



COLUMBIA CENTER FOR CHILDREN'S ENVIRONMENTAL HEALTH

MAILMAN SCHOOL OF PUBLIC HEALTH

Columbia University

Residential insecticide exposure during
pregnancy among African American and
Dominican mothers and newborns from
NYC

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Residential Pesticide Use



85% to 90% of U.S. homes use pesticides and 50% with young children have pesticides stored within the child's reach

NYPIRG 1997 study: heaviest application of pesticides in NY state occurs in NYC

Chlorpyrifos was the pesticide applied most heavily in NYC

93% of NYC public housing residents report use (2000)



Raining roaches



Pesticide	Exposure	Effect
Diazinon	Gestation	Lower birth weight, balance, swimming, maze effects
Chlorpyrifos	GD15-PND21	Impairment on maze, increased righting reflex time, reduced body weight, reduced cliff avoidance, lowered activity, gait abnormalities, tremors
Methyl Parathion	GD6-15	Effects in maze (slight) and open-field activity, impaired cage emergence, locomotor activity, operant behavior in mixed paradigm
Parathion	PND 5-20	Small defects in spatial memory on maze



Cohort

Number: 571 mother/newborn pairs (goal=730)

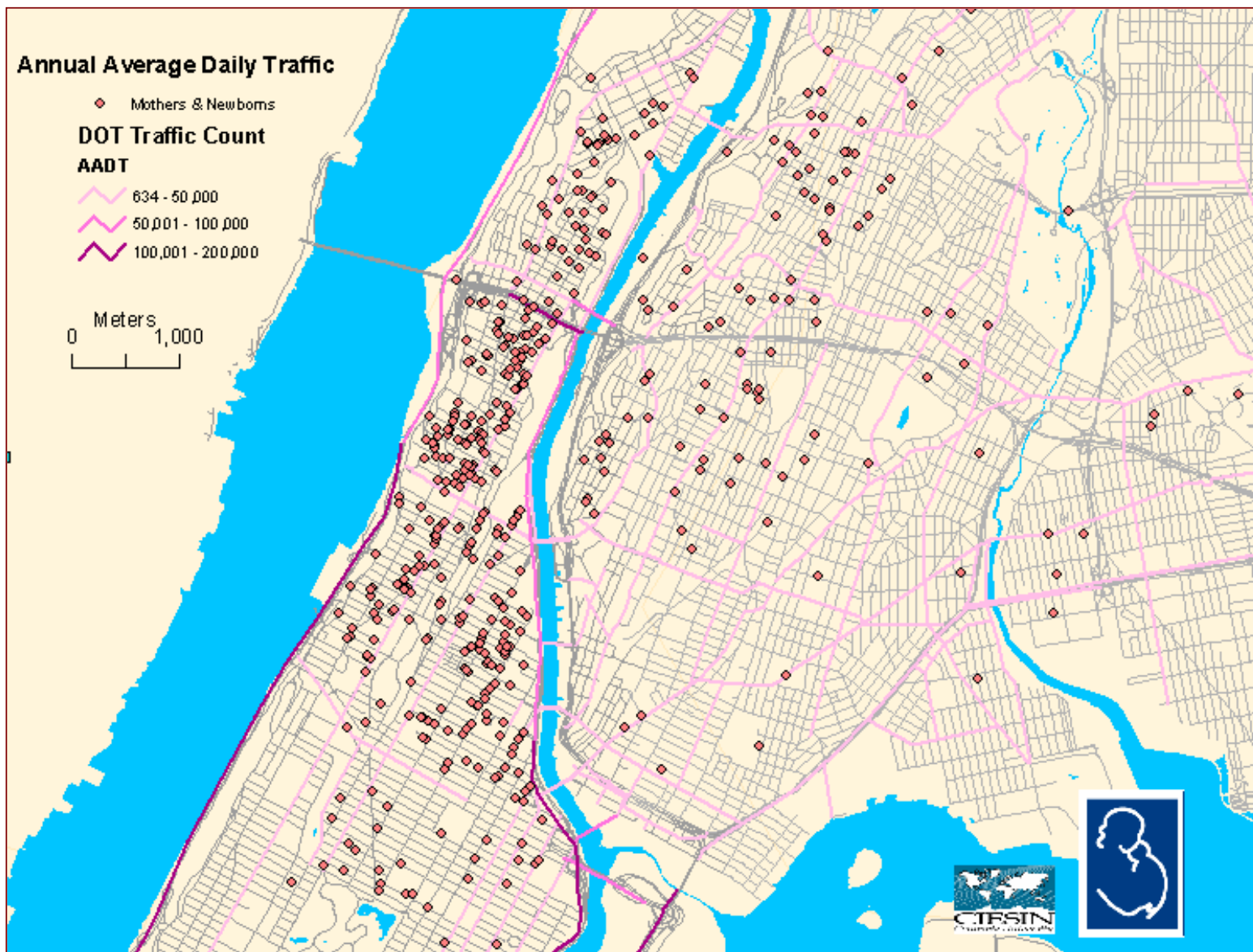
Ethnicity: African American and Dominican

Residence: Northern Manhattan & South Bronx

Characteristics:

- Non-smokers
- Non-illicit drug users
- No history of HIV, hypertension, diabetes

GIS: Residences of Study Subjects in NYC Cohort Study





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Exposure measures: questionnaire





Environmental measures of exposure

48-hour personal air monitoring





Biologic Samples

- umbilical cord blood
- maternal blood
- meconium
- urine



Medical record data: gestational age, gender, birth weight, length, head circumference, maternal height, pre-pregnancy weight and weight gain, medications



Insecticides measured in environmental and biologic samples

Organophosphates

Chlorpyrifos

Diazinon

Malathion

Methyl parathion

Carbamates

Bendiocarb

Carbaryl

Carbofuran

Propoxur

Pyrethroids

cis-Permethrin

trans-Permethrin



Regulatory action to phase out residential use of chlorpyrifos and diazinon

Chlorpyrifos

- In 6/2000 U.S. EPA began phasing out residential uses
- Phase-out completed by 12/2001

Diazinon

- In 1/2001 U.S. EPA began phasing out residential uses
- Phase-out completed by 12/2002
- Prior to 2000, 75% of diazinon use and 50% of chlorpyrifos use in U.S. was for residential pest control



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Demographics (N=571)

Maternal Age 24.9 ± 5.0

Ethnicity

Hispanic 63%

African American 37%

Medicaid recipient 90%

Marital Status

Never married 67%

Education

< High School 35%

Annual Household Income

< \$10,000 42%

Lacked basic necessities

shelter, food, clothing, heat, medicine 41%

Indices of housing disrepair

holes, water damage, mold 61%



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Extent of pesticide use and exposure during pregnancy



Percent reporting pest sightings and use of pest control during pregnancy

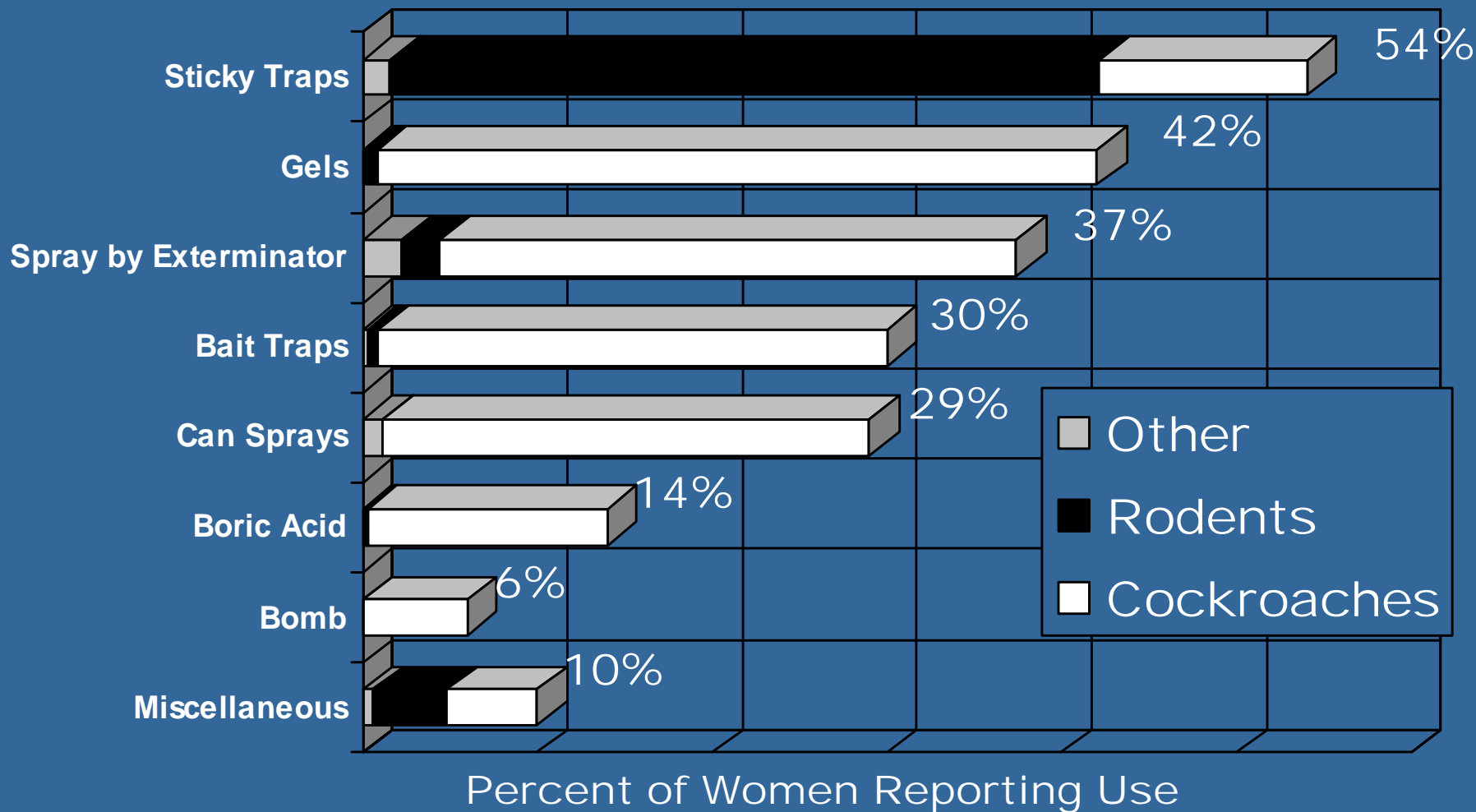
N=571

Pest sightings	85%
• Cockroaches	68%
• Rodents	54%
Pest control	85%
• By exterminator	37%

90% of women with pest sightings, versus 60% without, reported using pest control measures ($\chi^2= 44$, $p<0.001$), demonstrating the co-occurrence of exposure to pests and pesticides.



Specific pest-control measures



Overall, 54% of users used one or more higher toxicity methods



Association¹ between housing disrepair pests sightings and pest control

	Odds Ratio (C.I.) ²	p-value
Pests sighted	2.0 (1.5-2.8)	<0.001
Pest control used	1.4 (1.1-1.8)	<0.01

¹Logistic regression analyses controlling for ethnicity and neighborhood of residence

²For each unit increase in the degree of housing disrepair reported (0-5)



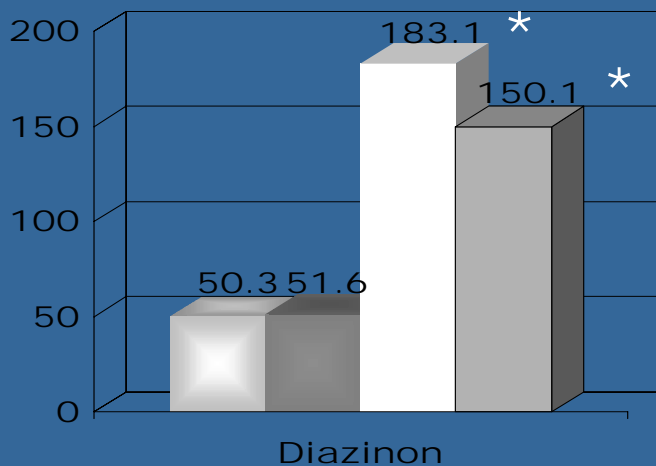
Levels of pesticides detected by personal air monitoring, maternal and newborn blood samples

	Personal air (ng/m ³) (n=394)		Maternal blood (pg/g) (n=326)		Cord blood (pg/g) (n=341)	
	%> LOD	Mean±SD	%>LOD	Mean±SD	%>LOD	Mean±SD
Chlorpyrifos	99.7%	14.3±30.7	70%	3.9±4.8	64%	3.7±5.7
Diazinon	100%	99.4±499.8	45%	1.3±1.8	44%	1.2±1.4
Propoxur ¹	100%	53.5±124.5	39%	2.8±2.7	40%	3.0±3.0

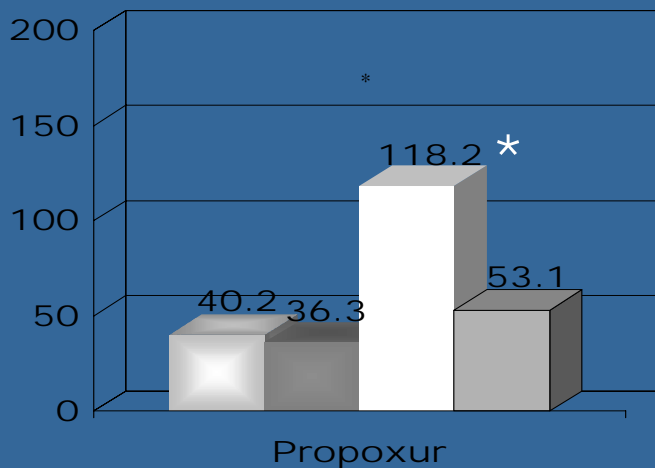
- Maternal personal air and blood levels weakly correlated ($r < 0.2$)
- Maternal and newborn blood levels highly correlated ($r = 0.4-0.8$)

¹2-isopropoxyphenol measured in blood samples

Mean insecticide levels (ng/m³) by pest control methods



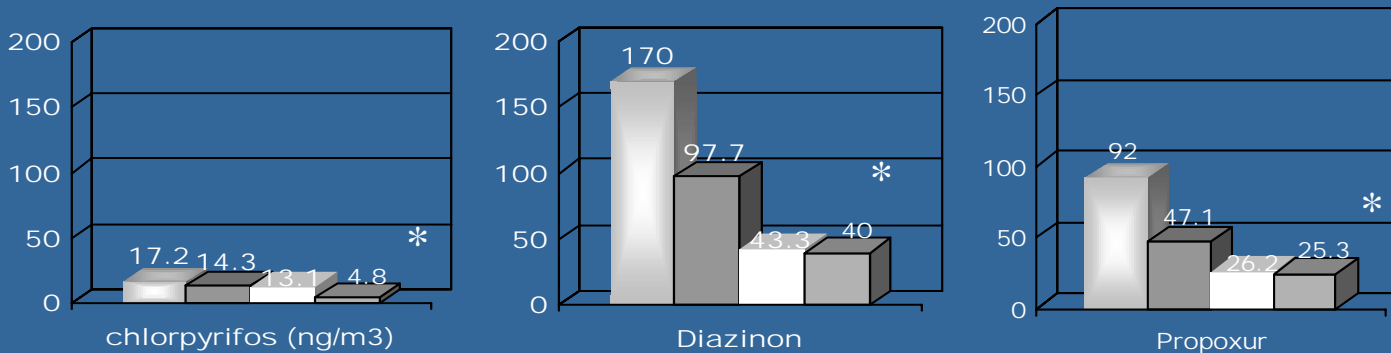
- No pest control methods
- Low toxicity methods
- Can sprays and bombs
- Exterminator



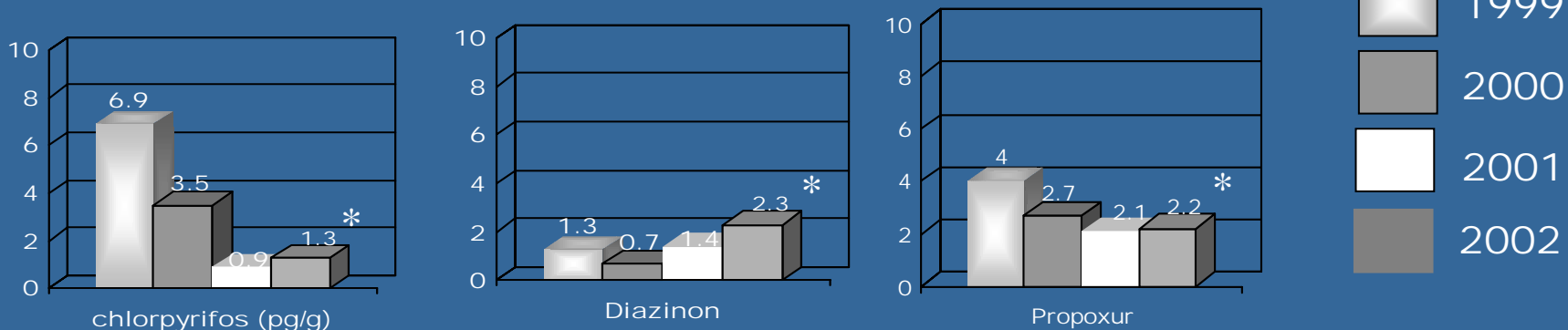
* p < 0.05

Insecticide levels among pregnant women began to drop immediately after the EPA ban in June, 2000

a. Maternal personal air levels (ng/m³)



b. Umbilical cord blood levels (pg/g)



*p < 0.05 ANOVA



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Effects of prenatal insecticide exposures on fetal growth and neurocognitive development



Change in birth weight/length for each log unit increase in insecticide levels in umbilical cord plasma (n=314)

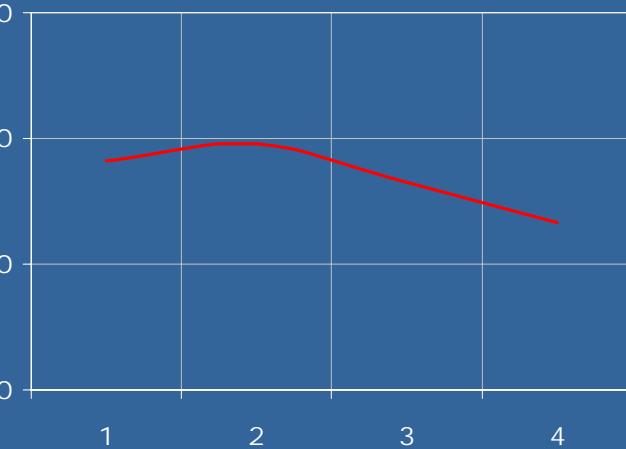
	Birth weight(gm)	Birth length (cm)
Chlorpyrifos	B= -42.6, p=0.03	B= -0.24, p=0.04
Sum OP ¹	B= -49.1, p=0.02	B= -0.27, p=0.03

¹Sum of diazinon and chlorpyrifos adjusted by U.S.EPA relative potency factors.

By multiple linear regression. Independent variable: (ln)pesticide controlling for active and passive smoking, ethnicity, parity, maternal pre-pregnancy weight and net weight gain during pregnancy, gender and gestational age of the newborn, and season of delivery

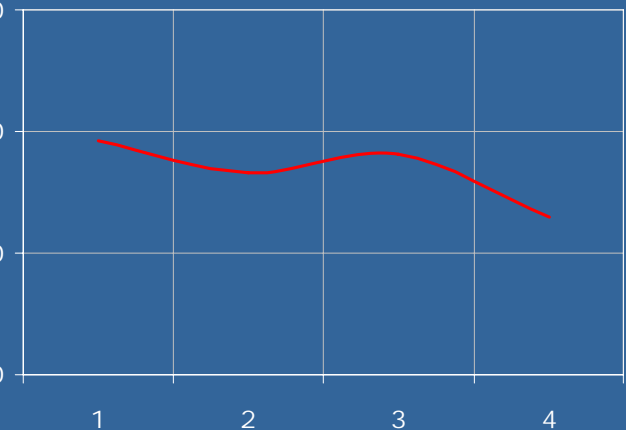
Mean birth weights by pesticide level in cord plasma

Chlorpyrifos



150.1 gm difference (lowest vs highest, $p=0.03$)

Sum chlorpyrifos and diazinon



186.3 gm difference (lowest vs highest, $p=0.01$)

group 1=below LOD; group 2=lowest 3rd > LOD; group 3=middle 3rd of > LOD; group 4=highest > LOD. Analyses by multiple regression



Associations between fetal growth and cord blood OP levels by year of delivery

Birth weight (gm)

Birth length (cm)

Born prior to 1/1/2001

Chlorpyrifos B= -67.3, p=0.008 B= -0.43, p=0.004

Sum OP² B= -68.5, p=0.007 B= -0.46, p=0.004

Born after 1/1/2001

Chlorpyrifos B=30.7, p=0.7 B= 0.07, p=0.9

Sum OP B= 0.6, p=1.0 B=0.07, p=0.8

Unit decrease in birth weight and length for each log unit increase in OP

² Sum of diazinon and chlorpyrifos adjusted by EPA relative potency factors



Our preliminary data indicate that the chlorpyrifos levels in the babies blood at birth are inversely associated with postnatal development.

Rauh, Whyatt, Garfinkel et al, in preparation



Conclusions

Results show widespread use of pest control measures among the African American and Dominican women during pregnancy.

Chlorpyrifos, diazinon, and propoxur were detected frequently in personal and indoor air and in blood samples.

Maternal and cord blood levels were similar and highly correlated.

Prenatal chlorpyrifos exposures adversely affected fetal growth. Diazinon exposures may also have adverse growth affects.



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