Does Living Near A Superfund Site Contribute to Higher Polychlorinated Biphenyl (PCB) Exposure?

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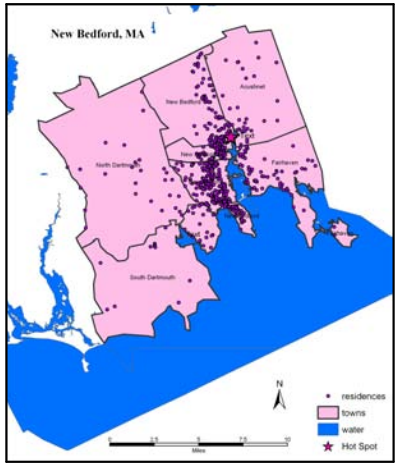
BACKGROUND

- Polychlorinated Biphenyls (PCBs) are synthetic organic compounds characterized by their persistent, bioaccumulative, and lipophylic properties
- PCBs are a family of 209 structurally related congeners that have a common biphenyl structure but differ in number and position of chlorine substitution
- PCBs were used as insulating fluids and lubricants in transformers. They were also used in the manufacture of sealants, paints, and pesticides
- Findings among epidemiologic studies overall indicate that prenatal PCB exposure in general populations may have adverse effects on the neurodevelopment of children
- The use of PCBs was banned in 1977 due to their toxicities and ability to bioaccumulate

OBJECTIVE

- There have been few studies of levels of PCBs in populations residing near Superfund sites
- We assessed the geographic distribution of cord serum PCB levels among infants of mothers living in the vicinity of the New Bedford Harbor Superfund site controlling for known pathways of PCB exposure

STUDY AREA



PCB waste was discharged in the New Bedford Harbor From 1940 until 1977. In 1982, New Bedford was placed under the Superfund Legislation for clean up. Sediments were dredged between April 1994 and September 1995 as part of the remediation plan

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METHODS

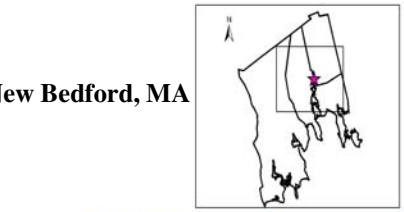
- 788 mother-infant pairs were recruited at birth at a local hospital between March 1993 and December 1998
- The mothers had resided in the four towns bordering the New Bedford Harbor PCB-contaminated site for the duration of pregnancy
- 718 infants had cord serum measurements including the sum of 51 PCB congeners (ΣPCB)
- Each subject's address, diet, PCB exposure risk factors, occupation, and demographics were obtained from maternal interviews and medical record reviews
- Addresses were geocoded to: 1) obtain distance of residences from the Superfund Hot Spot, 2) retrieve census block group level data on the proportion of houses built between 1940 and 1977, and 3) acquire census block group contextual variables to evaluate potential neighborhood-level influences
- A multivariate linear regression model of $\log_{10}$ ΣPCB as a function of individual exposure pathways and potential individual and neighborhood characteristics including covariates with p-value < 0.1
- Model residuals were mapped and a surface fitted by kriging to provide information on any unmeasured spatial correlates of PCB exposure
- Similar analyses were performed for the light (mono- to tetra-CBs) and heavy (penta- to deca-CBs) PCBs and Congener 118 to assess potential differences in exposure pathways

RESULTS

Table 1: Percent change in newborn cord serum ΣPCB levels as a function of significant maternal and infant prediction (p<0.1)

	%change (95% CI)	p-value
Child characteristics		
Male gender	-7% (-15%,3%)	0.16
Date of birth (5 years)	-36% (-52%,-13%)	0.004
Child born before/during dredging	17% (-3%,40%)	0.10
Mother's characteristics		
Maternal age (5 years)	36% (29%,43%)	<0.0001
Born outside USA/Canada		
Portugal/Azores/Cape Verde	42% (23%,63%)	<0.0001
Other countries	20% (-3%,48%)	0.09
Previous lactation (> 6months)	-25% (-35%,-12%)	0.0003
Smoking during pregnancy (yes)	-11% (-20%,-1%)	0.03
Household income (≥$40,000)	1% (-13%,10%)	0.70
Mother's diet		
Organ meat (>1/month)	21% (2%,44%)	0.03
Local dairy (yes)	19% (1%,39%)	0.03
Red Meat (>2/week)	7% (-5%,19%)	0.28
Dark fish (>1/month)	8% (-4%,21%)	0.21

RESULTS (continued)



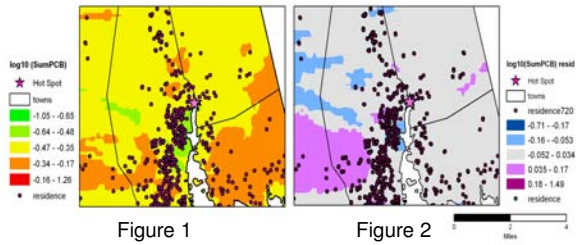


Figure 1 Figure 2

Restricting data to a 5-mile neighborhood of the Hot Spot $\log_{10}$ΣPCB (Figure 1) and residuals from the multivariate model (Figure 2)

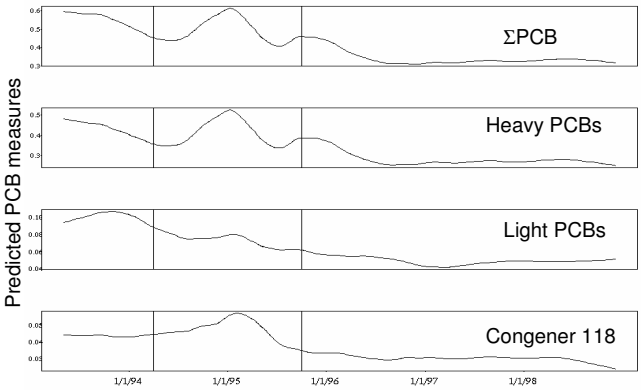


Figure 3. Covariate-adjusted smoothed plots of predicted PCB measure versus infant's date of birth

CONCLUSION

- The spatial variability did not have any apparent relationship to proximity of residence to the PCB Hot Spot
- Similar results were found with light, heavy PCBs and congener 118
- The analyses suggest that residing near a Superfund site does not lead to higher PCB levels independent of other exposure risk factors such as diet, maternal age, and, maternal birthplace
- Region-specific factors such as maternal consumption of locally-grown dairy foods and site dredging were correlated with cord serum PCBs