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Building Theory to Impact Practice

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The *International Fire Service Journal of Leadership and Management (IFSJLM)* is composed of peer-reviewed and editor-invited articles focusing exclusively on fire leadership and management topics. **To our knowledge, it is the only academic journal with this focus in the world.** *IFSJLM* is published by Fire Protection Publications (FPP) at Oklahoma State University (OSU). FPP is part of the College of Engineering, Architecture, and Technology at OSU and is the world's leading publisher of fire-related education and training materials.

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As a further indication of the support that FPP provides to the international fire community, all volumes of the *IFSJLM* are available for reading **free of cost** at the Journal's website. Please go to https://www.IFSJLM.org to read and/or download previous volumes of the *Journal*.

In this Issue

The Dr. John Granito Award

Dr. John Granito Award for Excellence in Fire Leadership and Management Research

The Dr. John Granito Award for Excellence in Fire Leadership and Management Research is presented at the *International Fire Service Journal of Leadership and Management (IFSJLM)* Research Symposium held annually in July at the International Fire Service Training Association (IFSTA) Validation Conference. The Granito Award is presented annually to an individual who has significantly advanced the fire leadership and management literature through their research efforts. The award honors the many contributions and achievements of Dr. John Granito to the scholarly study of fire leadership and management.

Until his retirement, John was one of the premier fire and public safety consultants in the United States. Just a few of his many Fire, Rescue, and Emergency Services research projects include: Oklahoma State University–Fire Protection Publications Line of Duty Death Reduction project (3 years); Centaur National Study (3 years); Research Triangle Institute/National Fire Protection Association/International City/County Management Association project (4 years); Fire Department Analysis Project (FireDAP) of the Urban Fire Forum (13 years); Combination Department Leadership Project, University of Maryland, Maryland Fire & Rescue Institute (4 years); and the Worcester Polytechnic/International Association of Fire Fighters/International Association of Fire Chiefs/National Institute for Occupational Safety and Health Fire Ground Performance Study. John has participated in more than 400 fire department studies.

John also has strong ties to academia. He served in a number of academic positions for almost 30 years, including 16 years at the State University of New York at Binghamton. He is Professor Emeritus and Retired Vice President for Public Service and External Affairs at SUNY Binghamton, which is consistently ranked among the top public universities by *U.S. News and World Report*.

John has published numerous articles, chapters, and technical papers. He served as co-editor of *Managing Fire and Rescue Services,* a book published by the International City/County Management Association in 2002, and he was a Section Editor of the 2008 NFPA *Fire Protection Handbook*®.

Dr. Granito was the first recipient of the award that was established in his honor to recognize individuals who, like Dr. Granito himself, have made outstanding contributions to the fire service and to academia. Each year the recipient of the Dr. Granito Award presents the Keynote Address at the annual *IFSJLM* Research Symposium. The Keynote Address is subsequently published as the lead article in the next volume of the *International Fire Service Journal of Leadership and Management.*

Recipients of the Dr. John Granito Award for Excellence in Fire Leadership and Management Research

Year	Recipient	Affiliation *May reflect previous affiliation(s)*
Research Symposium 2008	**Dr. John Granito**	Professor and Vice-President Emeritus, State University of New York Binghamton and Fire & Emergency Services Consultant
Research Symposium 2009	**Dr. Denis Onieal**	Deputy U.S. Fire Administrator
Research Symposium 2010	**Dr. Lori Moore-Merrell**	President and CEO, International Public Safety Data Institute
Research Symposium 2011	**Dr. Edward T. Dickinson**	Professor and Director of EMS Field Operations, Department of Emergency Medicine, Perelman School of Medicine, University of Pennsylvania
Research Symposium 2012	**Dr. Daniel Madrzykowski**	Director of Research, Fire Safety Research Institute, Underwriters Laboratories, Inc., Columbia, MD
Research Symposium 2013	**Dr. Anne Eyre**	Independent Consultant, Trauma Training, Coventry, United Kingdom
Research Symposium 2014	**Chief Dennis Compton**	Former Fire Chief, International Fire Service Training Association, Fire Protection Publications, Oklahoma State University
Research Symposium 2015	**Dr. Denise Smith**	Tisch Family Distinguished Professor, Department of Health and Human Physiological Sciences, Director of First Responder Health and Safety Laboratory, Skidmore College (NY) and Research Scientist, University of Illinois, Fire Service Institute, Champaign, IL
Research Symposium 2016	**Dr. Sara A. Jahnke**	Director and Senior Scientist, Center for Fire, Rescue & EMS Health Research, NDRI-USA, Inc., Leawood, KS
Research Symposium 2017	**Chief Ronald J. Siarnicki**	Executive Director, National Fallen Firefighters Foundation
Research Symposium 2018	**Dr. Jefferey L. Burgess**	Associate Dean for Research and Professor, Mel and Enid Zuckerman College of Public Health, University of Arizona
Research Symposium 2019	**Dr. Gavin Horn**	Research Engineer, Fire Safety Research Institute, Underwriters Laboratories, Inc., Columbia, MD
Research Symposium 2020-21	***No Recipient***	*Symposium Was Cancelled Due to Pandemic*
Research Symposium 2022	**Dr. Kenny Fent**	Industrial Hygienist and Team Leader of the National Firefighter Registry Program, Centers for Disease Control and Prevention
Research Symposium 2023	**Dr. Steve Kerber**	Vice President and Executive Director, Fire Safety Research Institute, UL Research Institutes, Columbia, MD

Message from Dr. Robert E. England

Founding Editor, *International Fire Service Journal of Leadership and Management* (*IFSJLM*),
Fire Protection Publications, Oklahoma State University

Welcome to Volume 16 of the *International Fire Service Journal of Leadership and Management (IFSJLM)*. Unlike last year, Volume 16 includes a Keynote Address article. After canceling the annual Research Symposium (RS) in 2020 and 2021, we met in person this year on July 9, 2022, in Tulsa, Oklahoma. As the Recipient of the Dr. John Granito Award for Excellence in Fire Leadership and Management Research, Dr. Kenny Fent presented the Keynote Address at RS 2022. The title of his presentation was "Charting New Territory: Understanding Cancer in Firefighters." Dr. Fent is an industrial hygienist and Team Leader of the National Firefighter Registry Program at the Centers for Disease Control and Prevention.

We hope you enjoy Dr. Fent's article and the other articles in Volume 16 of the *International Fire Service Journal of Leadership and Management*.

Keynote Address (Editor Invited)

Dr. John Granito Award for Excellence in Fire Leadership and Management Research Keynote Address presented at Research Symposium 2022 (RS 22) on July 9, 2022, by **Dr. Kenneth Fent,** Industrial Hygienist and Team Leader of the National Firefighter Registry Program, National Institute for Occupational Safety and Health, Cincinnati, OH.

Dr. Kenneth W. Fent[1]
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Charting New Territory: Understanding Cancer in Firefighters

Abstract

Considerable research has been conducted on firefighters over the last decade. Although this research has greatly increased our understanding of how the occupation of firefighting impacts firefighters' health and wellness, there is still much work to be done. If we want to fully understand cancer risk in firefighters, including among specific groups of firefighters, we must think big.

The National Firefighter Registry (NFR) is one attempt to address the big picture. The NFR is a voluntary registry of firefighters that is open to anyone who has ever served as a U.S. firefighter, in any capacity, regardless of their cancer or health status. The goal of the NFR is to generate detailed knowledge about cancer in the fire service that will be used to ultimately reduce cancer risk in firefighters.

The NFR is a long-term project with the potential to be one of the largest occupational databases ever assembled. Its success requires careful coordination and collaboration across the research and fire service landscape. With high participation rates among U.S. firefighters, the National Institute for Occupational Safety and Health (NIOSH) scientists and other researchers will be able to examine trends in cancer patterns, exposures, demographic and workplace characteristics, and protective measures. Data collected from participants will help to guide future interventions and best practices to reduce and prevent cancer in firefighting personnel.

Keywords: firefighter, cancer risk, chemical exposures, shift work, health, registry, surveillance

The Running Analogy

When given a choice between running outdoors and running on a treadmill, many runners will choose the great outdoors. There are many reasons to prefer running outdoors. Most runners will say they enjoy the fresh air and sunshine, but it is deeper than that. When you run outside, your course has not been plotted for you. You have the freedom to explore new paths, encounter new sights, and experience new sounds. There is a sense of adventure that comes from not knowing what is next, or who or what you might find along the way.

Treadmills offer many of the same benefits of outdoor running, but under controlled settings. When you run on a treadmill, there aren't any surprises. It's a predictable and comfortable experience. From the beginning to the end of the run, everything looks the same. Treadmills are very effective and useful pieces of equipment, but running outdoors is just more exciting.

Sometimes research is like running on a treadmill. We embark on a study and already know what to expect. The research is performed under tightly controlled parameters. We plot our direct course, collect the information, analyze the outcomes, and disseminate our findings. Although there are few, if any,

surprises along the way, this type of research is important and fruitful work. It often provides the foundation for future, more complex studies. This type of research may corroborate findings from earlier studies and provide critical evidence for supporting new policies or interventions.

Other times, research is like a long, outdoor run. This type of research is more of an expedition. It has a specific purpose, but it lacks defined expectations. Researchers are not sure what they will find on this journey. There may be a roadmap, but there are also multiple paths and destinations that provide the researcher with some freedom in deciding the route.

All good research has a hypothesis—an assumption, idea, or proposed explanation that can be tested and is usually based on previous observations. But sometimes previous observations are lacking. The research question may not have been asked or tested previously.

Firefighter Cancer Epidemiology

When it comes to cancer epidemiology research, two seminal studies have helped uncover and elucidate the cancer risk among U.S. firefighters. In 2006, Dr. Grace LeMasters from the University of Cincinnati led a meta-analysis of 32 relatively small, regional studies of firefighter cancer. By doing a meta-analysis, Dr. LeMasters' analysis was able to combine the studies and strengthen the statistical power.

She and her team found that firefighters had a *probable cancer risk* for multiple myeloma, non-Hodgkin's lymphoma (NHL), prostate cancer, and testicular cancer, with statistically significant summary risk estimates (SREs) of 1.53, 1.51, 1.28, and 2.02, respectively (LeMasters et al., 2006). SREs greater than 1 indicate higher odds or risk of cancer for firefighters (e.g., 1.53 = 53% increased risk) and are statistically significant when the 95% confidence intervals do not drop below 1.

Other cancer types with significant SREs were classified as *possible cancer risks.* These included skin (1.39), malignant melanoma (1.32), brain (1.32), rectum (1.29), stomach (1.22), and colon cancer (1.21). Overall, 10 of the 20 cancers studied appeared to be significantly elevated among firefighters.

Several years later, Dr. Doug Daniels from the National Institute for Occupational Safety and Health (NIOSH) led the largest cancer cohort study of U.S. firefighters ever undertaken. The study included nearly 30,000 career firefighters from Chicago, Philadelphia, and San Francisco, who were employed between 1950-2009. The authors calculated standardized incidence ratios (SIRs) and standardized mortality ratios (SMRs) to compare rates of cancer diagnoses and deaths in this cohort to those expected based on rates in the general population. An estimate greater than 1 indicates rates that were higher than expected. This study found that firefighters had rates of cancer diagnoses and deaths that were 9% and 14% higher, respectively, than those expected based on rates in the general U.S. population.

Specifically, firefighters had significantly elevated SIRs for cancers of the esophagus (1.62), intestine (1.21), lung (1.12), kidney (1.27), and oral cavity (1.39), and for mesothelioma (2.29) which had not been previously reported (Daniels et al., 2014). Daniels et al. (2014) also found increased risk of bladder and prostate cancer among younger firefighters (ages 17-64). Calculated SMRs for deaths caused by cancer further suggested associations between firefighting and digestive, respiratory, urinary, and oral cancers. An updated mortality analysis of this cohort also suggested an association between firefighting and non-Hodgkin's lymphoma (Pinkerton et al., 2020).

Over the past decade, additional studies have been conducted to evaluate cancer among U.S. firefighters. For example, several investigations of cancer in U.S. firefighters from California (Tsai et al., 2015), Florida (Lee et al., 2020), Indiana (Muegge et al., 2018), and Boston (Langevin et al., 2020) have pointed to specific cancer types that could be associated with firefighting.

Considerable international research on the association between firefighting and cancer has come from Australia (Glass & Del Monaco, et al., 2016, 2017, 2019; Glass & Pircher, 2016), Canada (Harris et al., 2018), France (Amadeo et al., 2015), Korea (Ahn & Jeong, 2015; Ahn et al., 2012; Min et al., 2020), Spain (Zhao et al., 2020), Denmark (Petersen et al., 2018a; Petersen et al., 2018b), Norway (Jakobsen et al., 2021; Marjerrison et al., 2022), Sweden (Kullberg et al., 2018), and other Nordic countries (Pukkala et al., 2014). These individual studies have varied substantially in design, years and methods of data collection, cancer outcome definition (e.g., incidence, prevalence, mortality), geographic regions of evaluation, sample sizes, and demographics. Subsequently, so have the variable findings for increased risk of specific cancer types.

In addition to the individual studies, multiple meta-analyses published in recent years have attempted to summarize the weight of evidence for types of cancers associated with firefighting. **Table 1** provides a comparison of the seminal LeMasters et al. (2006) meta-analysis with other recent meta-analyses.

The International Agency for Research on Cancer (IARC), which categorized firefighting as *possibly carcinogenic to humans* based on a review of the evidence in 2010, just completed their re-evaluation of the occupation of firefighting in the summer of 2022. As part of this re-evaluation, IARC conducted a meta-analysis and also considered current research related to firefighter exposures and biological mechanisms that may lead to cancer. IARC reached a new consensus evaluation, classifying firefighting as a *known human carcinogen* based on sufficient evidence of mesothelioma and bladder cancer. IARC also found limited evidence of five other cancers in firefighters (colon, prostate, testicular, melanoma, and non-Hodgkin lymphoma) (Demers et al., 2022).

Table 1
Select Meta-Analyses of Firefighter Cancer Studies Conducted Since 2006

	LeMasters et al. 2006	IARC 2010	Jalilian et al. 2019	Soteriades et al. 2019	Demers et al. 2022
Number of studies included in meta-analysis	32	42	48	49	>30
Specific types of cancer with increased risk					
Bladder			●	●	●
Brain				●	
Colorectal			●	●	●
Melanoma			●	●	●
Mesothelioma			●		●
Multiple myeloma	●				
Non-Hodgkin's lymphoma	●	●	●	●	●
Pancreatic					
Prostate	●	●	●	●	●
Testicular	●	●	●	●	●
Thyroid			●		

Note: The increased risk in this table is based on summary risk estimates for incidence, prevalence, mortality, or a combination of these factors.

Meta-analyses are an important tool in cancer epidemiology. However, it is important to note that the cancers identified as "significantly elevated" in these meta-analyses represent just a portion of the cancer types with increased risk estimates in the individual studies. Several hypotheses have been proposed to explain the variability in findings for specific cancer types across studies.

According to one of the most popular hypotheses, the considerable variability in the magnitude and composition of chemical exposures encountered by firefighters during combustion events throughout the United States and the rest of the world may explain the variability in findings related to cancer risk. Housing stock, commercial structures, furnishings, and other contents can vary considerably from one community to the next. These vary even more widely between countries throughout the world.

The items involved in fires and ventilation conditions greatly affect the combustion byproducts that are produced. Studies have shown that structure fires can produce hundreds of combustion byproducts, including numerous known or probable human carcinogens, such as benzo[a]pyrene, benzene, styrene, 1,3-butadiene, and formaldehyde (Austin et al., 2001; Bolstad-Johnson et al., 2000; Fent & Evans, 2011; Fent et al., 2018; Jankovic et al., 1991). Persistent organic compounds such as dioxins and furans, polybrominated flame retardants (PBDEs), and per- and polyfluoroalkyl substances (PFAS) may also be produced or released during fires (Fent et al., 2020; Mayer et al., 2021; Shaw et al., 2013).

Inhalation is not the only way that chemicals can enter firefighters' bodies. Skin absorption has received increased attention with several studies providing convincing evidence for the dermal absorption of polycyclic aromatic hydrocarbons (PAHs) and even benzene (Fent et al., 2017; Fent et al., 2014; Keir et al., 2017; Stec et al., 2018). It is also notable that firefighters and other first-responders are often assigned to long work shifts (24 hours or more). Night shift work is now classified as a probable human carcinogen by IARC (IARC, 2019).

Knowledge Gaps

Limitations of Past Studies

Despite these advances in research, there is still much we do not fully understand about firefighters' risk of cancer, especially the risk for women and people of color. Most published studies lack sufficient analyses of diverse populations in the fire service to draw definitive conclusions regarding their cancer risk.

Roughly 20% of career firefighters are non-white, approximately 8% of all firefighters are women, and select subspecialty groups of firefighters may be even more diverse (NFPA, 2020). A few select studies have suggested that cancer risk estimates could vary by demographic characteristics (e.g., age group, sex, race/ethnicity) (Daniels et al., 2014; Glass et al., 2019; Lee et al., 2020; Ma et al., 2006; Tsai et al., 2015) and firefighting subspecialty (instructors) (Glass & Del Monaco, et al., 2016), but more research is needed.

Volunteers make up nearly 70% of the firefighting workforce in the U.S. (NFPA, 2020). However, few studies have evaluated cancer among volunteer firefighters (Glass et al., 2017, 2019). To our knowledge, none of these studies have been conducted among U.S. volunteers. Likewise, the cancer risk among wildland firefighters, fire-cause investigators, airport rescue firefighters, and industrial firefighters is unknown.

Only a couple studies have evaluated potential exposure-response relationships among structural firefighters. Of these studies, some surrogates of exposure have included duration of employment/firefighting (Baris et al., 2001; Bates et al., 2001; Demers et al., 1994; Tornling et al., 1994), number of fire runs (Baris et al., 2001; Daniels et al., 2015; Tornling et al., 1994), and number of hours spent at fires (Daniels et al., 2015). Among structural firefighters, cancer types found to be significantly elevated with increasing exposure included testicular (Bates et al., 2001), prostate (Demers et al., 1994), lung, and leukemia (Daniels et al., 2015).

An Australian study that investigated cancer risk among paid and volunteer fire instructors found an exposure-response relationship between live-fire training exposures (based on job activities) and cancer incidence (Glass & Del Monaco, et al., 2016). More exposure-response (cancer) studies are needed, but these analyses are complex and dependent on work history documentation or accurate recall.

Most studies of cancer in firefighters have been records-based, primarily using data from employment, cancer registry, and death records. These studies have largely been unable to analyze or account for individual-level risk factors for cancer, such as workplace practices, behaviors and lifestyle, and comorbidities, because secondary data sources do not typically collect or provide this information. Self-reporting by firefighters is the best method of obtaining this type of information but, to date, there has not been a central, comprehensive data source on a national level to provide details about firefighters' occupation, personal risk factors and behaviors, and cancer status.

Carcinogenic Exposures and Control Measures

It is hard to imagine an occupation with more potential for exposure to carcinogens and more variability in the magnitude and composition of those exposures than firefighting. Many firefighters will cite the major incidents to which they have responded as the reason for their cancer risk. They will also talk about the ebb and flow of fire responses throughout the years. Structure fires are hotter and propagate faster than before

because of all the synthetic materials inside the buildings (Kerber, 2012). It is conceivable that the influx of plastics and other man-made materials in our society have made the occupation of firefighting more of a long-term health hazard.

At the same time, numerous control interventions have been adopted throughout the fire service, albeit at different degrees. These control interventions include preliminary exposure reduction (gross decontamination), bagging of contaminated gear, routine laundering of turnout gear, use of skin cleansing wipes, and showering as soon as possible following a fire response (Horn et al., 2020).

Moreover, the use of SCBA has become more consistent across the different stages of fire response, including during overhaul. Research suggests that these interventions will reduce exposures (Burgess et al., 2020; Fent et al., 2017; Fent et al., 2020; Mayer et al., 2020), but to what extent do they lessen firefighters' cancer risk?

Important Research Questions

Asking complex questions is critical to understanding the scope of cancer in the fire service and providing information that can be used by decision-makers to better protect firefighters' health. To find answers to these questions, we must get out of our comfort zone and explore new paths. Examples of research questions that have not yet been answered include the following:

- What is the cancer risk for volunteer firefighters?
- What is the cancer risk for the sub-specialties of the fire service, such as wildland firefighters, fire-cause investigators, industrial firefighters, airport rescue firefighters, and fire instructors?
- How does the cancer risk vary for demographic groups, especially among women and ethnic and racial minorities who have been understudied?
- How does the cancer risk vary regionally across the U.S. fire service?
- How prevalent are rare forms of cancer among firefighters?
- How does the cancer risk change with increasing exposures, including major events?
- What other occupational and non-occupational risk factors contribute to cancer risk among firefighters?
- To what extent do different control interventions and workplace practices reduce the risk of cancer?
- Are there other chronic illnesses that are elevated in firefighters?

Charting New Territory

Following passage of the landmark Firefighter Cancer Registry Act of 2018, Congress directed the Centers for Disease Control and Prevention (CDC) to develop and maintain a comprehensive database of health and occupational information voluntarily provided by firefighters. This information would be used to study the incidence of cancer and identify occupational risk factors for cancer in the U.S. fire service.

In response to this mandate, the CDC's National Institute of Occupational Safety and Health (NIOSH) established the National Firefighter Registry (NFR). Importantly, all firefighters are eligible to participate in the NFR: active and retired, career and volunteer, and those with or without a previous cancer diagnosis. By volunteering information about their individual health and work experiences, NFR participants will help researchers to better understand and reduce the cancer risks that firefighters face.

The NFR is designed to be linked with health surveillance systems, including state cancer registries, fire incident records, and exposure tracking data. The goal is to register 200,000 firefighters, which will make the NFR one of the largest occupational cohorts ever. Enrolling a large and diverse population of firefighters—including women and people of color—from all sub-specialties is essential to obtaining a representative response to the aforementioned questions.

Enrollment in the NFR takes place through a secure web portal. During the registration process, firefighters provide information on their work history and other occupational and non-occupational cancer risk factors. We also work with fire departments nationwide to obtain incident records over time that provide more details on fire responses. Participating firefighters can complete follow-up surveys that allow investigators to explore other health factors and health outcomes longitudinally.

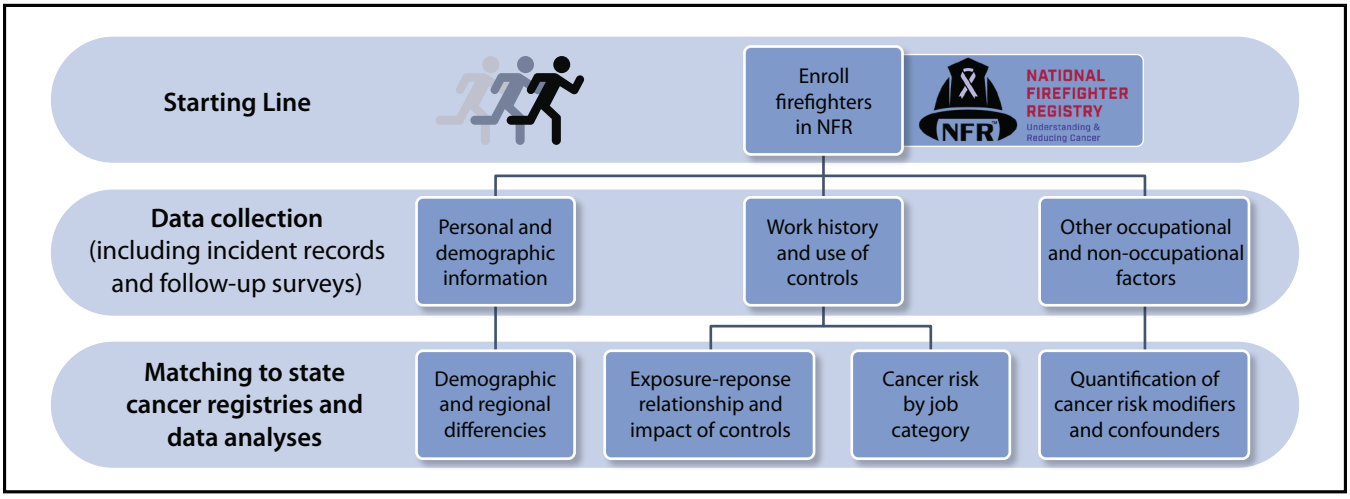
Most importantly, this registry allows us to match the information we collect from participating firefighters against state databases of cancer diagnoses. Cancer is a reportable illness in all 50 states. We recognize that when firefighters receive a cancer diagnosis, the last thing on their mind is to report that diagnosis to NIOSH. Self-reported cancer is also prone to error. By using existing cancer databases to augment the information collected from firefighters, we increase the accuracy and reliability of the NFR participants' cancer data.

NIOSH has involved countless fire service and public health stakeholders in the planning, designing, and implementation of the NFR. The NFR Subcommittee, a subcommittee of the NIOSH Board of Scientific Counselors, included 13 subject matter experts with backgrounds in the fire service, public health, epidemiology, medicine, and emergency management. This advisory committee provided valuable feedback on the enrollment process and reviewed our protocol (including the consent form and enrollment questionnaire). The finalized protocol, our roadmap for executing the scientific and logistical elements of the registry, is publicly available on the NFR Subcommittee website—http://www.cdc.gov/niosh/bsc/nfrs.

The starting point on our NFR roadmap is the enrollment of volunteers through the web portal. Multiple paths diverge from there (see **Figure 1**). The research potential of each path or direction depends on the NFR's ability to enroll and obtain information from a large number of demographically and geographically diverse firefighters.

Fire departments are critical partners in maximizing participation and obtaining more in-depth details about firefighters' work histories. The NFR will match the information collected from firefighters against state databases of cancer diagnoses and against the National Death Index, which provides all causes of death. Moreover, we will de-identify the NFR data and make it available to external researchers, opening even more pathways to collaboration, analysis, and discovery.

Figure 1
Simplified NFR Roadmap



Next Steps: Revisiting the Running Analogy

Anyone who has ever run a marathon knows about "the wall," an invisible opposing force that runners experience near the 20-mile mark when their depleted glycogen levels cause sudden fatigue and loss of energy. Hitting the wall feels like running in soft sand, where every step is harder than the last. This is where thoughts of stopping often enter a runner's mind, and where it is critically important to keep going.

As researchers, we encountered numerous walls while setting up the registry. These obstacles slowed our progress, but we persevered with the help of our stakeholders and the direction and support of our NFR Subcommittee. The NFR really is a marathon, not a sprint. We may get caught up in the process or deterred by a wall, but we cannot lose sight of what really matters: the mission and the people.

The goal of the NFR is to generate detailed knowledge about cancer in the fire service that will be used to ultimately reduce cancer in firefighters. That goal motivates our team to take on this important endeavor, and we believe that goal drives many other researchers and leaders in the fire service. We must keep in mind not only what is at stake, but *who* is at stake as we lace up our shoes and push forward.

The National Firefighter Registry (NFR) is open! Enroll at NFR.cdc.gov. The more firefighters who enroll, the more we can learn about the cancer risk among *all* firefighters, including those in groups who have been understudied in the past.

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Assault in the Atmosphere: Workplace Violence in the Fire Service

Abstract

Workplace violence has become an increasingly popular topic of discussion and includes forms of aggression such as general harassment, mobbing, ostracism, bullying, hazing, stalking, and sexual assault. Firefighting is a high stress job in a unique work environment with many known adverse health impacts that can be exacerbated by toxic work environments, including workplace violence. This study consists of interviews with 31 firefighters and fire service leaders. Answers from participants provided insight into the types of workplace violence experienced by fire service personnel, obstacles to reporting incidents of sexual assault, and inequities in disciplinary action. Our systematic examination of these personal accounts can be used to increase awareness of workplace violence in the fire service, promote understanding, and create a healthier, safer, and more inclusive fire service community.

Keywords: workplace violence, firefighting, harassment, bullying

Workplace violence is defined as a "form of workplace aggression that comprises behaviors intended to cause physical harm" (Barling et al., 2009). It has become an increasingly popular topic of discussion and research as a result of high-profile incidents such as the mass shooting at a California rail yard, the mass shooting at a FedEx facility, and physical altercations within the New York Giants football organization (Associated Press, 2021; Blankstein et al., 2021; Piquero et al., 2013; Raanan, 2021).

Although other forms of workplace violence may not receive as much media attention as mass shootings, they also contribute to a toxic and unsafe work environment. For example, sexual assault as a form of workplace violence may range from pervasive sexual harassment (Mulcahy, 2021) and sexual misconduct (Yandoli, 2020) to rape in the workplace (Marohn, 2021). Other forms of workplace violence include, but are not limited to, general aggression, harassment, mobbing, ostracism, hazing, and stalking (Ferris et al., 2015).

The frequency and prevalence of workplace violence is not easily captured. Although the Bureau of Labor Statistics collects data on workplace injuries and fatalities (Piquero et al., 2013), a national database on reports of workplace violence does not exist. Research examining the frequency of incidents seems to focus on specific occupational fields, and rates of violence vary greatly among different professions.

Workplace violence is most commonly reported in jobs associated with healthcare, education, public safety, retail, and justice industries. The violence may be perpetrated not only by coworkers, but also by clients, patients, and students (Piquero et al., 2013). Victimization rates for nurses range from 25% to 39% at the hands of patients (Anderson, 2002; Gacki-Smith et al., 2009). A national sample of social workers found 23% had been physically threatened at some point. Although only 3.3% reported being physically assaulted, almost half reported being verbally abused (Jayaratne et al., 2004). Although dated, the National Violence Against Women Survey found over 2.3 million men and 1.1 million women had experienced workplace violence by a coworker at some point during their lives (Tjaden & Thoennes, 2001).

The effects of workplace violence are felt at both the organizational and individual level. Organizationally, workplace violence negatively impacts job satisfaction and organizational commitment. This negative effect leads to higher rates of job burnout and turnover as well as increased personnel costs, all of which ultimately affect work performance (Anjum & Ming, 2018; Heponiemi et al., 2014; Sherman et al., 2008). As work productivity and performance decline, the organization is at risk of failing to meet its goals and mission, including the delivery of products to consumers (Ariza-Montes et al., 2019; Rasool et al., 2019, 2020).

At the individual level, the negative effects of workplace violence extend past the professional sphere to impact family and quality of life (Carmi-Iluz et al., 2005). High levels of anxiety and depression are related to victimization, as is post-traumatic stress disorder (PTSD) (Lanctôt & Guay, 2014). Job burnout, including increased levels of emotional exhaustion and depersonalization, is also related to workplace violence (Lanctôt & Guay, 2014).

Assessments of workplace violence across professions and various perpetrator groups (coworkers, clients, or patients) have provided valuable insight into the organizational and individual effects of victimization. Although Taylor et al. (2016) has examined *patient* violence against fire-based EMS responders, workplace violence in the fire service has not been systematically investigated in the peer-reviewed literature.

Firefighting is a high stress job with adverse health and behavioral impacts. Research shows that firefighters suffer from sleep deprivation, increased substance use, and higher rates of depression and PTSD (Carey et al., 2011; Fullerton et al., 2004; Haddock et al., 2012). Bullying and harassment are also prevalent in the fire service, leading to additional stresses and struggles among coworkers (Griffith et al., 2016; Jahnke et al., 2019; Titan Group, 2017). For example, bullying allegedly led to workplace violence when a Los Angeles County firefighter shot his coworker before committing suicide (Chen, 2021).

Our timely systematic examination can increase awareness of workplace violence in the fire service. This awareness and steps to improve response to these incidents can promote understanding and help to create a healthier, safer, and more inclusive fire service community.

Methods

The data presented here are part of a larger, mixed methods study of bullying and harassment funded by the Federal Emergency Management Agency (FEMA). The goal of the FEMA study was to collect qualitative and quantitative data on the prevalence, incidence, and risk factors of bullying and harassment for use in the development of prevention and intervention efforts, policies, and programs. Although the overarching goal of the interviews conducted for the FEMA study was to ascertain an understanding of bullying and harassment in the fire service, a number of questions specifically pertained to sexual assault and workplace violence. All protocols and procedures related to the study were approved by the appropriate institutions. Materials for this study are available by emailing the corresponding author.

Study Design

A purposive sampling strategy was used to conduct interviews with a nationally representative group of firefighters and fire service leaders. Two methods were used to solicit participation: 1) posting on the "Secret List," a popular fire service email list service (see https://www.firefighterclosecalls.com/secret-list/) and 2) contacting participants from previous fire service studies conducted by the research team (Jahnke et al., 2012, 2019). An announcement outlining the purpose of the study was provided to both outlets. Interested personnel were instructed to contact the Principal Investigator for possible study inclusion. Purposive sampling was based on a range of regions (East, Central, West) and different roles in the fire service — firefighters, fire service leaders, etc. (Palinkas et al., 2015).

Interview Methodology

Phone interviews were conducted between April 2018 and January 2019. Each interview session lasted approximately one hour and was recorded on a private, secure conference line. The interview began with an explanation of the study, including the terms of confidentiality, and participants had the opportunity to ask questions. Once participant consent was obtained, the interviewer began asking questions. The questions for the interview were developed by the research team with assistance from a stakeholder panel of fire

service experts. The interview guides ensured topic consistency among interviews and were designed to identify broad themes. As shown in **Table 1**, the open-ended questions asked about awareness of workplace violence, sexual assault in the fire service, traditions or behaviors similar to assault, and reporting patterns.

Table 1
Interview Questions

Are you aware of any experiences of workplace violence among firefighters? If yes, how were these instances handled?
What are you aware of related to sexual assault in the fire service? If affirmative, how are these instances handled?
Do you think there are rituals that have been passed down that at one time were considered tradition, but now would be considered assault or sexual assault?

Data-Analysis Procedures

Interviews were transcribed verbatim and coded for recurrent themes and divergence, consensuses and differing opinions, experiences, and perceptions about workplace violence using a grounded theory approach (Glaser et al., 1968; Miles & Huberman, 1994). Common themes were developed by using a multi-part inductive process. First, researchers reviewed transcripts to generate a preliminary set of working codes. These transcripts were reviewed by two different researchers who identified commonly occurring patterns and themes. After data was coded into major themes by hand (see Hill et al., 1997), the two primary coders compared analyses. Third and fourth researchers reviewed the findings to ensure accuracy. Thematic saturation was reached at 31 interviews, when a sufficiently diverse sample had been obtained, and no new themes were emerging from ongoing analysis.

Results

As shown in **Table 2**, the 31 participants included 15 firefighters and 16 fire service leaders. Twelve firefighters and 9 fire service leaders are quoted in this article. As a summary, firefighters 3, 5, 6, 9, 10, 11, 12, and 15 are white females; firefighter 4 is a Hispanic female; firefighter 1 and 8 are white males; and firefighter 13 is a black male. Fire service leaders 2, 4, 9, 14, and 16 are white females; fire service leader 3 is an American Indian/Alaskan Native female; and fire service leaders 11, 12, and 15 are white males.

Most participants (84%) were white and non-Hispanic. The average age of participants was 48.1 (±9.0) years, and they had an average of 22.1 (±9.4) years of fire service experience. The majority of the participants were female (61%). **Table 3 (p. 20)** presents the common themes that emerged from the data: awareness of workplace violence, types of workplace violence, sexual assault in the fire service, perceptions of reporting incidents, and disciplinary action.

Table 2
Participant Demographics

Variable	*N* (%)
Sex	
Male	12 (38.7)
Female	19 (61.3)
Race	
White	27 (87.1)
Black	2 (6.5)
American Indian/ Alaskan Native	1 (3.2)
Other	1 (3.2)
Ethnicity	
Hispanic	2 (6.5)
Non-Hispanic	29 (93.5)
Age (M, SD)	48.1 (9.0)
Role	
Firefighter	15 (48.4)
Leader	16 (51.6)
Years of Service (M, SD)	22.1 (9.4)

Note. N = number of participants; M = mean; SD = standard deviation.

Awareness of Workplace Violence

Most participants, including many fire service leaders, were generally aware of violence occurring in the workplace. A number of firefighters reported

Table 3
Thematic Summary

Main Themes	Sub-Themes
Awareness of workplace violence	• Generally aware • Not aware
Types of workplace violence	• General fistfights • Hazing
Sexual assault in the fire service	• As a type of violence • Awareness of it occurring • Not aware of it occurring
Perceptions of reporting incidents	• Incidents going unreported • Reporting discouraged • Fear of retaliation from coworkers
Disciplinary actions	• Separation of parties involved • Discrepancies based on gender

having heard about incidents. Firefighter 11, a white female, said "I've been lucky in that none of that stuff has happened to me. I only hear stories of it." Firefighter 9, another white female, said she had "heard of some physical fights bust out." Firefighter 10, also a white female, responded she was "vaguely aware, yes…I hear stories."

Fire Service Leader 16, a white female, had also "heard of [workplace violence]", although she had "not witnessed it firsthand." Other participants said they were personally acquainted with people who had been involved in violent incidents, most often sexual assault incidents. Finally, a small group of participants acknowledged being involved in workplace violence. Firefighter 3, a white female, had "been in two fistfights myself." When sharing about her involvement with hazing activities, Leader 14, a white female, noted "I'm a completely different person than I was 36 years ago."

Although some participants were unaware of workplace violence in their own organization, they noted it could occur in the fire service in general. Leader 2, a white female, was "grateful to say it hasn't happened in my department, but I know it's happened in FDNY. Guys have gotten in trouble outside of the department, but we have not had workplace violence." Firefighter 1, a white male, added "not to say it doesn't happen… I just think, fortunately, it's not super prevalent with us." Leader 15, another white male, said "I've heard it happens in the fire service, but [it is] not happening at the local level." His response was echoed by Leader 9, a white female: "I can't say I've experienced anything, or [been] made aware of anything in my state that led to the level of assault."

Types of Workplace Violence

Examples of workplace violence shared by participants can be grouped into two categories, general fistfights and hazing. Sexual assault was also a prominent example and will be discussed as its own theme. General fistfights can be described as fighting or shoving between firefighters, usually as a result of rising tension. Firefighter 8, a white male, shared an example of "physical violence even between males, where they were fighting, not getting along, some shoving." Firefighter 13, a black male, recalled "one time where a fight broke out on an incident… they got into a shoving match on the scene." Differences in personalities were mentioned as a catalyst for violence. Firefighter 5, a white female, recalled when "two firefighters didn't really get along. One of them threw something at the other."

Firefighter 3, a white female, shared her direct involvement in a number of situations, implying violence could establish a pecking order:

> I don't know if he was testing me or what. I punched him, and he stopped. He never, ever picked on me again. Ever… Same thing happened with another guy… I punched him… He never, ever picked on me again after that.

In addition to general fistfights, examples included workplace violence in conjunction with hazing. However, as Firefighter 5, a white female, pointed out, "some hazing doesn't happen to women because it would be inappropriate." Several participants described hazing practices as part of the promotional process. Firefighter 11, a white female, recalled that "a guy promotes and then his last shift before he leaves, they tie him down and pull his pants down and take a marker and write stuff on his butt." According to Firefighter 5, when firefighters pass probation:

> They usually do something to you, whether it's—I've seen people get tied up to chairs and then they take five days' worth of old, leftover food and cover you with it or strap you to a backboard and spray you down and put flour all over you.

Some stories included an element of escalation. Firefighter 8, a white male, for example, recounted the following:

> Standing in front of my firehouse…just in front of the apparatus bay, and another member sneaks up behind somebody else, a male and a male, and decides to de-pants him, and grabs his shorts, and pulls 'em down around his ankles. Now this guy's left standing in front of the firehouse naked. I don't know what more an example of bullying, harassing, and quite honestly, sexual assault, you're gonna find.

Firefighter 6, a white female, remembered that "one guy was so worried about another guy at work, he got authorization from our fire chief to carry a taser, at work." That type of escalation led several participants to acknowledge a change in culture. According to Fighter 8, a white male, "it was just boys being boys, and boys having fun." However, Leader 4, a white female, acknowledged that "things have changed… I think touching anybody now is a little bit more sensitive than when I came in."

Leader 11, a white male, noted a change in firefighters who "read about hazing rituals that come to light and thankfully, when they do come to light, many firefighters think to themselves or out loud, 'What the hell were they thinking doing that?'" Leader 12, another white male, echoed that sentiment: "I think in today's firehouse it's just a different culture…There's a lot of training from an HR perspective out there, and leadership and development training on what's acceptable and what's not."

Sexual Assault in the Fire Service

The topic of sexual assault came up often in participant responses, even before the interview question was explicitly asked. When asked directly if sexual assault occurs in the fire service, two groups of answers were shared. A few participants were not aware of it occurring, but the majority stated that they were. Several participants shared personal experiences. Firefighter 3, a white female, recalled "one time I was taking a nap. Two of the guys in camp woke me up by dry-humping me."

Female participants described behaviors ranging from inappropriate comments to sexual assault. Firefighter 4, a Hispanic female, remembers officers "making comments about my body parts for weeks." Firefighter 15, a white female, described the following:

> [behavior escalating] for many months into more verbal sexual advances, which escalated into actual sexual assault. He would grab me and corner me pretty much in every area of the station he could… After that one incident, he had raped me multiple times for months.

Some participants shared stories of colleagues who had been sexually assaulted. Leader 4, a white female, said, "I know two women who've been raped. I know several women who have been fondled, touched, [and] exposed. We have a guy who exposed himself in this woman's bunkroom." Firefighter 10, a white female, had a "colleague that was held down, and some men tried to basically physically assault her." Leader 3, an American Indian/Alaskan Native female, provided several examples:

> I have actually known personally three women, one of whom was raped by her commissioner. One was dick-whipped. She was in her bed. They came in. They held her down, and one of the guys took out his penis and proceeded to slap her with it.

Firefighter 4, a Hispanic female, "was told the story of how [a male perpetrator] intended to have sex with [another female firefighter], whether she said yes or not, and the other two males in the station were aware of his intentions."

Perceptions of Reporting Incidents

Discussing workplace violence, including sexual assault, is a first step toward providing a safe working environment in the fire service. As Leader 3, an American Indian/Alaskan Native female, explained, "[sexual assault is] …so disgusting, but I am glad to see that it's coming to light more and more."

Reporting incidents of workplace violence can also increase awareness of the problem, but not all participants were supportive of the notion. Responses described incidents not being reported at all, reporting being discouraged, and retaliation for reporting.

Although policies and training may encourage firefighters to report incidents of workplace violence, the reality is that many firefighters choose not to. There is a cultural norm or unwritten rule to not report incidents. As Firefighter 3, a white female, noted, "me filing a formal complaint is not gonna make my life easier. It's not gonna do anything to benefit me."

In addition to cases of sexual assault going unreported, reporting is actively discouraged. As Firefighter 10, a white female, explained: "Unfortunately, typically the female is highly encouraged to keep her story to herself; either she's encouraged to leave or just let go."

If a woman does file a report, it is not always well-received by Command. Leader 3, an American Indian/Alaskan Native female, shared the story of a woman who suffered retaliation after filing a formal complaint: "She walked into her battalion chief's office [and] gave him the letter. He looked at it, looked up at her, and said, 'well, I'm gonna show you where I'm filing this.' He threw it in the trash."

Examples of retaliation were a common response, especially for women, many of whom had no recourse. As Leader 4 explained, many victims could not "report [the incident] cuz the retaliation was far worse than the assault." According to Firefighter 11, a white female, women have "suffered a whole bunch of backlash." She went on to explain: "people don't believe her because that tends to be the rule. They just figure the woman's making up the story."

Firefighter 3, a white female, recounted how, even when she defied threats of retaliation, nothing changed:

> The guys even said, "If you complain or sue or pitch a fit, they're never gonna hire you, because you're gonna be the complainer, the whistleblower; no one wants a girl like that." …Every single time I complained, it never got better, and it just made things worse for me.

Firefighter 12, a white female, spoke to issues in the process of reporting and suggested the system was designed to deter victims instead of assisting them:

> When I called HR at the time, I said, "I'm being retaliated against for not lying, but if I put a claim and they investigate, there will be more retaliation." HR told me, "You're right. The onus is on you to prove the retaliation, so they'll probably win. Most people decide just not to report it."

Disciplinary Actions

When incidents of workplace violence were reported and moved through the process, the results were varied. Resolution usually involved physically separating the parties involved, such as moving personnel to separate stations or shifts. Firefighter 5, a white female, recalled the parties "were moved to different stations so they wouldn't be working together." Firefighter 9, a white female, described a move which usually "kept them at different stations as much as possible and stuff like that [to] try to prevent it." Leader 4, a white female, noted the separation of involved parties was immediate: "anytime someone files [a complaint about] a hostile work environment or workplace violence."

Although separating the parties involved was a common response to incidents of physical aggression, several participants reported that, after an incident and formal complaint, disciplinary measures for men and women were disproportionate. Males would be minorly disciplined. Women faced more major discipline, including reassignment, while being labeled as difficult or whistleblowers. Firefighter 12, a white female,

shared how "the union took [the male perpetrator] away for 30 days of treatment somewhere. He comes back. He keeps his work assignment. She gets moved... She has to wait until he leaves before she feels safe working an overtime shift." Firefighter 15, a white female, provided an example of discriminatory discipline at the officer level: "They ended up firing me. They let him resign."

Discussion

Current media attention to workplace violence and activism such as the #MeToo movement are shifting the conversation about acceptable behavior (Brown & Battle, 2019). The fire service is not and should not be immune to this social change. Historically, the fire service has been dominated by white males. Women have worked hard to gain access to firefighting positions and promotions, and their struggle continues.

Recent research by Jahnke et al. (2019) has highlighted issues such as bullying, hazing, and verbal, written, and sexual harassment of women in the fire service. The authors discuss the impact of these behaviors on the health and well-being of female firefighters. For example, they found that women who experienced harassment or discrimination reported 40% more poor health days in a 30-day period and were up to 120% more likely to report an injury during a single year. Women who experienced the greatest severity of harassment or discrimination were 300% more likely to experience depressive symptoms, had higher levels of anxiety, and were 150% more likely to meet the threshold for post-traumatic stress.

Research presented here adds to the growing body of literature focusing on workplace violence in the fire service. Participants in our study discussed serious incidents of workplace violence, including sexual assault — an act that is unnerving to consider in the workplace. Firefighters spend nearly a third of their lives in the firehouse. It should be a place of comfort among family, not a place of fear.

Additional remarks from participants indicate there is a need for sweeping policy changes in the fire service — from addressing personnel behavior to handling reports of violence. Leaders, including shift and crew captains, should be educated on how to handle interpersonal conflicts within their departments. Reporting an incident should never be discouraged or reason for retaliation. Although organizations reserve the right to assign personnel to different shifts and/or stations after an incident, it is important that reassignments be fair to both parties.

Every department should have policies in place to deal with complaints of workplace violence, including sexual harassment, abuse, and assault. These policies should have clear guidelines about the reporting process and the investigation of the incident. They should also include guidelines and procedures for safe separation of involved members, maintaining confidentiality regarding the issue, and any disciplinary measures administered.

A number of findings emerged from this investigation, many of which shed light on previously ignored areas of the fire service. However, the study has several limitations that should be noted and improved upon in future research. First, the participants were predominately white. Based on research citing high rates of workplace bullying and harassment against racial and ethnic minorities (Griffith et al., 2016), examining workplace violence against fire service personnel from racial and ethnic minority backgrounds is key to providing a comprehensive look at the issue.

Future research would also benefit from having participants that represent a wider range of ages and years of experience in the fire service. The average age of these participants was older than the average age of firefighters nationwide (48.1 years compared to 38.8 years; Data USA, 2019). This age difference may impact younger firefighters' perspectives about the work environment, conflict management, and coworker relationships. Finally, the small sample size should be noted. While saturation was reached and common themes emerged from the data of 31 interviews, care should be taken when generalizing conclusions from this sample to the larger fire service.

Despite these limitations, our study provides a strong foundation for future research on workplace violence in the U.S. fire service. Data from these participants revealed an awareness of workplace violence, from fistfights to hazing to sexual assault. Most participants were aware of sexual harassment, abuse, or assault in the fire service, even if workplace violence was not prevalent in their respective departments. Finally, personal accounts of obstacles to reporting these incidents — from discouragement to retaliation — indicate the need for improved policies and guidelines. These findings suggest that increased awareness, effective reporting procedures, and fair disciplinary action are essential to creating a safer and more inclusive fire service culture for all.

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Exploring Variation in Knowledge and Practice of Post-Fire Suppression Contamination Control Procedures Among New Jersey Volunteer Fire Departments: A Qualitative Study

Abstract

The purpose of this qualitative study was twofold. First, we identified post-fire suppression contamination control procedures used in 10 New Jersey volunteer fire departments. These decontamination (decon) procedures remove hazardous contaminants from firefighters' gear and equipment (see Burgess et al., 2020; Fent et al., 2017; Fent et al., 2020), Second, we determined the challenges these 10 departments faced in implementing the decon best practices recommended by NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* and several academic studies. Data was gathered using semi-structured telephone interviews with a member of the leadership team in each of the 10 New Jersey volunteer departments. Thematic analysis of these interviews revealed significant variation in the post-fire suppression contamination control practices implemented by the 10 departments. Although the interview participants were highly aware of the health risks that firefighters face and the importance of decon control measures, many departments did not implement the recommended best practices. Financial and time constraints were identified as significant challenges to implementing comprehensive decontamination control procedures.

Keywords: firefighter, contamination control procedures, volunteer fire departments

Firefighters face significant long-term health risks, including cancer-related morbidity and mortality. Several epidemiologic studies suggest that firefighters have an increased risk for cancer when compared to the general population (Daniels et al., 2014; LeMasters et al., 2006; Pinkerton et al., 2020; Pukkala et al., 2014). The meta-analysis of 48 studies by Jalilian et al. (2019) supports these findings. This meta-analysis found significantly elevated risk estimates for cancers of the colon, rectum, prostate, testis, bladder, thyroid, pleura, and malignant melanoma and increased mortality rates for rectal cancer and non-Hodgkin's lymphoma among firefighters (Jalilian et al., 2019).

While performing fire suppression duties and routine training drills, firefighters are exposed to multiple known and suspected human carcinogens, including polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and persistent organic pollutants (POPs) (Alharbi et al., 2021; Baxter et al., 2014; Fabian et al., 2014; Fent et al., 2014; Fent et al., 2015; Fent et al., 2020; Stec et al., 2018).

In light of these exposures, the National Fire Protection Agency (NFPA), an organization that publishes consensus technical standards and codes intended to minimize the possibility and effects of fire and other risks, developed a standard for the selection, care, and maintenance of firefighters' protective ensembles (turnout gear) (NFPA, 2020). Turnout gear consists of the garments (e.g., jacket, pants), helmet, gloves, boots, and interface components (e.g., hood, wristlet) designed to protect firefighters from some risks of emergency incident operations, including structural firefighting. NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, provides a detailed set of recommendations for the decontamination of turnout gear, an important contamination control practice intended to reduce firefighters' exposure to harmful contaminants.

Post-fire suppression decontamination (decon) procedures are a primary cancer prevention strategy that can be directly implemented by members of the fire service (International Association of Fire Chiefs [IAFC] & National Volunteer Fire Council [NVFC], 2018; Jahnke, 2016; Stull & Stull, 2014a, 2014b). Contamination control practices, such as decon, remove hazardous contaminants from firefighters' gear and equipment (Burgess et al., 2020; Fent et al., 2017; Fent et al., 2020). Other decon strategies, including application of skin wipes and showering as soon as possible following a fire response, have mitigated secondary skin exposures (Beitel et al., 2020; Stull et al., 2018).

According to Fahy et al. (2021), volunteer firefighters make-up the majority of the United States (U.S.) fire service, 67% (over 722,000). However, little research has been conducted on the health risks, exposure hazards, and contamination control practices of this group. Although most studies have focused on career (paid) firefighters, the volunteer and career sectors of the U.S. fire service differ demographically and geographically. The volunteer sector has a higher percentage of female volunteer firefighters than the career sector (10% vs. 4%), and a higher proportion of volunteers serve small, rural departments in the youngest (<30 years old) and oldest (50+ years old) age categories (Fahy et al., 2021). These differences suggest that volunteer firefighters' susceptibility to adverse health effects may vary substantially from the susceptibility of career firefighters.

Volunteer firefighters perform many of the same firefighting tasks as their career counterparts, but they often do so with fewer resources for risk mitigation measures such as contamination control. Anecdotal findings from the New Jersey Firefighter Cancer Assessment and Prevention Study (CAPS), a partnership between public health researchers and the volunteer fire service, suggest that the implementation of comprehensive contamination control procedures is a top priority for many volunteer fire departments. However, the extent to which volunteer fire departments implement these practices is unclear, and the challenges to doing so have not been systematically identified.

Methods

This study is part of a multi-year research project at the Rutgers School of Public Health funded by a grant from the Fire Prevention and Safety, Research and Development Grant Program at the Federal Emergency Management Agency (FEMA). The research project, titled "Firefighter Cancer Assessment and Prevention Study," is designed to investigate decontamination control procedures and challenges to their use among volunteer fire departments in New Jersey. Findings from the research can inform the development of future guidelines and interventions that may improve the use of contamination control practices within the volunteer sector of the U.S. fire service. This section discusses the methodology used in our study.

Study Population

According to the latest report from the state's Division of Fire Safety (New Jersey Department of Community Affairs & Division of Fire Safety, 2020), 80% (about 28,000) of New Jersey's firefighters are volunteers. The structure of the state's volunteer fire organizations varies. Some organize themselves into a single department, while others use smaller units, districts, or companies. Regardless of size, all fire service organizations included in this study are referred to as departments.

Sampling

New Jersey's 21 counties were divided into 11 distinct sampling regions based on shared county-level demographic and fire service characteristics such as population density, median household income, number of volunteer fire departments, racial/ethnic makeup of the county population, and number of firefighters (see **Table 1**). Next, a comprehensive list of all volunteer and combination (volunteer/paid) fire departments was compiled for each sampling region, using a directory obtained from the New Jersey Department of Community Affairs, Division of Fire Safety. Finally, 10 volunteer-only departments were randomly selected from each sampling region and contacted about participation in the study. The goal was to conduct an interview with a member of the leadership team in one fire department per region. Researchers used the email address, physical address, and/or phone information provided in the directory to notify departments of their selection for the study. Follow-up contact information was obtained from online searches, as needed. Each department received a minimum of six contact attempts, using at least two forms of contact (e.g., phone call and email, phone call and physical mail). If contact was unsuccessful after six attempts, outreach commenced to the next department on the list for that sampling region until an interview was completed.

Table 1

County- and Department-Level Characteristics of Participating Fire Departments

Fire Department[a]	Sampling Region	NJ County	Population (Municipality)	Median Household Income (County)	# of Active FFs	% Annual Call Volume (Structure Fires)[b]
A	1	Ocean	60,000–70,000	$75–$100,000	>250	2%
B	2	Hunterdon, Sussex, Warren	50,000–75,000	$60–$75,000	25-<40	0%
C	4	Passaic, Union	10,000–<20,000	$100–$130,000	40-100	12%
D	5	Essex	5,000– <10,000	$100–$130,000	25-<40	4%
E	6	Morris, Somerset	10,000–<20,000	$75–$100,000	40-100	3%
F	7	Middlesex	50,000–75,000	$75–$100,000	<25	2%
G			50,000–75,000	$75–$100,000	<25	3%
H	8	Monmouth, Burlington	5,000– <10,000	$100–$130,000	40-100	2%
I	9	Camden	5,000– <10,000	$60–$75,000	25-<40	N/A[c]
J	10	Gloucester, Cape May	5,000– <10,000	<$60,000	25-<40	2%

[a] No fire department was enrolled from Region 3, which included Bergen and Hudson counties, or Region 11, which included Salem, Cumberland, and Atlantic counties. [b] Fire department 2019 annual call data obtained from National Fire Incident Reporting System (NFIRS), NJ Department of Community Affairs, Division of Fire Safety. [c] This fire department did not complete incident reports through NFIRS in 2019; therefore, no call data was available.

Data Collection

Prior to the interviews, the chief or another designated fire department representative completed an online survey to provide background information about the department, including the number, type, and location of physical structures (e.g., fire stations) and the number of fire department members. Additional county- and municipal-level demographics and fire service-related data for each fire department were gathered from the Census Bureau and New Jersey resources online. These data provided additional context for the interviews and allowed some portions of the interview guide to be customized to the individual fire department.

Interviews

Interviews were conducted from April to September 2020. In-person interviews had been planned. However, due to the COVID-19 pandemic, interviews were conducted remotely using the Cisco Webex® video conferencing platform. All interviews were conducted by one author and observed by a second author. All interviews were audio recorded with the permission of participants. Research technicians used Temi®, a web-based tool for audio-to-text transcription, to transcribe the interview recordings. These transcriptions were reviewed and edited by study team members who had observed the interviews.

The interview questions covered a range of topics, including general department operations, membership recruitment and retention, and record-keeping practices. The discussion topics also included challenges to and facilitators of contamination control procedures (see **Table 2**). The interviews were conducted using a guide developed by the study team with input from local fire service partners and coauthors. Before the interview guide was finalized, a practice interview was conducted with a chief administrator of a volunteer fire department and a coauthor of the study team.

Table 2

Semi-Structured Interview Guide: Topics and Probes

Volunteer Fire Department Membership
• Motivations for joining the department
• Demographics and membership trends
• Recruitment and retention
Infrastructure and Response
• Fire stations and apparatuses
• Trends in call volume/type
• Dispatch process for firefighters
Record-keeping Practices
• Membership and training records
• Incident records
• Contents, format, and availability of records
Training
• Training for new and incumbent firefighters
• Content and schedule
• Inclusion of cancer prevention topics
Contamination Control Procedures
• On-scene decon procedures
• Gear care, cleaning, and maintenance
• Contamination control SOPs/SOGs

Data Analysis

Thematic analysis of the interviews was conducted to describe common themes, key concepts, and repeated words/phrases that emerged during the interviews (Austin & Sutton, 2014). The interview guide and discussion topics were used to generate the code dictionary, summarize key findings in each interview, and make comparisons between interviews. The interview transcripts were analyzed with ATLAS.ti®, a computer-assisted qualitative data analysis software (ATLAS.ti Scientific Software Development GmbH, Version 8 Windows), and codes were applied to their respective sections. Comparisons of the coded transcripts were conducted to assess variation in knowledge and practices among participants.

Results

Interviews were conducted with one representative from 10 volunteer fire departments in 9 of the 11 sampling regions designated for this study (see Table 1). The representatives were members of the volunteer department's leadership team, often the chief or another designated officer. Two interviews were conducted with departments from Sampling Region 7. Interviews were not conducted with departments from Sampling Regions 3 and 11 because their departments did not respond to our request for an interview. The interviews ranged in length from 30 to 45 minutes.

Five major themes related to fire department contamination control procedures emerged from these interviews:

1. General exposure/health concerns and motivations for performing contamination control
2. Current contamination control procedures, including cleaning and maintenance of turnout gear
3. Training on contamination control practices
4. Challenges to meeting contamination control practices recommendations and standards
5. Changing culture and norms surrounding contamination control practices.

General Exposure/Health Concerns and Motivations for Performing Contamination Control

All fire department representatives who participated in the interviews acknowledged the hazards that firefighters encounter while performing their firefighting duties. Many participants began their discussion of post-fire suppression contamination control practices by noting the numerous contaminants that firefighters are exposed to during a response:

> I always consider a structure fire as [a] hazardous condition… We're entering an atmosphere that does not sustain human life, so I treat every call other than a CO [carbon monoxide] alarm or a possible smoke detector as a hazardous condition because they all are.

Because volunteers often use personal vehicles for transportation to and from the fire scene, this exposure can also put family members at risk: "We don't want them to take carcinogens home to their families or in their vehicles." When acknowledging the presence of carcinogens, smoke, and other harmful chemicals, one volunteer representative specifically mentioned plastics:

> We deal with a lot of plastic. I mean… [at] the last structure fire we had… [the] … smoke was… [very] black … and all of us [firefighters] were exposed to that. And you know, you have to decontaminate that [turnout gear]. You can't just get back to the firehouse, hang up your gear… or you'll probably never get rid of all of it [the contamination].

Concerns about exposures and decontamination procedures often revealed a growing awareness of cancer-related morbidity and mortality within the fire service. One participant clearly stated: "As you know, the number one killer of firefighters, of course, is cancer." Another participant echoed this assertion, attributing his increased awareness of cancer prevention to the personal experiences of fellow firefighters with the disease: "Unfortunately, we've had firefighters that have been through cancer treatment and have spoken at some of the trainings in the firehouse about the importance of it [cancer prevention]. So right now, it's very high on their radar."

Current Contamination Control Practices, Including the Cleaning and Maintenance of Turnout Gear

The adoption of contamination control practices described by the participants varied considerably from one department to another. Several differences were cited in the implementation of contamination control, including on-scene procedures, availability and use of decon equipment, transportation practices, and gear washing.

Although seven out of the 10 volunteer fire departments reported performing some type of wet decon on scene following a structure fire, the specific procedures differed. In some departments, all firefighters who participated in interior response were rinsed down. According to one participant: "For any kind of structure fire or anything like that, we'll usually hose guys off after the call. You know, just give a quick rinse down and then, you know, they get back to the firehouse." Another participant acknowledged that, in his department, only firefighters with "visibly contaminated" turnout gear were hosed down: "Honestly, it's [contaminated turnout gear] probably going back to the firehouse and then from there the guys will take their gear off."

Most departments used water alone for wet decon. Only four out of the 10 departments reported using soap or some type of surfactant. One participant described a recent change in departmental practice:

> Usually, it's just a quick rinse down. I actually just ordered, a month ago, what they call a wet mitigation soap, which we can put into a pump sprayer and actually [use to] spray the turnout gear on scene. It's like… I guess it's called a washless soap, so it's supposed to start to clean off some of the particulates at the scene.

Participants also discussed departmental practices regarding contaminated turnout gear, including the doffing, transporting, and cleaning of PPE following a working fire response. Firefighters in only two out of 10 departments consistently doffed and bagged their gear on scene. According to one participant, "It [doffed turnout gear] goes back in the truck next to you, or in the front unit, depending on how many people were in the truck at a time." Another participant described how turnout gear was "put into a big trash bag and then put in a utility truck [open pick-up truck]." Typically, participants reported that department members did not fully doff their gear until they returned to the fire station. In some departments, doffing turnout gear on scene depended on its condition.

Some departments had clear requirements for laundering contaminated turnout gear. One participant reported the following procedures: "Our requirement for [cleaning] our fire gear is after every working fire or, at least once every six months, [their] gear has to be cleaned in our washer extractor." Other departments lacked well-defined expectations, as suggested by the participant who said, "We try to get the gear washed at least once a year." In some cases, gear washing was left to the individual firefighter's discretion.

One participant reported that their fire department officers are tasked with conducting visual gear inspections after vehicle or structure fires to ensure firefighters launder their turnout gear in a timely fashion:

> Normally, within 24 hours, we do an inspection of gear, and the guys are required to clean their turnout gear within 24 hours after a fire call… We go through and then we hang a notice on the locker of any turnout gear that needs to be washed.

Participants also indicated whether the fire station(s) in their department had gear extractors on-site. Seven out of 10 of the fire departments had a washer at each of their fire stations. The remaining three departments used different strategies for cleaning turnout gear in the absence of a specialized washer. These strategies included washing their gear at another fire company or neighboring fire department, using a household washer with a special gear wash chemical, or sending their gear out to be laundered by a third party. According to one participant:

> If you were actually in the fire [interior response], the chief will take your gear and have it laundered at a service for you. If you were kind of working on the outside, we'll just do a garden hose kind of thing and let your gear dry. We have a dryer, but we don't have a washer.

In order to remove any remaining contaminants and reduce the likelihood of further contaminant absorption into the body, it is recommended that any firefighter who participates in high-exposure duties, such as interior fire attack, primary search, overhaul, roof, or ventilation operations take a shower as soon as possible upon returning to the fire station (IAFC & NVFC, 2018). One participant acknowledged the difference between what "they always say" and what volunteers actually do:

> They always say, and I don't know how many guys follow through, but you're supposed to go home and shower as soon as possible. You know, scrub out all the areas, wash behind your ears, and all the stuff that you probably miss.

While "shower within the hour" is recommended, only one of the 10 volunteer departments had showers in their fire station. Firefighters from the other nine departments were not able to shower until they returned home after a call. This issue is further complicated by the fact that volunteers often return to work after a call, rather than going directly home or, if they do go home first, their time there is limited. As another participant explained:

> One of the big things we push is 'shower within an hour.' You know, not every call is in the middle of the day. Sometimes it's, you know, late at night and everybody's got to work the next day. But we try to, we try to push the members [to] "take a shower when you get home."

In spite of these differences, the interview results shared a common theme: that procedures and practices for contamination control are a continually evolving process. As one participant summarized: "This is one of the areas we have struggled in, but we've made significant progress."

Training on Contamination Control Practices

All of the fire departments held regular training activities for their active members. Larger departments trained within companies and tended to do so weekly. Small departments typically held bimonthly or monthly training sessions. These sessions, sometimes referred to as "training," "work nights," or "duty crews," generally consisted of group drills on technical skills. Some equipment and apparatus maintenance were also performed during these sessions. In the three volunteer fire departments where contamination control was integrated into regular training, members with specialized training, such as emergency medical services (EMS) providers or certified fire instructors, were identified as the driving forces behind the inclusion of these topics.

Seven out of 10 departments did not include contamination control practices and/or cancer awareness in their regular member training sessions. These participants described a 'teach as we go' approach to contamination control, in which new firefighters were primarily taught by example from incumbent firefighters:

> The washers are labeled on what they should do and what settings they should put the gear on. So it's pretty self-explanatory… When they come in after a fire or something, they're going to decon themselves, get showers, and when they clean gear, they're doing it as a group.

In some cases, the 'teach as we go' approach was used despite the existence of departmental written standard operating procedures (SOPs) for decon, laundering, and/or personal hygiene. As one participant explained: "It's kind of one of those things… It's written down, but it's not something that we actually just train on. You know, it's just… this is what we got to do."

Challenges to Meeting Recommended Contamination Control Standards

While discussing current contamination control practices, several participants acknowledged areas in need of improvement within their department. According to one participant:

> When you come off the truck [back at the fire station], you just take your gear off… I know probably we're not doing it the way it should be [done]. Because you're taking the turnout coat that was in a working fire, and you're putting that gear back inside the driver's compartment… Normally, if it's not really that big of a fire, you're going to get back in the engine or the ladder [with your gear]. You might not have that turnout coat on, but it'll probably be at your feet or in the dog house, which is the engine compartment.

In many cases, participants demonstrated knowledge of best practices, indicating that, rather than a lack of education, there were other challenges preventing the departments from meeting established standards. Financial challenges were the most common barrier facing the volunteer fire departments that were trying to implement comprehensive contamination control practices. These financial concerns, echoed by all participants, resulted from fluctuating municipal budgets, an increasing need to augment operating costs with grant funding, and the high cost of some contamination control-related equipment (e.g., second sets of turnout gear, extraction washers). According to one participant: "In previous years, we had a council that wasn't very receptive [to department needs], and a very nice, generous person donated money to get our gear cleaned and inspected." Another participant responded: "We got a grant years ago, which we used to purchase an industrial washer and industrial dryer."

When discussing financial challenges, all participants brought up the high cost of turnout gear and their goal to provide firefighters with the recommended second set of gear. While additional sets of turnout gear are not explicitly required to conduct proper cleaning, they can prevent firefighters from being considered 'out of service' while their gear is being cleaned. One participant explained that, in his department:

> We are lucky enough where we don't have those back-to-back fires, so I have the time to clean guys' gear and stuff like that. I would love, I'd absolutely love to have two sets of gear for each firefighter, but unfortunately I don't ever see that happening.

Another participant added: "I would love to do that [purchase second sets of turnout gear], but when you talk about an annual budget, that is so expensive. My administration, they would never go for it."

At the time of the interview, none of the departments had been able to meet this goal. However, all organizations were trying to do so. When asked how many of their active firefighters had two sets of gear, estimates ranged from 30–80%. Participants noted that budgetary restraints were normally the determining factor in a department's ability to purchase firefighters two sets of gear. After purchasing gear for new members of the department and replacing and repairing existing gear, funds were just not available to provide each active firefighter with two sets of gear. According to one volunteer representative:

> We struggle with not having two sets [of turnout gear] for each firefighter, but over the last few years we've replaced gear. We've asked the firefighters to wash their old gear and bring it to our office. We send it to an independent contractor to be repaired and then really cleaned. They send it back to us, and we leave it with the firefighters so they will have two sets of gear. That should help us get through the decontamination process.

Participants cited competing time commitments as another challenge to completing certain firefighter duties. According to one participant: "A lot of the guys, they're juggling, like myself for example, juggling 20 hats: being chief, public information officer, training, doing this [participating in research], even though there's still a handful of guys that do other jobs."

Job demands and responsibilities at home present additional challenges to volunteer firefighters tasked with completing duties such as training and/or post-fire suppression decon. As another participant explained:

> There's so much required training that they [volunteer firefighters] have to do. You know, it's hard in a volunteer setting. Some people work two jobs and raise a family and everything, so it's hard for people to get all that training in.

Changing Culture and Norms Surrounding Contamination Control Practices

Many participants discussed changing culture and attitudes related to contamination control practices within their fire departments. As one participant recalled: "You know, candidly, years ago… we never even thought twice about it [contamination control procedures]. Most guys were like, 'Yeah, whatever. It's [contamination on turnout gear] fine, it's a badge of honor, my stuff's dirty, that looks cool.'"

These changes in culture and attitude may parallel increasing concerns about the growing health risks facing firefighters. As another participant explained, "Years ago it was, it was like a badge of honor. They have dirty gear and a dirty helmet. And, you know, now it's leaning more towards where you want to have stuff, you know, clean."

Participants noted that age and firefighting tenure often influenced acceptance and adoption of new decon practices. Most fire departments described their struggle to increase adherence to new decon polices among older, more experienced firefighters who were accustomed to traditional practices. Conversely, in some cases, younger, less experienced firefighters were the ones less likely to follow new decon procedures. As one participant explained:

> The older generation of members actually are more intrigued [by new decon practices] because of all the years that they were exposed to these things [contaminants] and never had these precautions. Now they're buying into it and they're easy, more easy to bring along than the younger members.

Discussion

The purpose of this qualitative study was to explore the variation in post-fire suppression contamination control procedures utilized by New Jersey volunteer fire departments and to describe the challenges they faced in implementing best practices. While there is a growing body of scientific literature examining decon knowledge and practices among career firefighters, research on the use of these practices among volunteer firefighters, the understudied majority of the U.S. fire service, is limited (T. R. Harrison et al., 2018; Louzado-Feliciano et al., 2020). The extent to which volunteer fire departments are knowledgeable about and able to implement recommended decon practices is largely unknown.

Thematic analysis of these semi-structured interviews revealed significant variation in post-fire suppression contamination control practices among these volunteer fire departments. While interviews revealed a high level of awareness regarding health risks facing firefighters and the importance of control measures, many departments did not implement the recommended best practices at that time. These volunteer fire departments also faced challenges, including financial and time constraints, when trying to promote comprehensive contamination control.

In discussions about fire suppression and subsequent contamination control practices, we observed a high level of awareness regarding harmful firefighting-related exposures among the leadership of the volunteer fire departments interviewed. This high level of awareness was consistent with previous research which identified exposure to cancer-causing agents, including those resulting from combustion of common

synthetic materials, as a leading concern among members of the U.S. fire service (Jahnke et al., 2012). Anderson et al. (2017) identified similar concerns among career firefighters in Florida, including on-scene exposures, contaminated gear, and diesel exhaust. Maloney et al. (2021) found that firefighters consider themselves at very high risk for many chronic illnesses, including heart disease, lung disease, and cancer, as a result of these exposures.

Significant variation in contamination control practices was reported by the volunteer fire departments in this study, including differing combinations of the following elements: on-scene gross decon, doffing, transport and cleaning of turnout gear, and additional decon procedures performed upon return to the fire station. None of the approaches described by participants fully complied with current guidelines, and the practices received inconsistent application. These findings suggest that, despite the existence of national standards and recommendations from fire service organizations (e.g., IAFC & NVFC Lavender Ribbon Report, 2018; Washington State Council of Fire Fighters [WSCFF] Healthy in, Healthy Out, 2016), some volunteer fire departments do not fully implement the most commonly recommended post-fire suppression contamination control practices (IAFC & NVFC, 2018; NFPA, 2020; U.S. Department of Labor, Occupational Safety and Health Administration, 2020; WSCFF, 2016).

To address the gaps in contamination control practices revealed in these interviews, fire departments could implement small, cost-effective strategies that would increase adherence to current recommendations. For example, departments could provide trash bags and instruct firefighters to properly doff (Kesler et al., 2021) and bag their turnout gear on scene following wet decon. Gear-filled bags could be transported back to the fire station in an exterior apparatus compartment or in the bed of a utility vehicle. Bagging contaminated gear would reduce firefighters' exposure to the off-gassing of volatile chemicals from the turnout gear. (Fent et al., 2017; Fent et al., 2015; Kesler et al., 2021; Kirk & Logan, 2015).

Another effective low-cost approach to contamination control is to incorporate soap into on-scene wet decon, rather than water-only decon approaches to scrubbing gear (Calvillo et al., 2019). In fact, one study found that using soap in wet decon reduced the polycyclic aromatic hydrocarbons (PAHs) in gear contamination by 85%. PAHs are a class of combustion by-product compounds that include known, possible, and potential carcinogens (Fent et al., 2017). The use of trash bags and dish soap in on-scene preliminary exposure reduction are just two examples of inexpensive interventions that do not require technical training or significant financial investment.

Few departments currently include contamination control procedures in their regular training exercises, so it was not surprising that many participants reported inconsistency in the application of these practices among their firefighters. In order to maintain operational safety, leadership must ensure their members understand, continually review, and train on all department SOPs, including post-fire suppression decon (NVFC, 2018).

Discussions focused on challenges that New Jersey volunteer fire departments faced in implementing comprehensive decon procedures were particularly informative. Financial constraints received unanimous mention as a significant challenge to meeting these recommendations. Most participants reported that fiscal constraints prevented investments in some contamination control equipment such as second sets of turnout gear, extraction washers, and gear dryers for their station(s). The cost of a full set of turnout gear can exceed $10,000. Moreover, volunteer departments typically operate with fewer resources compared to most career departments (IAFC, 2014). Participants' concerns about fiscal constraints were consistent with prior research, which identified structural issues such as cost and accessibility as challenges to obtaining and maintaining turnout gear among rural volunteer firefighters (Macy et al., 2020). In comparison to their career counterparts, volunteers often lack the resources needed to properly clean and retire turnout gear according to NFPA standards (Hwang et al., 2019).

As demands on fire departments increase and local government budgets shrink, there is a critical need for innovative and effective methods to obtain funding. This is especially true for rural and volunteer fire departments who typically have access to fewer resources (United States Fire Administration, 2012). These financial challenges further underscore the need for volunteer departments to take advantage of low-cost practices that can be easily implemented.

While many participants noted changes in the health and wellness culture of the fire service, they presented differing accounts of how these changes played out in their respective departments. In some organizations, veteran firefighters embraced new decon practices more easily than younger firefighters. Previous research has suggested that, in this situation, senior firefighters exhibit a strong influence over younger firefighters and may have a positive impact on their decision-making as it relates to decon and PPE (Maglio et al, 2016). Other departments reported that their younger firefighters readily participate in decon activities, while veteran firefighters are less likely to follow new SOPs. This dynamic may result from cultural changes happening in the fire service at large, where new firefighters are taught to see dirty turnout gear as a potential health hazard, rather than a badge of honor (T. Harrison et al., 2017).

This qualitative study is not without limitations. The study group was limited to volunteer fire departments in one state, although the departments varied considerably in their size, structure, composition, and the communities they served. Future studies in which interviews and/or focus groups are conducted with departments from different geographic regions may further our understanding of contamination control practices among volunteer firefighters. However, it is worth noting that while generalizabilty of findings is an important consideration, it is not normally a chief goal of qualitative research (Austin & Sutton, 2014). It may also be beneficial to include the perspectives of other fire department members (e.g, training officers, health and safety officers, rank and file firefighters) in future studies.

Despite its limitations, this study also has several strengths. First, it provides valuable insight into an understudied group within the U.S. fire service: volunteer firefighters. This study collected information on a wide variety of contamination control-related topics, including current practices, challenges, knowledge, and attitudes, which help paint a more complete picture of the reality facing New Jersey volunteer fire departments. The use of semi-structured interviews, as opposed to a survey instrument, allowed the study team to probe certain topics in more detail and make adjustments to questioning in real time, depending on participants' responses.

The findings of this study suggest that, although there is significant diversity among volunteer fire departments in terms of contamination control practices, these organizations also share common challenges and concerns. There is significant knowledge and concern surrounding cancer in the fire service. There is also a strong body of research demonstrating that contamination control procedures effectively remove carcinogens from firefighters' gear, bodies, and equipment. These are primary cancer prevention practices that members of the fire service should be implementing. This research further supports a need for strategies to help volunteer departments meet the contamination control recommendations that are tailored to their organizations.

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"They're Just Never Told That They Can": Recruitment and Retention of Women in the Fire Service

Abstract

The percentage of females in the U.S. fire service is low. In 2018, only 8% of firefighters were women (National Fire Protection Association [NFPA], 2020). To better understand the reasons for this low participation rate, we analyzed responses from telephone interviews and focus groups conducted with 87 firefighters and fire service leaders in 2013. Analysis of these responses identified several reasons why it is so difficult to recruit and retain women firefighters. A better understanding of these reasons, including the unique challenges that women firefighters face, is essential to increasing and supporting their active participation in this profession. Tactics used to improve the recruitment and retention of women in the fire service are also discussed.

Keywords: firefighters, recruitment of women firefighters, retention of women firefighters, recruitment challenges, retention difficulties

The large presence of women in the United States labor force is well documented. In 2018, for example, females occupied 46.9% of the civilian workforce (U.S. Department of Labor, n.d.), and their rate of participation in the workforce stood at 57% (BLS Reports, 2021). However, women in uniformed occupations are significantly underrepresented relative to this share of total employment. In 2019, women accounted for 17.6% of police and sheriff's patrol officers, and 30% were employed as bailiffs, correctional officers, and jailers (Hussain, 2022). In 2020, the U.S. Department of Defense reported that 17.2% of active duty military personnel were women. By branch, participation rates for females were 21.1% in the Air Force, 20.4% in the Navy, 15.5% in the Army, and 8.9% in the Marine Corps (Military OneSource, n.d.).

The percentages for women in law enforcement and the military are much lower than the total percentage of women in the workforce, but the rate of participation for females in the fire service is even lower — especially in career firefighting positions. In 2018, 93,700 women held only 8% of the 1,115 million fire service positions in the U.S. Of that number, 15,200 women represented only 4% of career firefighters, and 78,500 women represented 11% of volunteer firefighters (NFPA, 2020). In addition to the disturbingly low number of female recruits, many women firefighters left fire service positions prior to reaching a typical retirement age (Fox et al., 2006; Hulett et al., 2008).

Understanding the barriers to hiring and retaining women firefighters is essential to increasing their presence in the fire service. Identifying gender-specific issues and concerns will allow for targeted program and policy development, ensuring more women enter the fire service and remain there. This analysis of the qualitative data collected from the 2013 interviews with firefighters and fire service leaders provides much-needed insight into the career considerations of women firefighters. These considerations can inform further research and help shape more inclusive policy development.

Methods

This research was part of a larger, mixed methods study funded by a grant from the National Institute of Health. The study, "A Formative Examination of the Health and Safety of Female Firefighters," was designed to examine the impact of health issues and health threats on the recruitment and retention of women in the fire service. The research had two main objectives: (a) to collect qualitative and quantitative data to determine the current health status and health concerns of female firefighters, and (b) to identify factors which serve as challenges to recruitment and retention of women in the fire service. The study protocol and consent procedures were approved by the Institutional Review Board of NDRI-USA, Inc.

Study Design

For the qualitative study, we used a purposive sampling strategy to recruit participants for key informant interviews and focus groups with a national sample of female firefighters and male and female fire service leaders. The national sample consisted of 87 participants: 46 female firefighters, 27 female fire service leaders, and 14 male fire service leaders.

Techniques used to secure study participants included active recruitment at national conferences, solicitations to fire departments who had large numbers of female firefighters accessible by the research team, and recommendations from fire service advisors. Interview participants were recruited from a range of regions (East, Central, West), positions in the fire service, ages, and years of service. A total of eight focus groups were conducted. Fire service leaders to include as participants were based on recommendations from our fire service advisors. Participants ranged in age from 25 to 66 years old. Their years in the fire service ranged from 3 to 30.

Interview Methodology

The telephone interviews and focus groups were conducted and audio recorded in 2013. The interviews began with an explanation of the study, including the terms of confidentiality, and participants had the opportunity to ask questions. Once participant consent was obtained, the interview and/or focus group began. The structured discussion guides were developed with assistance from an expert stakeholder panel of fire service leaders and researchers. The interview guides ensured topic consistency, yet encouraged participants to share their experiences in narrative form. The guides reflected open-ended questions about health issues faced by female firefighters, possible health-related areas for policy intervention, and key factors related to their recruitment and retention. The questions that elicited the responses used in the data analysis are presented in **Table 1**.

Table 1
Interview Questions

What makes it difficult to recruit women to the fire service?
What tactics could be useful in recruitment of women as firefighters?
How difficult is it to retain women as firefighters?
What would help retain women as firefighters longer?
How can you tell if a department is accepting of women?
What techniques would you use to increase recruitment of females into the fire service?

Data Analysis Procedures

Interviews were transcribed verbatim, and common themes were developed by using a multi-part inductive process. First, researchers reviewed transcripts to generate a preliminary set of working codes. These transcripts were reviewed by two different researchers who used a grounded theory approach (Glaser et al., 1968; Miles & Huberman, 1994) to identify recurrent themes and divergence, consensuses and differing opinions, experiences, and perceptions about the recruitment and retention of women the fire service. After data were coded into major themes by hand (see Hill et al., 1997), the two primary coders compared analyses. Third and fourth researchers reviewed the findings to ensure accuracy. Thematic saturation was reached at 31 interviews when a sufficiently diverse sample had been obtained and no new themes were emerging from ongoing analysis.

Results

Table 2 presents the common themes that emerged from the data. These themes include challenges and tactics for recruiting and retaining women in the fire service. Because similar answers were given by all three groups (male and female leaders and female firefighters), these themes were collapsed across subgroups.

Table 2
Thematic Summary

Main Themes	Sub-Themes
Challenges to recruiting women	• Misperceptions about job options • Lack of current representation • Male-dominated culture
Tactics for recruiting women	• Recruiting at younger ages • Increasing inclusivity
Difficulty in retaining women	• Hard to retain • Low turnover
Aids for retaining women	• More organizational and cultural support • Better opportunity for growth and promotion
Importance of reproductive health	• Key information for safety and health • Impacts policy development
Determining a department's acceptance of women	• Talk to women employees • Assess various aspects of the department

Challenges to Recruiting Women

Participants were asked about difficulties associated with recruiting women into the fire service, and they described a number of recurring challenges. Most commonly, participants mentioned how misperceptions about the fire service as a career option impacted recruitment. One female leader said, "I think it's misconceptions about the job—that everybody thinks of a firefighter as a great big, strapping man." Another female leader described a stereotype that misrepresents the job: "[People think] you got to be able to carry 500 pounds, and you know, run three days and wear a red cape. They don't understand, you know, that — that you — you can be, um, trained."

The media and a lack of education were deemed responsible for "the difference in work that men and women are characterized as appropriate to pursue," by another female leader. One male leader explained: "The average population doesn't see firefighting as an option for women...it's still seen as traditionally a male-oriented career." Another male leader placed responsibility on the fire service itself:

> I don't know that we do a very good job of reflecting in our literature and the things that we provide for in the fire service—generally, posters, education, campaigns. We don't do a very good job of reflecting women as firefighters.

A female leader asserted that standards need to be set "for young men to recognize that, um, they will have women as coworkers and that's expected to be normal."

The notion that women do not pursue firefighting as a career is confirmed by the low number of women currently involved in the fire service. This lack of female representation is another challenge associated with recruitment because, as a female leader noted, "role modeling is very, very critical." Another female leader agreed: "You're trying to recruit females and you don't have any females—I think that right there is going to be your number one biggest issue." A male leader also acknowledged the importance of having women in the department: "Our female firefighters are in the very best position to speak intelligently about what the department's position is as it relates to female firefighters."

A final theme emerging as a challenge to recruitment was the culture of the fire service. Both men and women acknowledged that the difficulties associated with joining a male-dominated culture can be a deterrent for women. According to one male leader, "they feel like they're not welcomed by the, uh, the male firefighters." Another male leader noted that the fire service is "seen as a male-dominated field, a culture in terms of brotherhood and stereotypical male behaviors of close-knit male bravado."

A female leader agreed that the male-dominated culture is a major deterrent. Women "don't want to go to a firehouse and get beat up by a bunch of guys, beat up verbally, or get picked on," she said. As another female firefighter explained: "Whenever you join something that's all male, there's such a fine line, you know. You can't act too much like a woman...and then you can't act too much like a man."

Tactics for Recruiting Women

The analysis of information gathered from participants on the gender and culture issues faced by women in the fire service provided data that could be used in developing tactics for recruitment. Two major sub-themes emerged from the data on the types of recruitment tactics that could prove useful: introducing women to the fire service at a younger age and making the fire service culture more inclusive.

The idea of long-term recruitment—beginning with school-age youth—presented itself in several novel ways. For example, one female leader spoke of a department's "junior fire camp," adding that, "to me, actually, [it] is probably the best recruiting tool that we have for females coming into the fire service right now." Another female leader described a department's "joint apprenticeship program," which included a female firefighter mentoring program. "They do different sessions where they'll go out to junior colleges or schools," she explained.

A different female leader stated that other departments "do direct outreach and…go into high schools and…try and connect with kids." She noted the importance of the "exposure of young women to the fire department, you know, in that middle school to high school time frame." Another female leader agreed that "exposure to other women firefighters" was essential. As a third female leader explained, these "opportunities [allow young women] to explore something that's non-traditional."

The second recruitment tactic mentioned by participants was to make the traditionally male-dominated fire service culture more inclusive. One participant, a female leader, highlighted the importance of "being inclusive in your language":

> So when you're trying to recruit women, if you're talking about, "Yeah, well, our manpower is at three people per engine, you know," or "our manning is we put four men on an engine"...and using the term firemen…you know, all of those things lend themselves to exclusion. You're trying to recruit me, I'm a woman, yet you only have firemen that work for you.

This sentiment was echoed by another female leader who suggested "changing our language to…be inclusive versus exclusive." A different female leader was even more specific: "Teach your organization what is acceptable and what will help make some women feel like they belong. That they're wanted [is] a concept best executed by communication. Talk to them. Find out what their needs are, what they like."

Difficulty in Retaining Women

The male-dominated culture mentioned as a barrier to recruitment was frequently mentioned in the discussion of retention issues. As one female leader explained, "I think some women have left early just because they couldn't stand working in that environment. You know, they didn't like the way that they were treated." A male leader agreed: "The ones that have left, we've really not serviced very well in the sense that they didn't feel comfortable in the workplace." One female firefighter discussed the job stress of working in "a hostile work environment that's a turnoff because there's no support."

Work-life balance is also a factor in retaining women firefighters. One male leader mentioned parenting as a factor: "A lot [of women] leave to raise a family." Women's lives are multifaceted, which may make it easier for them to leave the fire service. As a female leader pointed out, women have multiple identities. Instead of being tied solely to their work, she explained: "they're very vested in their families. They're very vested in their hobbies and in their other dreams, and they don't lose their identity in the fire service. So, it's easier for them to transition out." According to another female leader: "When this world gets to be untenable—which it will—they don't have a problem saying, 'You know, life is short. Screw this!' … They may have other options for earning a living."

Despite the many challenges to retaining women, several participants noted low turnover of women in their departments. According to one female firefighter, "Everybody that I've personally worked with that's been female in the fire service still works in the fire service. I haven't known anybody that's left." A female leader noted that women working for fire departments "have been in for the long haul," staying to "finish their careers and have a happy and healthy retirement."

One male leader cited "a very low turnover rate in our organization." A female firefighter echoed his sentiments: "I would say they probably go about as close as men do." Another male leader pointed out that men and women have similar reasons for early departures: "I've not had an experience where we've lost any women to early retirement for any other reason than a medical separation, just like their male counterparts."

Aids for Retaining Women

Participants were also asked to share aids for retaining women. Responses were related to the organization or culture and did not mention any specific job duties associated with the firefighter role. Initially, participants noted that additional organizational and cultural support could benefit women. According to a male leader, "keeping [women] active and keeping them involved in the organization is really critical."

One female firefighter suggested that a support system would address some cultural issues:

> I think having a support system would be a better way. It's still standard and still acceptable to say that women don't belong. As long as that is accepted, as long as that is tolerated, it's going to make it difficult for us.

Organizational support could also set the tone for inclusivity. As one female firefighter noted: "It's not my job as a female to say I belong. And I, you know, I need my boss and my peers to say I belong."

In addition to organizational and cultural support, a few participants mentioned that stronger avenues for growth and promotion might help retain women. According to one male leader, objective testing and promoting processes would provide "a well-defined career ladder." Another male leader agreed that objective testing and promoting would provide more "equal opportunity for advancement." As summarized by a third male leader, reassessing these processes would ensure "there are no artificial barriers to success, and that female firefighters are afforded every opportunity to ascend as high in an organization as they want."

Determining a Department's Acceptance of Women

An important indicator of retention is the extent to which women firefighters are accepted into a department. When asked how one can tell if a department is accepting of women, participants offered two simple methods. The first method was simply to ask the women, specifically the women, currently employed at the department. "The men will lie," a female leader explained. "It's the women who are in it," added a male leader, acknowledging that women have first-hand knowledge of the issue.

According to another female leader, "[you] get an idea of whether or not they're accepting of women by the way that you're treated." The role of the fire chief was specifically mentioned as a measure of department interest. As one female leader explained, "If the chief was really interested, he would come and talk to me or go out and talk to other women firefighters in the area about situations that make them uncomfortable… [and] situations [that] make them feel included."

Participants suggested that a department's levels of acceptance can also be assessed through personnel demographics, station structure, policies, and the overall culture. For example, according to one female leader, the culture may be more accepting "if you see that you have women in the department [that occupy] a variety of ranks other than office-type work." A lack of promotion can also indicate a lack of acceptance. As one female leader explained:

> You could tell [they were unaccepting of women] because no women had been promoted to the level of captain there. There were only one or two women who had ever been drivers. There were never any chiefs that were women.

One female leader noted that something as simple as "facilities for women" is noticeable because separate bathrooms and bunk rooms indicate a department's willingness to invest in a diverse workforce. Another female leader identified policy as an objective measure of acceptance: "I think that policy has to be very clear…We are going to accommodate both sexes, not one over the other." Citing personal experience, a male leader determined a department's inclusivity by the overall culture and attitude of the personnel: "When you talk to a department, if you get that good old boys' club attitude from the members, I tend to find they're not real accepting of females."

Importance of Reproductive Health

The discussion of recruiting and retaining women in the fire service would be incomplete without addressing reproductive health and any potential role it may play in women's career-related decisions. Responses surrounding reproductive health focused on information sharing and policy development. One female leader acknowledged the complexity of this issue, the pros and cons of providing information about potential reproductive health issues, and the impact of this information on a woman's decision to stay or leave the fire service:

> I think that it would help women stay longer knowing that I can still be a mother and have children and not risk my baby's health… Why would you want to go into a job that, if you know you want to be a parent, why would you knowingly put your baby at risk? Or is it worth it?

Participants also acknowledged that developing specific policies for women firefighters can be complicated. For example, departments may have a policy that specifies when a pregnant firefighter should leave the line. However, as one female leader acknowledged: "By law, we cannot make women come off the truck. You try to encourage them to come in to a light duty position." Another example involved staffing models. According to one male leader:

> There needs to be a recognition in government in general that when you hire female firefighters, that the fact of the matter is you're going to have to build in a staffing factor that accommodates that period of time where they're going to be off.

Tactics Used to Recruit and Retain Women Firefighters

The attitudes and beliefs expressed by interview and focus group participants helped to identify key challenges to the recruitment and retention of women in the fire service: limited outreach, lack of support, and reproductive health concerns. This section discusses tactics that can be used to address these challenges: (a) the recruitment of female firefighters at a younger age; (b) supporting and mentoring women in the fire service; and (c) improving the reproductive health of women firefighters.

Recruitment of Female Firefighters at a Younger Age

The increasing popularity of fire camps designed exclusively for girls and young women can help in the recruitment of females to the fire service. These all-girl camps introduce the fire service to young women in a supportive, yet challenging environment. Not only do the girls learn about fire behavior and emergency medical services, they learn about leadership, gain confidence, work as a team, and become stronger, more independent women (Women in Fire, n.d.-2).

A number of youth camps have been developed, and they offer activities for a wide range of ages. For example, Camp Fury is a Girl Scout affiliate for 10-12-year-old girls. It combines an overnight Girl Scout camp experience with immersive first responder training. Campers develop courage, strength, and confidence while learning hard skills associated with firefighting, such as handling hoselines, search-and-rescue, first aid, and CPR (Girl Scouts of Eastern Missouri, n.d.).

Another Girl Scout affiliate, CampHERO, provides graded involvement for girls from kindergarten through high school. Girls in elementary school get to meet first responders and partner with them for arts and crafts while gradually learning basic skills. Hands-on training with hoses and ropes begins by grades 3-4 (Girl Scouts of Wisconsin Badgerland, 2022). Camps designed for young women from 15 to 22 years of age may feature physical fitness, interviewing techniques, extrication, forcible entry, and water suppression (Fire Service Women Ontario, n.d.; Women in Fire, n.d.-2). Young women in this group are of prime recruitment age for the fire service. Many participants may be old enough to enter fire academies and apply for jobs shortly after their camp experience (Fire Service Women Ontario, n.d.; Portland Fire and Rescue, n.d.).

Many women firefighters value the opportunity to be involved in these programs, as evidenced by the creation of new camps and the duration of established camps. Some camps date back more than 20 years (Camp Blaze, n.d.). Several others have celebrated more than 10 years of existence (Camp Fully Involved, n.d.; Girl Scouts of Wisconsin Badgerland, n.d.; Portland Fire and Rescue, n.d.). New camps are developed annually, spreading opportunities for both women firefighters and young girls across the country.

Currently, fire camps can be found in the states of Missouri, California, Washington, Oregon, New York, Wisconsin, New Hampshire, Maryland, and Virginia, and in other countries such as Canada (Women in Fire, n.d.-2). Even the recent global pandemic did not deter involved firefighters from providing resources to young girls. For example, Portland Fire and Rescue (n.d.) offered a virtual edition of their camp. As these dynamic programs continue to grow, so does their positive effect on the long-term recruitment of women firefighters. These camps and the dedication of the firefighters involved can offer immense value in the long-term recruitment of women as firefighters.

Supporting and Mentoring Women in the Fire Service

The need for women to see and support each other in the fire service was another prominent theme cited by female respondents in the 2013 data. Because the fire service remains a male-dominated profession, a female firefighter spoke to the importance of seeing other women firefighters in action: “to let people know that we can do the job, that we can be role models, and that we can be supportive of each other.”

Recent efforts to address recruitment and retention include a pilot project known as the “virtual kitchen table,” which creates a web-based network designed to provide support and mentorship, build resilience, and reduce stress for women firefighters across the United States (Ascott, 2021). This project is based on the well-known support that men receive through conversations around the kitchen table at the fire station. The value of social inclusion is a known protective factor for retention (McDonald, 2016). The “virtual kitchen table” project includes a “virtual phonebook” of contact information to connect women firefighters across

the United States. It also features weekly zoom sessions on a variety of women-centric topics, including financial management, reproductive health, fitness for women, and promotional tips. Participants can foster personal relationships by joining coffee and chat sessions designed to be informal.

Another online resource for women firefighters is the Triple F Rescue website sponsored by the Triple F Foundation. Triple F stands for Fierce, Female Firefighters. Its mission is to "inspire, motivate, and empower female firefighters and females in Emergency Medical Services around the world" (Triple F, n.d.). The Triple F Rescue website provides links to an event calendar, blog posts, fire camp contacts, book reviews, and more.

Although its membership includes men in all ranks, the International Association of Women in Fire & Emergency Service (Women in Fire) is predominantly of and for women: "To the fire service, Women in Fire is their voice." (Women in Fire, n.d.-1). An interactive, non-profit network, Women in Fire provides support, advocacy, and education opportunities for fire service women through publications, recruitment materials, information packets on women's issues, international conferences, and training seminars.

Regional fire service organizations include the United Women Firefighters that represents women in the Fire Department of the City of New York (FDNY) and the Valley Women's Firefighter Society in Arizona. In addition to providing support and resources for women currently serving in their geographical areas, these groups actively recruit more women to join the fire service.

In short, the desire to provide mentoring and support was a common theme among female firefighters and fire officers in this study. For those in leadership roles, the chance to mentor younger firefighters was important. According to the first woman captain in Hawaii County, "I like being a resource for them, being supportive and helping them to gear up for whatever goals they have, and I try to help them achieve those goals" (Fairley, 2020). The first female fire chief of the Phoenix Fire Department further explained the value she found in providing support: "Mentoring those who are coming up through the ranks has helped me be a better leader" (Hatt, 2017).

Improving the Reproductive Health of Women Firefighters

Since the initial 2013 qualitative study, significant progress has been made in addressing women's reproductive health within the fire service. Federal funding has been dedicated to research on and a better understanding of the impact of job exposure on hormone levels, breastmilk, and child development (Ascott, 2021; Sherriff, 2021). This information may help both women and their departments develop inclusive, safe, and progressive policies regarding alternative assignments, time off, and other reproductive health needs (Ascott, 2021; Sherriff, 2021). Also, fire departments are beginning to include lactation rooms in their designs, understanding the importance of privacy for women who pump breast milk (Andrade, 2021).

Other recent research focuses on the impact of ill-fitting gear and equipment (McQuerry, 2020; McQuerry et al., 2019) and occupational exposures that endanger reproductive health (Jahnke et al., 2018; Kehler et al., 2018). Up to 80% of women firefighters have reported problems with ill-fitting gear, including loose fitting neck areas and the use of oversized coats and pants to compensate for bust and hip circumferences (Hulett et al., 2008; McQuerry et al., 2019). The gaps created by excess material lead to increased carcinogen exposure during fires (McQuerry et al., 2019; Park & Hahn, 2014). This exposure compounds the previous occupational exposure experienced simply by being a firefighter (Jung et al., 2021; Kehler et al., 2018).

Occupational exposures to toxic substances and physical hazards not only impact the risk of adverse health outcomes such as cardiovascular disease, respiratory disease, and certain cancers, these exposures also have a direct effect on reproductive health. Women firefighters experience miscarriage rates over twice as high as women in other professional fields, with rates increasing by pregnancy order (Jahnke et al., 2018; Jung et al., 2021). Almost 23% of women firefighters report a miscarriage during their first pregnancy, while almost a third (31.7%) of women firefighters report that their fourth pregnancy ended in miscarriage (Jahnke et al., 2018). Rates of low birth weight ranged from 5.9% for the first pregnancy to 11.1% during the fourth pregnancy. Well over 10% of second to fourth births were considered preterm, a number higher than the national average (Jahnke et al., 2018). The high rates of miscarriage among female volunteers suggest that women are more likely to wear oversized bunker gear in small departments with limited funding for PPE.

Volunteer firefighters were up to 2.5 times more likely to experience miscarriages than their career counterparts (Jung et al., 2021), a finding that is of particular concern as more women are volunteer firefighters than career (NFPA, 2020).

These reproductive health findings highlight the need for better personal protective equipment, education, and policies in the fire service to protect the children of firefighters. Bunker gear should be designed for women's bodies, accounting for differing bust and hip circumferences and other physical differences between men and women (McQuerry, 2020; McQuerry et al., 2019). Properly fitting gear increases the health and safety of women firefighters. In addition, fire departments must develop policies that ensure the safety of all firefighters. Almost one-fourth of the women firefighters in a study by Jahnke et al. (2018) indicated their departments had no policies related to pregnancy. Another 17.5% of the female firefighters did not know if their department had a policy (Jahnke et al., 2018). Department policies that address reproductive health issues can promote a more inclusive work environment and aid in the recruitment and retention of women in the fire service.

Study Limitations

While the data presented in this article were foundational in addressing challenges associated with the recruitment and retention of women firefighters, three study limitations should be addressed. First, the interview and focus group data is almost 10 years old. However, we could not find a peer-reviewed academic study published since 2013 with the same specific focus (recruitment and retention of female firefighters) and scope (a national sample of 87) as ours. Clearly, a follow-up study is needed.

Second, the demographic information about the participants was limited. It did not include their age, and the analyses were not stratified by years of service. Both of these factors may have affected participant responses. Older, more experienced firefighters might have had different perspectives on the issues than younger and less experienced firefighters.

Third, the race and ethnicity of participants were not recorded, a factor which may have greatly impacted the type of recruiting and retention experiences that participants shared. The fire service lacks significant racial and ethnic diversity, and some departments still struggle with racial discrimination and tension (Seicol, 2020). Women of different racial and ethnic groups may experience both racial/ethnic *and* gender discrimination.

Conclusion

The number of women in the U.S. fire service remains remarkably low. Why? One of the female firefighter participants in this study summarized the issues surrounding recruitment and retention with the following statement: "I just think that a lot of women don't look at it as an option. Not because they're told that they can't, but they're just never told that they can."

Obtaining feedback from current volunteer and career women firefighters is essential to tailoring recruitment strategies that attract and keep prospective female firefighters. Feedback from these women is essential to creating policies and procedures that represent and include women in the fire service culture. Females in this study advocated for a change in societal messages about who can be a firefighter. Perhaps a rebranding of the firefighter image is needed. Traditionally, physical fitness, strength, and bravery were firefighting traits associated with men. Emphasizing the value of compassion, warmth, and communication—traditionally feminine characteristics—may reduce gender bias within the firefighting profession (Totty, 2019).

Policies regarding reproductive health and family leave can be further developed and openly shared with personnel to promote a more family-friendly environment. Well-developed reproductive health policies can also be shared among departments as best practice resources. Social media that shows women firefighters maintaining a healthy work-home balance may help attract women to the profession, emphasizing that women no longer need to choose between being a firefighter or a mother, teacher, or social worker. Once women are in the field, professional development programs, including formal mentorship programs, can provide them access to and support for advancement.

The full integration of women, their skills, and their values, is essential to the success of the fire service. A diverse workforce can also strengthen the services they offer to their communities. Men and women working together can more effectively address the host of challenges associated with first-responding professions. Women, in addition to other minority groups, are an untapped pool of employees as departments face staffing shortages in both career and volunteer departments (Byron, 2018; Dunlap, 2018). As Dunlap (2018) has shown, women are attracted to a career in the fire service for similar reasons as men, including compassion and a sense of community. Recruiting and retaining women in the fire service is not about lowering the entry bar, but rather raising the level of service.

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