



# The relationship between dioxin concentrations in blood and breast feeding

Kristine Knutson, Billing Hong, Xiaohui Jiang, Elizabeth Hedgeman, Qixuan Chen, Chiung-Wen Chang, Timothy Towey, Brenda W. Gillespie, Alfred Franzblau, James Lepkowski, Peter Adriaens, Avery Demond, David H. Garabrant - The University of Michigan, Ann Arbor, Michigan, USA

## Introduction & Objectives

- The University of Michigan Dioxin Exposure Study (UMDES) was conducted to identify exposure pathways by which dioxin contamination in the environment contribute to dioxin concentrations in blood. Studies of blood and breast milk from mothers have demonstrated that dioxins are eliminated from the body during breast feeding.
- The objective of this study is to explore the relationship between dioxin toxic equivalency (TEQ) levels and 2378-TCDD (TCDD) concentrations in serum and breast feeding for participants in a large population-based exposure study, the UMDES, conducted in Michigan, USA. It will focus on exploring the overall effect of lifetime duration of breast feeding and the effects of duration of breast feeding the first time compared to duration of breast feeding additional children for participants in living in the target population in Midland and Saginaw counties (MS) and those living in Jackson and Calhoun counties (JC), the referent population (Figure 1).

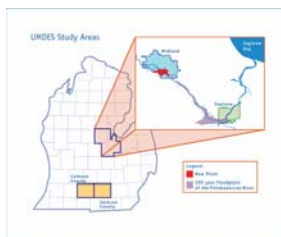


Figure 1: UMDES study areas



Figure 2: Tittabawassee River, Midland, MI

## Methods

- **Serum Analysis:** Performed for the 29 polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and dioxin-like polychlorinated biphenyls (PCBs) with published toxic equivalency factors (TEF). Results for concentrations below the limit of detection (LOD) were estimated using LOD/√2. TEQs were calculated based on the WHO 2005 TEFs. Results were lipid adjusted and survey weighted to characterize the populations of the regions.
- **Interview:** Information on pregnancy and breast feeding were obtained during a 1 hour interview that included questions grouped into eight categories: health, residential history, property use, work history, recreational activities, food consumption, current diet, and demographics.
- **Statistical Analysis:** Stepwise selection regression models were run on the 532 female UMDES participants for the log<sub>10</sub> of the serum concentration, adjusting for all other covariates in the UMDES model. Influence diagnostics were performed on each model to investigate the effects of potentially influential observations on the models.

## Results

- Serum samples and interviews were collected from 946 UMDES participants. 532 were women, 442 women had at least one child, and 241 women with at least one child breast fed for at least one month (Table 1).

Table 1: Survey weighted descriptive statistics for female UMDES study participants

Variable	N	Breast Feeding (months)						
		Mean	S.E.	Min	Median	75th%ile	95th%ile	Max
Duration of breast feeding, first child, months*	241	5.72	0.63	1	3	6	18	45
Duration of breast feeding, additional children, months	157	14.1	3.18	1	7	18	42	120
Total lifetime breast feeding, months	241	14.1	2.09	1	6	16	54	120

\*Note: The first breast fed child is not necessarily the first born child

Financial support for this study comes from the Dow Chemical Company through an unrestricted grant to the University of Michigan.

## Results, cont.

Table 2: Models for the months of breast feeding in a lifetime

	Estimate (SE)	p-value	6 Month Change (%)
<i>Midland &amp; Saginaw (n=373)</i>			
TEQ	-0.003 (0.001)	<0.001	-4.58
2378-TCDD*	-0.003 (0.002)	0.097	-4.41
<i>Jackson &amp; Calhoun (n=159)</i>			
TEQ*	-0.002 (0.001)	0.063	-3.24
2378-TCDD*	-0.004 (0.002)	0.018	-5.22

\*variable is not stable

- Lifetime breast feeding was significantly associated with a lower serum TEQ in MS. Each six month increase was associated with a 4.6% decrease in serum TEQ. For TCDD in MS, TEQ in JC, and TCDD in JC, the lifetime breast feeding variables are not stable (Table 2).

Table 3: Models for months of breast feeding for the first time and additional children

	Child	Estimate (SE)	p-value	6 Month Change (%)
<i>Midland &amp; Saginaw (n=373)</i>				
TEQ	First BF months*	-0.001 (0.003)	0.765	-1.38
	Additional BF months	-0.004 (0.001)	<0.001	-5.00
2378-TCDD	First BF months	-0.006 (0.005)	0.215	-7.88
	Additional BF months	-0.002 (0.002)	0.235	-3.13
<i>Jackson &amp; Calhoun (n=159)</i>				
TEQ	First BF months*	-0.008 (0.003)	0.020	-10.8
	Additional BF months	0.001 (0.003)	0.068	1.59
2378-TCDD	First BF months	-0.005 (0.004)	0.237	-6.94
	Additional BF months	-0.003 (0.003)	0.354	-4.07

\*variable is not stable

### Midland & Saginaw Counties (Table 3)

- Months of breast feeding the first time and additional children were associated with lower TEQ and 2378-TCDD concentrations.
- Months of breast feeding additional children was significantly associated with a lower serum TEQ. The parameter estimates indicate that each six month increase breast feeding additional children was associated with a 5.00% decrease in blood TEQ.
- For 2378-TCDD, months of breast feeding the first time and additional children were not significantly associated with a lower serum concentrations. The effect of breast feeding the first breast fed child was larger than the effect of breast feeding additional children.

### Jackson & Calhoun Counties (Table 3)

- Months of breast feeding additional children was not significantly associated with serum TEQ. The parameter estimates indicate that each six month increase in breast feeding additional children was associated with a 1.59% increase in blood TEQ.
- For 2378-TCDD, months of breast feeding the first time and additional children were not significantly associated with a lower serum concentrations. The effect of breast feeding the first breast fed child was larger than the effect of breast feeding additional children.

## Conclusions & Future Considerations

- In both the MS and JC population, negative parameter estimates show that breast feeding, in general, was associated with lower TEQ and 2378-TCDD concentrations.
- Lifetime breast feeding was associated with lower serum TEQ levels in MS (Table 2).
- In both the MS and the JC population, the months of breast feeding the first time and additional children were not significantly associated with 2378-TCDD concentrations in serum (Table 3).
- Future investigations will look at the impact of breast feeding during time periods with different levels of environmental contamination. Regression analyses will also be performed on 123678-HxCDD, 23478-PeCDF, 12378-PeCDD, and PCB126.