Molecular Epidemiology—Linking Source, Exposure, and Effects

Gustav Klimt, *Baby (Cradle),* 1917/1918.
National Gallery of Art. From www.nga.gov

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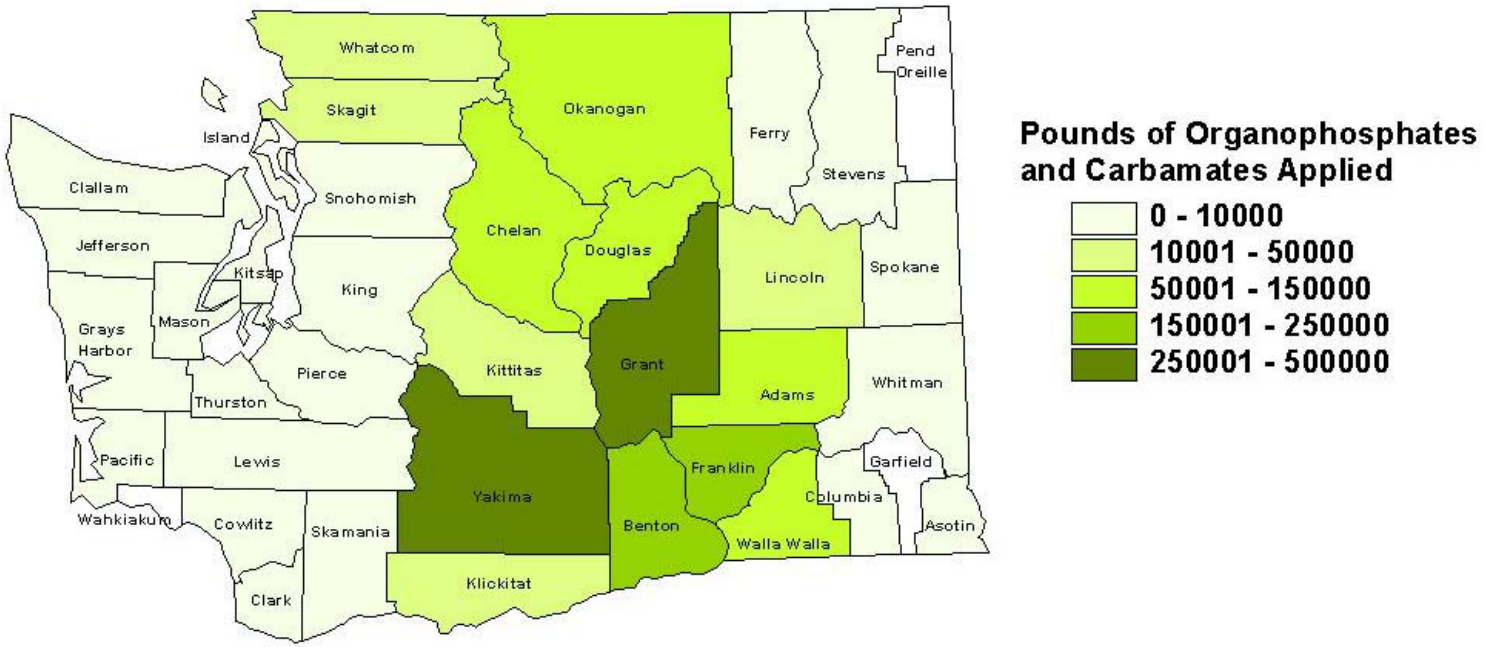
Outline

- Discussion of Children's Studies from our Center
- Discussion of Integrative Framework Model
- Assessment of Intervention and Uncertainty Analysis
- Future Directions

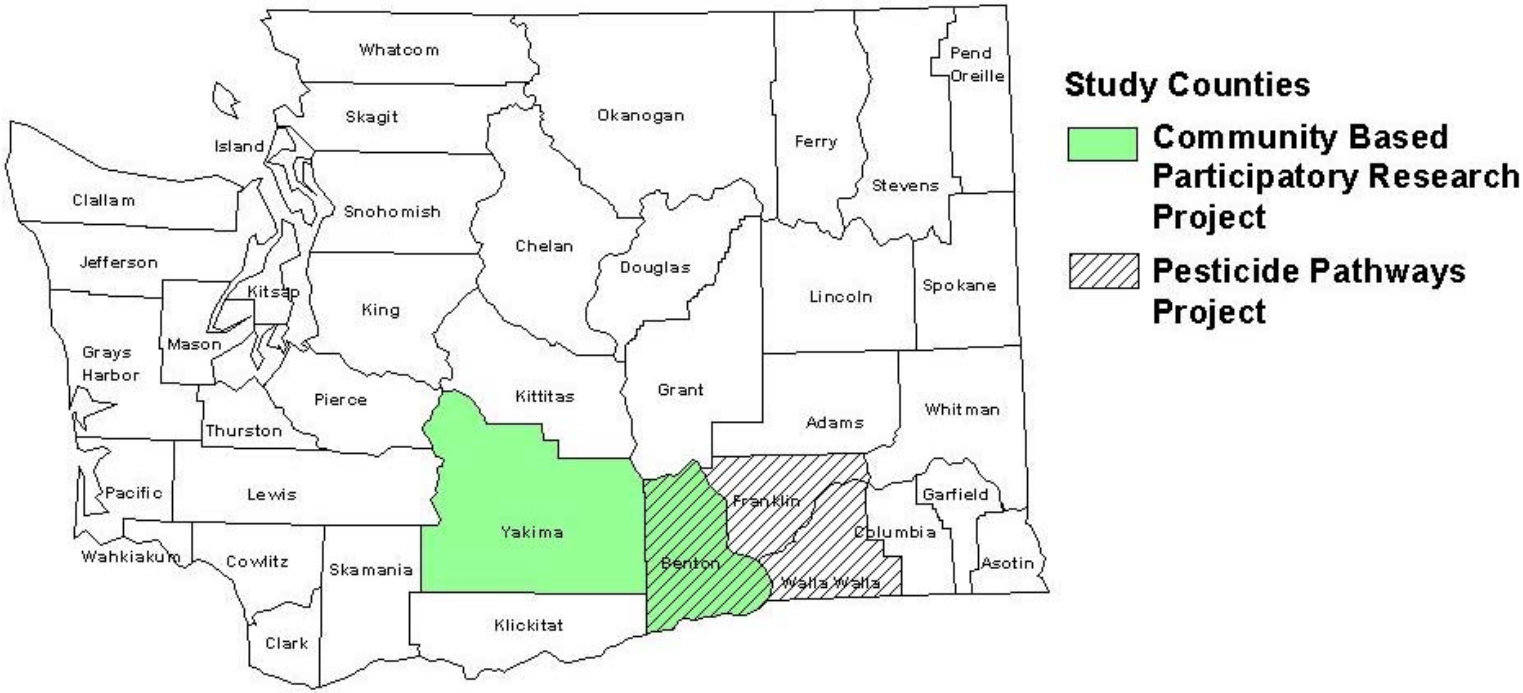
Three types of studies were examined in order to understand what pesticide exposures were occurring in children

1. Community Based Participatory Research project (CBPR)
2. Longitudinal multiple sampling project aimed at understanding between and within family variability
3. Longitudinal Cohort Study

Estimated Organophosphate and Carbamate Usage on Apples and Potatoes in Washington State, 2001



Study Counties for the Center for Child Environmental Health Risks Research



Examples of Chemicals Applied to Washington State Crops, 2001

Chemical class	crop	Chemical	Pounds applied
Organophosphates	Apples	Azinphos-methyl	241,000
		Chlorpyrifos	234,000
		Phosmet	138,000
	Potatoes	Ethoprop	119,000
		Metamidophos	143,000
N-Me Carbamates	Apples	carbaryl	202,000
	Potatoes	Aldicarb	153,000
Dithiocarbamate	Apples	Mancozeb	82,000
	Potatoes	Mancozeb	343,000

Source: "Agricultural Chemical Usage (PCU-BB)" National Agricultural Statistics Service, Agricultural Statistics Board, U.S. Department of Agriculture (http://jan.mannlib.cornell.edu/reports/nassr/other/pcubb Accessed 05/03)

The Take-home Pathway for Agricultural Pesticides: Contributions of Occupational Factors to Home Contamination

G.C. Coronado, I. Islas, S.A. Snipes,
J. Grossman, and B. Thompson

Communities in the CBPR Project

- Community was defined as either a town or a labor camp
- Pairing of an intervention community with a control community was performed separately for towns and labor camps
- All Communities are in the Yakima Valley of Eastern Washington

Towns

Intervention	Control
Sawyer	Harrah
Donald	Tieton
Buena	Outlook
Moxee	Zillah
Cowiche	Wapato
Mabton	Whitstran
Granger	Prosser
Toppenish	Grandview

Labor Camps

Intervention	Control
Bond Varner Camp	Golding Farms Camp
Green Giant Camp	Crewport
Willow Park	Rainbow court
Yakima Golding Farms	Horse Heaven Mobile Park

Over 250 community-wide events occurred.

This Community Health Fair is an example.

Photo: Gloria Coronado

Total number of participants at community-wide events is greater than 6,000!

Over 1,800 total events took place in the communities.

Approx. 1,000 Home Health Parties such as this occurred.

Photo: Gloria Coronado

Total number of participants in all levels of community activities was over 18,000!

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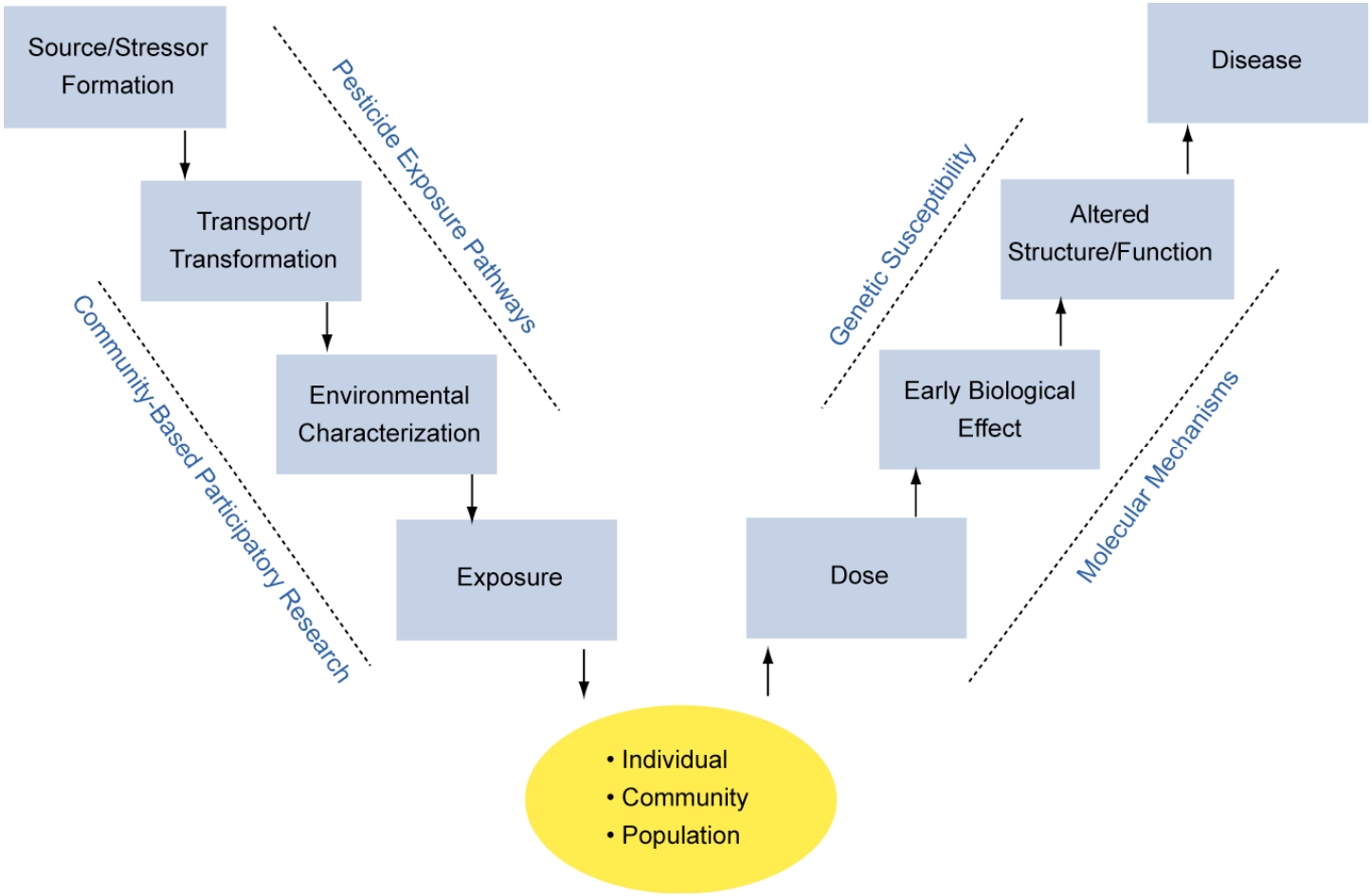
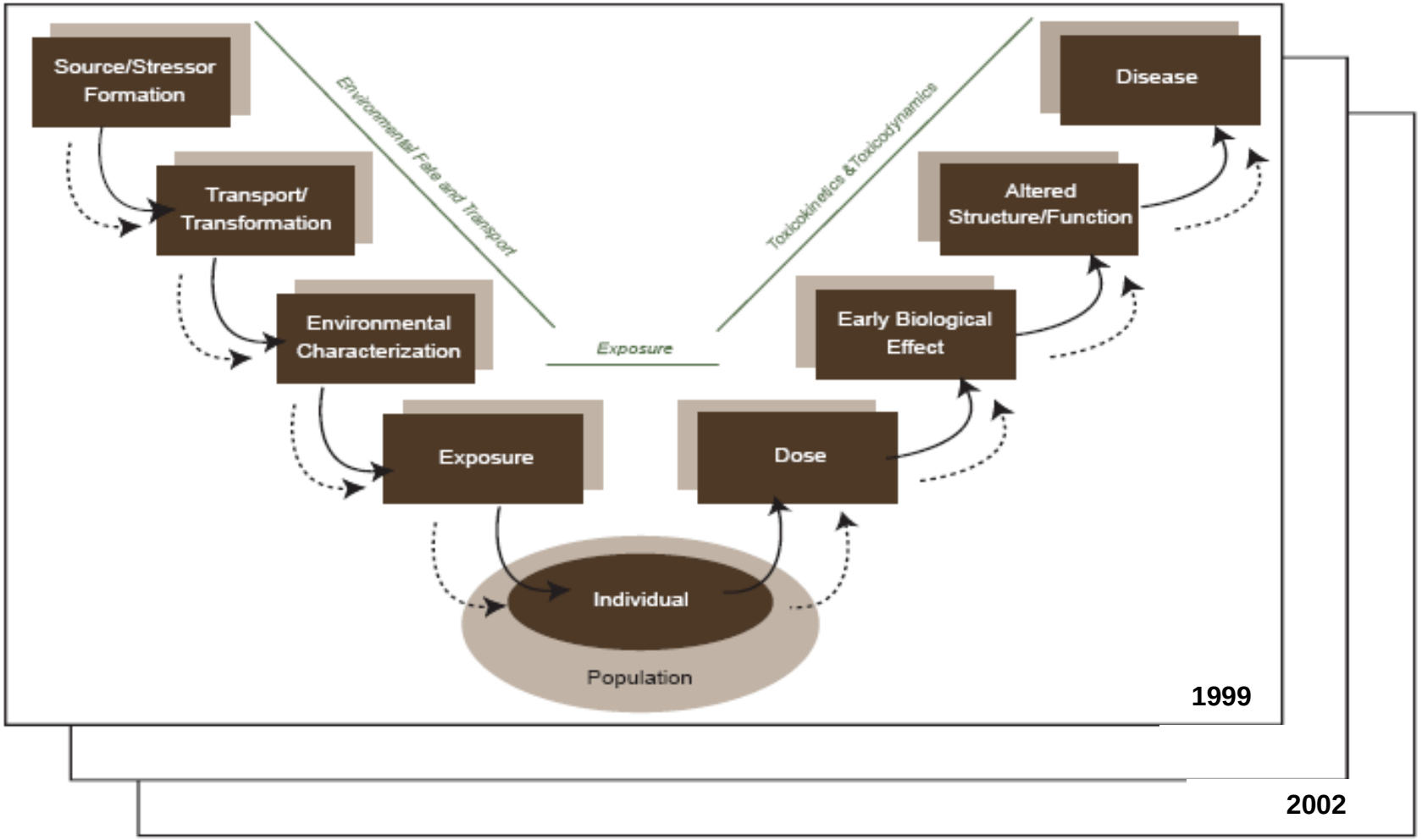


Integrated Framework Tool



1999 vs non spray as 2002

Monitoring Results

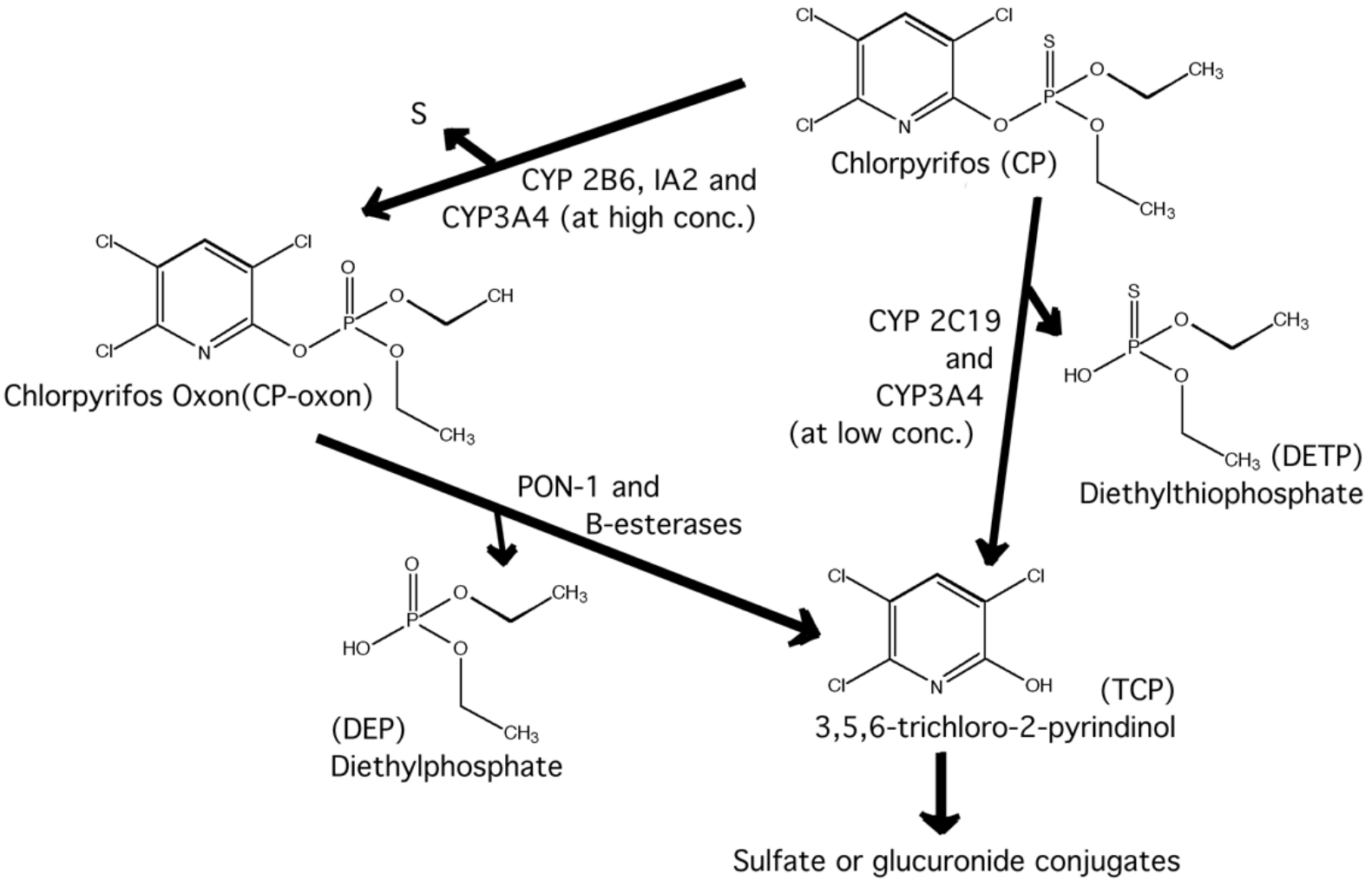
Most children are exposed

- 86% of children had quantifiable levels of at least one dialkyl metabolite.
- 95% of adults had quantifiable levels of at least one dialkyl metabolite.

Evidence of **multiple** exposures

- 36% of children had quantifiable levels of both dimethyl and diethyl metabolites.
- 45% of adults had quantifiable levels of both dimethyl and diethyl metabolites.

Metabolic Scheme for CP



Faustman et al. (2006)

Metabolites of Organophosphate Pesticides

- Biomarkers of exposure
- Nonspecific Diakyl Phosphate (DAP) metabolites
  - Six DAP Metabolites
  - Each metabolite can be produced by multiple OPs
  - Divided into two groups
    - Dimethyl metabolites
      - DMP, DMTP, DMDTP
    - Diethyl metabolites
      - DEP, DETP, DEDTP
- Specific metabolites
  - Chlorpyrifos metabolites
    - TCP, DEP, DETP
  - Chlorpyrifos-methyl metabolites
    - TCP, DMP, DMTP

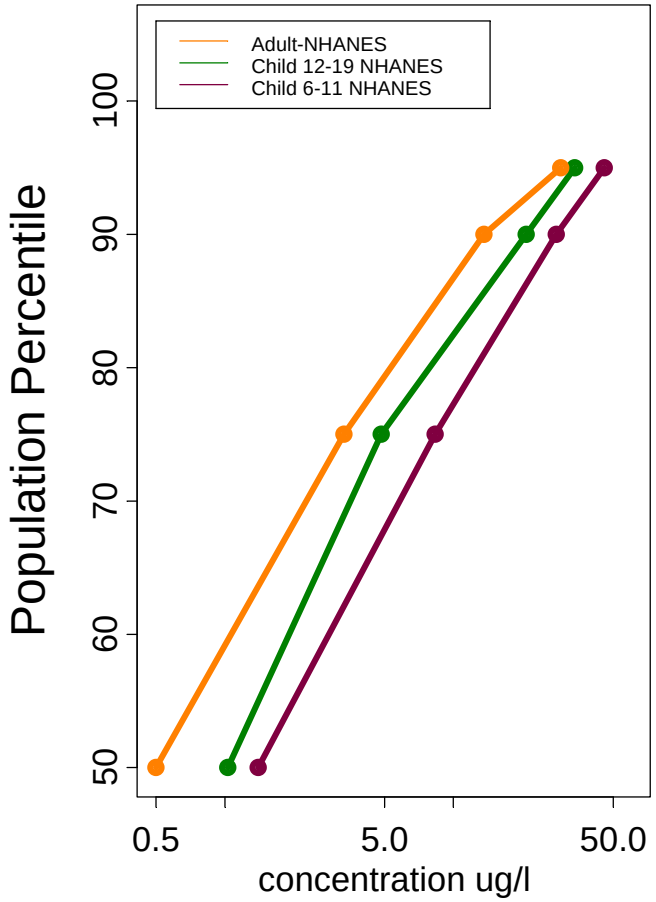
Evidence of Take-home Pathway

- **Workers** who thinned were more likely than those who did not thin to have detectable levels of azinophos-methyl in their house dust and vehicles.
- **Children** of thinners were more likely to have detectable levels.
- **Contrary to expectations,** workers who reported mixing, loading or applying pesticides had lower incidence of detectable pesticide residues in their homes, vehicle dust, and in their children's urine.

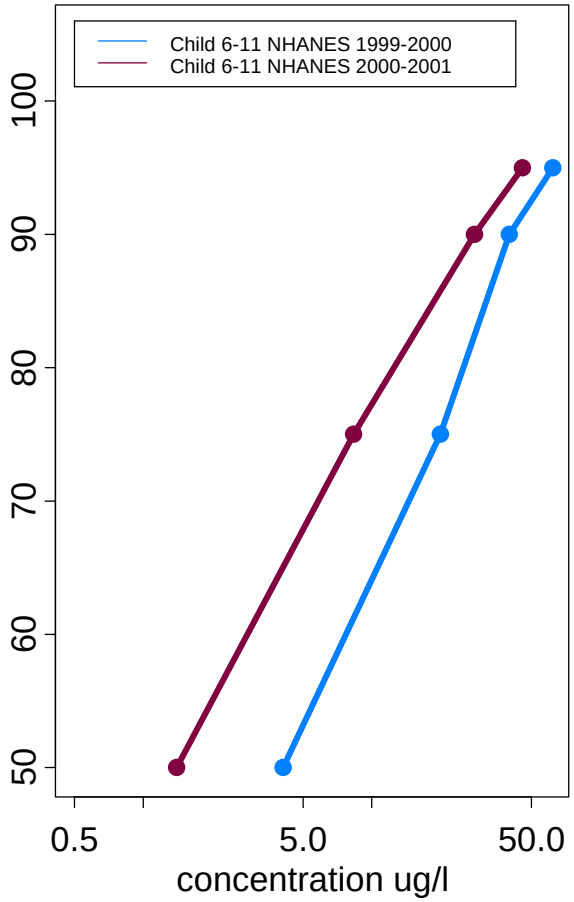
NHANES Data for DMTP in Urine

Random sample of US Population

Comparison across ages in 2000-2001

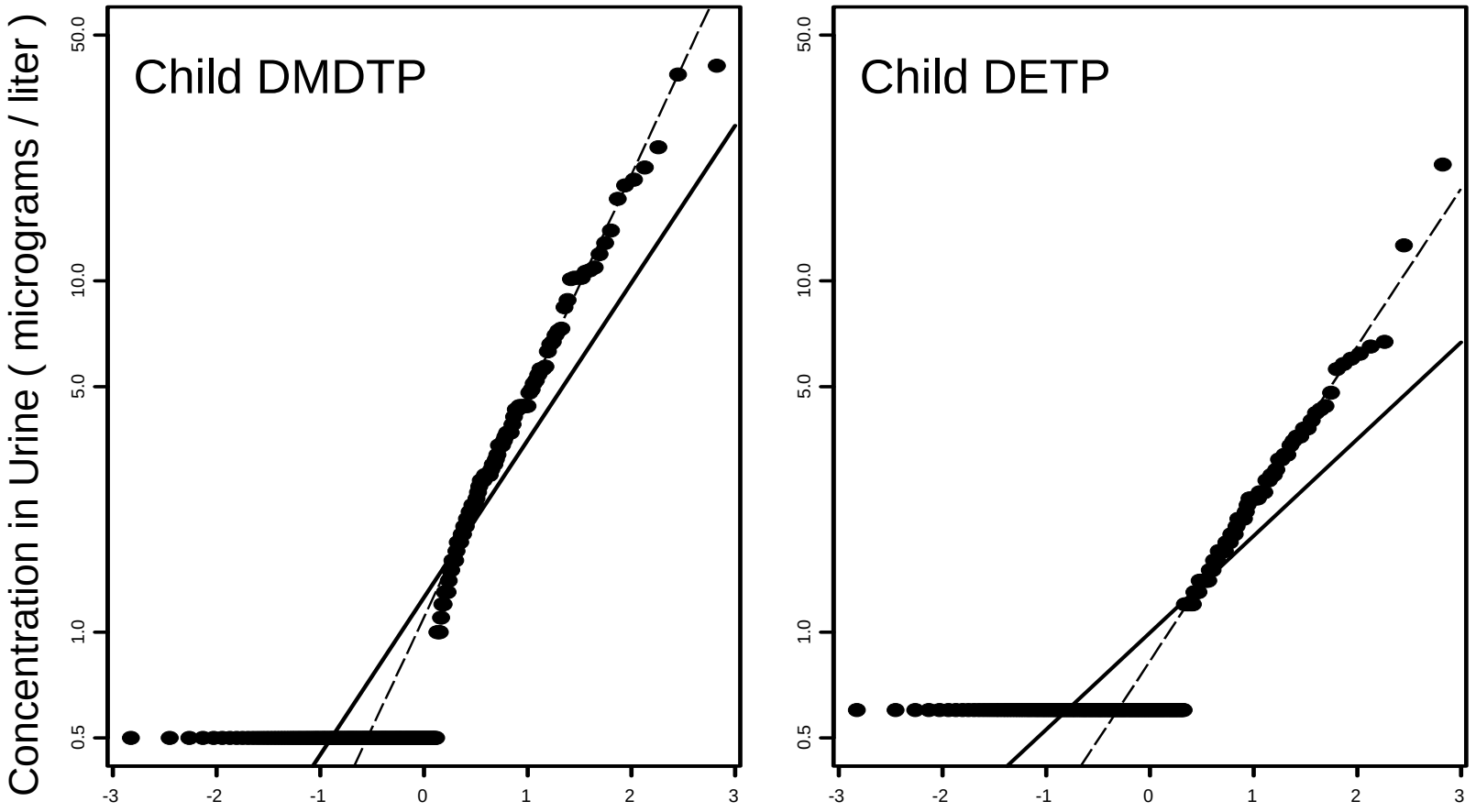


Comparison for children (6-11 years old) across time

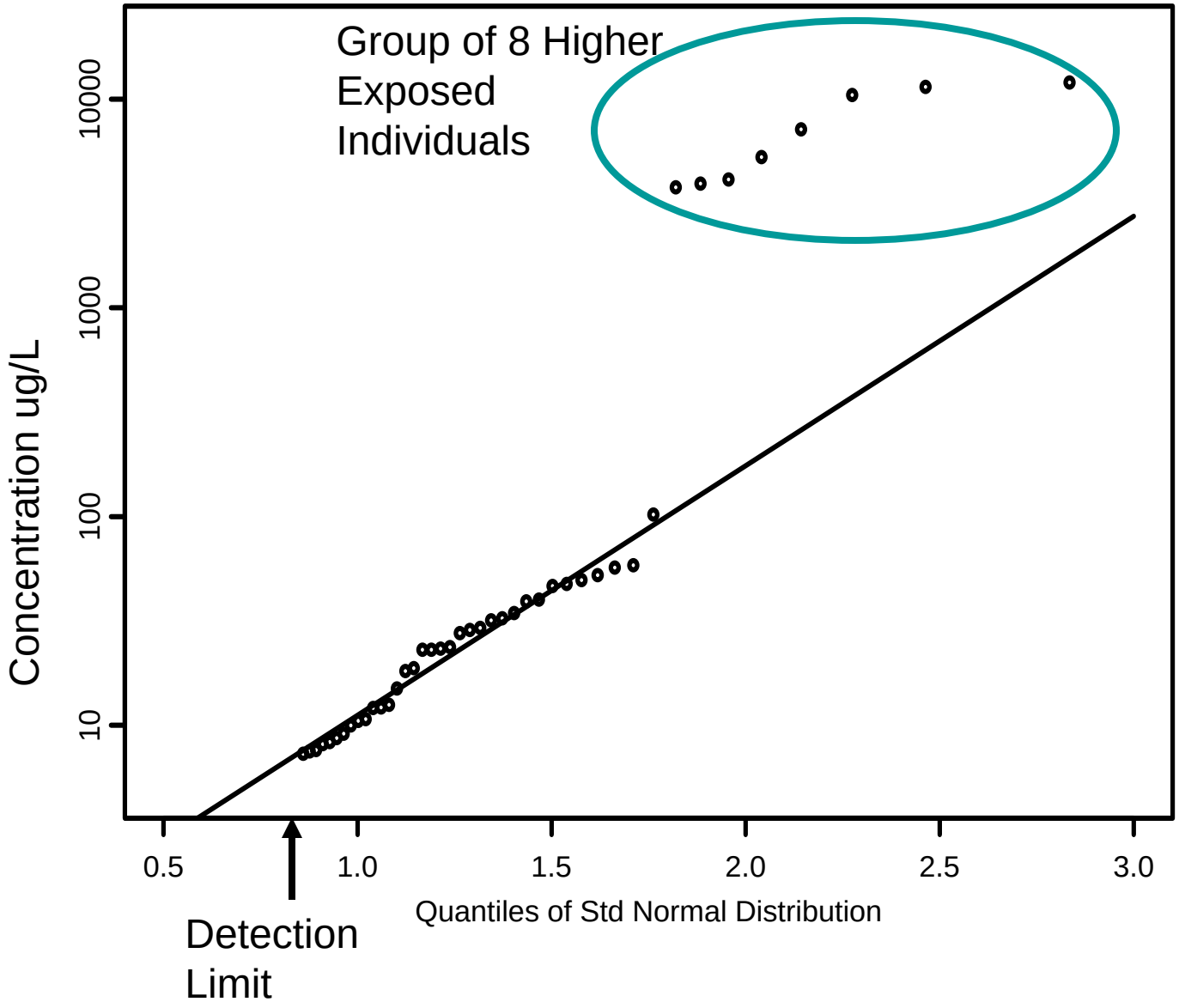


Many Values Are Below Limits of Detection

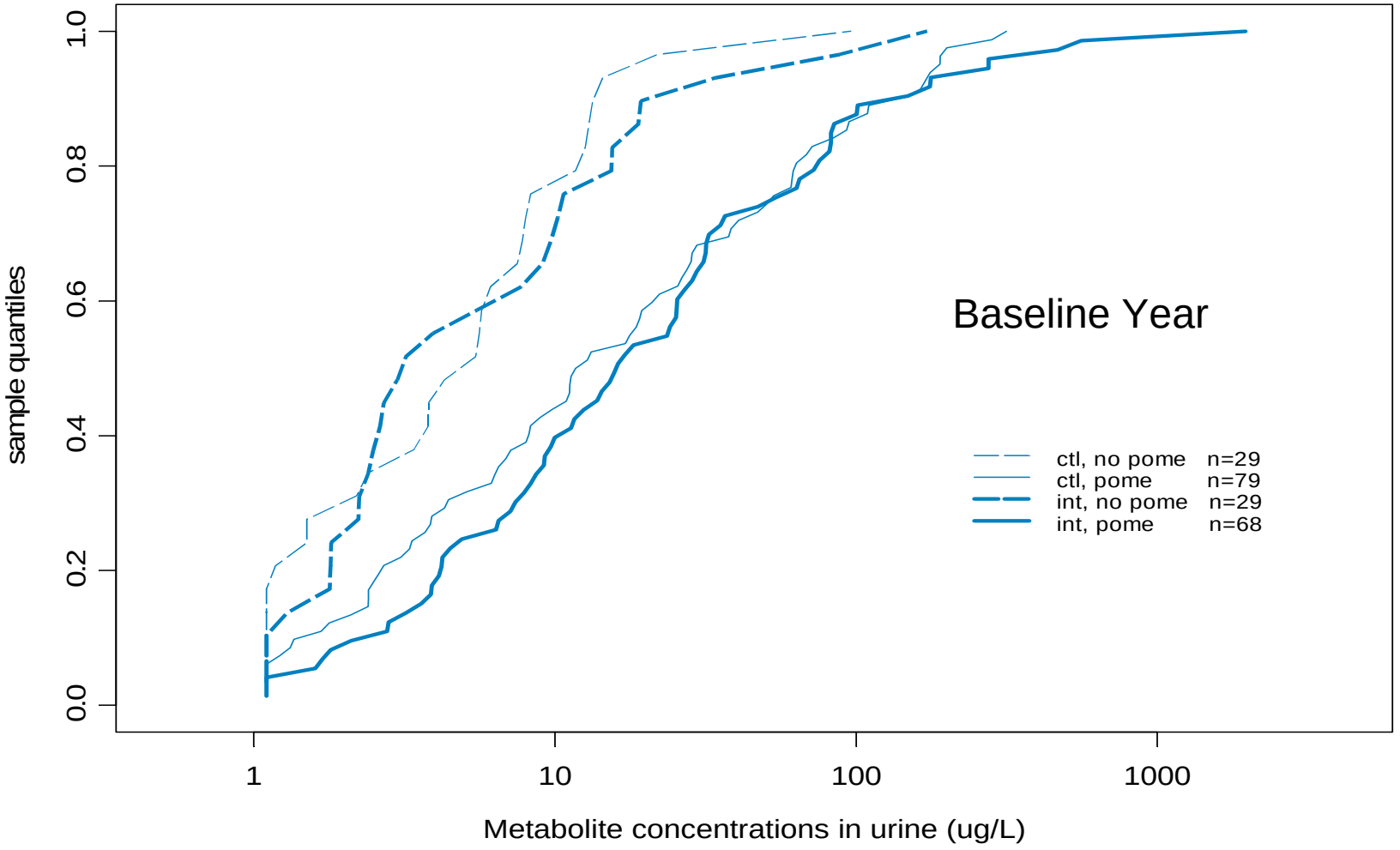
Baseline Year - 1999



DMP in Adult Urine: QQ Plots to Estimate Population Distribution



Distribution of Adult DMTP from year 1 (1999): Impact of Crop



Sources of Uncertainty

Stochasticity

- Characterization of Within and Between Person Variability

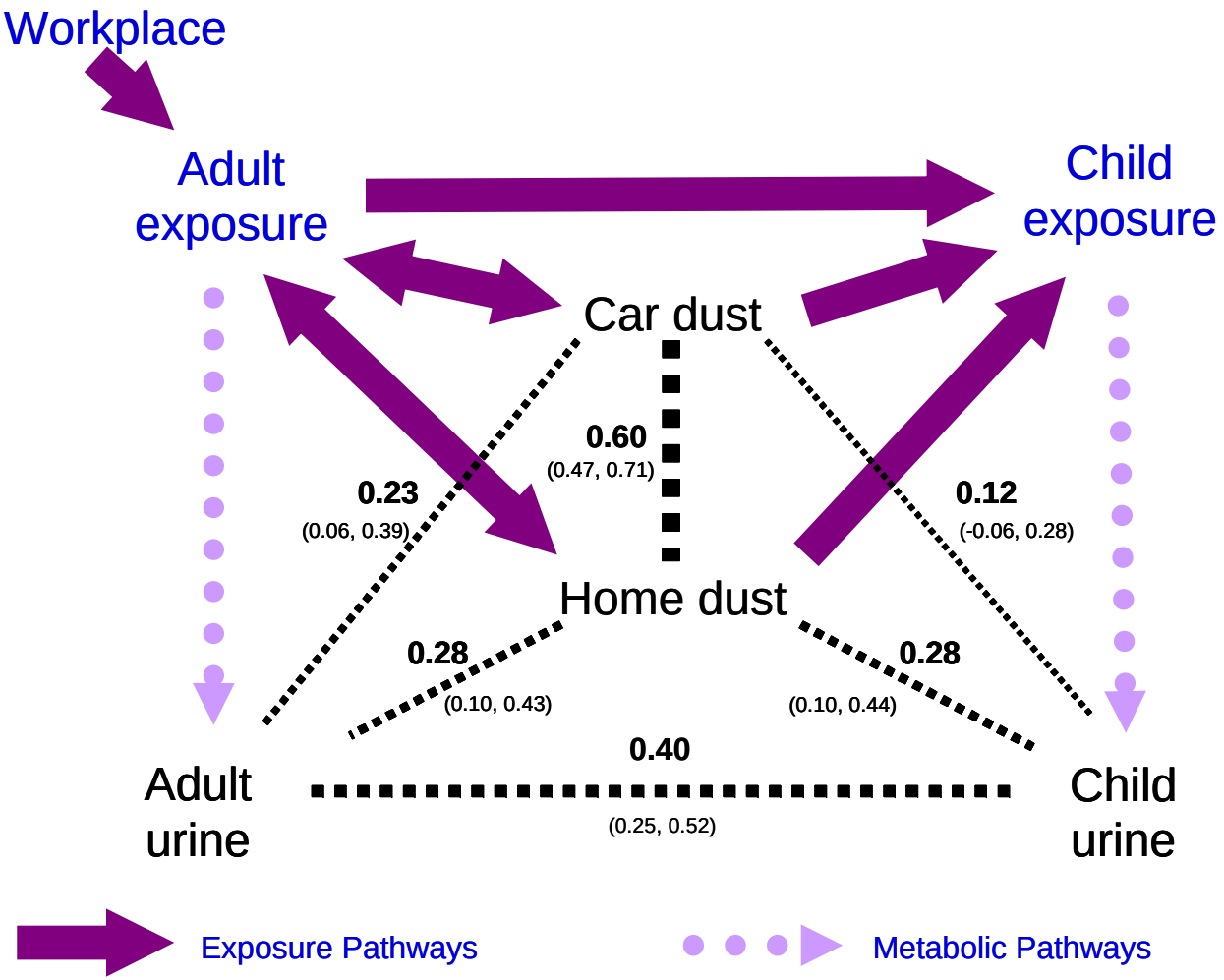
Parameter Uncertainty

- Year-to-Year Variability
- Observations below Limits of Detection (LOD)

Model Uncertainty

- Crop vs. Agricultural Job Task
- Identification of Highly Exposed Individuals

Azinphos-methyl Take-home Pathway



The dashed black lines that connect the samples illustrate the correlations between the sample concentrations. The lines are weighted according to the strengths of the correlations. The correlations are statistically significant if the 95% posterior probability intervals (in parentheses) do not include zero.

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