

PCBs and Health: The Hudson River Communities Project

- General Goal
 - Evaluate Environmental Exposure to and Nervous System Effects of PCBs Among Older Residents of Communities Along Hudson River in New York State

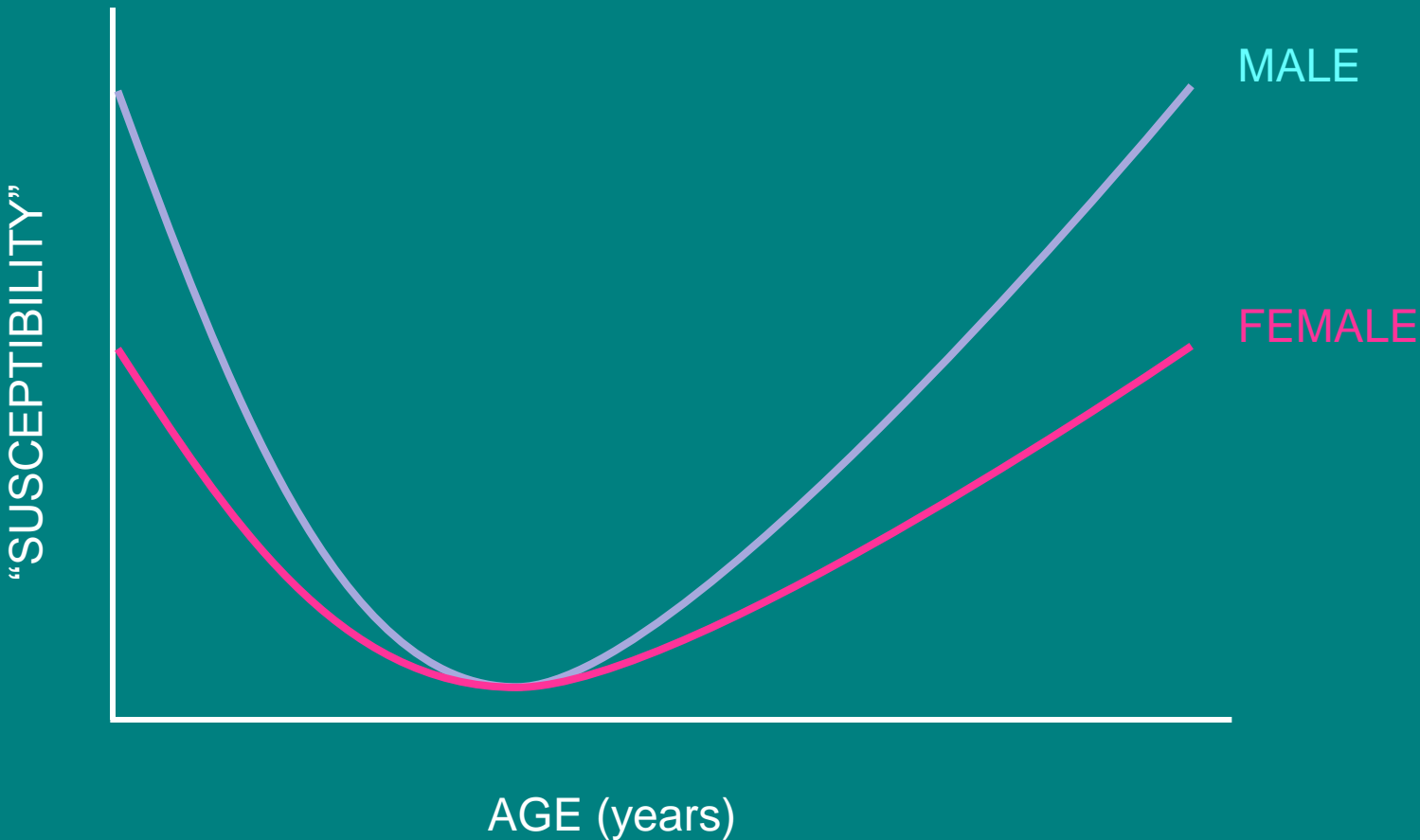
PCBs and the Nervous System

- Brain Target Organ for PCBs
 - Particularly Fetus and Infant
 - Reduced Memory and Learning, Motor Development
 - Developing Brain More Susceptible
 - Older Adults May Also Be at Risk
 - Aging Brain May Be More Susceptible
 - Accelerate Nervous System Declines That Occur Normally with Age
 - Decline May Occur Earlier or Be More Severe
 - Hypothesis Posed by Richard Seegal of NYSDOH
 - Increasing Evidence that Lead Affects Older Persons
 - Also Occur with Neurotoxins Such as PCBs?



AT- RISK POPULATIONS

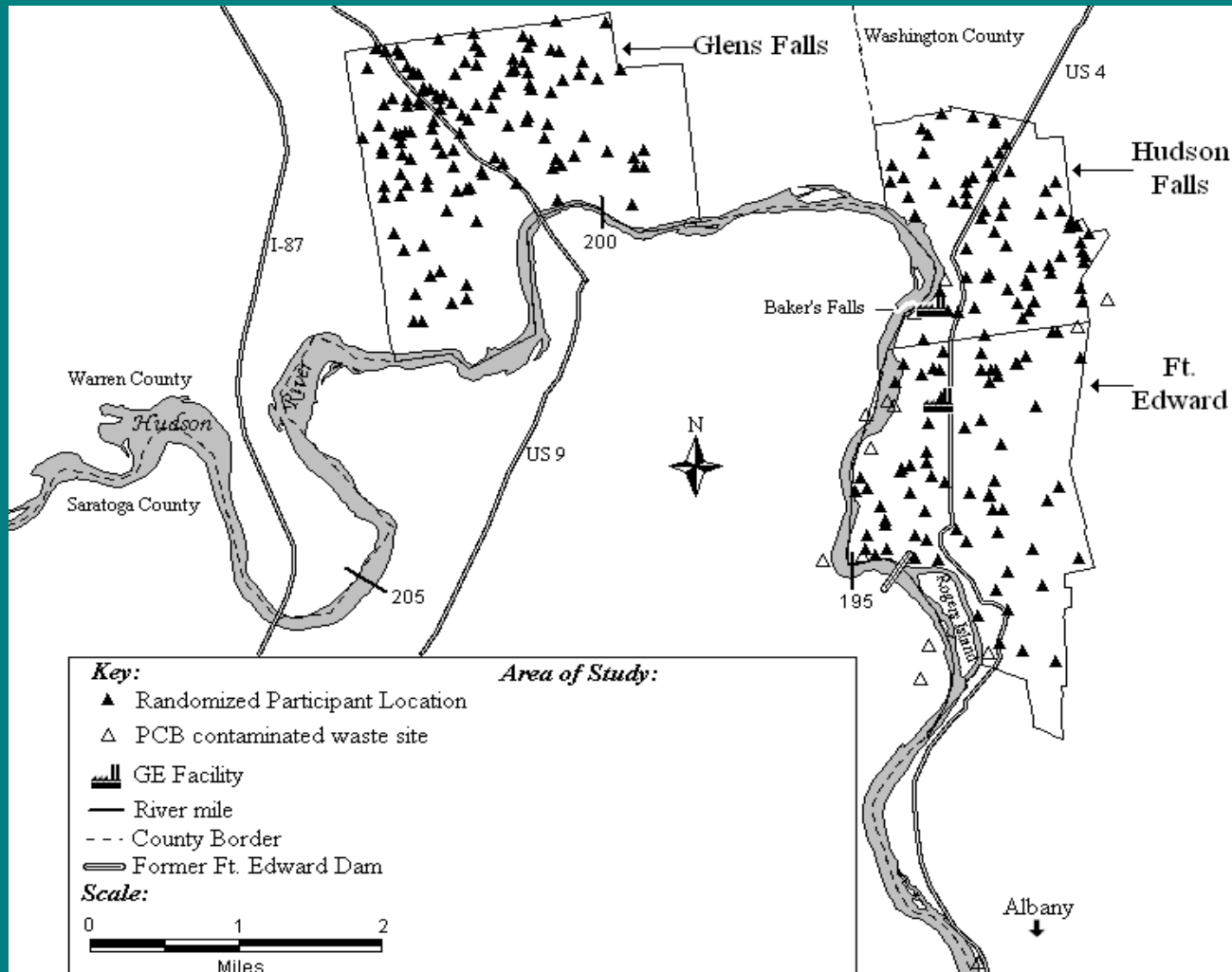
Susceptibility of Nervous System by Age and Sex



Specific Aims

- Measure Levels of PCBs in Blood of Study Participants
- Evaluate Relationship Between Levels of PCBs in Blood and Potential Sources of Exposure
 - Consumption of Fish From Hudson River
 - Levels of PCBs in Both Outdoor and Indoor Air
- Evaluate Relationship Between Levels of PCBs in Blood and Nervous System Function

Map of Study Area



Method

- Study and Comparison Populations
 - Men and Women 55 to 74 Years of Age
 - Residents of Hudson Falls or Fort Edward Villages (Study Area) or Glens Falls (Comparison Area) for at Least 25 Years
 - Randomly Selected through Computerized Telephone Directories and Other Digital Databases
 - Persons with Occupational Exposures or Severe Neurological Disorders Excluded
 - Included in Separate Study of Former GE Workers with Richard Seegal
 - Final N = 133 in Study Area and 120 in the Comparison Area

Method

- Exposure Assessment
 - Personal Interviews
 - Residential, Occupational, and Medical Histories; Health Habits; Demographics
 - Hudson River Fish Consumption By Decade
 - 1970's or Earlier, 1980's, 1990's, Last Year
 - Environmental Monitoring
 - PCB Measurements in Outdoor and Indoor Air
 - Biological Monitoring
 - PCB Measurements in Blood Serum

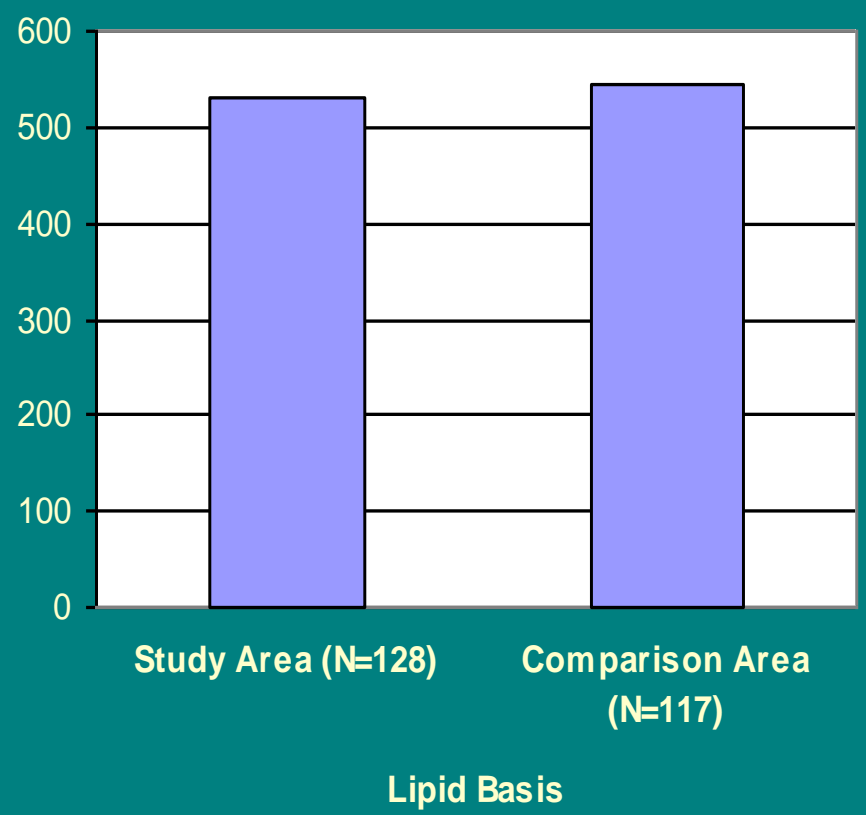
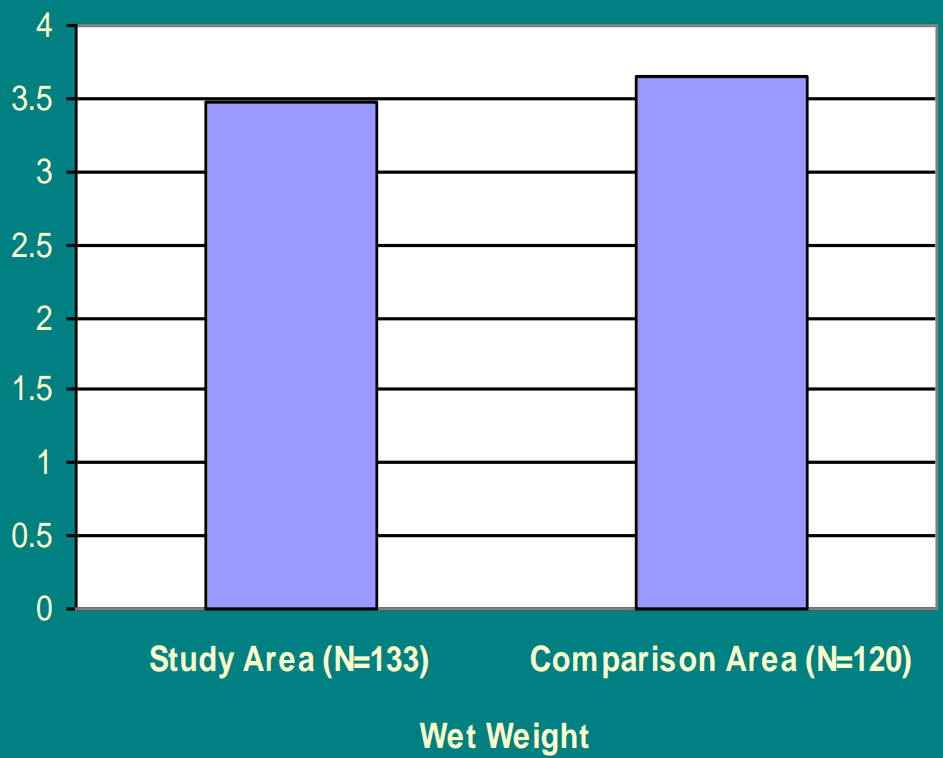
Method

- Outcome Assessment
 - Used Standard Psychological Tests to Measure Nervous System Function
 - Cognition
 - Memory and Learning
 - Intellectual Function
 - Reaction Time
 - Fine Motor Control
 - Depression and Anxiety

Serum PCB Concentrations (ppb, wet weight) for Current Study and Other Similar Studies

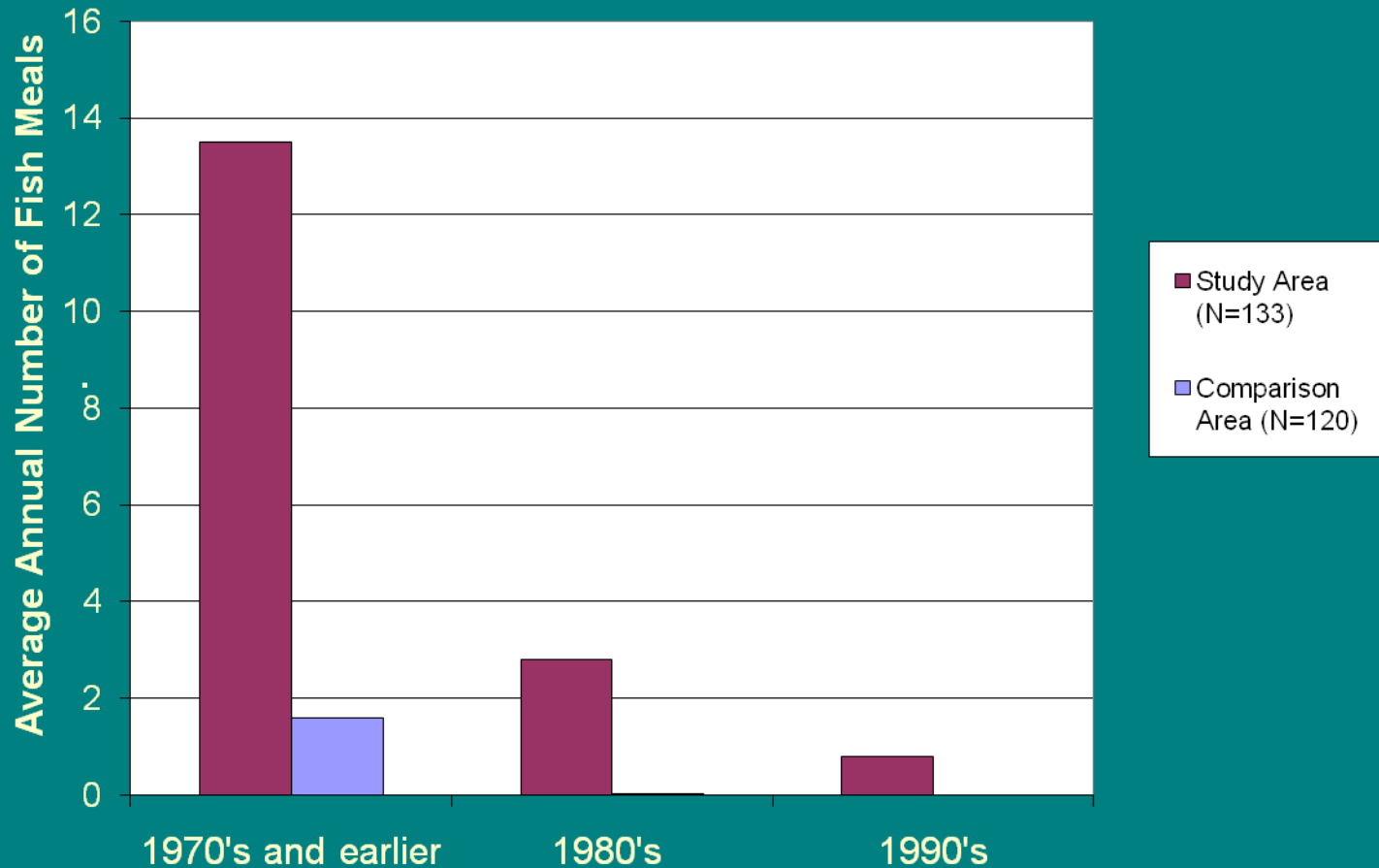
	Median	Minimum	Maximum
CDC (2005) - Background	2.4	0.6	9.6
Current Study	3.2	1.0	19.3
Seegal et al. (2010) – GE Workers	6.7	0.8	138.4
Schantz et al. (2001) – Great Lakes Fish eaters	7.9	< Detection Limit	75

Average Serum PCB Concentration (ppb) By Study and Comparison Area

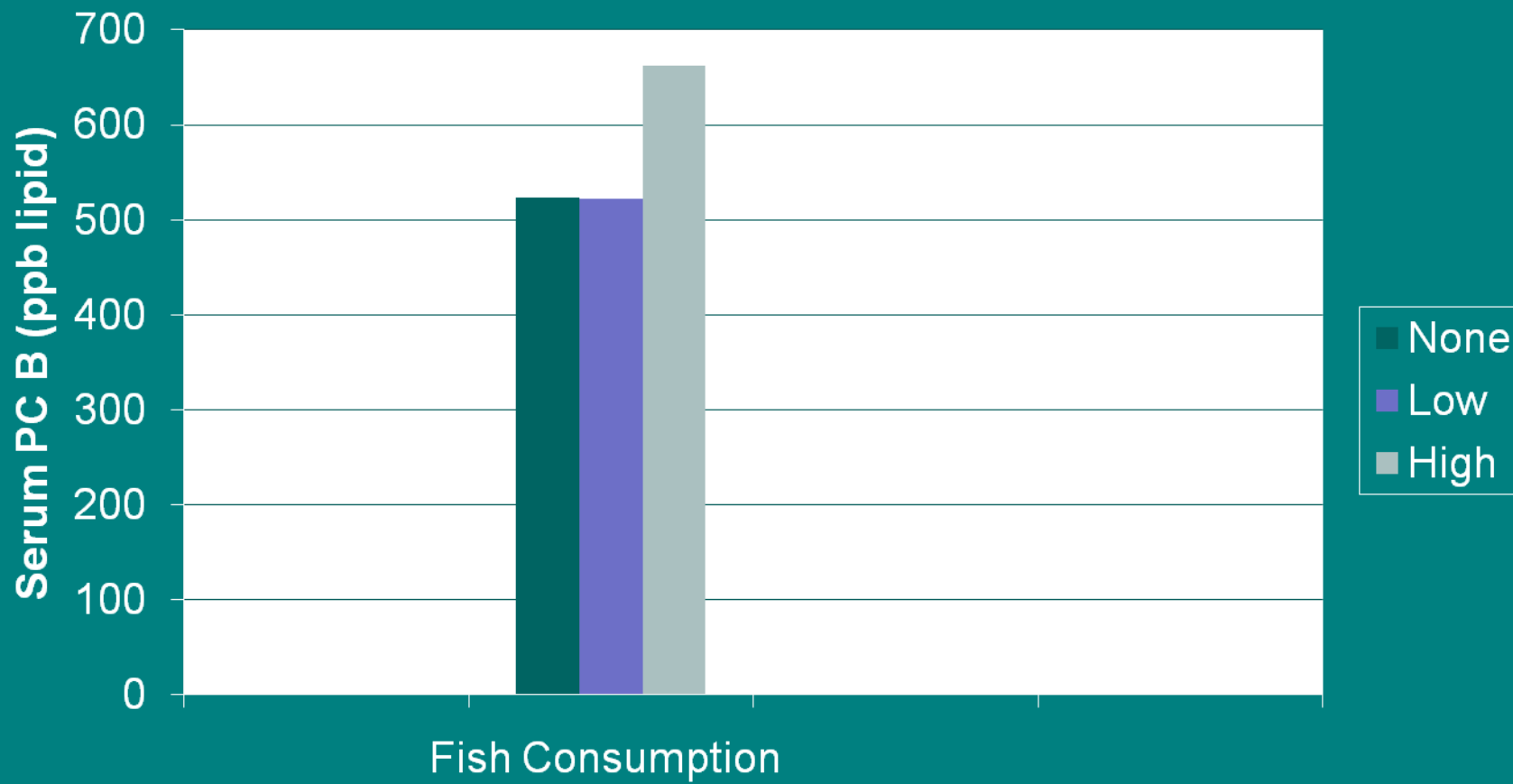


Adjusted for Age, BMI, and
Smoking

Average Annual Number of Fish Meals from Contaminated Portions of Hudson River By Decade

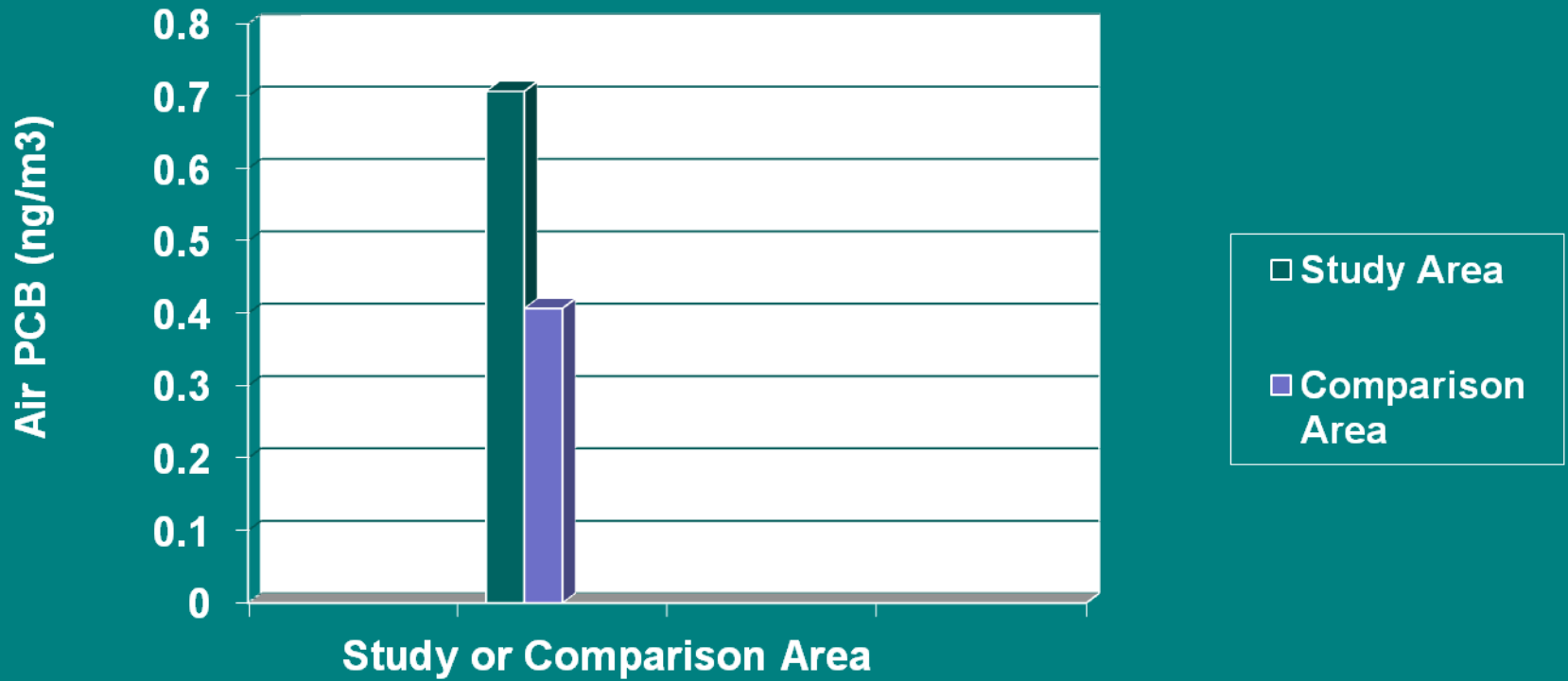


Average Serum PCB Concentration by Exposure to PCBs from Hudson River Fish Consumption: Both Areas Combined



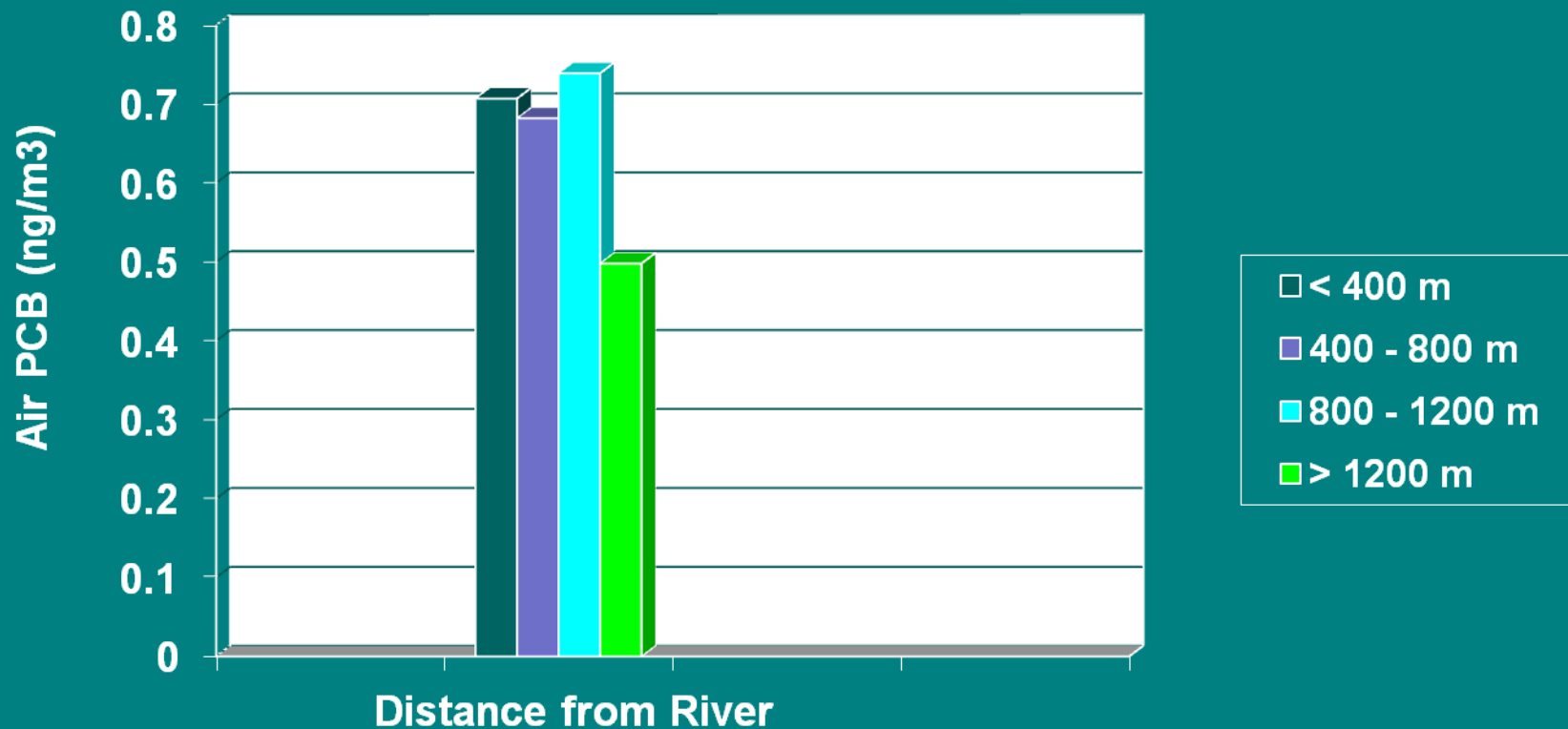
Adjusted for Age, BMI, and Smoking

Average Outdoor Air PCB Concentrations by Study or Comparison Area



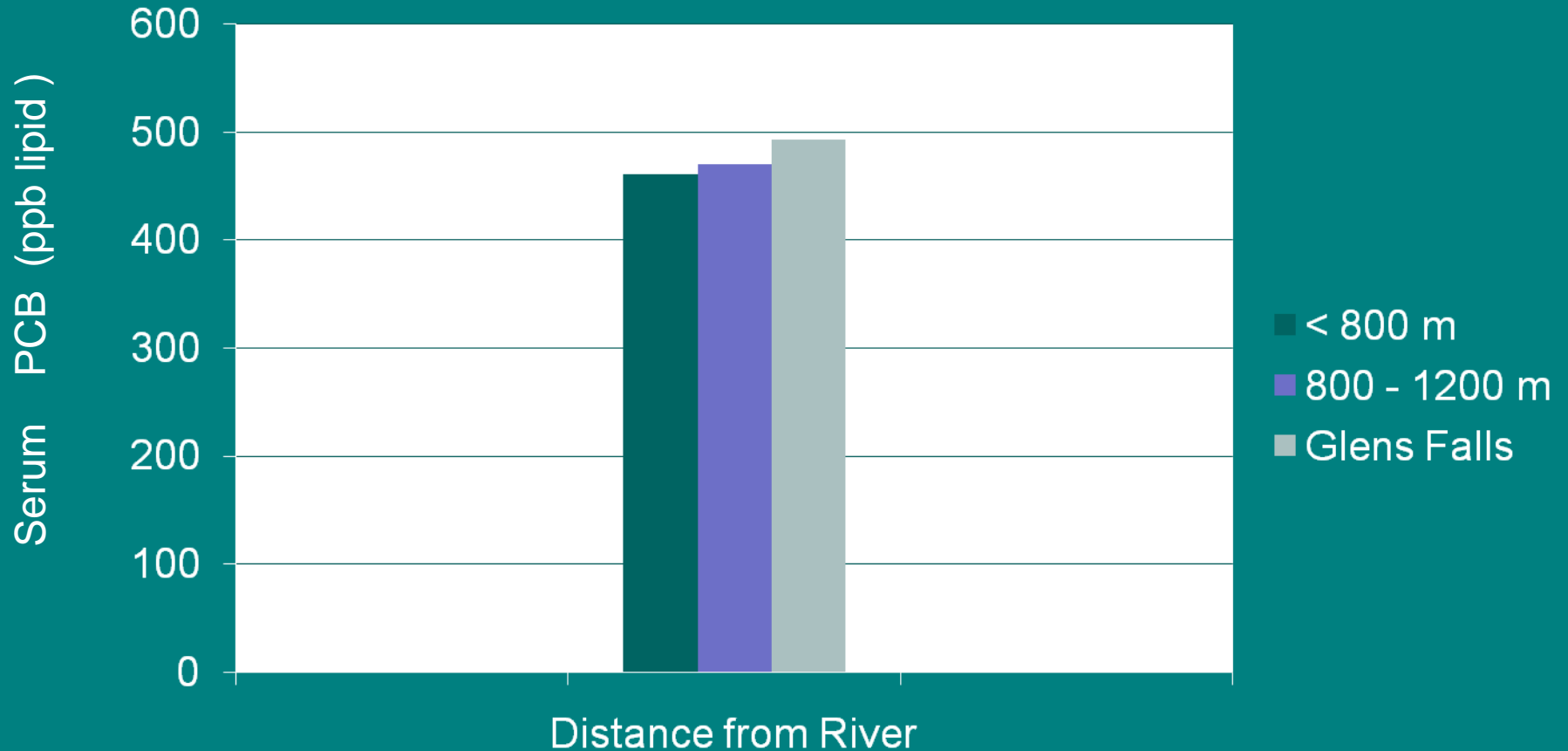
Adjusted for Temperature and Wind Speed

Average Outdoor Air PCB Concentrations by Distance from Hudson River: Fort Edward and Hudson Falls Only



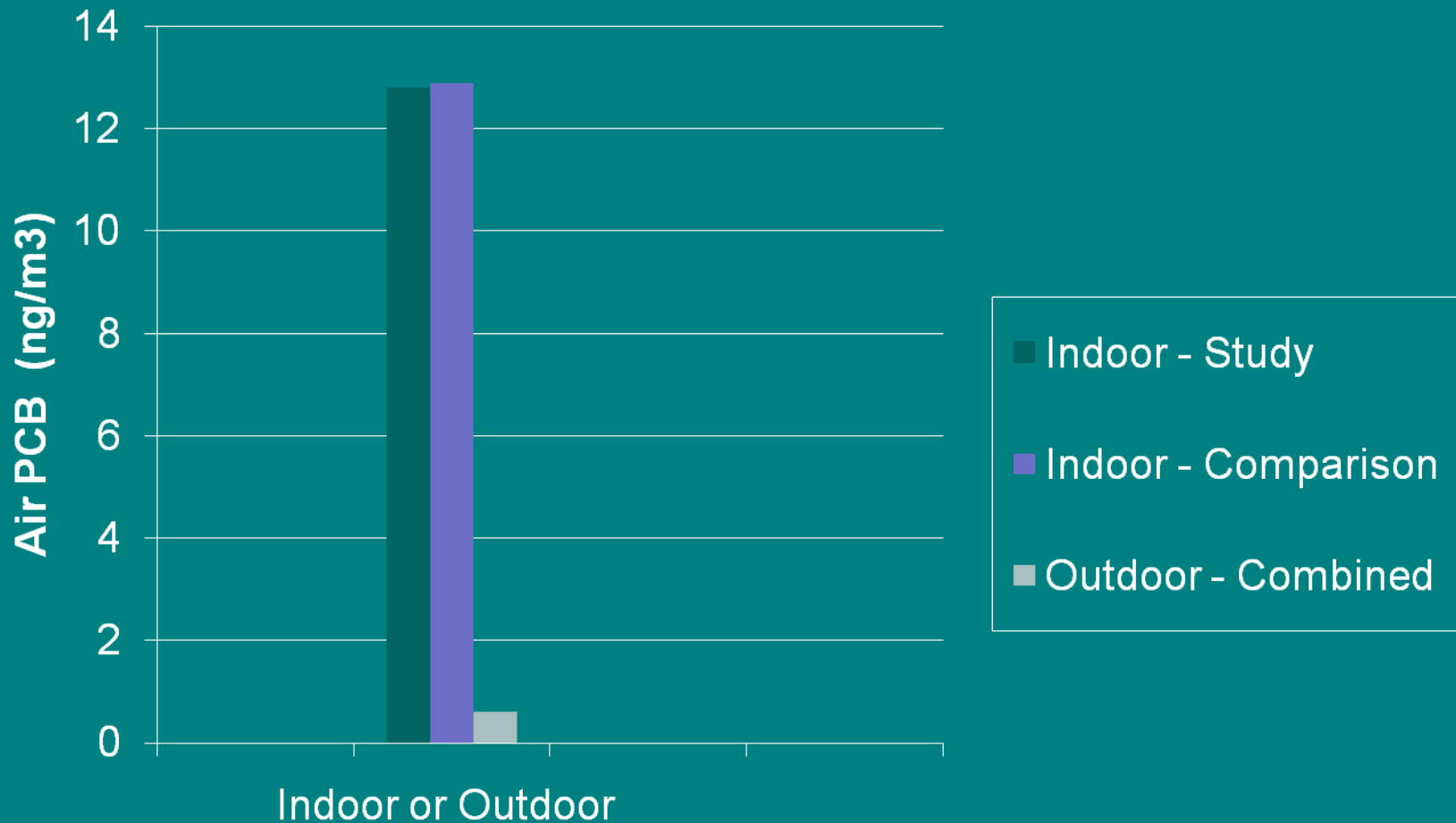
Adjusted for Temperature and Wind Speed

Average Serum PCB Concentration by Distance from Hudson River



Adjusted for Age, BMI, Smoking, and Fish Consumption

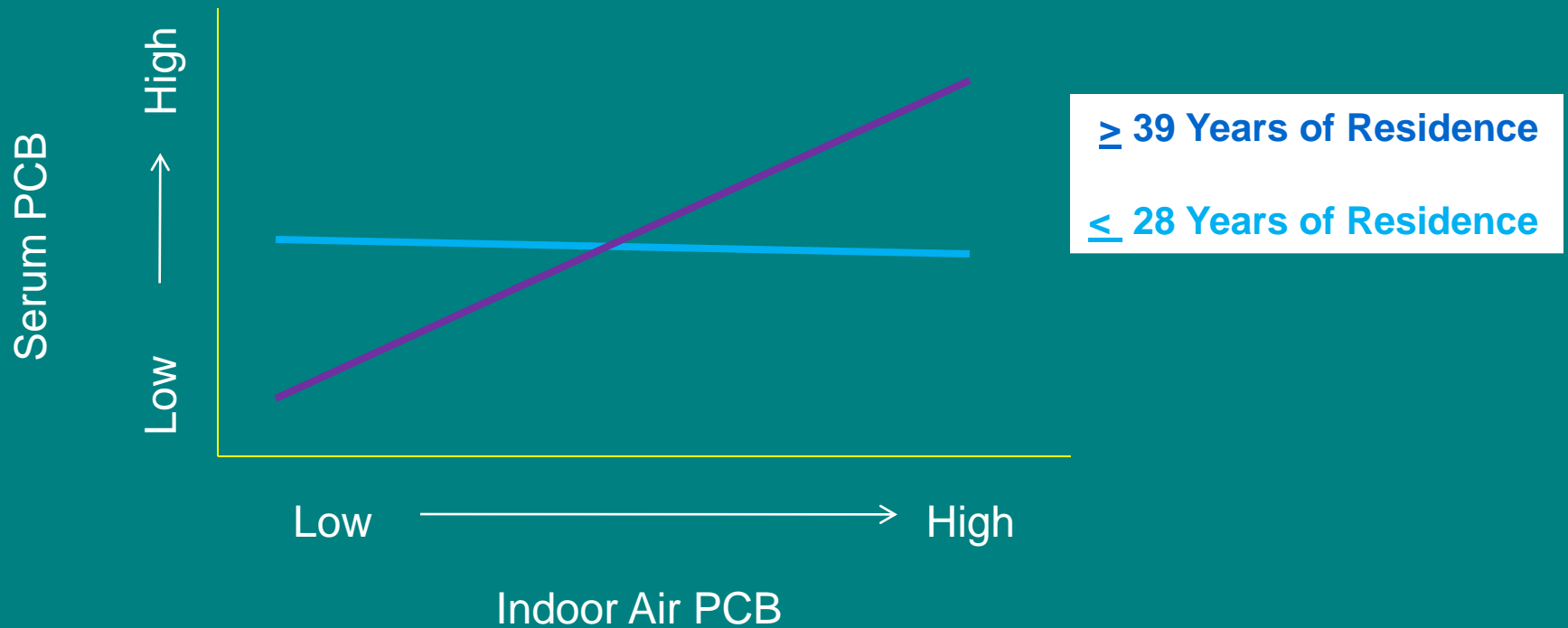
Indoor and Outdoor Air PCB Concentrations By Study or Comparison Area



Indoor Air

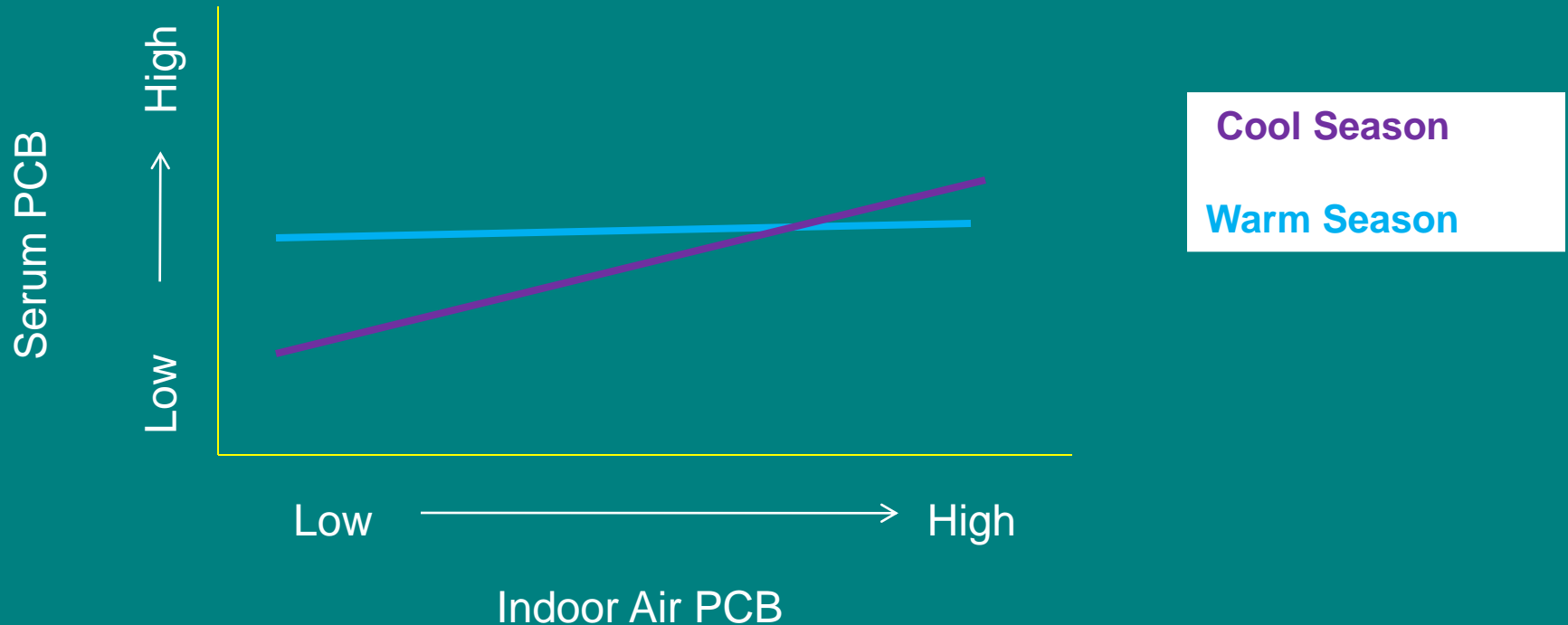
- Indoor Levels > Outdoor in Most Studies
- Due to Indoor Sources, Not River
 - Caulk and Other Building Products
 - Lights and Appliances
 - Paints and Sealers
- Common in Houses Built Before 1980
 - Average Age of Homes = 75 Years in Both Areas

Serum PCB Concentration by Indoor Air Concentration and Length of Residence



Adjusted for Age, BMI, and Hudson River Fish Consumption

Serum PCB Concentration by Indoor Air PCB Concentration and Warm or Cool Season

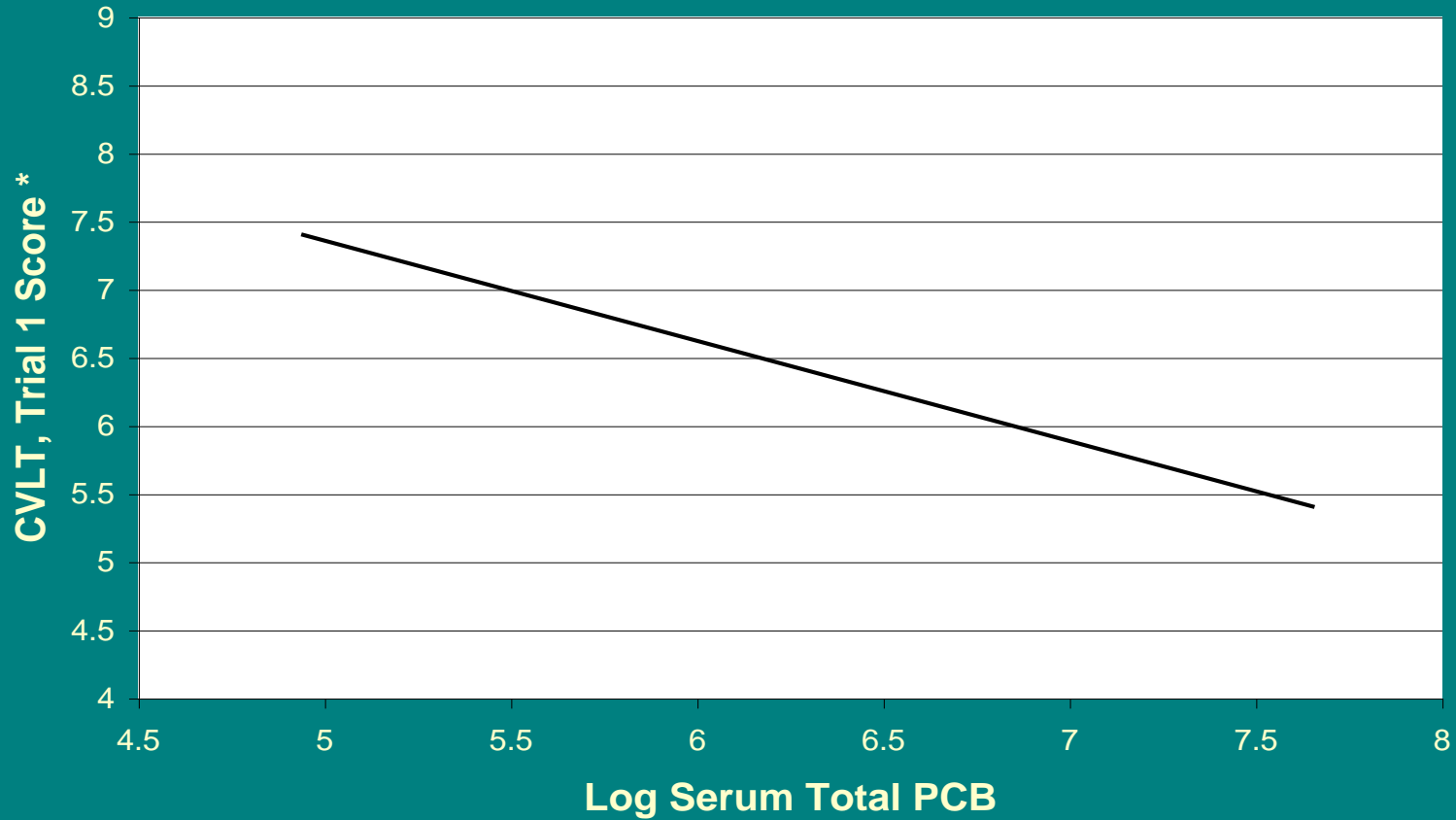


Adjusted for Age, BMI, and Hudson River Fish Consumption

Potential Control Variables for Nervous System Tests

- Demographic Factors
 - Age, Sex, Education, Income, BMI, Marital Status, Employment Status
- Lifestyle Factors
 - Smoking, Alcohol Consumption, Physical Activity Level, Hours of Sleep Per Night
- Medical Factors
 - Health Conditions, Medications
- Exposures to Heavy Metals, Solvents, Pesticides From Jobs and Hobbies
- Concentrations of Lead and Mercury in Blood and DDE + DDT in Serum

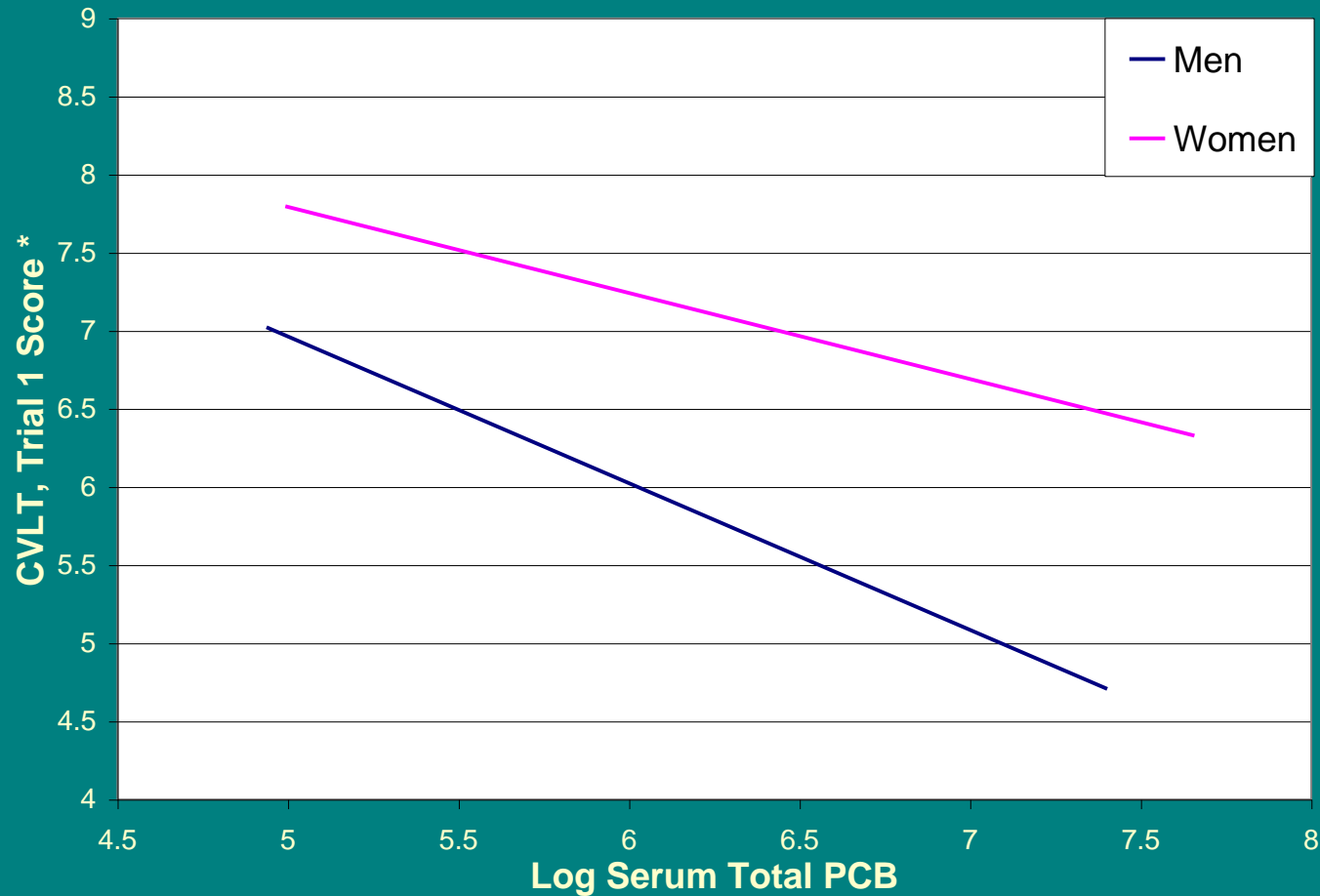
California Verbal Learning Test (CVLT), Trial 1 Score By Serum PCB Concentration



$b = -0.576, p = 0.035$

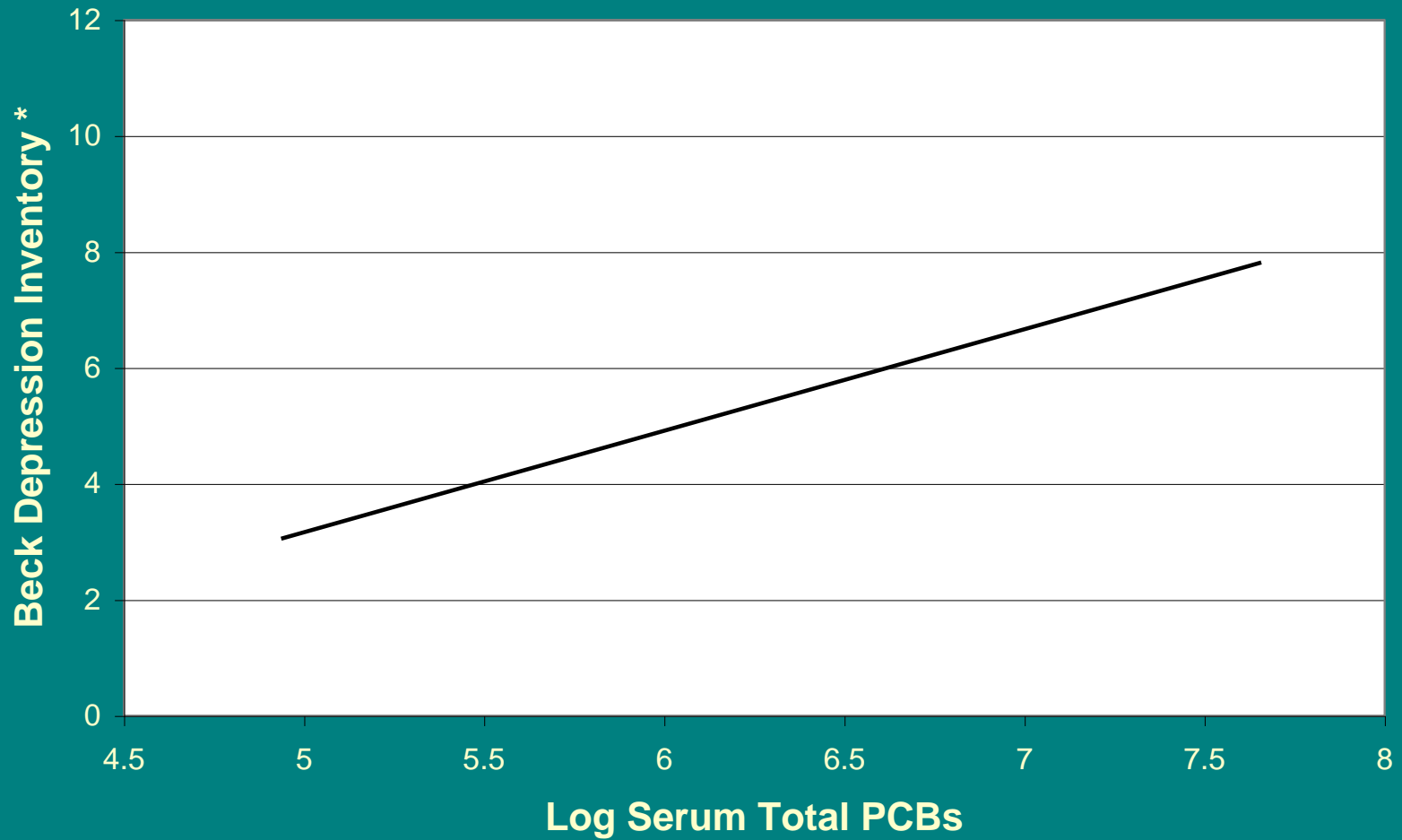
Adjusted for gender, age, education, IQ, smoking, and activity level

CVLT, Trial 1 Score by Serum PCB Concentration and Sex



Adjusted for education, IQ, smoking, and activity level

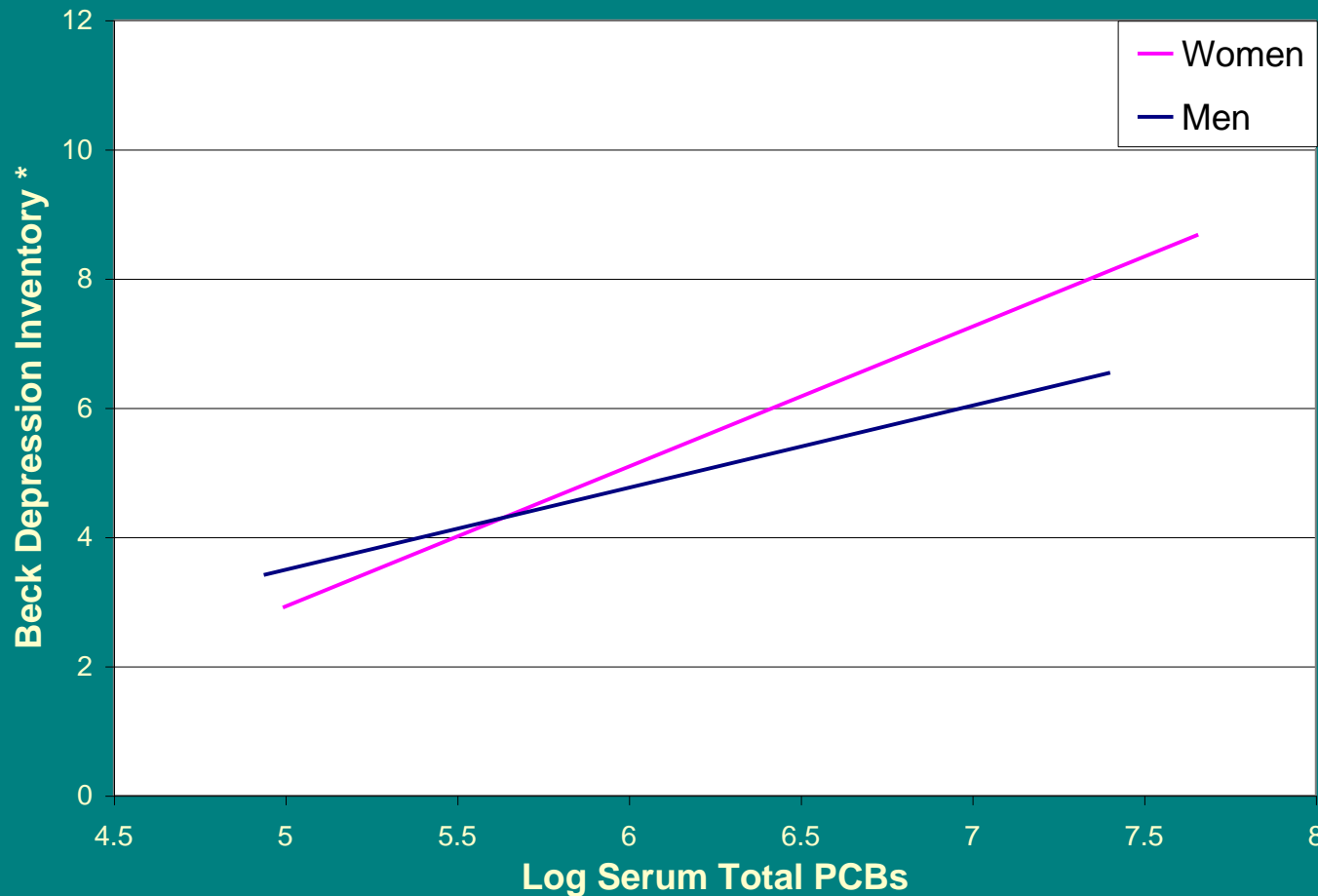
Beck Depression Inventory by Serum PCB Concentration



$b = 1.189, p = 0.007$

Adjusted for BMI, trait anxiety, employment status, gout meds, and antidepressants

Beck Depression Inventory by Serum PCB Concentration and Sex



* Adjusted for BMI, trait anxiety, employment status, gout meds, and antidepressants

Limitations

- Serum PCB Concentrations May Have Been Higher in Past
 - Current Levels Relatively Low
- Accuracy of Fish Consumption Histories
- Association Between PCB Levels in Serum and Nervous System Function Does Not Prove Cause and Effect
 - May Be Due to Some Other Uncontrolled Factor
- Results Indicate Subtle Changes in Nervous System Function, But Relationship to Neurological Diseases Such as Alzheimer's Uncertain
- Further Studies of How Chemical Exposures Affect Nervous System of Older Adults Needed

Conclusions to Date – Exposure

- Hudson River Fish Consumption
 - Consumption Declined Over Time
 - Consistent with Ban and Advisories
 - Past Consumers Had 30% Higher Serum PCB Levels
- Outdoor Air PCB Levels
 - Higher Closer to Hudson River, But Difference Small
 - Not Related to Serum PCB Concentrations
- Indoor Air PCB Levels
 - 20 x Higher than Outdoor Levels
 - Positively Related to Serum PCB Concentrations If Lived in Home for ≥ 39 Years or if Sampled in Cool Season
 - 50% Increase in Indoor Air PCB Associated with 10% Increase in Serum PCB

Conclusions to Date – Nervous System Function

- Serum PCB Concentrations Associated with:
 - Deficits in Verbal Memory
 - More Frequent Symptoms of Depression
- Other Studies of PCBs and of Lead Also Report Cognitive and other Nervous System Effects in Older Persons
- Suggest that Older Persons, Like Infants and Children, May Be Sensitive Subgroup