The California Teachers Study: Persistent Organic Pollutants and Breast Cancer

Study Background and Preliminary Results

Report to Scientific Guidance Panel
Sacramento, CA
November 8, 2012

Myrto Petreas, Ph.D., MPH
Peggy Reynolds, Ph.D.
Outline

• The California Teachers Study (CTS)
• CTS sub-study (POPs and Breast Cancer)
• Sub-study aims/general protocol
• Chemicals to be analyzed
• Study challenges/strengths
• Preliminary results
CTS Overview

• Statewide cohort of (133,479) female members of the State Teachers Retirement System
• Annual re-contact since inception (1995)
• Periodic questionnaires (every 2 - 3 years)
• Annual outcome follow-up via linkage to Cancer Registry, hospitalization, mortality databases
• Baseline addresses geo-coded
• Initially supported with California Prop-99 funds; subsequently with Federal and State research grants
California Teachers Study
Residence at Baseline (1995-1996)
CTS and Persistent Organic Pollutants (POPs)

A sub-study from the original CTS cohort
CTS and POPs Research Team

❖ Cancer Prevention Institute of California
  • Peggy Reynolds, Susan Hurley, David Nelson, Erika Garcia, Andrew Hertz, Julie Von Behren, Pam Horn-Ross, Chris Collins

❖ DTSC Environmental Chemistry Laboratory
  • Myrto Petreas, June Soo Park

❖ City of Hope
  • Leslie Bernstein

❖ UC Irvine
  • Hoda Anton-Culver

Funded by the California Breast Cancer Research Program, grant # 16ZB-8501
CTS and POPs: Specific Aims

1. Screen for major predictors of PBDEs
   • Behavioral factors
   • Sociodemographic disparities
   • Indoor and outdoor correlates

2. Assess POPs as risk factors for breast cancer
   • Use case-cohort design
CTS and POPs:
Aim 1: Predictors of PBDEs/Disparities

• 360 participants targeted:
  • Not known to have breast cancer
  • Oversampled for women of color/rural residence targeting: 90 White/90 Black/90 Hispanic/90 API

• Data collection (2011-2013):
  • Blood samples
  • Questionnaire re: potential sources of exposure
  • GIS attribute data for residences
CTS and POPs:
Aim 2: POPs and Breast Cancer Risk

• Case-cohort design
  • 1,000 cases and 1,000 controls from CTS nested case-control study
  • Diagnoses 2007-2012

• Data collection (2011-2013)
  • Blood samples
  • Questionnaire re: potential sources of exposure
  • GIS attribute data
  • Genotyping (funded by parent CTS study)
CTS and POPs: Chemicals to be measured in serum

- PBDEs (19)
- PFCs (12)
- PCBs (15)
- Chlorinated Pesticides (7)
- Cholesterol
- Triglycerides
- Thyroid Hormones (T4, TSH)
CTS and POPs: Overcoming a Challenge

- Phlebotomists visit participants throughout the State (home, work)

- Very difficult to process samples in the field following standard procedure (centrifuge, transfer serum into clean vials, freeze within 24 hrs)

- Pilot study to test alternative sample processing
CTS and POPs:
Pilot Study to Address Field Constrains

- Can we have more flexibility in the field?
- How long can samples be stored frozen?

- **Type of blood draw tube**
  - Red Top (RT) requiring centrifuging and lab processing within 24 hrs is the standard method
  - Serum Separator Tube (SST) only requires centrifuging in the field

- **Time between blood draw and processing:**
  - 2hr vs. 48 hr

- **Time in lab freezer between processing and analysis:**
  - 1 month vs. 2 yrs
Blood from 11 volunteers was:

- drawn in 6 tubes (3 RT and 3 SST)
- processed at different times (2hr vs. 48hr)
- stored frozen for 1 month (and for 2 years)
- analyzed for Persistent Organics (OCPs, PCBs, PBDEs, PFCs, BFRs) and lipids

- No difference between SST-48hr and RT-2hr (standard)
- SST-48hr can be used for Persistent Organics and lipids in this and future studies

- Effects of storage for 2 yrs will be examined in Feb 2013
CTS and POPs: Study Strengths

• Large well-defined cohort
  • Statewide - diverse geography
  • Extensive questionnaire information
  • Extensive GIS attribute data

• Independent assessment of outcome
  • Annual linkage to CCR

• State of the art laboratory techniques

• Advanced statistical methods for selecting & ranking variables
CTS and POPs: Preliminary Results

• As of November 1, 2012:
  • 1,510 samples have been shipped to ECL (cases/non-cases)
  • Collection period May 2011-October 2012 (several shipments)

• 638 samples have been aliquoted for PFC, POPs, lipids
• 638 samples have been analyzed for lipids
• 279 samples have been analyzed for PFCs
• 80 samples have been analyzed for PBDEs

• Analyses underway for remaining samples
CTS and POPs:
Location of participants (n=279)
CTS and POPs: Characteristics of participants (n=279)

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49 years</td>
<td>15</td>
<td>5%</td>
</tr>
<tr>
<td>50-59 years</td>
<td>40</td>
<td>14%</td>
</tr>
<tr>
<td>60-69 years</td>
<td>95</td>
<td>34%</td>
</tr>
<tr>
<td>70+ years</td>
<td>129</td>
<td>46%</td>
</tr>
<tr>
<td>Total:</td>
<td>279</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>206</td>
<td>74%</td>
</tr>
<tr>
<td>Black</td>
<td>29</td>
<td>10%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>21</td>
<td>8%</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>19</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>1%</td>
</tr>
<tr>
<td>Total:</td>
<td>279</td>
<td>100%</td>
</tr>
</tbody>
</table>

Mean age = 68 years; Range = 40 to 94 years
CTS and POPs: Major PFCs (ng/mL) in participants (n=279)

<table>
<thead>
<tr>
<th></th>
<th>PFOS</th>
<th>PFOA</th>
<th>PFNA</th>
<th>PFHxS</th>
<th>PFDaE</th>
<th>PFUdA</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Detection Frequency</td>
<td>99.6</td>
<td>99.6</td>
<td>100</td>
<td>100</td>
<td>90.3</td>
<td>99.3</td>
</tr>
<tr>
<td>min</td>
<td>&lt;0.08</td>
<td>&lt;0.30</td>
<td>0.16</td>
<td>0.05</td>
<td>&lt;0.03</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>max</td>
<td>73.7</td>
<td>27</td>
<td>9.7</td>
<td>17.4</td>
<td>3.91</td>
<td>1.31</td>
</tr>
<tr>
<td>median</td>
<td>7.86</td>
<td>2.62</td>
<td>1.0</td>
<td>1.67</td>
<td>0.24</td>
<td>0.16</td>
</tr>
<tr>
<td>GM</td>
<td>7.57</td>
<td>2.65</td>
<td>1.0</td>
<td>1.71</td>
<td>0.21</td>
<td>0.14</td>
</tr>
<tr>
<td>NHANES Females &gt;20yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.79</td>
<td>2.70</td>
<td>1.44</td>
<td>1.21</td>
<td>0.27</td>
<td>0.18</td>
</tr>
</tbody>
</table>

GM 09-10
## CTS and POPs: Minor PFCs (ng/mL) in participants (n=279)

<table>
<thead>
<tr>
<th></th>
<th>PFOSA</th>
<th>Me-PFOSA-AcOH</th>
<th>Et-PFOSA-AcOH</th>
<th>PFHpA</th>
<th>PFDoA</th>
<th>PFBuS</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Detection Frequency</td>
<td>97.5</td>
<td>100</td>
<td>91.4</td>
<td>56.3</td>
<td>27.2</td>
<td>21.9</td>
</tr>
<tr>
<td>min</td>
<td>&lt;0.01</td>
<td>0.02</td>
<td>&lt;0.01</td>
<td>&lt;0.06</td>
<td>&lt;0.03</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>max</td>
<td>1.24</td>
<td>9.2</td>
<td>1.36</td>
<td>0.73</td>
<td>1.57</td>
<td>0.21</td>
</tr>
<tr>
<td>median</td>
<td>0.07</td>
<td>0.24</td>
<td>0.05</td>
<td>0.07</td>
<td>&lt;0.03</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>GM</td>
<td>0.08</td>
<td>0.28</td>
<td>0.05</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

| NHANES Females >20yrs GM 09-10 | * | 0.19 | * | * | * | * |

* Not calculated: Proportion of results below the limit of detection was too high to provide a valid result.
CTS and POPs:
Future Steps

• Complete Pilot Study by evaluating freezing for 2 years (February 2013)
• Continue recruitment to end of 2013
• Continue sample analyses
• Periodically post aggregate results to Biomonitoring California website
CTS and POPs:
Biomonitoring California

• Statewide recruitment
• Special demographic (women, mostly over 60 yrs old)
• Collaborative effort with CPIC
• Partially funded by CBCRP

• Blood draw in SST found equivalent to standard Red Tops
  ➢ Can be used in other studies

• CTS data to complement data from other studies (FOX, MIEEP, BEST), expanding our data base.

• Model for future collaborations to sustain Program