Women Worker Biomonitoring Collaborative (WWBC)

Investigators

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Abstract

Introduction: As first-responders and health care providers, women firefighters and nurses work on the front lines to protect community well-being, yet their exposures to chemicals, particularly potential breast carcinogens, are understudied. Nurses are exposed to complex mixtures of potentially carcinogenic agents including ionizing radiation, disinfectants, chemotherapeutic agents, and medications, but few studies have used biomonitoring to identify exposures and markers of effect. Breast cancer is elevated among nurses despite their expected lower risk based on alcohol consumption, smoking, and reproductive characteristics. Firefighters are also exposed to breast carcinogens. Our prior CBCRP-funded study applied innovative approaches to biomonitoring to compare exposures between firefighters and office workers. Results show elevated exposures among firefighters to highly fluorinated chemicals, thought to be from fire-fighting foams, and previously unstudied exposures to potential breast carcinogens using innovative, non-targeted biomonitoring methods. This proposal builds on our "exposome approach" to compare three female CA occupational cohorts (firefighters, nurses and office workers). Instead of choosing a priori which

chemicals to measure, which may or may not be present in our study population, we now propose a discovery-driven method that first uses non-targeted analysis to derive candidate chemicals that can then be measured in human serum (collected from blood); this exposome approach can improve knowledge about occupational exposures to chemicals and identify important biological responses relevant to breast cancer. Question: - What are exposure profiles for potential breast carcinogens among women firefighters, nurses and office workers? - How do occupational categories of nursing and job stressors related to fire events among firefighters affect exposures? - How are exposures in firefighting and nursing associated with biological responses relevant to breast cancer? General methodology: First, we will develop a large chemical database to which we can compare data generated by a non-targeted scan of serum collected from nurses, firefighters and office workers for potential breast carcinogens. Second, using a lab technique known as liquid chromatography-quadrupole time-of-flight mass spectrometry we will screen serum samples for multiple breast carcinogens and their associated hormone or inflammatory molecule levels. This chemical exposure and biological response screen will compare results between 60 nurses and 40 office workers. We will then measure the actual concentrations of 15 potential breast carcinogens that have not been previously studied. Third, we will also apply the same combination of chemical screening, followed by a targeted analysis to measure serum concentrations of 5 additional breast carcinogens in a longitudinal biomonitoring analysis of 10 women firefighters before and after a fire event. Results of this chemical exposure and biological response scan will be compared across time in serum taken from women firefighters before, 1 day after and 1 month after a fire event. Finally, we will report individual and aggregate results to study participants who want them, and translate research results into exposure reduction activities at the individual, workplace and policy levels. Innovative elements: This project applies newly available technologies to more holistically profile among nurses, firefighters and office workers unique occupational chemical exposures and associated biological responses of relevance to breast cancer risk. Data from our study can be analyzed by other researchers who can query it in the future for newly emerging chemicals of concern. Community involvement: The WWBC integrates two occupational groups who are eager to collaborate on research that addresses chemical exposures linked to breast cancer. Our firefighter and nurse collaborators are affiliated with unions and other organizations that are concerned about workplace chemical risks; both have been involved in developing the study aims, protocol design and will engage in recruitment, data collection, analysis, and dissemination of results. With support from Breast Cancer Prevention Partners, the community and scientist collaborators will implement an integrated strategy to report-back results to participants and translate the research for nursing and firefighter communities, health advocates and decision-makers. Future Plans: Novel exposure data and archived serum and urine samples generated from the WWBC represent a timely and cost-effective investment that will also support future research on occupational exposures of women to breast carcinogens and their potential health risks.

Progress Report Abstract

The Women Workers Biomonitoring Collaborative (WWBC) study is a community-based

participatory research project that uses non-targeted biomonitoring methods to evaluate potential occupational exposures related to breast cancer in female nurses, office workers, and firefighters in San Francisco. The WWBC study aims to: 1. Develop a chemical database for use in non-targeted biomonitoring of potential breast carcinogens; 2. Identify potential occupational exposures, particularly to breast carcinogens, and associated biological responses among female nurses and office workers using non-targeted analysis; 3. Identify potential occupational exposures, particularly to breast carcinogens, and associated biological responses related to fire events among female firefighters; 4. Report individual and aggregate results to study participants using an online report-back interface and translate study results into exposure reduction initiatives. As previously reported, our collaborative completed the development of a chemical database (Aim 1). Since our last report, we have completed most steps in the non-targeted analysis (NTA), and are finalizing the confirmation and semi-quantification of chemicals in participant samples. This work on Aims 2 and 3 has been performed in parallel. 33 chemicals were selected to confirm and semi-quantitate in individual samples. We are in the final stages of this stem in the workflow of the non-targeted analysis. Our team faced significant delays due to the COVID-19 pandemic which slowed the lab work considerably. We are thus in the final stages of data analysis and hope to be able to begin digital results report back to participants (Aim 4) in the next 6-12 months, pending approval of our No Cost Extension request. Given this, we have preliminary results at this time. Our collaborative continues to meet monthly with the entire project team, including community partners, and has made ample progress on Aims 1-3 despite the challenges mentioned above. Our final year of work will focus on finishing the non-targeted analysis, developing the online report-back interface for use in reporting individual results to participants, and disseminating aggregate results via presentations, posters, and peer-reviewed papers. We aim to translate findings into actionable exposure reduction initiatives with help from community partners in the next year.

Publications

Title	Authors	Year
Gaussian graphical modeling of the serum exposome and metabolome reveals interactions between environmental chemicals and endogenous metabolites.	Bessonneau, V., Gerona, R.R., Trowbridge, J. Grashow R., Lin T., Buren H., Rudel R.A., Morello-Frosch R.	2021
Exposure to Perfluoroalkyl Substances in a Cohort of Women Firefighters and Office Workers in San Francisco	Trowbridge J., Gerona R.R., Lin T., Rudel R.A., Bessonneau V., Buren H., Morello-Frosch R.	2020
Integrating exposure knowledge	Grashow R., Bessonneau V.,	2020

and serum suspect screening as a new approach to biomonitoring: An application in firefighters and office workers.	Gerona R., Wang A., Trowbridge J., Lin T., Buren H., Rudel R.A., Morello-Frosch R.	
Understanding Cancer in Women Firefighters	Buren, Heather	2020
Organophosphate and Organohalogen Flame-Retardant Exposure and Thyroid Hormone Disruption in a Cross-Sectional Study of Female Firefighters and Office Workers from San Francisco	Jessica Trowbridge, Roy Gerona, Michael McMaster, Katherine Ona, Cassidy Clarity, Vincent Bessonneau, Ruthann Rudel, Heather Buren, Rachel Morello-Frosch	2022
Associations between polyfluoroalkyl substance and organophosphate flame retardant exposures and telomere length in a cohort of women firefighters and office workers in San Francisco	Cassidy Clarity, Jessica Trowbridge, Roy Gerona, Katherine Ona, Michael McMaster, Vincent Bessonneau, Ruthann Rudel, Heather Buren, Rachel Morello-Frosch	2021
A non-targeted approachto identifypotential breast carcinogens in women firefighters after a fire event.	Jessica Trowbridge, Vincent Bessonneau, MiaoMiao Wang, June-Soo Park, Ruthann Rudel, Rachel Morello-Frosch	2021
Organophosphate and organohalogen exposure and thyroid hormone disruption in a cohort of women firefighters and office workers from San Francisco.	Jessica Trowbridge, Roy Gerona, Mike McMaster, Katherine Ona, Cassidy Clarity, Vincent Bessonneau, Ruthann Rudel, Heather Buren, Rachel Morello-Frosch	2021
A non-targeted approachto identifypotential breast carcinogens in women firefighters after a fire event.	Jessica Trowbridge, Vincent Bessonneau, MiaoMiao Wang, June-Soo Park, Ruthann Rudel, Rachel Morello-Frosch	2020
WWBC Women Workers Biomonitoring Collaborative	Rachel Morello-Frosch, Erin Carrera, Lisa Hartmayer	2022

Everyone loves firefighters: Advancing the rigor, relevance and reach of exposure science through community driven research.	Jessica Trowbridge	2021
Everyone loves firefighters: Advancing the rigor, relevance and reach of exposure science through community driven research.	Jessica Trowbridge	2021
The Women Workers Biomonitoring Collaborative: PFAS, flame retardants and biomarkers of effect	Jessica Trowbridge, Cassidy Clarity	2022
Removing Toxic PFAS from Firefighting Foam in the U.S.: A Legislative Update	Nancy Buermeyer	2020
Non-targeted analysis and exposomics to identify novel chemical exposures and associated biological changes in a cohort of California women firefighters	Ruthann Rudel	2020
Reporting personal exposure results in a recent biomonitoring study of women firefighters in San Francisco	Ruthann Rudel	2020
The Women Workers Biomonitoring Collaborative: PFAS, flame retardants and biomarkers of effect	Jessica Trowbridge	2020
A generalized suspect screening approach for identifying novel chemical exposures in firefighting	Jessica Trowbridge	2020
Testimony	Jessica Trowbridge	2020

Everyone loves firefighters-Community based participatory research in occupational health settings	Jessica Trowbridge	2020
Assessing Firefighter Exposure; Challenges and Benefits of Biomonitoring	Sharyle Patton	2020
PFAS Chemicals - Relevance to Firefighters	Sharyle Patton	2019
SFFD, Roller Derby and UFSW--Women Workers Biomonitoring Collaborative	Emily O'Rourke	2019
Women Firefighters Biomonitoring Collaborative - A community-based participatory research study	Rachel morello Frosch, Jessica Trowbridge, Heather Buren, Anthony Stefani, Ruthann Rudel, Vincent Bessonneau	2019
SFFCPF Studies involved with included WFBC	Tony Stefani	2018
WFBC and UFSW status	Heather Buren	2019
Health effects in firefighting-update on WFBC and WWBC	Jessica Trowbridge	2019
Everyone loves firefighters-Community based participatory research in occupational health settings	Jessica Trowbridge	2019
WFBC report-back and WWBC update	Jessica Trowbridge, Cassidy Clarity, Rachel Morello-Frosch	2019
Advisory Committee Meeting	Cassidy Clarity, Miaomiao Wang, Vincent Bessonneau, Sharyle Patton	2019

Characterizing occupational exposures to toxic environmental chemicals and thyroid hormone disruption in women firefighters in San Francisco	Jessica Trowbridge	2022
Translating Science to Policy	Jessica Trowbridge	2023
Panel for Breast Health Symposium for First Responders on October 6th for Breast Cancer Awareness month.	Jessica Trowbridge	2022
Everyone loves firefighters: Advancing the rigor, relevance and reach of exposure science through community driven research.	Jessica Trowbridge	2022
Jessica Trowbridge	Jessica Trowbridge	2023
Translating Science to Policy	Jessica Trowbridge	2023
Community based research and policy in environmental health	Jessica Trowbridge	2023
Associations between polyfluoroalkyl substance and organophosphate flame retardant exposures and telomere length in a cohort of women firefighters and office workers in San Francisco.	Clarity C, Trowbridge J, Gerona R, Ona K, McMaster M, Bessonneau V, Rudel R, Buren H, Rudel RA, Morello-Frosch R	2021
Organophosphate and Organohalogen Flame-Retardant Exposure and Thyroid Hormone Disruption in a Cross-Sectional Study of Female Firefighters and Office Workers from San Francisco	Trowbridge JA, Gerona RR, McMaster M, Ona K, Clarity C, Besseneau V, Rudel R, Buren H, Morello-Frosch R	2022
Translating community-based participatory research into	Ohayon JL, Rasanayagam S, Rudel RA, Patton S, Buren H,	2023

broadscale sociopolitical change: insights from a coalition of women firefighters, scientists, and environmental health advocates	Stefani T, Trowbridge J, Clarity C, Brody JG, Morello-Frosch R	
Occupational Exposure as a Firefighter	IARC	2023
Application of an in Vitro Assay to Identify Chemicals That Increase Estradiol and Progesterone Synthesis and Are Potential Breast Cancer Risk Factors	Cardona, B. and Rudel, R.	2021
Mapping the Human Exposome to Uncover the Causes of Breast Cancer.	Bessonneau, V., and R.A. Rudel	2020
Chemical exposures in the firefighting occupation are associated with increased breast cancer risk	Cardona, B., Rodgers, K., Trowbridge, J., Buren, H., Rudel, R.	2023
Community engagement of the WFBC and WWBC as a CBPR study	Jessica Trowbridge	2023