Presenter Disclosures

Marcella Remer Thompson

(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No Relationships to Disclose

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Multiple Environmental Chemical Exposures to Lead, Mercury and Polychlorinated Biphenyls Among Childbearing-Aged Women (NHANES 1999-2004): Body Burden and Risk Factors

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Body Burden

- The body burden from past exposures as well as those maternal exposures that occur during gestation can transfer to the fetus via the placenta and to infant and child during lactation.
- Little is known about the prevalence of co-exposures to these chemicals among childbearing-aged women.
- Health impact of these co-exposures may be magnified among vulnerable population subgroups.

Wigle et al. (2007); Denham et al. (2005); Qin et al. (2010); Woodruff et al. (2011)

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Aim and Research Questions

The aim of this research was to characterize the body burden and covariates for exposure to three neurotoxicants among childbearing-aged women living in the U.S. 1999 through 2004.

1. What was the percentage of childbearing-aged women who had body burdens at or above the median for lead, mercury, and PCBs?
2. What was the extent of their mixed exposures?
3. What, if any, subsets of these women were disproportionately burdened by two or more of these environmental chemicals based on susceptibility-related attributes, exposure-related attributes, socioeconomic factors, and race-ethnicity?

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Methodology

CDC (2008)

Research Design. Descriptive and Exploratory Study. Secondary Data Analysis.

Data Source. Centers for Disease Control and Prevention National Center for Health Statistics National Health and Nutrition Examination Survey (NHANES) http://www.cdc.gov/nchs/nhanes.htm

Study Population. 3,173 childbearing-aged females aged 16-49 of all races and ethnicities who lived in the U.S. from 1999 to 2004 who were tested for all chemicals of interest, reliable dietary recall. (Weighted to U.S. Population 1.34M.)

Dependent Variable. Two or more xenobiotic levels at or above the median. Lead and total mercury were measured in blood. The sum of four lipid-adjusted PCB congeners (118, 138/158, 153, 180) were measured in serum.

Independent Variables. Measures of vulnerability: susceptibility- and exposure-related attributes, socioeconomic factors and race-ethnicity

(Sexton, Olden & Johnson, 1993)

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Xenobiotic Levels in Childbearing-Aged Women

(NHANES weighted data 1999-2004)

Xenobiotic	LoD	≥ LoD (%)	GM (SE)	50th Percentile	95th Percentile	CV (GSE/GM)
Lead [blood (µg/dl)]	0.3	**98.50**	0.93 (0.03)	0.89	**2.24**	0.03
Total Mercury [blood (µg/L)]	0.2	**95.85**	0.94 (0.06)	0.99	**5.55**	0.06
PCB 118 [serum (ng/g lipid)]	NA	67.50	5.95 (0.20)	5.14	20.22	0.03
PCB 138/158 [serum (ng/g lipid)]	NA	74.12	12.84 (0.52)	13.79	45.38	0.04
PCB 153 [serum (ng/g lipid)]	NA	78.29	17.09 (0.72)	18.18	60.72	0.04
PCB 180 [serum (ng/g lipid)]	NA	74.81	10.85 (0.40)	10.38	42.89	0.04
Σ PCBs [serum (ng/g lipid)]	NA	**55.50**	48.09 (1.82)	51.59	198.75	0.04

Schmidt (2006)

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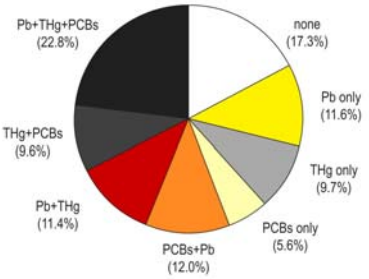
Percentage of Childbearing-Aged Women in U.S. burdened by specific xenobiotic combinations at or above the median
(NHANES weighted data 1999-2004)



Denham et al. (2005); Boucher et al. (2011); Stewart et al. (2006)

ENV 3125.1 7

Risk Factors

(NHANES weighted data 1999-2004)

Best-Fit Logistic Regression Model

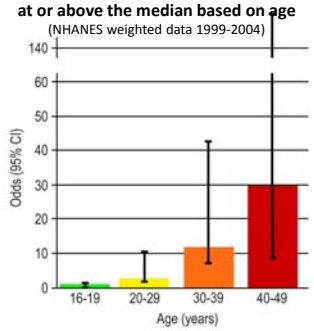
Age
Fish Consumption
Alcohol Consumption
Past Breastfed Child
Household Size
Education
Shellfish Consumption
Language Spoken at Home
Race-Ethnicity
Selenium Intake
Currently Breastfeeding
Employment

$p \leq 0.05$

Morello-Frosch & Schenassa (2006); Payne-Sturges & Gee (2006); Montoya (2007)

ENV 3125.1 8

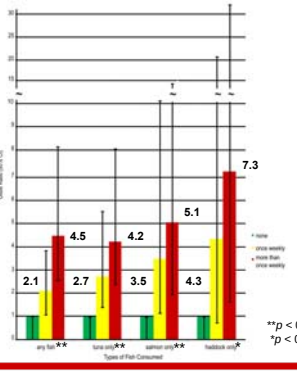
Odds of childbearing-aged women in U.S. with two or more xenobiotics at or above the median based on age
(NHANES weighted data 1999-2004)



Axelrad et al. (2009); Mushak (1998); Caldwell et al. (2009); Laden et al. (2001)

ENV 3125.1 9

Odds of childbearing-aged women having two or more xenobiotic levels at or above median based on fish consumption



$^{**}p < 0.001$
$^{*}p < 0.02$

Grandjean et al. (1992); Gunderson (1995); Falco et al. (2006); Tran et al. (2004)

Variable Names	df	-2LL Wald F	*P* value	Odds Ratio	95% CI
Alcohol Consumption	2	4.01	*0.03*		
never, seldom drinker[R]				1.00	ns
including 16-19 y/o data restricted					
drinker				0.63	0.33-1.19
heavy and/or binge drinker				**1.56**	0.81-3.01

Gupta & Gill (2000); Maia et al. (2009)

Variable Names	df	-2LL Wald F	*P* value	Odds Ratio	95% CI
Past Breastfed Child	1	5.09	***0.03***		
never breastfed[R]				1.00	ns
breastfed more than one month				**0.56**	0.33-0.94

Currently Breastfeeding	1	1.20	*0.28*		
no[R]				1.00	ns
currently breastfeeding				1.97	0.56-6.89

ATSDR (2004); Gundacker et al. (2002); Arendt (2008); Needham et al. (2011); CDC NCEH (2010)

Study Limitations

- cross-sectional study
  - associations, not causations
- goodness of fit (R^2=.25)
  - binary interactions (33% $p < 0.001$)
- limited understanding of exposure covariates
- body burden ≠ identify exposure sources
  - time and place
- generalized to U.S. population of childbearing-aged women only
- population-based study, not individualized risk
- only these three environmental chemicals

Lehmann (1975); Murray (2005)

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Conclusions

- Childbearing-Aged Women in U.S.
- Body Burden for Pb, Hg, PCBs
  - 23% all three xenobiotics at or above median
  - Equally likely to have two as one at or above median
- Covariates
  - increasing age
  - any fish consumption
  - heavy and/or binge drinking alcohol consumption
  - prior history of breastfeeding (lower)

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