Female Firefighters & Breast Cancer Risk

Presented by:

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San Francisco Fire Department and United Fire Service Women

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Connie Engel
Breast Cancer Fund
Agenda

- How the study developed
- What we know and don’t know
- About the Women’s Firefighters Biomonitoring Collaborative Study
- Translating Science
- Policy Implications
Our Mission & Vision

To achieve health justice for all women at risk of and living with breast cancer

VISION: A world where lives and communities aren’t threatened by breast cancer.
BCAction’s Core Values

- Health justice
- Honesty, fearlessness, and truth-telling
- Honoring diverse voices
- People’s health and well-being
- Transparency and accountability
- Collective action
- Freedom from conflict of interest
Our Commitment to Social Justice

• Unequal burden of disease
• Root Causes
• Intersectionality
• Allyship
BCAction’s Strategic Priorities

1) Breast Cancer Screening, Diagnosis and Treatment

2) Root Causes of Breast Cancer

3) Pink Ribbon Marketing and Culture
Rachel Morello-Frosch, PhD, MPH

Professor, UC Berkeley School of Public Health and Department of Environmental Science, Policy and Management & Principal Investigator
Connie Engel, PhD

Science & Education Manager, Breast Cancer Fund
Lt. Heather Buren

Lieutenant & Paramedic, San Francisco Fire Department and United Fire Service Women President
Women Firefighters Biomonitoring Collaborative
Who?

- San Francisco Firefighter Cancer Prevention Foundation
- United Fire Service Women
- UC Berkeley School of Public Health
- UC San Francisco
- Silent Spring Institute
- Breast Cancer Fund
- Commonweal
What?

A Biomonitoring study that will examine exposures to chemicals linked to breast cancer, including carcinogens and chemicals that disrupt the body’s normal hormone function.
How?

California Breast Cancer Research Foundation

- The mission of the California Breast Cancer Research Program is to prevent and eliminate breast cancer by leading innovation in research, communication, and collaboration in the California scientific and lay communities.
Why?
A little about the job of fighting fire.
What can we control/change?

- Personal protective equipment (PPE)
- Wearing Air packs
- Being healthy and fit
- Cleaning PPE after exposures
- Standard operating procedures (SOP)
What we can not control?

- What’s burning **
- Length of time exposed to smoke/toxins
- Intensity

**Toxicity of fuel load can be changed through policy regarding what chemicals can/cant be used in manufacturing.
Moving forward

- Ongoing education
- Prevention
Women Firefighters Biomonitoring Collaborative

Collaborative Partners:

- CBCRP: Community Research Collaboration Fund
- San Francisco Firefighters Cancer Prevention Foundation
- International Association of Firefighters (IAFF), Local 798
Studies in multiple countries of male firefighters and other first responders indicate elevated risk of certain cancers, such as thyroid, bladder, kidney, prostate, testicular, breast, brain, digestive, multiple myeloma, and non-Hodgkin’s lymphoma compared to the general population.

Some studies have linked these diseases to occupational exposures
Mounting concern among SF firefighters about high rates of premenopausal breast cancer among the women in their ranks.
Previous studies show firefighters have higher exposures to:

• Polycyclic Aromatic Hydrocarbons (PAHs)  
  – Products of combustion
• Diesel exhaust – nitro-PAHs  
  – Fire equipment
• Flame retardants  
  – burning furniture, protective clothing, etc.
• Perfluorinated chemicals  
  – Chemical in firefighter turnouts
• Dioxins and Furans  
  – Combustion by-products during fire events

Studies so far almost exclusively on men.
Many of these chemicals have been shown to be mammary carcinogens in animal toxicology studies and warrant further study.

- Characterize exposures in humans.
- Inform regulatory, occupational and individual actions to reduce exposures.
SFFD has one of the largest populations of women among its ranks in the US ($N \approx 225$)
Women Firefighter Biomonitoring Collaborative Team

Firefighter Organizations:
• United Fire Service Women
• San Francisco Firefighters Cancer Prevention Foundation

Science Team:
• UC Berkeley
• UC San Francisco
• Silent Spring Institute

Environmental Health Advocates:
• Commonweal
• Breast Cancer Fund
What we want to learn:

- Are chemicals known or suspected to cause mammary tumors more elevated among women firefighters than non-firefighters?
- Are there other unknown or unmeasured chemicals that are higher among women firefighters?
- Is higher chemical exposure or exposure to night shift work associated with early health effect biomarkers of potential relevance for breast cancer?
  - thyroid hormone disruption
  - altered melatonin levels
  - telomere length
Study Aim 1

Measure and compare levels of environmental chemicals between women firefighters (N=80) and non-firefighter female controls (N=80)

**Targeted analysis:**
- Flame retardants
- Polybrominated Biphenyl Ethers (PBDEs) and their metabolites (OH-PBDEs)
- Firemaster 550 and other current use flame retardants
- Perfluorinated Compounds (PFCs)
- Polycyclic Aromatic Hydrocarbons (PAHs & nitro-PAHs)

**Non-targeted chemical analysis:**
- Time of Flight (TOF) LC/MS
- Reveals exposures we might not have thought about
Study Aim 2

Evaluate the impact of chemical exposures and chronic exposure to night shift work on biomarkers of early effect of potential relevance to breast cancer

- Night shift work and melatonin
- PBDE and OH-PBDE exposures and thyroid hormone disruption (T4 and TSH)
- Chemical exposure and shortened telomere length (Exploratory)
Exposure Assessment Interview

- Occupation and work activities
- Shift work and sleep
- Chronic stress
- Diet
- Personal product use
- Consumer and home products, hobbies, etc.
Biospecimen Collection

Firefighter Karen Heald bleeding for a cause. WFBC team provided blood and urine samples to help with methods development to measure chemicals.

(R-L): Jessica Trowbridge, WFBC Study Coordinator (UCB), Emily O’Rourke (UFSW) & Nancy Carmona (UCB), processing blood and urine samples.
Study Aim3

Report back individual-level and aggregate results to study participants who want them

- Focus groups and usability testing with study participants to develop report-back materials
- Aggregate dissemination to broader firefighter community, decision-makers, policy arena, and broader public
WFBC participants recruited, interviewed & samples collected so far...

Goal is 160 participants (80 firefighters and 80 female “controls”)

<table>
<thead>
<tr>
<th></th>
<th>Recruited and eligible</th>
<th>Enrolled and interviewed</th>
<th>Samples collected</th>
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</thead>
<tbody>
<tr>
<td><strong>Firefighters</strong></td>
<td>97</td>
<td>86</td>
<td>56</td>
</tr>
<tr>
<td><strong>Non-firefighter (Controls)</strong></td>
<td>115</td>
<td>83</td>
<td>75</td>
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<tr>
<td><strong>Total</strong></td>
<td>212</td>
<td>169</td>
<td>131</td>
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WFBC Emphasizes Prevention Evidence

- Biological mechanism
- Human exposure

Basis for action

- Education
- Policy
- Regulation
- Reformulation
Future work may extend study to include other female occupational groups

- Nurses, nail salon workers, teachers, etc.
Impact – Rigor, Relevance & Reach

Rigor: Advance biomonitoring science in new directions
• First study to examine the range of exposures to potential breast carcinogens and other EDCs among women firefighters compared to female controls
• Measuring biomarkers potentially relevant to breast cancer risk.
• Use of non-targeted biomonitoring techniques in a firefighter population

Relevance: Potential to extend to other female occupational groups
• Future recruitment of women from other occupations, such as nursing, nail salon workers, teachers, etc.

Reach: Disseminate results to diverse audiences
• Leverage research results to inform policy change
• Report-back to study participants
Thank you!

SFFD Firefighters & WFBC Members (L-R): Anita Paratley, Heather Buren, Lisa Holdcroft, Karen Stone, & Karen Heald
Women Firefighters Biomonitoring Study

- Communication
- Results report-back
- Potential policy implications
Communication

• Ongoing with firefighter community
• Biggest asset here has truly been our firefighter team
• One-on-one engagement
• Website
• Events
• Possible education and training
Results report-back

- Focus groups
- Individual results for those who opted-in
- Aggregate report-back to the anyone from the two occupational communities who wants to attend
- Will include results, educational component, and policy implications
Results report-back

Values of perfluorooctanoate [PFOA] (Perfluorochemical)

Results report-back

How to Read the Results Charts for You and Your Baby

There are 31 Results Charts. The charts show the amount, or level, of each chemical found in your blood or urine or in your baby’s blood. Some charts show results for both you and your baby. Some show the results for you only. This is because we tested both blood and urine samples from mothers, but only blood samples from babies.

What the Symbols Mean:

1. **National average**: This is the average level found in pregnant women in the U.S.

2. **Benchmark**: Levels close to or above the benchmark are a health concern. Benchmarks do not appear in most charts, because they have not been established for most chemicals that we measured.

3. **Your result**: This is the amount found in your sample. If there is no blue circle, that chemical was not found in your sample.

4. **Other people’s results**: Results for the other mothers and babies in the study.

5. **Your baby’s result**: If there is no purple circle, that chemical was not found in your baby’s sample. Charts about tests in urine do not have results for babies. This is because babies’ urine was not tested.

Understanding Averages and Benchmarks

You can compare your results to the levels for other people in this study or for pregnant women nationwide. The national averages are taken from the National Health and Nutrition Examination Survey (NHANES). This survey was conducted by the Centers for Disease Control and Prevention, a federal agency.

You can also compare your results to benchmarks when they exist. Benchmarks are established by different government agencies, such as the U.S. Environmental Protection Agency (EPA) and California’s EPA. Levels close to or above the benchmark are a possible health concern. Benchmarks have not been established for most chemicals that we measured.

Policy Implications

• We anticipate the findings could have implications for public policy on multiple levels.

• Depending upon study results, these could include:
  – LOCAL: Changes to protective equipment policies, station design for any new stations, purchasing ordinances
  – OCCUPATION-SPECIFIC: Policy work with state, national, and federal firefighting organizations to develop appropriate worker exposure protections
  – State & Federal: Chemicals Policy Reform. If the products that burn in fires are less toxic, then firefighters will have fewer exposures
Policy Implications

Hierarchy of Controls

1. **Elimination**
   - Physically remove the hazard

2. **Substitution**
   - Replace the hazard

3. **Engineering Controls**
   - Isolate people from the hazard

4. **Administrative Controls**
   - Change the way people work

5. **PPE**
   - Protect the worker with Personal Protective Equipment

Most effective

Least effective
Review resources mentioned in the presentation

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