ANNISTON COMMUNITY HEALTH SURVEY: UPDATE OF RESULTS

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Studies of Environmental Exposure to PCBs in Anniston

- Anniston Environmental Health Research Consortium was formed to examine health effects of PCBs in residents of Anniston
  - Funded by ATSDR through a cooperative agreement with Jacksonville State University (JSU) and in collaboration with the University of Alabama at Birmingham (UAB)
  - Studies were conducted in 2005-2007
- Anniston Community Health Survey
  - Study interviewed 1,100 residents, 765 had PCBs measured
  - Focused on diabetes, heart disease (hypertension) and related health outcomes

Studies of Environmental Exposure to PCBs in Anniston

- Studies examine association between health outcomes and PCBs
- Cannot make conclusions about causality, i.e. PCBs caused the disease
  - Cumulative weight of evidence of all valid studies in the field can lead to determination of causal pathway

Levels of PCBs in Anniston

- PCB levels were measured in 765 Anniston residents
- Total PCBs were two to five times higher than the national average
- PCB levels were on average two to three times higher in African American residents than in White residents of Anniston
- The levels were much higher in older residents than in younger residents
- Those younger than 40 years old had levels similar to general US population

Predictors of PCBs Exposure

- Age and race determined most of the variation in PCB levels but certain specific exposures or behaviors may have also contributed to total body burden
  - Ever eating fish from local streams was related to having higher PCB levels
  - Ever eating locally raised livestock and clay were related to having higher PCB levels
  - Length of residence, living in west Anniston, and smoking were important predictors of PCB levels

- In a separate preliminary analyses, soil PCB levels (data provided by EPA) close to residences were not associated with serum PCBs of Anniston residents

Hypertension and PCBs

- We examined 758 Anniston residents for hypertension and levels of PCBs
  - Demographic (age, residence) and life-style factors such as smoking, exercise and medication were taken into account in the analyses
- Overall, those with higher levels of PCBs had two to three times higher risk of hypertension
- The risk was three to five times higher in those who were not taking antihypertensive medications
- Little or no risk with higher PCBs was found for those taking antihypertensive medication

Blood Pressure and PCBs

- Additional analyses were performed to evaluate relationship between blood pressure and levels of PCBs in those not taking anti-hypertensive medication
  - If blood pressure is well-controlled by medication, it would be difficult to study effect of PCBs
- Higher blood pressure (both systolic and diastolic) was found in those with higher PCB levels
- Relationship between PCBs and blood pressure was observed even in those whose blood pressure was in normal range

Diabetes and PCBs

- We observed some associations between elevated PCB levels and diabetes in the whole survey group
  - The prevalence of diabetes overall in this group was 27%
  - Diabetes was more likely to be found in people with higher PCB levels
- Two to three times higher risk of having diabetes with PCBs was found in those under age 55
- Additionally, elevated PCBs doubled the risk of diabetes among women but not men

Metabolic Syndrome and PCBs

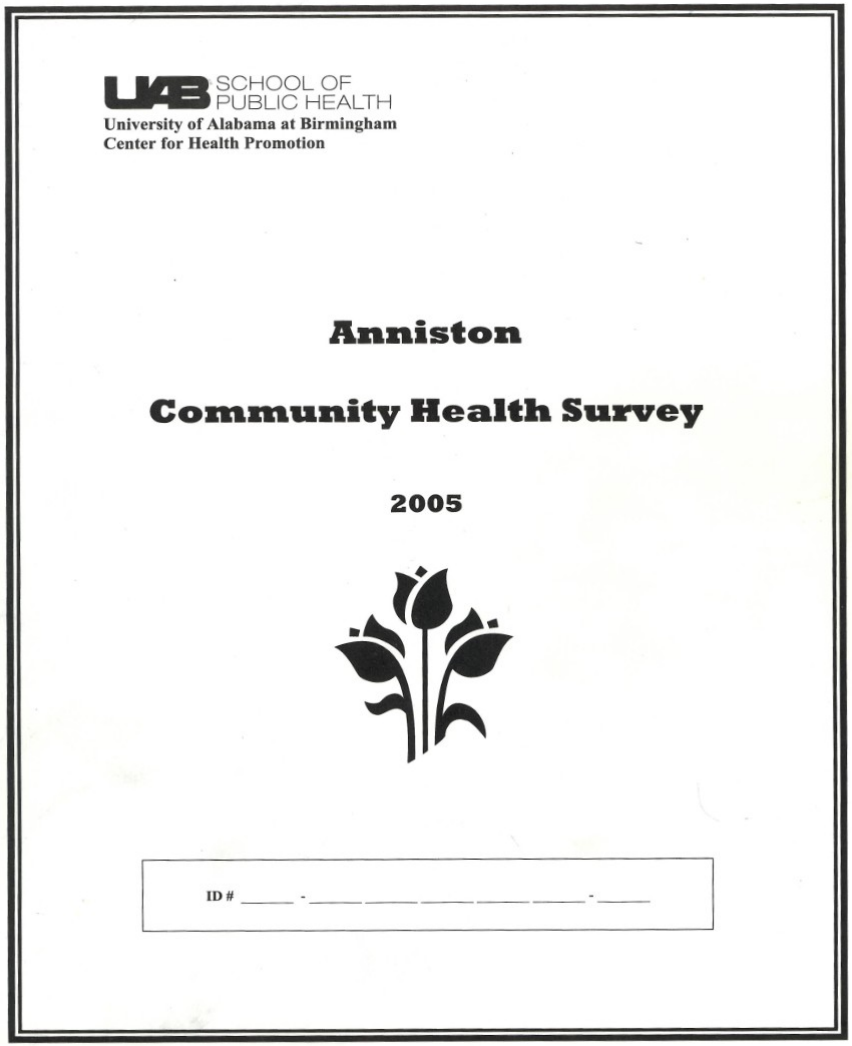
- Metabolic syndrome is a combination of hypertension, diabetes (or high blood sugar), high levels of bad fats and low levels of good fats (in blood), and obesity (high body mass index)
  - May lead to increased risk of mortality from heart disease or other complications
  - 60% percent of study sample had metabolic syndrome (452/753)
- Higher PCBs were not related to being likely to have metabolic syndrome
- Persons who had higher levels of DDT and Lindane had higher risk of having metabolic syndrome
  - Other pesticides showed no relation to metabolic syndrome

Future Updates of PCBs Studies

- We will coordinate with the community representatives to periodically come to Anniston and present updates of the results from the Anniston PCBs studies as they are published in peer-review scientific journals

Additional Slides

Anniston Community Health Survey



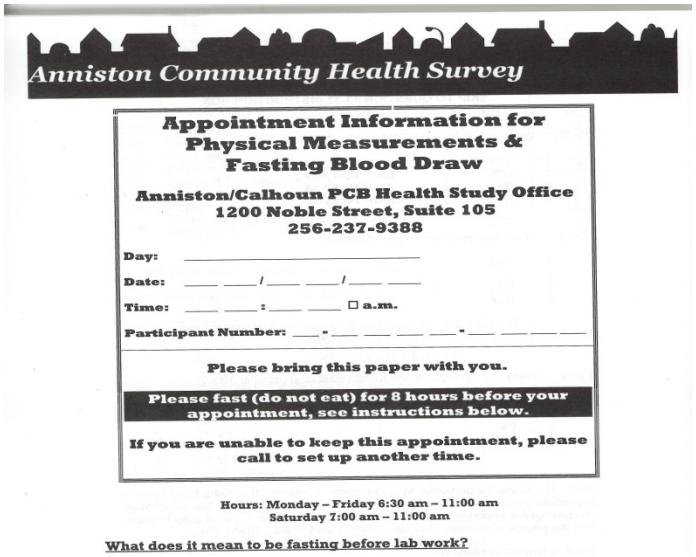
UAB SCHOOL OF PUBLIC HEALTH
University of Alabama at Birmingham
Center for Health Promotion

Anniston

Community Health Survey

2005

ID # _____ - _____ _____ _____ _____ _____ _____ - _____



Anniston Community Health Survey

Appointment Information for Physical Measurements & Fasting Blood Draw

Anniston/Calhoun PCB Health Study Office
1200 Noble Street, Suite 105
256-237-9388

Day: _____

Date: ___ ___ / ___ ___ / ___ ___

Time: ___ ___ : ___ ___ ☐ a.m.

Participant Number: ___ - ___ ___ ___ ___ - ___ ___ ___ ___

Please bring this paper with you.

Please fast (do not eat) for 8 hours before your appointment, see instructions below.

If you are unable to keep this appointment, please call to set up another time.

Hours: Monday – Friday 6:30 am – 11:00 am
Saturday 7:00 am – 11:00 am

What does it mean to be fasting before lab work?

- Study questionnaire, IRB approvals, and consent forms developed and approved at University of Alabama at Birmingham
- Consent obtained during home visit
- Biometrics, blood pressure, medication verification and blood sample collection during study office visit

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA
CDC Environmental Health
ATSDR AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Studies of PCB Exposure and Health in Anniston

2003-2005

- Anniston Environmental Health Research Consortium formed and funded by ATSDR
- Development and approval of protocols, questionnaires, other study materials

2005-2007

- Collection of data and biological samples

2007-2008

- Chemical analyses
- Data management and quality control
- Preliminary results presented at community meeting in Anniston

2009-present

- Statistical analyses, preparation of peer-reviewed manuscripts

Geometric Means and 95% Confidence Intervals of the Sum of PCBs by Age Group and Race (ng/g lipid)

	Anniston, 2005-7		NHANES, 2003-4	
Age group	African American [b]	White [c]	African American	White
20-39 years[a]	175.1 (139.9-219.2)	68.8 (58.7-80.4)	83.9 (72.7-96.9)	82.8 (76.5-89.7)
40-60 years	870.9 (756.6-1,002)	306.1 (272.2-344.1)	246.6 (209.2-290.6)	181.5 (161.9-203.3)
60+ years	1,874 (1,602-2,193)	683.8 (617.5-757.2)	630.1 (491.0-808.7)	332.8 (312.8-354.1)

a. 18-39 for the Anniston Survey (4 persons younger than 20).

b. The corresponding whole weight geometric means were 0.93 ng/g, 5.22 ng/g, and 10.93 ng/g.

c. The corresponding whole weight geometric means were 0.39 ng/g, 1.99 ng/g, and 4.21 ng/g.

Pavuk M, Olson JR, Sjödin A, Bonner M, Dearwent SM, Turner WJ, Needham LL for the Anniston Environmental Health Research Consortium. Assessment of human exposure to PCBs in the Anniston Community Health Survey. Organohalogen Compounds 71: 1066-1069, 2009.

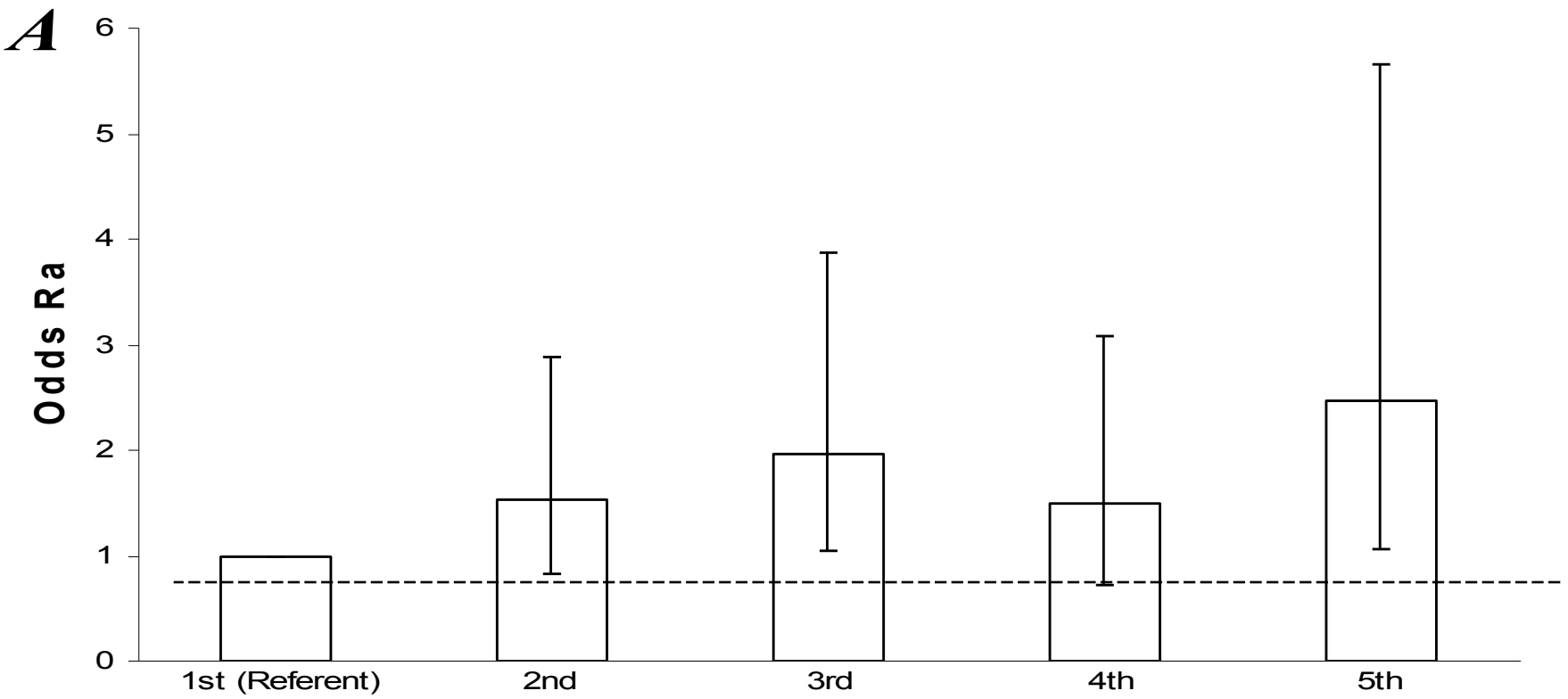
Hypertension and Exposure to PCBs
(sum of 35 PCBs in ng/g whole weight)

		Normotensive	Hypertensive		Total
Covariate	**Parameter**	**(n=322)**	**No medication (n=72)**	**On medication (n=364)**	**(n=758)**
Age	**Mean**	**46.4**	**52.9**	**62.8**	**54.9**
Sum of PCBs	**Mean**	**3.78**	**8.52**	**8.78**	**6.67**
	Median	**1.78**	**3.49**	**4.82**	**3.28**
	STD	**7.22**	**20.55**	**12.64**	**12.01**
	Range	**0.09 – 82.9**	**0.19 – 170.4**	**0.20 – 146**	**0.09 – 170.4**

In: Goncharov A, Bloom M, Pavuk M, Birman I, Carpenter DO. Blood pressure and hypertension in relation to levels of serum polychlorinated biphenyls in residents of Anniston, Alabama. J Hypertens 2010;28(10):2053-60.

Clinical Hypertension and Sum of PCBs

(A) Clinical hypertension for all 759 participants

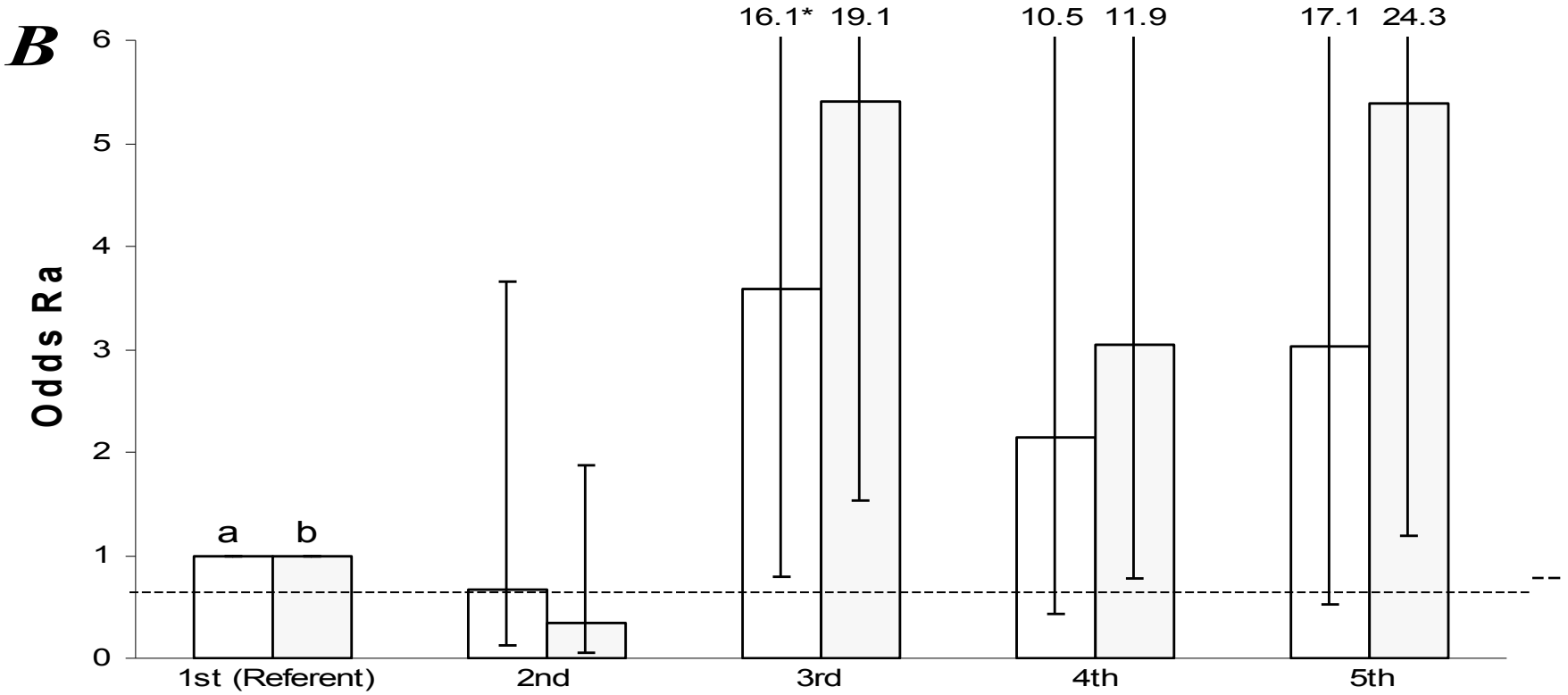


Referent PCB concentration range was 0.09-0.55 ng/g and the ranges for the second to fifth quintiles were 0.56-1.55, 1.56-2.91, 2.92-5.69 and 5.70-170.42 ng/g whole weight.

In: Goncharov A, Bloom M, Pavuk M, Birman I, Carpenter DO. Blood pressure and hypertension in relation to levels of serum polychlorinated biphenyls in residents of Anniston, Alabama. J Hypertens 2010;28(10):2053-60.

Systolic and Diastolic Hypertension and Sum of PCBs

(B) Systolic and diastolic hypertension for those participants not on antihypertensive medication (n=365).



Referent PCB concentration range was 0.09-1.15 ng/g and the ranges for the second to fifth quintiles were 1.16-2.42, 2.43-4.32, 4.38-9.38 and 9.420-170.42 ng/g whole weight.

In: Goncharov A, Bloom M, Pavuk M, Birman I, Carpenter DO. Blood pressure and hypertension in relation to levels of serum polychlorinated biphenyls in residents of Anniston, Alabama. J Hypertens 2010;28(10):2053-60.

Hypertension and PCBs: Conclusions

- For all hypertensive participants
  - Odds ratios elevated in participants with higher PCB levels (third and fifth quintiles of sum of PCBs compared to quintile with lowest PCBs)
- For hypertensive participants not on medication
  - Stronger associations observed
  - Stronger associations for diastolic pressure and for those who had both systolic and diastolic pressure elevated

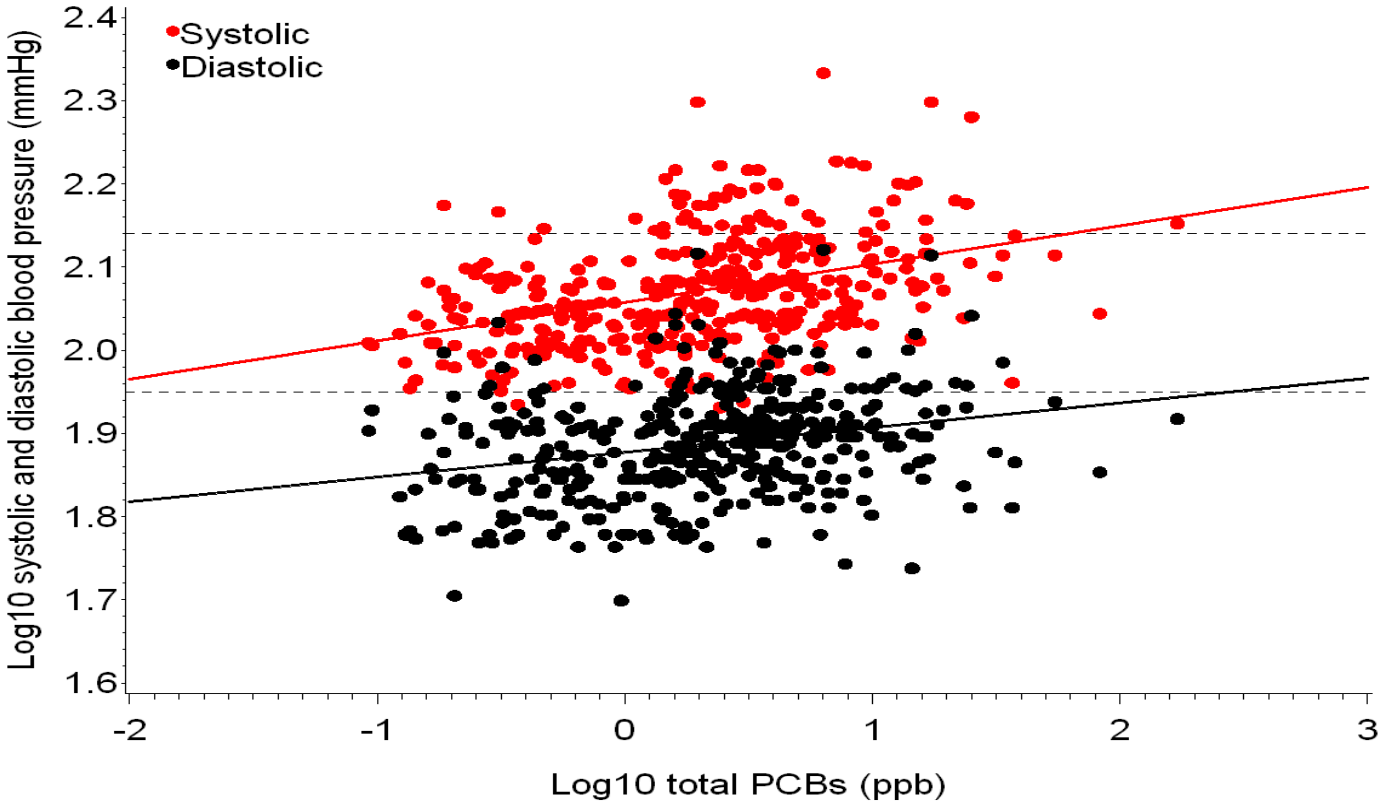
Blood Pressure and PCBs

- Participants were classified as having elevated systolic or diastolic blood pressure using the same cut points as those for hypertension
  - Elevated systolic (>140 mm Hg) or diastolic blood pressure (>90 mm Hg) in those not on anti-hypertensive medication

In: Goncharov A, Pavuk M, Foushee HR, and Carpenter DO for the Anniston Environmental Health Research Consortium. Blood pressure in relation to concentrations of PCB congeners and chlorinated pesticides. Environ Health Perspect 2011; 119 (3): 319-326.

Linear Regression of Systolic and Diastolic Blood Pressure and Sum of PCBs

Participants NOT on antihypertensive medication were included in the analyses (n=394).



a **Beta=0.028, p=0.007**

b **Beta=0.032,p=0.005**

In: Goncharov A, Pavuk M, Foushee HR, and Carpenter DO for the Anniston Environmental Health Research Consortium. Blood pressure in relation to concentrations of PCB congeners and chlorinated pesticides. Environ Health Perspect 2011; 119 (3): 319-326.

Mean Systolic and Diastolic Blood Pressure and Tertiles of Sum of PCBs

	B1 ±SE (2nd vs 1st)	p-value	B2 ±SE (3rd vs 1st)	p-value
Not on medication				
Systolic	0.023±0.09	0.009	0.028±0.10	0.009
Diastolic	0.034±0.09	0.0002	0.035±0.10	0.001
Normotensive				
Systolic	0.007±0.006	0.57	0.020±0.007	0.035
Diastolic	0.013±0.007	0.06	0.020±0.008	0.040

Total wet weight PCBs concentration in tertiles (ppb): 1st (referent): 0.1-1.23 ; 2nd 1.24 -3.65; 3rd 3.66-170. Adjusted for age, BMI, total lipids, gender, race, smoking and exercise.

In: Goncharov A, Pavuk M, Foushee HR, and Carpenter DO for the Anniston Environmental Health Research Consortium. Blood pressure in relation to concentrations of PCB congeners and chlorinated pesticides. Environ Health Perspect 2011; 119 (3): 319-326.

Systolic Blood Pressure and Groups of PCBs

	β_1 (2^{nd} vs. 1^{st})±SE[a]	p-value	β_2 (3^{rd} vs. 1^{st})±SE[a]	p-value
Total PCBs	**0.024±0.009**	**0.009**	**0.031±0.01**	**0.009**
Estrogen-like	**0.003±0.008**	**0.53**	**0.015±0.009**	**0.11**
Dioxin-like TEQs	**0.011±0.009**	**0.16**	**0.013±0.01**	**0.27**
Mono-*ortho*	**0.0006±0.009**	**0.91**	**0.002±0.010**	**0.88**
Di-*ortho*	**0.019±0.009**	**0.028**	**0.027±0.011**	**0.019**
Tri- and tetra-*ortho*	**0.024±0.009**	**0.0057**	**0.043±0.01**	**0.0003**

PCB groups concentrations in tertiles after adjustment for age, BMI, total lipids, gender, race, smoking status, and physical activity.

Systolic and Diastolic BP log-transformed.

Blood Pressure and PCBs: Conclusions

- PCB exposure may be a contributing factor in the regulation of blood pressure (and a risk factor for hypertension)
  - Some strong associations observed especially for those not on medication
  - We cannot exclude that confounding by risk factors not measured in the study would substantially weaken association(s) observed
  - The cross-sectional design of this study precludes the assessment of temporality and assumptions of causality
- No association with hypertension was seen in participants on antihypertensive medication
  - Most likely due to the use of medication
  - If blood pressure is well-controlled it precludes evaluation of associations with blood pressure