Women’s Occupations and Risks from Chemicals: Introduction to a Visualization Tool

Elana Silver
Laurelton Research

CHE webinar
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Women’s Occupations and Risks from Chemicals (WORC) Study

- Funded by California Breast Cancer Research Program (CBCRP, Grant #21ZB-0901)

- Co-PIs: Robert Harrison (CDPH, UCSF), Peggy Reynolds (UCSF)

- Overarching objective: advance our understanding of the degree to which workplace chemical exposures may increase breast cancer risk among California working women

- 5-year project (2016-2020)

- 3 phases

Reasons for developing the tool

- To make the chemical exposure hazards faced by working women more visible

- To point to the key data gaps in understanding occupational exposures to breast carcinogens in California

Not (fully) achieved:

- To point to industries in California that appear to pose the greatest breast cancer risk and should be investigated further

- To explore differences in exposures based on race, class, age, immigrant status and other demographic markers
Where Women Work

Reviewed variety of data sources for California workforce

- American Community Survey (ACS) data from US Census identified as most complete (2010-2014)

Summarized and compiled data on ~ 8 million women employed in CA

- For all industries and occupations (~ 500 occupations)
- Includes sociodemographic characteristics (age, race/ethnicity, education, income, citizenship, language, presence/age of children in home)
Working Women at Risk

161 occupations were reviewed for potential exposure to chemical groups linked to breast cancer.

There are more than 6.5 million women working in these occupations, according to the U.S. Census’s American Community Survey. In addition, there are women who work in “informal” jobs. Informal jobs do not show up in official data sources and operate outside of established labor laws. The number of women working in informal jobs in California is not known. We can only estimate the number of women who work informally. Here, we examine what we do know about all women in the California workforce and the chemicals they are potentially exposed to.

Viewing 161 occupations with 6,609,127 formal women workers:
Chemicals of Concern

- Evaluated multiple data resources, final list based primarily on:
  - Silent Spring Institute’s list of mammary gland carcinogens and mammary gland toxicants
  - TEDX list of endocrine disruptors

- Created a list of 1,000+ chemicals of concern for breast cancer
  - Includes indicators for mammary gland carcinogens, endocrine disruptors, mammary gland toxicants, and high production volume chemicals
  - Categorized in 27 groups based on chemical properties and/or usage

- Constructed another dataset summarizing workplace sampling data (OSHA) - data sparse by chemical and industry
Results - Chemicals of Concern

Chemicals-of-concern (n=1,082) in 27 categories

<table>
<thead>
<tr>
<th>Category</th>
<th># Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkyphenols/ethoxylates</td>
<td>15</td>
</tr>
<tr>
<td>Antimicrobials</td>
<td>32</td>
</tr>
<tr>
<td>Biogenic substances</td>
<td>54</td>
</tr>
<tr>
<td>Combustion products</td>
<td>62</td>
</tr>
<tr>
<td>Dioxins</td>
<td>121</td>
</tr>
<tr>
<td>Dyes</td>
<td>34</td>
</tr>
<tr>
<td>Flame retardants</td>
<td>52</td>
</tr>
<tr>
<td>Food constituents and additives</td>
<td>49</td>
</tr>
<tr>
<td>Fragrance ingredients</td>
<td>62</td>
</tr>
<tr>
<td>Household products</td>
<td>28</td>
</tr>
<tr>
<td>Industrial chemicals</td>
<td>172</td>
</tr>
<tr>
<td>Metabolites and degradates</td>
<td>20</td>
</tr>
<tr>
<td>Metals</td>
<td>27</td>
</tr>
<tr>
<td>Natural hormones</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
<tr>
<td>Parabens</td>
<td>12</td>
</tr>
<tr>
<td>Perfluorinated compounds</td>
<td>13</td>
</tr>
<tr>
<td>Personal care products</td>
<td>74</td>
</tr>
<tr>
<td>Pesticides</td>
<td>308</td>
</tr>
<tr>
<td>Pharmaceuticals - antineoplastic</td>
<td>20</td>
</tr>
<tr>
<td>Pharmaceuticals - other</td>
<td>57</td>
</tr>
<tr>
<td>Phthalates</td>
<td>16</td>
</tr>
<tr>
<td>Plastics</td>
<td>61</td>
</tr>
<tr>
<td>Research chemicals</td>
<td>58</td>
</tr>
<tr>
<td>Solvents</td>
<td>31</td>
</tr>
<tr>
<td>Synthetic hormones</td>
<td>19</td>
</tr>
</tbody>
</table>
Chemical Groups

What chemicals of concern for breast cancer are working women exposed to on the job?

24 Chemical Groups | 1,037 Chemicals of Concern linked to breast cancer risk
California working women have potential exposure to the following chemical groups. These groups may contain hundreds of chemicals-of-concern that have evidence linking them to breast cancer or relevant effects such as endocrine disruption. The size of each hexagon signifies the number of chemicals with that particular hazard, with overlapping hexagons showing where they share chemical traits, including mammary gland carcinogens ("CARC"), developmental toxicants ("TOX"), and endocrine disruptors ("EDC"). Explore each chemical group in more detail.

### Alkylphenols and alkylphenol ethoxylates
- **15 CHEMICALS**
- **3,208,000+ potentially exposed**

### Antimicrobials
- **32 CHEMICALS**
- **2,207,100+ potentially exposed**

### Antineoplastic pharmaceuticals
- **21 CHEMICALS**
- **736,500+ potentially exposed**

### Biogenic substances
- **59 CHEMICALS**
- **578,600+ potentially exposed**

### Cleaning and Maintenance Products
- **31 CHEMICALS**
- **4,020,300+ potentially exposed**

### Combustion byproducts
- **62 CHEMICALS**
- **1,930,700+ potentially exposed**

### Dioxins and dioxin-like chemicals
- **121 CHEMICALS**
- **852,200+ potentially exposed**

### Dyes
- **34 CHEMICALS**
- **439,700+ potentially exposed**
Estimating Chemical Exposures Among Workers

- Created Job Exposure Matrix (JEM) to identify overlap of occupations with exposures to categories of chemicals of concern

- Based on expert review by two industrial hygienists
  - Tie-breaking review by board-certified occupational medicine physician

- JEM includes 145 occupations (representing ~ 85% of CA female workforce)
Informal workers

- Jobs that do not show up in formal data sources and that operate outside of established labor laws.

- Reliable data on the numbers of informal workers by industry or occupation is not available.

- We generated estimates of numbers of women informally employed, using self-employed women in ACS data as a proxy - interpret with caution.
# Chemical Concerns for Occupations with Informal Employment

*from WORC Advisory Committee (AC)*

<table>
<thead>
<tr>
<th>Workforce</th>
<th>Chemical Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Workers</td>
<td>Chemicals in cleaning products</td>
</tr>
<tr>
<td>Restaurant Workers</td>
<td>Disinfectants, indoor air pollutants (e.g. PAHs)</td>
</tr>
<tr>
<td>Agriculture Workers</td>
<td>Pesticides</td>
</tr>
<tr>
<td>Makeup Artists and Hairdressers</td>
<td>Chemicals in cosmetics</td>
</tr>
<tr>
<td>Janitors and Custodians</td>
<td>Chemicals in cleaning products</td>
</tr>
<tr>
<td>Day Laborers</td>
<td>Formaldehyde, wood preservatives, paints, pesticides</td>
</tr>
<tr>
<td>Garment Workers</td>
<td>Flame retardants and fabric preservatives</td>
</tr>
<tr>
<td>Artists</td>
<td>Solvents, paints</td>
</tr>
<tr>
<td>Street Vendors</td>
<td>Air pollutants from traffic</td>
</tr>
</tbody>
</table>
Working Women at Risk

Maids and housekeeping cleaners

Women may be exposed to harmful chemicals on the job. 24 categories of chemicals that include chemicals of concern for breast cancer are shown below. We investigated the potential exposure of women in this occupation group to these 24 categories of chemicals.

Being exposed to even one of the chemicals in these groups may be cause for concern.
Select a category to learn more about exposure, the chemicals, and the women who are exposed.

SHOW

197,778 formal workers  76,600 informal workers

- Alkylphenols and alkylphenolate
- Antimicrobials
- Antineoplastic pharmaceuticals
- Biogenic substances
- Cleaning and Maintenance
- Combustion byproducts
- Dioxins and dioxin-like chemicals
- Dyes
- Flame retardants
- Food substances
- Fragrance ingredients
- Human hormones
- Industrial chemicals
- Metals
- Parabens
- Perfluorinated compounds
- Personal care product ingredients
- Pesticides
- Pharmaceuticals (other than drugs)
- Phthalates
- Plastics
- Research chemicals
- Solvents
- Synthetic hormones

What is the ethnic/racial and age breakdown for these women?

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9,399</td>
</tr>
</tbody>
</table>
| 9.399% of this occupation

Customer service representatives
173,840 women

Managers, all other
Key Findings

- Constructed a database of chemicals of concern for breast cancer and occupations that employ many women in California

- Among working women in CA
  - > 1 million at risk for exposures to industrial chemicals
  - > 2 million at risk for exposures to antimicrobials
  - > 4 million at risk for exposures to phthalates

- US Census data pretty good for tracking contemporary workplaces occupations and industry
  - Grouping of occupations not optimal
  - Lack information on informal workers

- Lack of systematically-collected quantitative chemical exposure data
Who we hope will use the tool

- Lay audience: Breast cancer and/or Workplace stakeholders
  - Community-based organizations
  - Workers, worker centers, unions

- Researchers/Policy makers
  - Prioritize occupations/industries for targeted exposure surveillance, health studies, and/or biomonitoring
  - Continue / Enhance statewide surveys

- We want feedback!
  - elana@laureltonresearch.com
WORC Advisory Committee

Catherine Porter, JD
CA Healthy Nail Salon Collaborative/
Asian Health Services (Shared Role)

Lisa Fu, MPH

Gail Bateson
WorkSafe
(formerly)

Janette Robinson Flint
Black Women for
Wellness

Laura Stock
Labor Occupational Health Prog

Mila Thomas
SEIU Local 790

Data Visualization Development
WORC Research Staff

- Robert Harrison (Co-PI, OHB/CDPH)
- Peggy Reynolds (Co-PI, UCSF)
- Susan Hurley (Project Manager/Epidemiologist, UCSF)
- Stella Beckman (Environmental Health Scientist, UCSF)
- Jackie Chan (Industrial Hygienist, OHB/CDPH)
- Matt Frederick (Data Specialist, OHB/CDPH)
- Paula Johnson (Epidemiologist, OHB/CDPH)
- Minhthu Le (Administrative Assistant, UCSF)
- Marcel Reynolds (Communications Specialist, OHB/CDPH)
- Elana Silver (Epidemiologist, Laurelton Research)
- Laura Stock (Director/LOHP/UCB)
- Suzanne Teran (Associate Director/LOHP/UCB)
- Julie Von Behren (Epidemiologist, UCSF)
- Justine Weinberg (Industrial Hygienist, OHB/CDPH)

- Carmela Lomonaco/Judy Thai/Nick Anthis (CBCRP)