ANNISTON COMMUNITY HEALTH SURVEY:
UPDATE OF RESULTS

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Studies of Environmental Exposure to PCBs in Anniston

- Anniston Environmental Health Consortium was formed to examine health effects of PCBs in residents of Anniston
  - Funded by ATSDR through a grant to Jacksonville State University and assistance of the University of Alabama - Birmingham
  - 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

- Neurocognitive and neurobehavioral study of PCB exposure
  - Included 321 children (10-17 years old) and their parents
  - Neurobehavioral testing of children and adults, PCB levels and heavy metals (in kids) measured
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
Pathways of PCBs Exposure

- Age and race determine most of variation in PCB levels but certain specific exposures or behaviors may have also contribute to total body burden
- Ever eating fish from local streams was related to higher PCB levels
- Ever eating locally raised livestock was related to high PCBs
- Ever eating clay was related to high PCBs
  - Length of residence, living in west Anniston, and smoking were important for White residents of Anniston
- Soil PCB levels close to residences were not associated with PCBs
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 the effect of PCB
- 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%
  - More diabetes was found in people with higher PCBs

- Two to three times higher risk of diabetes with PCBs was found in those under age 55

- Additionally, elevated PCBs doubled the risk of diabetes among women but not in men
Metabolic Syndrome and PCBs

- Metabolic syndrome is a combination of hypertension, diabetes (or high sugar), high bad fats (in blood), low good fats, and obesity (large waist)
  - May lead to increased risk of mortality from heart disease or complications of its parts
- 60% percent of study sample had metabolic syndrome (452/753)
- Higher PCBs were not related metabolic syndrome
- Persons who had higher levels of two pesticides, DDT and Lindane, had higher risk of metabolic syndrome
- Other pesticides showed no relation to metabolic syndrome
Neurocognitive and Neurobehavioral Study of PCBs

- Separate study of 321 children (10-17 years old) and 103 parents (mostly mothers and grandmothers)
- Measures of memory function, performance on various language, visual, numeric, and decision making tests were performed
- Most tests found no associations with PCBs
Neurocognitive and Neurobehavioral Study of PCBs

• Higher PCBs seemed to be linked with lower result on IQ test in kids but that result went away when accounted for parents' education, ethnicity of children, and lead levels
  – Lead levels were not elevated in children

• A suggestion of deficit in decision making test in children with higher PCBs was observed (Tower test)
  – Other tests in the decision making test battery were normal

• A suggestion of differences in test results in parents (IQ) were found related to higher PCB levels
  – Results could not be controlled for lead levels (not measured) which may have strongly influenced this result
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

• Some things that may be of interest to look at include:
  – Lipid (fat) profiles in blood/Heart Disease and PCBs
  – Thyroid hormone levels and PCBs
  – Female/Male reproductive data and PCBs
Additional Slides
Published Peer-reviewed Articles


Peer-reviewed Papers Submitted for Publication


Papers in External Peer Review/ATSDR Review


Recent Presentations at Dioxin Symposia

- "Environmental Exposure to PCBs - Anniston Community Health Survey (ACHS)/PCBs and Other POPs in Schools and the Workplace" session scheduled for Monday, 13-Sep, 2010

- SPATIAL DISTRIBUTION AND DETERMINANTS OF PCB CONTAMINATION IN RESIDENTIAL SOIL IN ANNISTON, ALABAMA – Olson JR (University at Buffalo)

- PREDICTORS OF HUMAN SERUM POLYCHLORINATED BIPHENYLs (PCBs) CONCENTRATIONS IN THE ANNISTON COMMUNITY HEALTH SURVEY – Pavuk M/Dearwent S (ATSDR)

- ASSOCIATIONS BETWEEN BLOOD PRESSURE AND SERUM LEVELS OF PCB CONGENERS AND CHLORINATED PESTICIDES – Pavuk M (ATSDR)

- METABOLIC SYNDROME AND PESTICIDE EXPOSURE IN THE ANNISTON COMMUNITY HEALTH SURVEY – Rosenbaum P (SUNY Upstate Medical University, Syracuse, NY)

- "Exposures to Dioxin-Like Compounds in Soil and the Potential Impact on Human Health" session scheduled for Thursday, 16-Sep, 2010

- SOIL-SERUM PCB ASSOCIATIONS IN THE ANNISTON COMMUNITY HEALTH SURVEY – Jolson JR (University at Buffalo)/Marian Pavuk (ATSDR)
## Sum of 35 PCB Congeners and Hypertension
*(ng/g whole weight)*

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Parameter</th>
<th>Normotensive (n=322)</th>
<th>Hypertensive (n=72)</th>
<th>Hypertensive (n=364)</th>
<th>Total (n=758)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mean</td>
<td>46.4</td>
<td>52.9</td>
<td>62.8</td>
<td>54.9</td>
</tr>
<tr>
<td>Sum of PCBs</td>
<td>Mean</td>
<td>3.78</td>
<td>8.52</td>
<td>8.78</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>1.78</td>
<td>3.49</td>
<td>4.82</td>
<td>3.28</td>
</tr>
<tr>
<td>STD</td>
<td>7.22</td>
<td>20.55</td>
<td>12.64</td>
<td>12.01</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0.09 – 82.9</td>
<td>0.19 – 170.4</td>
<td>0.20 – 146</td>
<td>0.09 – 170.4</td>
<td></td>
</tr>
</tbody>
</table>
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.
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.
Conclusions

- For all hypertensive participants
  - Odds Ratios with the sum of PCBs participants elevated in third and fifth quintiles

- For hypertensive participants not on medication
  - Stronger associations - all Odds Ratios above 3
  - 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
Linear Regression of Systolic and Diastolic Blood Pressure and Sum of PCBs

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

- Beta = 0.028, p = 0.007
- Beta = 0.032, p = 0.005
### Mean Systolic and Diastolic Blood Pressure and Sum of PCBs Tertiles

<table>
<thead>
<tr>
<th></th>
<th>B1 ±SE (2nd vs 1st)</th>
<th>p-value</th>
<th>B2 ±SE (3rd vs 1st)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not on medication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>0.023±0.09</td>
<td>0.009</td>
<td>0.028±0.10</td>
<td>0.009</td>
</tr>
<tr>
<td>Diastolic</td>
<td>0.034±0.09</td>
<td>0.0002</td>
<td>0.035±0.10</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Normotensive</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>0.007±0.006</td>
<td>0.57</td>
<td>0.020±0.007</td>
<td>0.035</td>
</tr>
<tr>
<td>Diastolic</td>
<td>0.013±0.007</td>
<td>0.06</td>
<td>0.020±0.008</td>
<td>0.040</td>
</tr>
</tbody>
</table>

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.
### Systolic Blood Pressure and Groups of PCBs

<table>
<thead>
<tr>
<th></th>
<th>$\beta_1$ (2$^{nd}$ vs. 1$^{st}$)$^{\pm}$SE$^a$</th>
<th>P-value</th>
<th>$\beta_2$ (3$^{rd}$ vs. 1$^{st}$)$^{\pm}$SE$^a$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total PCBs</td>
<td>0.024$^{\pm}$0.009</td>
<td>0.009</td>
<td>0.031$^{\pm}$0.01</td>
<td>0.009</td>
</tr>
<tr>
<td>Estrogen-like</td>
<td>0.003$^{\pm}$0.008</td>
<td>0.53</td>
<td>0.015$^{\pm}$0.009</td>
<td>0.11</td>
</tr>
<tr>
<td>Dioxin-like TEQs</td>
<td>0.011$^{\pm}$0.009</td>
<td>0.16</td>
<td>0.013$^{\pm}$0.01</td>
<td>0.27</td>
</tr>
<tr>
<td>Mono-ortho</td>
<td>0.0006$^{\pm}$0.009</td>
<td>0.91</td>
<td>0.002$^{\pm}$0.010</td>
<td>0.88</td>
</tr>
<tr>
<td>Di-ortho</td>
<td>0.019$^{\pm}$0.009</td>
<td>0.028</td>
<td>0.027$^{\pm}$0.011</td>
<td>0.019</td>
</tr>
<tr>
<td>Tri- and tetra-ortho</td>
<td>0.024$^{\pm}$0.009</td>
<td>0.0057</td>
<td>0.043$^{\pm}$0.01</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

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.
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
Scatterplots of Serum PCB by Race

Lines indicate 50th percentile (lower) and 95th percentile (upper) of NHANES 2003-2004.
Scatterplots of serum PCB and Age by Race (log-transformed sum of PCBs)
Geometric Means and 95% Confidence Intervals of the Sum of PCBs by Age Group and Race (ng/g lipid)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Anniston, 2005-7</th>
<th>NHANES, 2003-4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>African American</td>
<td>White</td>
</tr>
<tr>
<td>20-39 years²</td>
<td>175.1 (139.9-219.2)</td>
<td>68.8 (58.7-80.4)</td>
</tr>
<tr>
<td>40-60 years</td>
<td>870.9 (756.6-1,002)</td>
<td>306.1 (272.2-344.1)</td>
</tr>
<tr>
<td>60+ years</td>
<td>1,874 (1,602-2,193)</td>
<td>683.8 (617.5-757.2)</td>
</tr>
</tbody>
</table>

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.
## Significant Multivariate Predictors by Race

<table>
<thead>
<tr>
<th>Variable</th>
<th>African American</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$10^8$</td>
<td>P-Value</td>
</tr>
<tr>
<td>Age (at int.-55)</td>
<td>1.2563</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age (at int.-55)$^2$</td>
<td>0.9990</td>
<td>0.0170</td>
</tr>
<tr>
<td>Gender*Age</td>
<td></td>
<td>1.0290</td>
</tr>
<tr>
<td>Total lipid (log)</td>
<td>4.8634</td>
<td>0.0009</td>
</tr>
<tr>
<td>Smoker (yes=1)</td>
<td></td>
<td>1.3899</td>
</tr>
<tr>
<td>Reside (yrs total)</td>
<td></td>
<td>1.0214</td>
</tr>
<tr>
<td>West Anniston</td>
<td></td>
<td>1.5469</td>
</tr>
<tr>
<td>No. drinks (30d.)</td>
<td></td>
<td>1.0036</td>
</tr>
<tr>
<td>Ate Livestock</td>
<td>1.9578</td>
<td>0.0053</td>
</tr>
<tr>
<td>Ate Fish</td>
<td></td>
<td>1.9244</td>
</tr>
<tr>
<td>Ate Clay</td>
<td>2.3295</td>
<td>0.0016</td>
</tr>
</tbody>
</table>

- Model $R^2$ = 0.561 for African American (n=353), Model $R^2$ = 0.749 for White (n=397)
- Base model variables Gender and BMI not shown in the table (not significant)
### Significant Multivariate Predictors by Age Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>18-39 years*</th>
<th>40-59 years</th>
<th>60+ years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$10^{\beta}$</td>
<td>P-Value</td>
<td>$10^{\beta}$</td>
</tr>
<tr>
<td>Age (at int.-55)</td>
<td>1.1668</td>
<td>&lt;0.0001</td>
<td>1.1102</td>
</tr>
<tr>
<td>Race (Afr.Am.=1)</td>
<td>6.5887</td>
<td>&lt;0.0001</td>
<td>9.9609</td>
</tr>
<tr>
<td>Gender (female=1)</td>
<td>0.7437</td>
<td>0.3820</td>
<td>0.8519</td>
</tr>
<tr>
<td>BMI (centered)</td>
<td>0.9807</td>
<td>0.2607</td>
<td>0.8518</td>
</tr>
<tr>
<td>Total lipid (log)</td>
<td>1.2375</td>
<td>0.7593</td>
<td>6.9818</td>
</tr>
<tr>
<td>Smoker (yes=1)</td>
<td>1.0772</td>
<td>0.8084</td>
<td>1.2753</td>
</tr>
<tr>
<td>West Anniston</td>
<td>2.0319</td>
<td>0.0314</td>
<td>1.8479</td>
</tr>
<tr>
<td>Reside (yrs total)</td>
<td></td>
<td></td>
<td>1.0168</td>
</tr>
<tr>
<td>Occup. PCBs</td>
<td>2.1671</td>
<td>0.0357</td>
<td></td>
</tr>
<tr>
<td>Ate Local Fish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate Local Livestock</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 18-39 year old (n=141/2); 40-59 year old (n=266/38); 60+ year old (n=315/3)
Conclusions - Significant Predictors of Sum of PCBs

- Age and race strongly associated with PCB levels in linear regression models
- Age and gender interaction was significant
- Total lipids highly significant with whole weight PCBs
- Dietary factors including ever eating potentially contaminated local fish, hogs, chicken or other livestock, as well as clay were associated with the sum of PCBs
- Current smoking positively associated with PCB levels
- BMI not associated with PCB levels
  - (Recent) change in BMI variable not available
- Current soil levels not significant predictors
Conclusions – Significant Predictors of PCBs by Race and Gender

- Eating fish and clay, living in west Anniston, total years of residence, and occupational exposure to PCBs were important predictors in females
- Working in the garden around the house was significant in males
  - Smoking and dietary variables were not
- Eating livestock and clay were important predictors in African Americans
  - Smoking and residential factors were not; most of them (89%) live in west Anniston
- Eating fish, living in west Anniston, total years of residence, and number of drinks consumed in the past month were important predictors in Whites
### Diabetes by PCB Quartiles

<table>
<thead>
<tr>
<th>PCBs (ng/g wet weight)</th>
<th>Number DM/Total</th>
<th>Unadjusted OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1) 0.11 - 1.43</td>
<td>30/152</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
</tr>
<tr>
<td>Q2) 1.44 - 3.28</td>
<td>54/150</td>
<td>2.29 (1.36-3.85)</td>
<td>1.46 (0.73-2.91)</td>
</tr>
<tr>
<td>Q3) 3.29 - 7.42</td>
<td>53/141</td>
<td>2.45 (1.45-4.14)</td>
<td>1.50 (0.71-3.18)</td>
</tr>
<tr>
<td>Q4) 7.43 – 171</td>
<td>65/137</td>
<td>3.67 (2.18-6.19)</td>
<td>1.48 (0.61-3.56)</td>
</tr>
<tr>
<td>Log Transformed</td>
<td>202/580</td>
<td>2.49 (1.79-3.47)</td>
<td>1.41 (0.77-2.58)</td>
</tr>
</tbody>
</table>

Adjusted for age, BMI, family history diabetes, race, gender, total lipids, and lipid lowering medication.
# Age Stratified Analyses of Diabetes by PCB Quartiles

<table>
<thead>
<tr>
<th>PCBs (ng/g wet weight)</th>
<th>&lt;55 years</th>
<th></th>
<th></th>
<th>55 years and older</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number DM/Tot.</td>
<td>Adjusted OR (95% CI)</td>
<td>Number DM/Tot.</td>
<td>Adjusted OR (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1) 0.11 - 1.43</td>
<td>25/141</td>
<td>1.0 (Ref.)</td>
<td>5/11</td>
<td>1.0 (Ref.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2) 1.44 - 3.28</td>
<td>22/68</td>
<td>2.2 (1.0-4.8)</td>
<td>32/82</td>
<td>1.6 (0.4-6.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3) 3.29 - 7.42</td>
<td>17/50</td>
<td>2.4 (1.0-5.7)</td>
<td>36/91</td>
<td>1.7 (0.4-7.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4) 7.43 – 171</td>
<td>12/29</td>
<td>3.5 (1.2-10.7)</td>
<td>53/108</td>
<td>1.7 (0.4-7.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Transformed</td>
<td>76/288</td>
<td>2.8 (1.4-5.6)</td>
<td>126/292</td>
<td>1.4 (0.7-2.9)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adjusted for BMI, family history diabetes, race, gender, total lipids, and lipid lowering medication.
Conclusions

• Unadjusted logistic regression indicated a significant increase in the likelihood of diabetes across each quartile of PCB exposure

• Adjustment for standard diabetes-related risk factors attenuated the PCB effect in the fully adjusted model (not significant in any quartile)
Conclusions

Age Stratified Analyses

• In the younger participants (<55 years), the likelihood of diabetes was 2.2 to 3.5 times higher among those with greater PCB exposure even after adjustment for established diabetes-related risk factors

• In the older participants, PCB levels were not significantly associated with diabetes

• Family history and BMI remained significantly associated with diabetes in both the younger and older participants

• Nonwhite race was significantly associated with diabetes only in the older age group

• Gender effects were not observed in either age subgroup
Discussion

- PCB levels in Anniston higher than in most other studies of organochlorines and diabetes risk
- Prevalence of diabetes overall (27%) higher than in many other studies (5-15%)
- Participants with pre-diabetes not included in the control group
  - These participants had characteristics intermediate to those with and without diabetes
  - Inclusion in the control group would have biased the results towards the null
- Adjustment for family history of diabetes and other risk factors
  - Not available in NHANES studies
Results: Metabolic Syndrome & Components

N = 452/753 (60%) Metabolic Syndrome

• 341 (45%) - Elevated triglycerides or meds
• 471 (62%) - Increased waist circumference
• 484 (64%) - Low HDL or meds
• 477 (63%) - Hypertension (NCEP def. or meds.)
• 367 (49%) - Elevated glucose, glycemic meds or diagnosed diabetes

n= 63 (8%) had NONE of above and n=128 (17%) had all 5 components present
## Sum of PCBs and Metabolic Syndrome

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Metabolic Syndrome (Yes/No)</th>
<th>Unadjusted OR (95% CI)</th>
<th>Adjusted* OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quintile 1: 16 - 190.72</td>
<td>60/80</td>
<td>1.0 (Referent)</td>
<td>1.0 (Referent)</td>
</tr>
<tr>
<td>Quintile 2: 190.73-405.90</td>
<td>94/52</td>
<td>2.41 (1.50-3.88)</td>
<td>0.96 (0.54-1.70)</td>
</tr>
<tr>
<td>Quintile 3: 405.91-717.45</td>
<td>91/55</td>
<td>2.21 (1.37-3.54)</td>
<td>0.67 (0.35-1.25)</td>
</tr>
<tr>
<td>Quintile 4: 717.46-1445.52</td>
<td>96/48</td>
<td>2.67 (1.65-4.32)</td>
<td>0.73 (0.37-1.44)</td>
</tr>
<tr>
<td>Quintile 5: 1445.53-27337</td>
<td>94/50</td>
<td>2.51 (1.55-4.05)</td>
<td>0.52 (0.24-1.13)</td>
</tr>
</tbody>
</table>

* Covariates include age, gender, race, ever smoke, family history of heart disease, education, marital status. Note: n=720 in models.
Summary

• Metabolic Syndrome highly prevalent

• $\sum 35$ PCBs, $\sum$ dioxin-like ortho PCBs, estrogenic and mono-ortho PCBs: no associations with Metabolic Syndrome

• $\beta$-HCCH and $p,p'$-DDT: significant positive associations with Metabolic Syndrome after adjustment for standard factors

• Other OC pesticides, positive NS relationship except for $\gamma$-HCCH and $o,p'$-DDT (inverse NS).

• Mirex: significant inverse association with Metabolic Syndrome
Studies of PCB Exposure and Health in Anniston

2003-2005

- Anniston Environmental Health Consortium formed and funded by ATSDR
- Development and approval of protocols, questionnaires, informed consents

2005-2007

- Data and biological samples collection
- Chemical analyses
- Data management and quality control

2008

- Results presented at the Anniston Community Meeting (April 2008)

2009-2010

- Data analyses, presentation of results, preparation of manuscripts
Anniston Community Health Survey

- 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 samples collection during study office visit