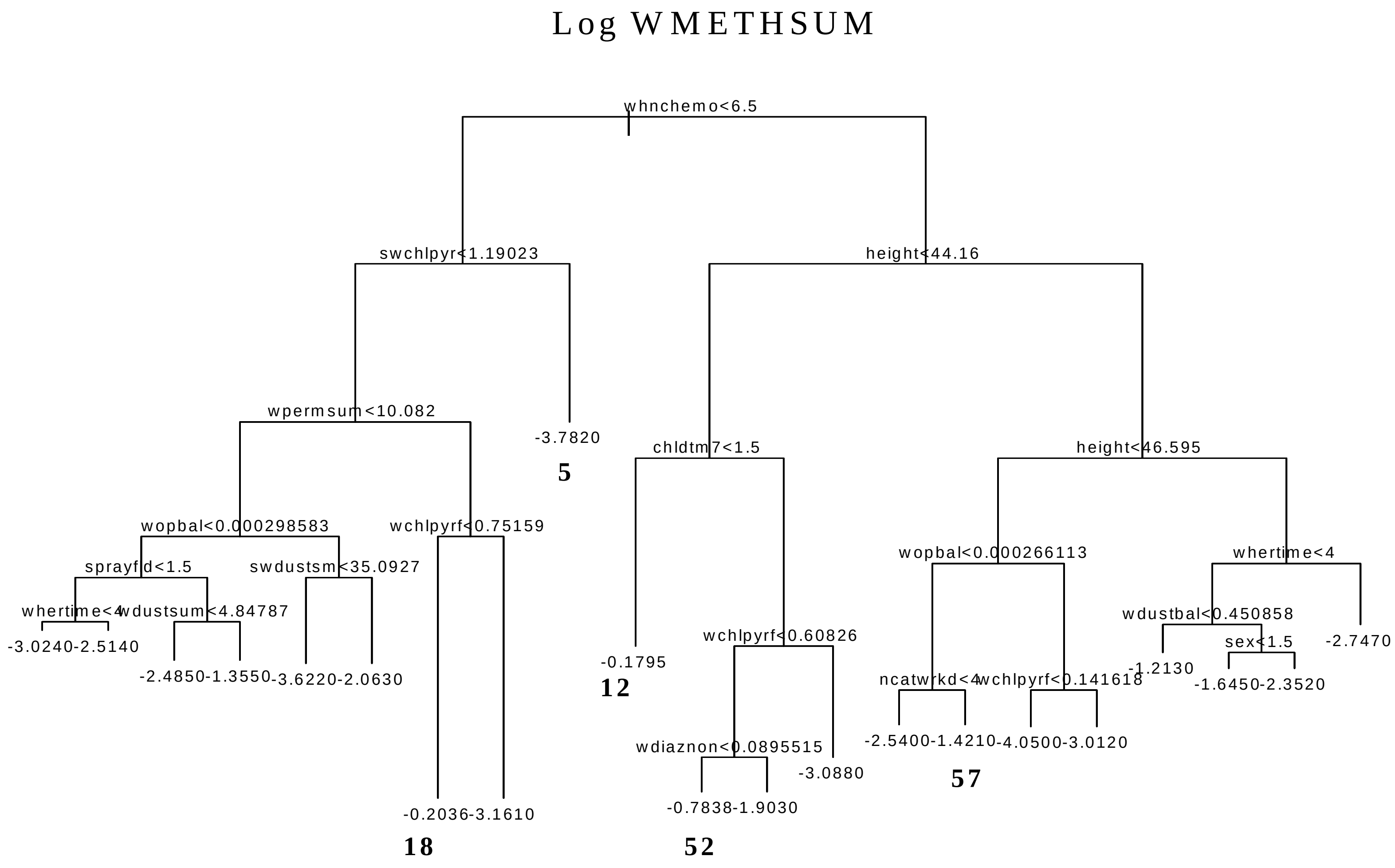

Figure G.3.11.a CART Analysis of LWMETHSM [LOG(WMETHSUM)] with All Questions and House and School Dust Measurements for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

1) ROOT 130 237.4000 -2.2580
    2) WHNCHEMO<6.5 57 100.6000 -2.6210
      4) SWCHLPYR<1.19023 48  76.1800 -2.4040
        8) WPERMSUM<10.082 37  36.0000 -2.6580
         16) WOPBAL<0.000298583 23  11.9400 -2.4100
           32) SPRAYFLD<1.5 12   2.3950 -2.8120
             64) WHERTIME<4 7   0.9452 -3.0240 *
             65) WHERTIME>4 5   0.6906 -2.5140 *
           33) SPRAYFLD>1.5 11   5.4950 -1.9720
             66) WDUSTSUM<4.84787 6   0.9541 -2.4850 *
             67) WDUSTSUM>4.84787 5   1.0580 -1.3550 *
         17) WOPBAL>0.000298583 14  20.3200 -3.0650
           34) SWDUSTSM<35.0927 9   9.0480 -3.6220 *
           35) SWDUSTSM>35.0927 5   3.4580 -2.0630 *
        9) WPERMSUM>10.082 11  29.7300 -1.5480
         18) WCHLPYRF<0.75159 6   4.0920 -0.2036 *
         19) WCHLPYRF>0.75159 5   1.7830 -3.1610 *
      5) SWCHLPYR>1.19023 9  10.0000 -3.7820 *
    3) WHNCHEMO>6.5 73 123.4000 -1.9740
      6) HEIGHT<44.16 24  46.8300 -1.2700
       12) CHLDTM7<1.5 9   3.5000 -0.1795 *
       13) CHLDTM7>1.5 15  26.2000 -1.9250
         26) WCHLPYRF<0.60826 10  13.5800 -1.3430
           52) WDIAZNON<0.0895515 5   6.0950 -0.7838 *
           53) WDIAZNON>0.0895515 5   4.3540 -1.9030 *
         27) WCHLPYRF>0.60826 5   2.4690 -3.0880 *
      7) HEIGHT>44.16 49  58.8900 -2.3190
       14) HEIGHT<46.595 23  29.1300 -2.7890
         28) WOPBAL<0.000266113 10   9.9560 -1.9810
           56) NCATWRKD<4 5   4.0880 -2.5400 *
           57) NCATWRKD>4 5   2.7380 -1.4210 *
         29) WOPBAL>0.000266113 13   7.6150 -3.4110
           58) WCHLPYRF<0.141618 5   1.5730 -4.0500 *
           59) WCHLPYRF>0.141618 8   2.7310 -3.0120 *
       15) HEIGHT>46.595 26  20.1500 -1.9020
         30) WHERTIME<4 20  12.4800 -1.6490
           60) WDUSTBAL<0.450858 8   3.2770 -1.2130 *
           61) WDUSTBAL>0.450858 12   6.6620 -1.9400
            122) SEX<1.5 7   2.0010 -1.6450 *
            123) SEX>1.5 5   3.2010 -2.3520 *
         31) WHERTIME>4 6   2.1060 -2.7470 *
```

The four nodes with the highest average levels of Log(WMETHSUM) are 12, 18, 52, and 57. Node 5 has the lowest average level of Log(WMETHSUM). The nodes are numbered in bold on Figure G.3.11.a and the final split characteristics are bolded in the above tree description.

- **Node 12** is characterized by participants with WHNCHEMO > 6.5, HEIGHT < 44.16 (inches), and CHLDTM7 < 1.5. The average level of WMETHSUM for these participants was 0.8357 nmoles/g Creatinine (Log(WMETHSUM) = -0.1795).
- **Node 18** is characterized by participants with WHNCHEMO < 6.5, SWCHLPYR < 1.19023, WPERMSUM > 10.082, and WCHLPYRF < 0.75159. The average level of WMETHSUM for these participants was 0.8158 nmoles/g Creatinine (Log(WMETHSUM) = -0.2036).
- **Node 52** is characterized by participants with WHNCHEMO > 6.5, HEIGHT > 44.16 (inches), CHLDTM7 > 1.5, WCHLPYRF < 0.60826, and WDIAZNON < 0.895515. The average level of WMETHSUM for these participants was 0.4567 nmoles/g Creatinine (Log(WMETHSUM) = -0.7838).
- **Node 57** is characterized by participants with WHNCHEMO > 6.5, HEIGHT > 44.16 (inches), HEIGHT < 46.595 (inches), WOPBAL < 0.000266113, and NCATWRKD > 4. The average level of WMETHSUM for these participants was 0.2415 nmoles/g Creatinine (Log(WMETHSUM) = -1.4210).
- **Node 5** is characterized by participants with WHNCHEMO < 6.5, and SWCHLPYR > 1.19023. The average level of WMETHSUM for these participants was 0.0228 nmoles/g Creatinine (Log(WMETHSUM) = -3.7820).

Figure G.3.11.b CART Analysis of LWMETHSM [LOG(WMETHSUM)] with All Questions and House and School Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.11.a)

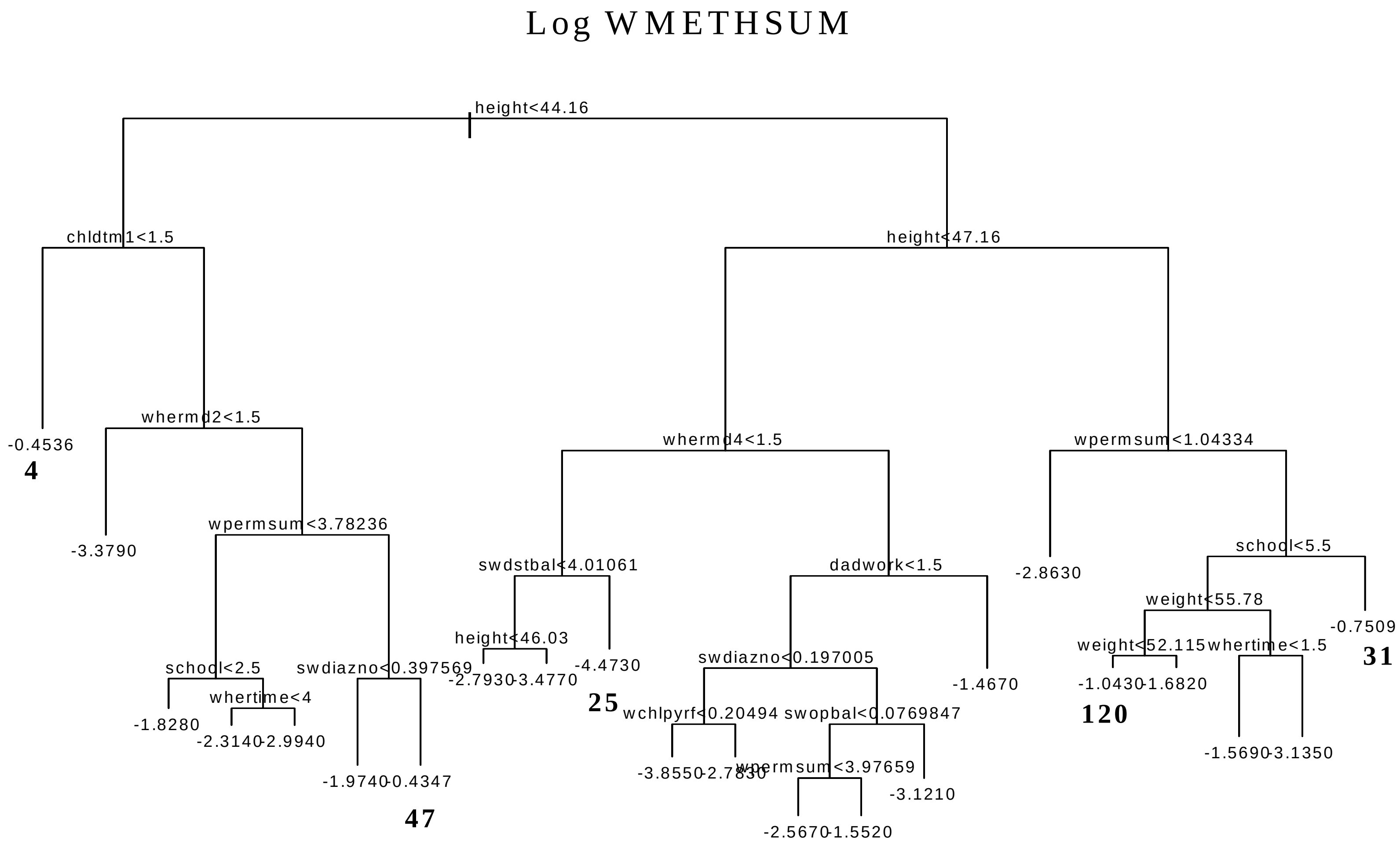

Figure G.3.12.a CART Analysis of LWMETHSM [LOG(WMETHSUM)] with Limited Questions and House and School Dust Measurements for 130 Yuma Study Participants: CART Tree

```
Legend:
node#), split characteristic, n, std deviation, mean
      * denotes terminal node

  1) ROOT 130 237.4000 -2.2580
    2) HEIGHT<44.16 43 101.7000 -1.8360
      4) CHLDTM1<1.5 7  15.8700 -0.4536 *
      5) CHLDTM1>1.5 36  69.8800 -2.1050
       10) WHERMD2<1.5 5  14.2400 -3.3790 *
       11) WHERMD2>1.5 31  46.2100 -1.8990
         22) WPERMSUM<3.78236 18  15.5900 -2.4440
           44) SCHOOL<2.5 5   6.7420 -1.8280 *
           45) SCHOOL>2.5 13   6.2240 -2.6800
             90) WHERTIME<4 6   3.2790 -2.3140 *
             91) WHERTIME>4 7   1.4510 -2.9940 *
         23) WPERMSUM>3.78236 13  17.9000 -1.1450
           46) SWDIAZNO<0.397569 6   4.5090 -1.9740 *
           47) SWDIAZNO>0.397569 7   5.7350 -0.4347 *
    3) HEIGHT>44.16 87 124.2000 -2.4660
      6) HEIGHT<47.16 52  61.4000 -2.8390
       12) WHERMD4<1.5 16  11.1700 -3.5320
         24) SWDSTBAL<4.01061 11   2.9830 -3.1040
           48) HEIGHT<46.03 6   0.8057 -2.7930 *
           49) HEIGHT>46.03 5   0.9004 -3.4770 *
         25) SWDSTBAL>4.01061 5   1.7430 -4.4730 *
       13) WHERMD4>1.5 36  39.1300 -2.5310
         26) DADWORK<1.5 30  26.7600 -2.7440
           52) SWDIAZNO<0.197005 10   3.6930 -3.3190
            104) WCHLPYRF<0.20494 5   0.5163 -3.8550 *
            105) WCHLPYRF>0.20494 5   0.3018 -2.7830 *
           53) SWDIAZNO>0.197005 20  18.1000 -2.4560
            106) SWOPBAL<0.0769847 13   9.5600 -2.0990
              212) WPERMSUM<3.97659 7   2.5990 -2.5670 *
              213) WPERMSUM>3.97659 6   3.6320 -1.5520 *
            107) SWOPBAL>0.0769847 7   3.7850 -3.1210 *
         27) DADWORK>1.5 6   4.2220 -1.4670 *
      7) HEIGHT>47.16 35  44.8800 -1.9130
       14) WPERMSUM<1.04334 8   6.1140 -2.8630 *
       15) WPERMSUM>1.04334 27  29.4000 -1.6310
         30) SCHOOL<5.5 22  19.4500 -1.8310
           60) WEIGHT<55.78 10   3.3010 -1.3620
            120) WEIGHT<52.115 5   1.3320 -1.0430 *
            121) WEIGHT>52.115 5   0.9485 -1.6820 *
           61) WEIGHT>55.78 12  12.1200 -2.2220
            122) WHERTIME<1.5 7   2.9680 -1.5690 *
```

```
      123) WHERTIME>1.5 5   1.9990 -3.1350 *
   31) SCHOOL>5.5 5   5.1990 -0.7509 *
```

The four nodes with the highest average levels of Log(WMETHSUM) are 47, 4, 31, and 120. Node 25 has the lowest average level of Log(WMETHSUM). The nodes are numbered in bold on Figure G.3.12.a and the final split characteristics are bolded in the above tree description.

- **Node 47** is characterized by participants with HEIGHT < 44.16 (inches), CHLDTM1 > 1.5, WHERMD2 > 1.5, WPERMSUM > 3.78236, and SWDIAZNO > 0.397569. The average level of WMETHSUM for these participants was 0.6475 nmoles/g Creatinine (Log(WMETHSUM) = -0.4347).
- **Node 4** is characterized by participants with HEIGHT < 44.16 (inches), and CHLDTM1 < 1.5. The average level of WMETHSUM for these participants was 0.6353 nmoles/g Creatinine (Log(WMETHSUM) = -0.4536).
- **Node 31** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT > 47.16 (inches), WPERMSUM > 1.04334, and SCHOOL > 5.5. The average level of WMETHSUM for these participants was 0.4719 nmoles/g Creatinine (Log(WMETHSUM) = -0.7509).
- **Node 120** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT > 47.16 (inches), WPERMSUM > 1.04334, and SCHOOL < 5.5, WEIGHT < 55.78 (pounds) and WEIGHT < 52.115 (pounds). The average level of WMETHSUM for these participants was 0.3524 nmoles/g Creatinine (Log(WMETHSUM) = -1.0430).
- **Node 25** is characterized by participants with HEIGHT > 44.16 (inches), HEIGHT < 47.16 (inches), WHERMD4 < 1.5, and SWDSTBAL > 4.01061. The average level of WMETHSUM for these participants was 0.0114 nmoles/g Creatinine (Log(WMETHSUM) = -4.4730).

Figure G.3.12.b CART Analysis of LWMETHSM [LOG(WMETHSUM)] with Limited Questions and House and School Dust Measurements for 130 Yuma Study Participants: Summary Statistics for Nodes in CART Tree (Figure G.3.12.a)

Tables G.3.4 and G.3.5 show the questions and dust measurements selected by CART as classifiers of exposure measurement levels under the six scenarios for LWETHSUM and LWMETHSM (Table G.3.2), respectively. For ease of presentation, these classifiers will be termed predictors, although these analyses are not performed with the intent of offering traditional predictive tools as in regression analysis. Instead CART is used as a tool to understand the factors and the interactions of the factors that may affect the exposure levels found in the Yuma Study participants.

The LTD questions (X in column LTD Q) were considered more likely to be predictors of exposure level. The shaded rows represent questions or dust measurements that were selected as predictors or differentiators of exposure level in the scenarios a majority of the time (> 50%). Some questions and the dust measurements were not used in all six scenarios. Questions marked as LTD were included in six scenarios; the other questions were included in only three scenarios. House dust measurements were included in four scenarios; school dust measurements were included in only two scenarios. Thus, the majority (>50%) criterion is based on the number of scenarios in which the question or measurement was included as a potential predictor in a CART analysis.

The CART analyses were performed as preliminary indicators of questions and measurements that may be useful in classifying a child's level of exposure to pesticides (section G.2.4.1). No fine-tuning of the CART trees was performed to create the "best" models under each scenario. Thus the results in the following tables should be considered as identifying the predictors "more likely" to be the primary classifiers or surrogate predictors for the primary classifiers.

Table G.3.4 Results of Classifying Yuma Study Children's Measurements of LWETHSUM [Log(WETHSUM)][a] for Six Scenarios of Predictors

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
Questions										
SEX	Child's gender	X	*	*					33	6
HEIGHT	Child's height (inches)	X	*	*	*				50	6
WEIGHT	Child's weight (lbs)	X	*	*	*	*	*	*	100	6

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
SCHOOL	Child's school	X		*	*	*	*	*	83	6
GRADE	Child's grade	X		*		*	*	*	67	6
ETHNIC	Child's ethnic and racial background								0	3
CHEMINHS	Pesticides used inside home last month?								0	3
WHOCHEMI	Who applied pesticides inside the house?		*						33	3
LIVINGRM	Living room treated with pesticides?				*				33	3
FAMILYRM	Family room treated with pesticides?				*		*		67	3
DININGRM	Dining room treated with pesticides?								0	3
KITCHEN	Was kitchen treated with pesticides?								0	3
BATHROOM	Bathroom treated with pesticides?								0	3
BEDROOM	Bedroom treated with pesticides?								0	3
CHILDBED	Child's bedroom treated with pesticides?								0	3
BASEMENT	Basement treated with pesticides?								0	3
NRMSPRYD	Number of rooms sprayed last month								0	3
OTHERRM	Other rooms treated with pesticides?		*				*		67	3
OFTCHEMI	How often is home treaedt for pests?								0	3
CHEMOUTH	Pesticides used outside home last month?								0	3
WHOCHEMO	Who applied pesticides outside house?								0	3

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
FARFIELD	Distance between home and agricultural field		*		*				67	3
CLOSEAPP	Distance between home and nearest application of pesticides		*						33	3
WHEEL	Distance between home and field - rotary wheel								0	3
HOWCHEMO	How pesticides were applied to fields								0	3
WHNCHEMO	Last time field treated with pesticides?		*				*		67	3
VEGGIES	How often child eats local fresh fruit/veg?								0	3
WASHVEGI	How often wash local fresh fruit/veg before eating?								0	3
HOURAWAY	Number hours/wk child not at home	X	*	*	*	*	*		83	6
CHLDTM1	Child spends time in another home?	X							0	6
CHLDTM2	Child spends time at day care center?	X							0	6
CHLDTM3	Child spends time at school?	X	*	*	*	*	*	*	100	6
CHLDTM4	Child spends time at sport event?	X							0	6
CHLDTM5	Child spends time playing in field?	X							0	6
CHLDTM6	Child spends time playing in irrigation water?	X							0	6
CHLDTM7	Child spends time playing outside?	X							0	6
WHERTIME	Room where child spends most awake time	X	*	*	*		*		67	6

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
SPRAYFLD	Child in yard when fields sprayed or dusted?		*						33	3
WATERSR1	Drinking water source - public/commercial	X							0	6
WATERSR2	Drinking water source - private well	X							0	6
WATERSR3	Drinking water source - cistern	X							0	6
DADWORK	Is the father currently employed?	X	*	*		*		*	67	6
NCATWRKD	Father's occupation -- categories				*		*		67	3
DADPEST	Are pesticides used where father works?								0	3
DADCON2	Father's occupation -- location and pesticide use						*		33	3
MOMWORK	Mother now employed (not as housewife)?	X							0	6
NCATWRKM	Mother's occupation -- categories								0	3
MOMPEST	Are pesticides used where mother works?								0	3
MOMCON2	Mother's occupation -- location and pesticide use		*						33	3
ADLTPEST	Non-parent in home works where pesticides used?								0	3
CHILDFLD	Child worked in fields last month?						*		33	3
WHENFILD	Last time child was in work field								0	3
WHERMD1	Family med care at private medical clinic	X	*			*			33	6

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
WHERMD2	Family med care at health dept clinic	X		*					17	6
WHERMD3	Family med care at other med clinic	X							0	6
WHERMD4	Family med care in Mexico	X							0	6
WHERMD5	No access to medical care	X							0	6
WHERMD6	Family med care at other place	X							0	6
WHERMD7	Family med care - do not know	X							0	6
POISON	Anyone treated for pesticide poison?	X							0	6
HOWCHILD	Child’s health in general	X		*		*			33	6
LICE	Child treated for head lice past six months?								0	3
INSURED	Is child covered by medical insurance?	X							0	6
House Dust Measurement Sums										
WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane								0	4
WCHLPYRF	Weighted chlorpyrifos				*	*			50	4
WDDSUM	Weighted sum of 4,4’DDD, 4,4’DDE and 4,4’DDT							*	25	4
WDIAZNON	Weighted diazinon					*		*	50	4
WDUSTBAL	Weighted sum of dust analytes except OP pesticides					*		*	50	4
WDUSTSUM	Weighted sum of all dust analytes				*	*	*	*	100	4

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios with Predictor Selected	Number of Scenarios with Predictor Included
WOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol								0	4
WOPSUM	Weighted sum of OP pesticides				*	*	*	*	100	4
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin				*	*	*	*	100	4
School Dust Measurement Sums										
SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane								0	2
SWCHLPYR	Weighted chlorpyrifos								0	2
SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT							*	50	2
SWDIAZNO	Weighted diazinon								0	2
SWDSTBAL	Weighted sum of dust analytes except OP pesticides						*	*	100	2
SWDUSTSM	Weighted sum of all dust								0	2
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol						*		50	2
SWOPSUM	Weighted sum of OP pesticides						*	*	100	2
SWPERMSM	Weighted sum of cis-permethrin and trans-permethrin								0	2
	Number of predictors selected in scenario		15	11	14	14	18	13		

[a] log (molar-weighted sum of ethylated DAPs adjusted for creatinine) – see Appendix F.
[b] See Table G.2.1 for extended descriptions of questions, and Appendix F for descriptions of dust sums.
[c] Questions considered more likely to be predictors.
* Question or measurement was selected as predictor in CART analysis for this scenario.

Table G.3.5 Results of Classifying Yuma Study Children's Measurements of LWMETHSM [Log(WMETHSUM)][a] for Six Scenarios of Predictors

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios Predictor Selected	Number of Scenarios Predictor Included
Questions										
SEX	Child's gender	X			*		*		33	6
HEIGHT	Child's height (inches)	X	*	*	*	*	*	*	100	6
WEIGHT	Child's weight (lbs)	X	*	*		*		*	67	6
SCHOOL	Child's school	X	*	*	*	*		*	83	6
GRADE	Child's grade	X							0	6
ETHNIC	Child's ethnic and racial background								0	3
CHEMINHS	Pesticides used inside home last month?								0	3
WHOCHEMI	Who applied pesticides inside the house?		*						33	3
LIVINGRM	Living room treated with pesticides?								0	3
FAMILYRM	Family room treated with pesticides?								0	3
DININGRM	Dining room treated with pesticides?								0	3
KITCHEN	Kitchen treated with pesticides?								0	3
BATHROOM	Bathroom treated with pesticides?								0	3
BEDROOM	Bedroom treated with pesticides?								0	3
CHILDBED	Child's bedroom treated with pesticides?								0	3

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios Predictor Selected	Number of Scenarios Predictor Included
BASEMENT	Basement treated with pesticides?								0	3
NRMSPRYD	Number of rooms sprayed last month								0	3
OTHERRM	Other rooms treated with pesticides?								0	3
OFTCHEMI	How often is home treated for pests?		*						33	3
CHEMOUTH	Pesticides used outside home last month?								0	3
WHOCHEMO	Who applied pesticides outside house?				*				33	3
FARFIELD	Distance between home and agricultural field		*						33	3
CLOSEAPP	Distance between home and nearest application of pesticides								0	3
WHEEL	Distance between home and field - rotary wheel		*		*				67	3
HOWCHEMO	How pesticides were applied to fields								0	3
WHNCHEMO	Last time field treated with pesticides?		*		*		*		100	3
VEGGIES	How often child eats local fresh fruit/veg?								0	3
WASHVEGI	How often wash local fresh fruit/veg before eating?								0	3
HOURAWAY	Number hours/wk child not at home	X				*			17	6
CHLDTM1	Child spends time in another home?	X		*		*		*	50	6
CHLDTM2	Child spends time at day care center?	X							0	6

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios Predictor Selected	Number of Scenarios Predictor Included
CHLDTM3	Child spends time at school?	X							0	6
CHLDTM4	Child spends time at sport event?	X							0	6
CHLDTM5	Child spends time playing in field?	X							0	6
CHLDTM6	Child spends time playing in irrigation water?	X							0	6
CHLDTM7	Child spends time playing outside?	X	*		*		*		50	6
WHERTIME	Room where child spends most awake time	X	*	*	*	*	*	*	100	6
SPRAYFLD	Child in yard when fields sprayed or dusted?						*		33	3
WATERSR1	Drinking water source - public/commercial	X							0	6
WATERSR2	Drinking water source - private well	X							0	6
WATERSR3	Drinking water source - cistern	X							0	6
DADWORK	Is the father currently employed?	X		*		*		*	50	6
NCATWRKD	Father's occupation -- categories				*		*		67	3
DADPEST	Are pesticides used where father works?								0	3
DADCON2	Father's occupation -- location and pesticide use		*						33	3
MOMWORK	Mother now employed (not as housewife)?	X		*					17	6

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios Predictor Selected	Number of Scenarios Predictor Included
NCATWRKM	Mother's occupation -- categories		*						33	3
MOMPEST	Are pesticides used where mother works?								0	3
MOMCON2	Mother's occupation -- location and pesticide use								0	3
ADLTPEST	Non-parent in home works where pesticides used?								0	3
CHILDFLD	Child worked in fields last month?								0	3
WHENFILD	Last time child was in work field								0	3
WHERMD1	Family med care at private medical clinic	X	*						17	6
WHERMD2	Family med care at health dept clinic	X		*		*		*	50	6
WHERMD3	Family med care at other med clinic	X							0	6
WHERMD4	Family med care in Mexico	X		*		*		*	50	6
WHERMD5	No access to medical care	X							0	6
WHERMD6	Family med care at other place	X							0	6
WHERMD7	Family med care - do not know	X							0	6
POISON	Anyone treated for pesticide poison?	X							0	6
HOWCHILD	Child's health in general	X	*	*					33	6
LICE	Child treated for head lice past six months?								0	3

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios Predictor Selected	Number of Scenarios Predictor Included
INSURED	Is child covered by medical insurance?	X							0	6
House Dust Measurement Sums										
WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane								0	4
WCHLPYRF	Weighted chlorpyrifos				*	*	*	*	100	4
WDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT								0	4
WDIAZNON	Weighted diazinon				*	*	*		75	4
WDUSTBAL	Weighted sum of dust analytes except OP pesticides				*		*		50	4
WDUSTSUM	Weighted sum of all dust analytes						*		25	4
WOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol				*		*		50	4
WOPSUM	Weighted sum of OP pesticides								0	4
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin				*	*	*	*	100	4
School Dust Measurement Sums										
SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane								0	2
SWCHLPYR	Weighted chlorpyrifos						*		50	2
SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT								0	2

Predictor	Brief Description[b]	LTD Q[c]	Scenario 1 All Questions	Scenario 2 Ltd Questions	Scenario 3 All Questions and House Dust	Scenario 4 Ltd Questions and House Dust	Scenario 5 All Questions, House Dust and School Dust	Scenario 6 Ltd Questions, House Dust and School Dust	% Scenarios Predictor Selected	Number of Scenarios Predictor Included
SWDIAZNO	Weighted diazonon							*	50	2
SWDSTBAL	Weighted sum of dust analytes except OP pesticides							*	50	2
SWDUSTSM	Weighted sum of all dust analytes						*		50	2
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol							*	50	2
SWOPSUM	Weighted sum of OP pesticides								0	2
SWPERMSM	Weighted sum of cis-permethrin and trans-permethrin								0	2
			14	10	14	12	15	13		

[a] log (molar-weighted sum of methylated DAPs, adjusted for creatinine) – see Appendix F.
[b] See Table G.2.1 for extended descriptions of questions, and Appendix F for descriptions of dust sums.
[c] Questions considered more likely to be predictors.
* Question or measurement was selected as predictor in CART analysis for this scenario.

In the CART analysis results (Table G.3.4), the questionnaire variable CHLDTM3 (Child spends time at school) was the first-level predictor for LWETHSUM (Log(WETHSUM)) in all six scenarios and no further splits of the node with the eight "No" responses occurred. Since all children whose responses were included in the CART analyses were in kindergarten or first grade, neither the intent of the response nor the reason for the segmentation based on that question were clear. Other CHLDTM questions asked about the child's extracurricular activities, thus, CHLDTM3 was hypothesized to indicate that a child may have spent "additional" time at school. The subset of children with a "No" response to CHLDTM3 had the highest measure of ethylated DAPs. This situation may reflect additional exposure from the home environment because the children were not spending more time at school. Table G.3.6 shows the predictors selected with and without CHLDTM3 as a potential predictor in the CART analyses.

Table G.3.6 Results of Classifying Yuma Study Children's Measurements of LWETHSUM [Log(WETHSUM)][a] for Six Scenarios of Predictors Including and Excluding CHLDTM3 (Questions Sorted Alphabetically)

			Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6				
Predictor	Description[b]	LTD Q	All Questions		Ltd Questions		All Questions and House Dust		Ltd Questions and House Dust		All Questions, House Dust and School Dust		Ltd Questions, House Dust and School Dust		% Scenarios Predictor Selected[c]		Number of Scenarios with Predictor Included
			W[d]	WO[d]	W	WO	W	WO	W	WO	W	WO	W	WO	W	WO	
Questions																	
ADLTPEST	Non-parent in home works where pesticides used?														0	0	3
BASEMENT	Basement treated with pesticides?														0	0	3
BATHROOM	Bathroom treated with pesticides?														0	0	3
BEDROOM	Bedroom treated with pesticides?														0	0	3
CHEMINHS	Pesticides used inside home last month?														0	0	3
CHEMOUTH	Pesticides used outside home last month?			Δ											0	33	3
CHILDBED	Child's bedroom treated with pesticides?														0	0	3
CHILDFLD	Child worked in fields last month?										*				33	0	3
CHLDTM1	Child spends time in another home?	X													0	0	6

			Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6				
Predictor	Description[b]	LTD Q	All Questions		Ltd Questions		All Questions and House Dust		Ltd Questions and House Dust		All Questions, House Dust and School Dust		Ltd Questions, House Dust and School Dust		% Scenarios Predictor Selected[c]		Number of Scenarios with Predictor Included
			W[d]	WO[d]	W	WO	W	WO	W	WO	W	WO	W	WO	W	WO	
CHLDTM2	Child spends time at day care center?	**X**													0	0	6
CHLDTM3	Child spends time at school?	**X**	*		*		*		*		*		*		100	0	6
CHLDTM4	Child spends time at sport event?	**X**													0	0	6
CHLDTM5	Child spends time playing in field?	**X**													0	0	6
CHLDTM6	Child spends time playing-irrigation water?	**X**													0	0	6
CHLDTM7	Child spends time playing outside?	**X**				Δ		Δ				Δ			0	50	6
CLOSEAPP	Distance between home and nearest application of pesticides		*												33	0	3
DADCON2	Father's occupation -- location and pesticide use			Δ							*				33	33	3
DADPEST	Are pesticides used where father works?			Δ											0	33	3
DADWORK	Is the father currently employed?	**X**	*		*	Δ			*				*		67	17	6
DININGRM	Dining room treated with pesticides?														0	0	3
ETHNIC	Child's ethnic and racial background							Δ				Δ			**0**	**67**	3
FAMILYRM	Family room treated with pesticides?						*				*				67	0	3
FARFIELD	Distance between home and agricultural field		*	Δ			*								67	33	3
GRADE	Child's grade	**X**			*			Δ	*	Δ	*	Δ	*		67	50	6
HEIGHT	Child's height (inches)	**X**	*	Δ	*	Δ	*			Δ					50	50	6
HOURAWAY	Number hours/wk child not at home	**X**	*	Δ	*	Δ	*	Δ	*	Δ	*	Δ		Δ	**83**	**100**	6
HOWCHEMO	How pesticides were applied to fields														0	0	3

			Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6				
Predictor	Description[b]	LTD Q	All Questions		Ltd Questions		All Questions and House Dust		Ltd Questions and House Dust		All Questions, House Dust and School Dust		Ltd Questions, House Dust and School Dust		% Scenarios Predictor Selected[c]		Number of Scenarios with Predictor Included
			W[d]	WO[d]	W	WO	W	WO	W	WO	W	WO	W	WO	W	WO	
HOWCHILD	Child^s health in general	**X**			*				*						33	0	6
INSURED	Is child covered by medical insurance?	**X**													0	0	6
KITCHEN	Was kitchen treated with pesticides?														0	0	3
LICE	Child treated for head lice past six months?														0	0	3
LIVINGRM	Living room treated with pesticides?			Δ			*								33	33	3
MOMCON2	Mother's occupation -- location and pesticide use		*												33	0	3
MOMPEST	Are pesticides used where mother works?														0	0	3
MOMWORK	Mother now employed (not as housewife)?	**X**													0	0	6
NCATWRKD	Father's occupation -- categories			Δ			*				*				67	33	3
NCATWRKM	Mother's occupation -- categories														0	0	3
NRMSPRYD	Number of rooms in house sprayed last month			Δ				Δ				Δ			**0**	**100**	3
OFTCHEMI	How often is home treated for pests?														0	0	3
OTHERRM	Other rooms treated with pesticides?		*								*				67	0	3
POISON	Anyone treated for pesticide poison?	**X**													0	0	6
SCHOOL	Child's school	**X**		Δ	*		*		*	Δ	*		*	Δ	83	50	6
SEX	Child's gender	**X**	*		*	Δ									33	17	6
SPRAYFLD	Child in yard when fields sprayed or dusted?		*	Δ											33	33	3
VEGGIES	How often child eats local fresh fruit/veg?			Δ								Δ			**0**	**67**	3

			Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6				
Predictor	Description[b]	LTD Q	All Questions		Ltd Questions		All Questions and House Dust		Ltd Questions and House Dust		All Questions, House Dust and School Dust		Ltd Questions, House Dust and School Dust		% Scenarios Predictor Selected[c]		Number of Scenarios with Predictor Included
			W[d]	WO[d]	W	WO	W	WO	W	WO	W	WO	W	WO	W	WO	
WASHVEGI	How often wash local fresh fruit/veg before eating?														0	0	3
WATERSR1	Drinking water source--public/commercial	**X**													0	0	6
WATERSR2	Drinking water source--private well	**X**													0	0	6
WATERSR3	Drinking water source--cistern	**X**													0	0	6
WEIGHT	Child's weight (lbs)	**X**	*	Δ	*	Δ	*	Δ	*	Δ	*	Δ	*	Δ	**100**	**100**	6
WHEEL	Distance between home and field-- rotary wheel			Δ				Δ				Δ			**0**	**100**	3
WHENFILD	Last time child was in work field														0	0	3
WHERMD1	Family med care at private medical clinic	**X**	*			Δ			*						33	17	6
WHERMD2	Family med care at health dept clinic	**X**			*										17	0	6
WHERMD3	Family med care at other med clinic	**X**													0	0	6
WHERMD4	Family med care in Mexico	**X**													0	0	6
WHERMD5	No access to medical care	**X**													0	0	6
WHERMD6	Family med care at other place	**X**													0	0	6
WHERMD7	Family med care--do not know	**X**													0	0	6
WHERTIME	Room where child spend most awake time	**X**	*	Δ	*	Δ	*				*				67	33	6
WHNCHEMO	Last time field treated with pesticides?		*	Δ				Δ			*	Δ			**67**	**100**	3
WHOCHEMI	Who applied pesticides inside the house?		*												33	0	3
WHOCHEMO	Who applied pesticides outside house?														0	0	3
House Dust Measurement Sums[a]																	

			Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6				
Predictor	Description[b]	LTD Q	All Questions		Ltd Questions		All Questions and House Dust		Ltd Questions and House Dust		All Questions, House Dust and School Dust		Ltd Questions, House Dust and School Dust		% Scenarios Predictor Selected[c]		Number of Scenarios with Predictor Included
			W[d]	WO[d]	W	WO	W	WO	W	WO	W	WO	W	WO	W	WO	
WCHDNSUM	Weighted sum of alpha-chlordane and gamma-chlordane							Δ							0	25	4
WCHLPYRF	Weighted chlorpyrifos						*	Δ	*	Δ				Δ	**50**	**75**	4
WDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT												*		25	0	4
WDIAZNON	Weighted diazinon								*				*		50	0	4
WDUSTBAL	Weighted sum of dust analytes except OP pesticides							Δ	*	Δ		Δ	*	Δ	**50**	**100**	4
WDUSTSUM	Weighted Sum of all dust analytes						*	Δ	*	Δ	*	Δ	*	Δ	**100**	**100**	4
WOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol														0	0	4
WOPSUM	Weighted Sum of OP Pesticides						*		*	Δ	*		*	Δ	100	50	4
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin						*	Δ	*	Δ	*	Δ	*	Δ	**100**	**100**	4
School Dust Measurement Sums[a]																	
SWCHDNSM	Weighted sum of alpha-chlordane and gamma-chlordane											Δ			0	50	2
SWCHLPYR	Weighted chlorpyrifos										*		*		100	0	2
SWDDSUM	Weighted sum of 4,4'DDD, 4,4'DDE and 4,4'DDT												*		50	0	2
SWDIAZNO	Weighted diazinon														0	0	2
SWDSTBAL	Weighted sum of dust analytes except OP pesticides										*		*		100	0	2
SWDUSTSM	Weighted sum of all dust analytes													Δ	0	50	2

			Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6				
Predictor	Description[b]	LTD Q	All Questions		Ltd Questions		All Questions and House Dust		Ltd Questions and House Dust		All Questions, House Dust and School Dust		Ltd Questions, House Dust and School Dust		% Scenarios Predictor Selected[c]		Number of Scenarios with Predictor Included
			W[d]	WO[d]	W	WO	W	WO	W	WO	W	WO	W	WO	W	WO	
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol										*	Δ		Δ	**50**	**100**	2
SWOPSUM	Weighted sum of OP pesticides										*	Δ	*	Δ	**100**	**100**	2
SWPERMSM	Weighted sum of cis-permethrin and trans-permethrin													Δ	0	50	2

[a] log (molar-weighted sum of ethylated DAPs, adjusted for creatinine) -- See Appendix F for detailed descriptions of weighted measurement sums.
[b] See Table G.2.1 for extended descriptions of questions, and Appendix F for descriptions of dust sums.
[c] Percents in bold are questions or measurements for which the percent of the analyses without CHLDTM3 was > 50%. (See summary in Table G.3.7)
[d] W: CHLDTM3 was included as a potential predictor. WO: CHLTM3 was not included as a potential predictor. *, Δ indicate predictor was selected in W or WO scenarios, respectively.

A summary of this comparison (Table G.3.6) is included in Table G.3.7. Additional discussion of results from the CART analyses is included in the section 4.3.2.4.

Table G.3.7 compares the selected predictors from the CART analyses with and without CHLDTM3 as a potential predictor. The predictors selected when CHLDTM3 was not included in the CART analyses can be considered surrogate predictors for CHLDTM3 or the situation that the children represented. Surrogate predictors, although not interchangeable, offer options for differentiating exposure levels based on available responses. Examples of surrogates can be seen in the questions selected. For example, the W case includes FARFIELD, and the WO case includes WHEEL. Both are measures of proximity to agricultural fields. Pesticide treatment in the house switches from specific rooms to number of rooms sprayed. Although different dust measurement variables were selected for both cases (with and without CHLDTM3), overall the analyses track the same pesticides. The scenarios with CHLDTM3 seemed to include the more specific school parameters, such as SCHOOL and GRADE, while the scenarios without CHLDTM3 picked up ETHNIC and VEGGIES.

Table G.3.7 Predictors Selected for Classifying Yuma Study Children's Measurements of LWETHSUM [Log(WETHSUM)][a] for Six Scenarios of Predictors Including and Excluding CHLDTM3

Predictor[b]	Description[c]	LTD Q	% Scenarios Predictor Selected		Number of Scenarios with Predictor Included	Selection Comparison Code[e]
			W[d]	WO[d]		
Questions						
CHLDTM3	Child spends time at school?	**X**	**100**	0	6	A
DADWORK	Is the father currently employed?	**X**	**67**	17	6	A
ETHNIC	Child's ethnic and racial background		0	**67**	3	C
FAMILYRM	Family room treated with pesticides?		**67**	0	3	A
FARFIELD	Distance between home and agricultural field		**67**	33	3	A
GRADE	Child's grade	**X**	**67**	50	6	A
HOURAWAY	Number hours/wk child not at home	**X**	**83**	**100**	6	B
LIVINGRM	Living room treated with pesticides?		**67**	33	3	A
NCATWRKD	Father's occupation--categories		**67**	33	3	A
NRMSPRYD	Number of rooms sprayed last month		0	**100**	3	C
OTHERRM	Other rooms treated with pesticides?		**67**	0	3	A
SCHOOL	Child's school	**X**	**83**	50	6	A

Predictor[b]	Description[c]	LTD Q	% Scenarios Predictor Selected		Number of Scenarios with Predictor Included	Selection Comparison Code[e]
			W[d]	WO[d]		
Questions						
VEGGIES	How often child eats local fresh fruit/veg?		0	**67**	3	C
WEIGHT	Child's weight (lbs)	**X**	**100**	**100**	6	B
WHEEL	Distance between home and field - rotary wheel		0	**100**	3	C
WHERTIME	Family room treated with pesticides?	**X**	**67**	33	6	A
WHNCHEMO	Last time field treated with pesticides?		**67**	**100**	3	C
House Dust Measurement Sums						
WCHLPYRF	Weighted chlorpyrifos		50	**75**	4	C
WDUSTBAL	Weighted sum of dust analytes except OP pesticides		50	**100**	4	C
WDUSTSUM	Weighted sum of all dust analytes		**100**	**100**	4	B
WOPSUM	Weighted sum of OP pesticides		**100**	50	4	A
WPERMSUM	Weighted sum of cis-permethrin and trans-permethrin		**100**	**100**	4	B
School Dust Measurement Sums						
SWCHLPYR	Weighted chlorpyrifos		0	**100**	2	C
SWDSTBAL	Weighted sum of dust analytes except OP pesticides		**100**	0	2	A
SWOPBAL	Weighted sum of OP pesticides except chlorpyrifos, diazinon, permethrins, and o-phenylphenol		50	**100**	2	C
SWOPSUM	Weighted sum of OP pesticides		**100**	**100**	2	B

[a] log (molar-weighted sum of ethylated DAPs, adjusted for creatinine) -- See Appendix F for detailed descriptions of weighted measurement sums.
[b] Predictors listed are only those that were selected for > 50% of the scenarios either with or without CHLDTM3.
[c] See Table G.2.1 for extended descriptions of questions, and Appendix F for descriptions of dust sums.
[d] W: CHLDTM3 was included as a potential predictor.
WO: CHLDTM3 was not included as a potential predictor.
[e] A: Selected with CHLDTM3, but not selected without CHLDTM3
B: Selected with and without CHLDTM3
C: Selected without CHLDTM3, but not selected with CHLDTM3.

G.3.4 Comparison of Questionnaire Responses for High- and Low-end Measurements

A non-statistical approach was implemented to identify any predictors that could differentiate between the high and low exposure levels based on the DAP urinary metabolites. In the previous analyses, CART and CDC (2002), the questionnaire responses, dust measurements, and urine measurements for all of the principal participants were considered. Because the range of the distribution of the urine and dust measurement values is limited, it seemed reasonable to compare the information of participants from the extremes of the distribution. Thus, approximately 10% of the respondents from the low end of a specific distribution and approximately 10% of the respondents from the high end of the distribution were selected.

Twenty-one questions considered more likely predictors of a child's pesticide exposure level were identified. The weighted sum of the responses for each respondent was created from 18 of the questions where the weight was added to the sum if the response indicated a potential exposure to pesticides. Table G.3.5 shows the questions used in the exposure weighted sum, and the amounts added to the sum based on the responses. The values of this weighted sum and the responses to the 21 individual questions were compared between the high- and low-end values of each measurement sum to determine if any patterns in the responses were evident.

Table G.3.8 Questions and Weights Used to Create the Exposure Weighted Sum for Comparing High and Low End Measurements

Q Name	Q Description[a]	Value	Value Label	Amount Added to Sum[b]
adltpest	Nonparent in home works where pesticides used?			
		1	Yes	1.0
		2	No	
childfld	Child worked in fields in last month?			
		1	Yes	1.0
		2	No	
		3	Do not know	
		4	No Response	
chldtm5	Child spends time playing in field?			
		1	Yes	1.0
		2	No	
chldtm6	Child spends time playing in irrigation water?			
		1	Yes	1.0
		2	No	
chldtm7	Child spends time playing outside?			
		1	Yes	1.0
		2	No	
closeapp	Distance between home and nearest application of pesticides			
		1	In your yard/garden	1.0
		2	In neighbor's yard	0.5
		3	Further away	

Q Name	Q Description[a]	Value	Value Label	Amount Added to Sum[b]
		4	Not used near home	
		5	Do not know	
		6	No Response	
dadcon2	Father works outdoors + with pesticides			
		1	Works Inside, no pesticides assumed	
		2	Works Outside, no pesticides assumed	
		3	Works Inside, pesticides assumed	0.5
		4	Works Outside, pesticides assumed	1.0
		5	Dad doesn't work	
		6	No job response	
farfield	Distance between home and agricultural field			
		1	250 feet or less	1.0
		2	Over 250 feet	
		3	Do not know	
		4	No Response	
howchemo	How pesticides were applied to fields			
		1	By airplane	1.0
		2	Mechanized spraying	0.5
		3	Hand application	
		4	Other (Specify)	
		5	Not used near home	
		6	Do not know	
		7	No Response	
lice	Child treated for head lice past six months?			
		1	Yes	1.0
		2	No	
		3	No Response	
momcon2	Mother works outdoors + with pesticides			

Q Name	Q Description[a]	Value	Value Label	Amount Added to Sum[b]
		1	Works Inside, no pesticides assumed	
		2	Works Outside, no pesticides assumed	
		3	Works Inside, pesticides assumed	0.5
		4	Works Outside, pesticides assumed	1.0
		5	Mom doesn't work	
		6	No job response	
oftchemi	How often is home treat for pests?			
		1	About once a week	1.0
		2	About once a month	0.5
		3	Several times a year	0.5
		4	About once a year	
		5	Infrequently	
		6	Never or not yet	
		7	Do not know	
		8	No Response	
poison	Anyone treated for pesticide poison?			
		1	Yes	1.0
		2	No	
		3	Do not know	
		4	No Response	
sprayfld	Child in yard when fields sprayed or dusted?			
		1	Yes	1.0
		2	No	
		3	Do not know	
		4	No Response	
veggies	How often child eats local fruit/veg?			
		-1	No Response	
		0	Do not know	
		1	Never	

Q Name	Q Description[a]	Value	Value Label	Amount Added to Sum[b]
		2	About once a year	
		3	About once a month	
		4	About once a week	0.5
		5	About once a day	1.0
wheel	Distance between home and field--rotary wheel			
		1	< 250 feet	1.0
		2	≥ 250 and < 500 feet	
		3	≥ 500 feet	
whenfild	Last time child was in work field			
		1	Today	1.0
		2	Yesterday	1.0
		3	> 2 days ago	0.5
		4	A week ago	0.5
		5	> a week ago	
		6	Do not know	
		7	Child not in field	
		8	No Response	
whnchemo	Last time field treated with pesticides?			
		1	Today	1.0
		2	Yesterday	1.0
		3	> 2 days ago	0.5
		4	A week ago	0.5
		5	> a week ago	
		6	Other	
		7	Do not know	
		8	Not applicable	
		9	No Response	

[a] See Table G.2.1 for extended descriptions of questions, and Appendix F for descriptions of dust sums.
[b] Blank indicates no amount was added to the exposure sum.

Table G.3.9 shows the measurement sums considered and any of the questions that showed a difference (not statistically significant) in responses between the two ends of the measurement distribution.

Table G.3.9 Results from Non-statistical Comparison of Questionnaire Responses between High and Low End Measurements

Measurement Sum[a]	Questions Indicating Differences between High and Low Groups[b]
WETHSUM + WMETHSUM	EXPOSURE SUM [d], FARFIELD [c], WHNCHMO[d, e], WHEEL [d], DADCON2 [d], MOMCON2 [c]
WOPSUM	SCHOOL, HOWCHEMO [d, e], FARFIELD [d], CLOSEAPP [d, e], WHEEL [d], CHLDTM7 [d], WHENFILD [d], CHLDFLD [d]
WDUSTSUM	SCHOOL, NRMSRYD [c], HOWCHEMO [d, e], OFTCHEMI [c], FARFIELD [d], WHNCHMO [d,e], WHEEL [d], SPRAYFLD [d], DADCON2 [c], MOMCON2 [d]

[a] See Appendix F for description of sums.
[b] See Table G.2.1 for abbreviated description of question variables.
[c] Some difference ($\geq$ 15%) in responses between participants at both ends of measurement distribution was evident. Difference was in direction expected, that is, exposure to factor is associated with high-end measurement value.
[d] Some difference ($\geq$ 15%) in responses between participants at both ends of measurement distribution was evident. Difference was not in direction expected based on current knowledge; that is, t exposure to factor is associated with low-end measurement values.
[e] Some difference ($\geq$ 15%) in responses between participants at both ends of measurement distribution was evident. Difference is based on response (some exposure to factor) compared to non-response (Don't know, No response).

The questions that point to some differentiation of the exposure levels are reasonable; however, most of them show the difference to be in the direction opposite of what is expected based on current knowledge (Table G.3.9). As noted for the results in CDC (2002), relationships with the responses are considered one question at a time. This view may hide interactions with other risk factors or it may point to other factors that have a related effect.

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