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Perceptions of Work-related Health and Cancer Risks among Women Firefighters: A Qualitative Study

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Abstract

Objectives: We use a qualitative method to gain further insight into women firefighters' experiences, perceptions of cancer, health and safety risks in the fire service.

Methods: We conducted six focus groups with U.S. women firefighters. Participants engaged in a 60–75-minute, semi-structured discussion and completed a sociodemographic questionnaire. A

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qualitative descriptive approach was used to inductively create themes. Data collection concluded when saturation was met.

Results: Forty-nine women firefighters participated. Qualitative results indicated the main health concerns include: Occupational cancer risks including, risks related to hazardous exposures, sleep disruption and stress; and Women's health concerns including, cancer, pregnancy and breastfeeding and lack of resources.

Conclusions: Women firefighters are concerned about their risk for cancer due to their occupation and identify a lack of resources specific to health and safety needs of women firefighters.

Keywords

cancer; firefighters; women's health; occupational cancer; qualitative

Firefighting is a high-risk hazardous profession with elevated rates in injury, illness, and mental health disorders as a result of fire suppression and emergency response duties[1–4]. Women firefighters have become a growing segment of the overall firefighter workforce, yet few studies have examined their specific health and safety risks compared to their male counterparts[5]. According to estimates based on the 2020 National Fire Protection Agency's (NFPA) Survey of Fire Departments for US Fire Experience, women firefighters represented 8% of all 1,115,000 career and volunteer firefighters in the United States (U.S.), a 3% increase since 2015. Four percent of U.S. career firefighters and 11% of volunteer firefighters are women[6].

Although the proportion of women in the firefighter workforce is increasing, the body of literature related to their occupational health risks is still limited. Occupational researchers have been documenting specific health and safety issues in women firefighters. Increased physical injuries and fatalities have been documented in women firefighters due to the strenuous demand of their work [7] as well as complications related to pregnancy and fertility [8]. In addition to the physical risks, rates of depression, anxiety, PTSD and suicide are elevated within the population of women firefighters [2]. Epidemiologic studies have also indicated women firefighters have a heightened risk for certain site-specific cancers [9–11].

The scientific literature is limited in the focus of women firefighters' cancer risk. Ma and colleagues reported that women firefighters in Florida were more likely to have higher overall cancer risk and an increased incidence of Hodgkin's disease, cervical and thyroid cancers compared to the general Florida population [9]. In a national occupational cohort study of firefighters, researchers reported that women firefighters had higher incidence and mortality rates of bladder cancer compared to the general U.S. population, although the study lacked power for women [10]. A recent study out of San Francisco reported that women firefighters are exposed to higher levels of some carcinogenic compounds compared to office workers, thus likely increasing their risk for certain cancers, like breast cancer [12]. In addition, an increased incidence of melanoma was identified in Australian women volunteer firefighters [13]. There is a dearth of literature focusing on cancer among

women firefighters, including projects focusing on overall well-being, exposures and cancer mortality rates[9–20].

There is a critical need to recognize and understand the work-related health and safety challenges women firefighters face during their careers in the fire service. This study aims to address these gaps and characterize key themes reported by a sample of women firefighters. We conducted a qualitative research study with the primary focus of perceived work-related health and cancer risk among women firefighters.

METHODS

Study Design, Participants, and Recruitment.

A qualitative descriptive design (i.e. focus groups with cross-sectional, demographic survey) was used to better understand the experiences of women firefighters and their perceived occupational health and safety risks. As part of larger multicenter prospective cohort study (the Fire Fighter Cancer Cohort Study (FFCCS)), we conducted a total of 6 focus group sessions with 49 female career firefighters. Participants were eligible to participate as long as they were active firefighters. Two focus group sessions included male participants, who were asked the same questions, but not included in this analysis. Focus group sessions took place at the fire stations of the participants' designated departments and participants were grouped as best as possible by their rank to ensure a rich discussion without fear of reprisal from their department leaders. Women participants were recruited through our ongoing collaboration with national firefighter stakeholders and leadership. All women participants were invited through their department's e-mail and recruitment flyers from Fire Fighter Cancer Cohort Study research staff. Women were able to participate while on shift or on their off day to best accommodate their scheduling needs.

Focus Group Script, Survey Measures and Administration.

A semi-structured focus group script was developed to gain insight from women firefighters' experiences and perceptions of cancer, health and safety risks of the fire service. The script was designed with probes to ensure key topics were explored. The five main domains of the script included: job description, perceived hazards at work, cancer risk for job exposures, information needs of risk reduction and engagement in a national occupational cohort study. Prior to the conduct of the focus groups, all participants gave verbal consent and completed a brief paper-based demographic survey. All focus groups were audio recorded and transcribed.

Data Analysis for Quantitative and Qualitative Data.

We calculated descriptive statistics for continuous variables, expressed as means with standard deviation, and for categorical variables, expressed as frequency and percent of the sample. We stratified sociodemographic and work characteristics responses between women firefighters who self-reported a cancer diagnosis and those who did not. For categorical data, we conducted Fisher's exact test to compare groups. A p-value less than 0.05 were considered statistically significant. All data management and statistical analyses were done on SPSS v26 for Windows (IBM Corp). Qualitative data were analyzed using a

qualitative descriptive design. Qualitative description was selected because of its usefulness in obtaining straight and largely unadorned answers to exploratory questions. In addition, the description in qualitative descriptive studies entails the presentation of facts in everyday language [21]. Themes were inductively developed, and open coding was completed, creating first line coding for each phrase of the transcript. Codes were compared to identify themes among the six focus groups. Data saturation was reached by comparing patterns within the individual focus groups and comparatively with all six groups. Data analysis was led by a qualitative research expert with a team of researchers to distinguish key topics that emerged from the focus groups using NVivo 12. This research protocol was reviewed and approved by the University of Miami Institutional Review Board (#20170997).

RESULTS

Among the 49 women firefighters who participated in the focus group sessions, the mean age was 44.1 ± 9.6 years (minimum age 24 and maximum age 64 years), 69.4% self-identified as Caucasian and 87.8.% as non-Hispanic/Latinx, 45.8% were married, 71.4% were college graduates, 57.4% have children, and 14.3% reported a diagnosis of cancer (Table 1). Among the 7 reported cancer cases, 71.5% (5) were breast cancer and 28.5% (2) were skin cancer (unidentified type). The geographical spread from women firefighters participating in the focus groups included: California (71.4%), Florida (20.4%), Delaware (4.1%), and New Jersey (4.1%). The average amount of time spent working as a firefighter was 14.9 years ± 9.5 years (minimum 8 months and maximum 32 years). Among all participants, 30.6% reported a concurrent second job and the greatest portion were entry Firefighter/Paramedics (44.9%) followed by the rank of Lieutenant (14.3%). .

Qualitative Results

Two main themes emerged from the data regarding the health and safety concerns of the interviewed women firefighters, including: 1) work-related hazardous exposures, and 2) women's health concerns. The main themes induced from the focus groups were organized into six overarching categories describing specific concerns (Figure 1). In addition, there were significant conversations describing how the culture has shifted in a positive direction; study participants described that the new generation of firefighters is more knowledgeable about health and have more resources for prevention.

Work-related Hazardous Exposures

In all six focus groups, when asked, "what is your main health and safety concern?" cancer was reported as the top concern. Although other topics were mentioned, cancer was the most significant. The women firefighters reported that their perceived cancer risk was related to the hazardous chemicals they are exposed to at a fire scene and in the station. They also believed that sleep disruption and high stress levels on the job may cause short and long-term health risks that could potentially lead to cancer.

Hazardous occupational exposures.

Participants were initially asked to describe their typical work shift and what they believed caused their reported increased health and safety risk. Women firefighters stated that their

exposure to hazardous chemicals on a routine basis was the principal factor. One participant stated,

> You're [at the fire station] a third of the time. And that's a long time to be somewhere and be exposed to this stuff (hazardous chemicals) constantly. For the 24 hours that we are at work, we are constantly exposed to it.

When at a fire scene, they are exposed to hazardous burning materials, but often times, many of the burning materials are unknown to them, as one woman reported, "Every incident basically is a hazmat incident even though we don't think of it that way." Another added remarks of her experience of being on a large fire and not knowing what materials were burning,

> There was houses, there were buildings, all these establishments that had God knows what in them. Hardware stores, everything's burnt, everything's still off gassing, things are still burning.

Overall, participants believe that they are at higher risk than ever before due to the materials homes and furniture are built from today. The amount of plastics and large electronic equipment is the most concerning for this group. A participant describes the change in burning materials from the start of her career until now,

> There's so much more plastics, and everybody's houses. When we came in, it was more wood, and natural type of fibers. Now you go anywhere, and you get that smell right away. You know it's all plastic.

In addition to the fire scene exposures, the sample of women were very apprehensive of the type of cleaning supplies used at the station. The supplies and chemicals required to clean and polish the fire apparatus and other equipment were reported as extremely hazardous. Many believe these harsh agents are causing physical ailments presently. One participant noted,

> To go back to the cleaning products…like during triannual (3 time a year cleaning). It's so toxic. Doing the, polishing the brass with the blue stuff is, I feel it in my throat, like I can feel it collecting right there. I mean I have a cough like the rest of the day.

We did not pose questions related to cleaning supplies, therefore are unaware of the types of supplies the women were describing in the discussion (i.e. blue stuff). In addition, it was not asked if the women used a Material Safety Data Sheet (MSDS) for the cleaning supplies.

Women also stated that when returning from medical calls, in order to ensure proper sanitation following a hazardous medical exposure, they need to use strong disinfectants on themselves, their gear and trucks, which is often extremely worrisome. One woman stated,

> And it's cyclical, too because what you're doing to combat those things are probably very toxic as well. So, what we use, [chemical cleaner] which is like death in a bottle and so –It kills everything, but you're in biological waste. So, you want to get rid of those germs before you bring them into the firehouse.

The final exposure discussed was related to the firefighters' turnout gear. All firefighters are issued turnout gear when they start their career and many departments issue new sets every ten years to its members. The gear is meant to protect them from the high temperatures of a fire; however, firefighters believe the materials protecting them are also harming them. According to study participants, turnout gear was described as a contaminant since it may contain flame retardants and other known carcinogens from the fire scene or as textile additives. The women we interviewed conveyed that this has become an important topic of interest that needs further investigating and understanding. When asked about their main health concern, one leader in the group reported:

> Brand-new turnouts out of the bag, boom, fresh, clean. Full of chemicals.

With recent efforts to improve fire scene decontamination, the present concern of the gear is not as much related to the remnants of a fire call, but more so what the gear is made of and how it may increase their exposure to carcinogens prior to even being used in a fire.

Sleep disruption

Sleep was another significant topic of discussion. A majority of the women believed that the lack of sleep as well as the poor quality of sleep while on the job can potentially lead to long-term health effects including their risk for cancer.

> It can take a toll on you in terms of being more prone to sickness and injury even… Compromised immune, you know different things start showing up, can be related to cancer being able to come in and set its roots into the whatever.

The high bursts of adrenaline when receiving a call from a state of sleep has already caused many of the participants to feel constantly on edge and has increased their blood pressure and heart rate while on the job. They believe that the impact of residual adrenaline after receiving a call, but not using that energy, is causing negative health effects.

> Residual effect of adrenaline. Yeah. So, we have the adrenaline that releases when you get a call, and then, you don't use it. It stays.

Moreover, many of the women described the struggle of finding time to recover after a night on shift due to their responsibilities at home. Many of the women we interviewed were full-time working mothers, who stated that once they leave their job at the fire station, they go right into their role as mother and caretaker. For those with younger children, finding time to sleep is a challenge.

> I have four children. And so, you don't sleep at home because you're taking care of your baby at home, and then you go to work and you're not sleeping at work. So, you're struggling as a mom at home and you're struggling as a firefighter at work and you're just exhausted.

Stress

The third most relevant topic discussed when asked about health risk was stress. The physical stress on the body from repetitive movements was a concern, but the emotional stress of the job was the most prominent concern of the women we interviewed. As one woman stated,

> I also think we're exposed to emotional stress. You know we have a high volume of seeing violent things and accidents, and mental illness which can be taxing when you're serving.

The women participants reported on the mental toll they have endured throughout their career compromised both their mental and physical well-being. Many of the women discussed how they believe the stress of the job impacts their immune system.

> Stress. It weakens your immune system. So. And your ability to deal with stress. So, some people deal with stress better than others.

It was also discussed that the stress they experience is hardly ever a single incident, but more an accumulation of events they have witnessed. For many of the women, a stressful event triggers other negative memories they have seen in their career thus taking a long-term toll on their overall health.

> I find it's cumulative like we could been on runs, and we're like okay we got through that, but then you might have something similar then it's like a trigger. Like you think you got through it, but then it just accumulates.

Women's Health Concerns

The second key theme of the focus group discussions centered on the work-related health risks specific to women in the fire service. The women were very knowledgeable of the cancer risks specific to women and were most concerned about their heightened risk for female specific cancer, breast cancer in particular. The women also discussed their concern of being an active firefighter while pregnant and breastfeeding their children. The final concern was the overall lack of resources and research being conducted on women in the fire service.

Occupational Cancer

As the women started to discuss cancer risk, breast cancer was their main topic of concern. Many of the interviewed women said that they were breast cancer survivors themselves or knew of multiple women firefighters with similar diagnoses. They believed that the number of women firefighters with breast cancer has increased, which may be attributed to the shift in culture in the fire department and increased conversation surrounding the topic of cancer.

> It's become more apparent to me through the years, because I can count on two hands [the] women I know in this department who had breast cancer. I said two hands. I did say two hands.

The participants believe that they are more at risk for breast cancer due to the absorbency of the breast tissue and the way in which the gear is open in the front, causing entry of carcinogenic particles.

> I was told that breasts are the most absorbent of all the parts, because they're out there, you know. And they're like, it's going in your shirt, and so it's like, right out there

Breast cancer survivors spoke about their experiences of being diagnosed and how their initial thought process was that it was expected being that they were firefighters.

Pregnancy and Breastfeeding

The second main area of concern included, how to manage a healthy pregnancy while being active and once the baby arrived, how to nourish the child safely while on duty. For most of the women, it was a difficult situation to plan for and often felt guilty of the decision because of how it would make them appear as a firefighter.

> It's a weird thing to navigate through, because I'm new in the department and if I do want to start a family, there's a lot of consideration into how much time you have to take off.

Once pregnant, the women stated that it is very difficult to make the decision of when to stop answering fire calls. The women were unaware of any set guidelines of when to go on light duty or leave. They reported that this was a source of extra stress on the expectant mother.

> Well, and that, we all have kids, and been through it, but being pregnant and being on the fire ground is another one. When do you call it quits? When do you step out of that environment? There's no rule really for our fire department right now about it. You make your own choices, which I kinda like, but then everybody should be educated on what the risks are, being pregnant and being at work

Many of the women stated that they never knew about the possible risks breastfeeding could have on their children while being back on duty. Again, there is no set schedule or recommendation for women firefighters on how to navigate their pregnancy and maternity needs once the child is born.

> That's – because no one told me anything, and I came back to work when he was six months old and I pumped in the firehouse for six additional months. So, I breastfed him for one year, which means six months of me being a firefighter going to fires and continuing to breastfeed him and pump at work and bring the milk home from work.

Some women chose to take a full year of unpaid leave in order to continue breastfeeding and limit their child's exposure to hazardous exposures. Although this is a favorable option for some, many of the women stated that due to financial responsibilities, this was not an option for them and therefore stopped breastfeeding earlier than planned. One woman described how she decided to take a year off,

> I wasn't getting paid. That's just the way it was. I wanted them to breastfeed for a year, and I didn't want to have to pump at work, and I didn't want bring that all back (home).

Lack of resources for women's health

The final concern of the women firefighters was the overall lack of resources and research being conducted specifically for them. As one woman replied when asked about changes made for women in the fire service, "Yeah, it's just, I think women in the fire service haven't been [studied], when you don't have the statistical numbers, it's hard to drive change."

Women in the groups also describe how it is very difficult to have a voice or be a driver of change when they feel so underrepresented in the field. Many of these women are making changes and sharing their opinions with leadership, but report that it is never easy. The reason they participated in this discussion was to keep moving the dialogue forward and have women's concerns included.

> I was mentioning earlier, when we sit like this if – lucky if I have one woman. And very few and often times they're younger and they don't want to rock the boat. And they don't vocalize any individual concerns that they may have, because they're sitting with their – you know, fellow Chiefs and Captains. So, it's just been very – part of the reason we're here is because women are very underrepresented in science in the fire service, or the research.

Lastly, in addition to the resources needed for the women firefighters on their health and pregnancy plans, it was also brought up how crucial it is for health care providers to know their risk as women and as firefighters. The women acknowledged that there are pamphlets of recommended screenings for firefighters, but it is still your responsibility to advocate for yourself. The women stated that in order to receive certain cancer screenings, they had to push and often convince the doctors of their occupational risks.

> And you do have to be extremely vocal to your own private doctor. I've had to be… It's really hard to do. It's hard to convince doctors to do that.

DISCUSSION

The aim of this project was to gain further insight into the experiences and perceived work-related health risks of women firefighters. Through our qualitative analysis, the data indicated that women firefighters are aware of their heightened risk for cancer and identify their most significant health concerns as routine occupational exposures to hazardous materials and gender specific health risks. Since the focus groups were part of a larger cancer related study, the participants may have been biased in their overall health concern being cancer. The larger study includes a comprehensive questionnaire surveying firefighters' cancer history, risks and screening behaviors; therefore, a majority of our sample were already aware of cancer in the fire service. The women identified lack of resources related to women's health, specifically how to navigate through a healthy pregnancy while on the job as well as how to breastfeed their young child when returning to work. At the time of the focus group discussion, women also noted scientific gaps in research being conducted on women firefighters, an issue that continues to be brought up at a national level, with several studies newly underway to address these concerns [22 23].

The first theme and most significant concern of the interviewed women is their work-related cancer risk. The women identified three main reasons they believe they are at an increased risk for cancer, including: routine exposure to hazardous materials, sleep deprivation and stress. All three concerns have been previously cited as factors that may increase an individual's risk for cancer[16 24–26].

The women firefighters also expressed an overall health concern related to their occupational exposures to hazardous materials while at a fire scene. This topic has been

reported on extensively. Firefighters are significantly exposed, via multiple routes, to combustion byproducts including several known carcinogenic compounds during on-shift fire suppression [27–29]. These exposures can potentially increase firefighters' risk for cancer. Our findings indicate that the women are concerned with health outcomes that predominantly affect females. This sample of women believe they are at an increased risk for breast cancer. This concern is supported by research conducted by Trowbridge et al, reporting higher risk for breast cancer in women firefighters due to their increased exposure to perfluoroalkyl substances (PFAS) [12]. It has also been reported that breast cancer has impacted male firefighters [9 30]Moreover, the focus groups helped identify a work-related exposure concern that has not been heavily highlighted or studied in this occupational group. Women report their heightened concern related to the cleaning supplies used at the fire stations to clean and polish fire equipment and vehicles as well as the materials used after a medical call. Although several studies have described firefighters' occupational exposure to hazardous materials [31 32], these studies have focused predominately on exposure at the fire scene or remnants of a fire scene returning to the station. There are no reports on exposure to potentially hazardous materials that firefighters routinely use when not on a fire scene such as cleaning supplies or other products firefighters use routinely or following a fire call or a medical call. As the women noted, the options are limited because they need to disinfect themselves and their equipment following a biological exposure, however they believe the materials' potency is impacting their short and long-term health, which may be of greater concern now during the COVID-19 pandemic. Future research should investigate what type of cleaning products are being used, if they are safe and if not, what alternative methods are possible when cleaning and polishing fire equipment as well as disinfecting items following a biological exposure.

Additionally, the women firefighters identify their shift work sleep schedule and deprivation as a concern for their health. Several studies support this notion and have shown that sleep deprived women have an increased risk of breast cancer and colorectal cancer [33 34]. Most firefighters experience disruptive sleep schedules due to their shift work, which has been classified as "probably carcinogenic to humans" by the International Agency for Research on Cancer[35]. Shift work disrupts individuals' circadian rhythms and can affect their melatonin level, which in turn can affect the expression of core circadian genes. Besides short-term changes in cortisol levels, long-term, prolonged sleep deprivation can lead to more detrimental outcomes including cancer [35 36]. In the same regard, acute stressful situations increase cortisol levels. The women firefighters stated that the stress of the job takes a toll on them mentally and physically. They believe the prolonged exposure to stressful events is impacting their immune function. Li and colleagues report that the longer individuals work night shifts, the higher their cortisol level compared to day workers, which can lead to immune dysfunction [37]. Firefighters experience both a disruptive sleep and wake schedule and high stress situations and although this is a job characteristic and extremely hard to avoid, an appropriate sleep schedule can be designed to allow firefighters to restore normal sleep patterns and rest in between duties [38].

In addition, the interviewed women spoke in detail about the need for more resources and information related to their risks when pregnant and breastfeeding. They stated that there are no set guidelines or recommendations which leave many of them very concerned on

how to successfully be a firefighter and plan for motherhood. A recent study surveying women firefighters also noted a key concern related to return to work after pregnancy and breastfeeding [15]. Jahnke and colleagues also reported that many women firefighters run calls while pregnant and one-quarter of first and second pregnancies and one-third of third and fourth pregnancies end in miscarriage [8], a rate twice above the average miscarriage rates previously reported in literature [8 39]. There is a critical need to further study the relationship between firefighter exposure and women's health; it is apparent that the reproductive health of women firefighters in relation to their occupational exposures need to be examined. Furthermore, it is clear that women firefighters are understudied; in our review of the literature, only 12 studies focused on women firefighters and cancer [9–20].

Our study is not without limitations. Although qualitative data saturation was met, additional focus groups of women firefighters could have altered the findings or improved our understanding of their concerns from additional geographic regions. Our sample of women was predominately from the West Coast and Southeast region of the United States. Expanding the reach of our sample to other areas in the country, as well as other firefighter subgroups (i.e. volunteers, wildland), could have identified other health concerns. Additionally, bias could have been introduced as a result of this project being related to a larger cancer cohort which could have primed study participants to discuss concerns predominantly around cancer. Despite our limitations, this study adds substantial insight to the occupational cancer literature as it is one of very few studies focusing specifically on women in the fire service and their perceived health risks and needs. The information gathered from this study will help researchers better understand and prioritize future research projects that address women and their health concerns and create education materials and trainings for women to better understand the work-related health risk of firefighting.

CONCLUSION

Our research findings suggest women firefighters have a general awareness of cancer risk in their profession, but have limited access to resources, guidance, and training on topics such as how workplace exposures may impact their health and how to best implement evidence based protective measures and procedures. The main health concerns identified focused on the relationship between workplace exposures such as hazardous chemicals and sleep deprivation and the health of the women firefighters when trying to conceive, during pregnancy, while breastfeeding, as well as future development of cancer. Therefore, future epidemiologic studies on women firefighters and cancer should collect survey and workplace exposure data specific to women's health to inform workplace intervention.

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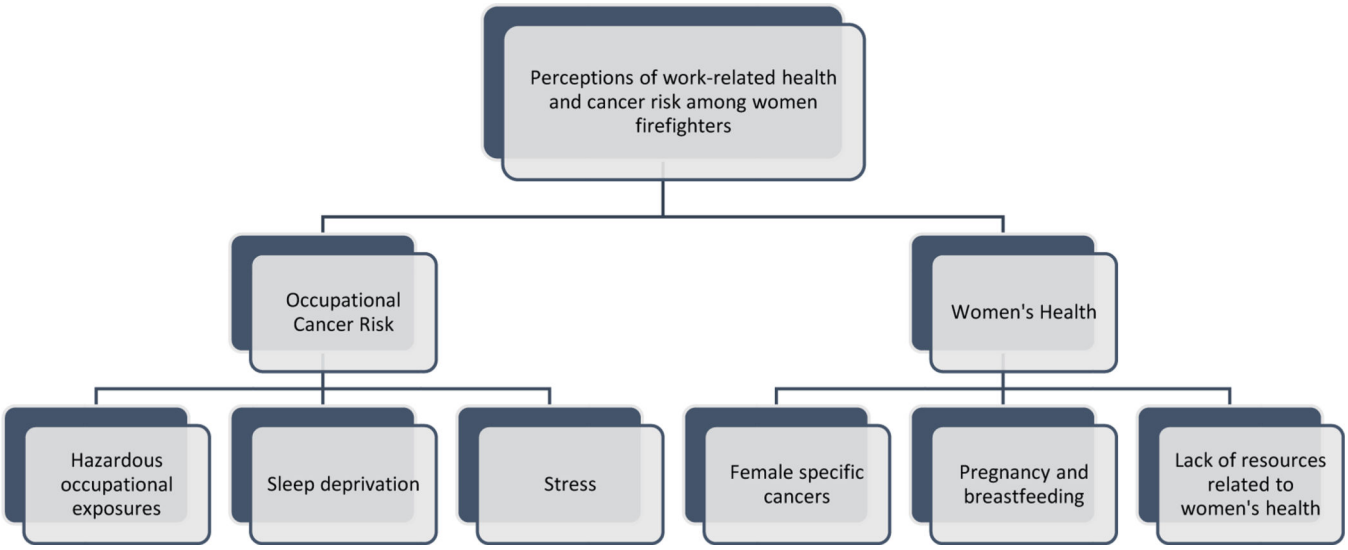

FIGURE 1:
Qualitative themes

Table 1.

Socio-demographic and work characteristics among women firefighters participating in the national Fire Fighter Cancer Cohort Study Expansion Project, Nov 2019 – March 2020

Characteristics	Total Sample N (%)	Yes Cancer History n (%)	No Cancer History n (%)	p-value
Total Sample	**49 (100.0)**	**7 (14.3)**	**42 (85.7)**	
Age Group				
24–40 year olds	15 (34.9)	1 (16.7)	14 (37.8)	.082
41–50 year olds	17 (39.5)	1 (16.7)	16 (43.2)	
51 years and older	11 (25.6)	4 (66.7)	7 (18.9)	
Race				
White	34 (69.4)	5 (71.4)	29 (69.0)	.865
Black	5 (10.2)	1 (14.3)	4 (9.5)	
Other	10 (20.4)	1 (14.3)	9 (21.4)	
Ethnicity				
Hispanic/Latinx	6 (12.2)	1 (14.3)	5 (11.9)	.861
Non-Hispanic/non-Latinx	43 (87.8)	6 (85.7)	37 (88.1)	
Marital Status				
Married	22 (45.8)	4 (57.1)	18 (43.9)	.436
Divorced/Widowed/Separated	9 (18.8)	2 (28.6)	7 (17.1)	
Single/Member Unmarried Couple	17 (35.4)	1 (14.3)	16 (39.0)	
Educational Attainment				
Less than high School	1 (2.0)	0 (0.0)	1 (2.4)	.792
High School / GED	2 (4.1)	0 (0.0)	2 (4.8)	
Some College / Technical School	11 (22.4)	1 (14.3)	10 (23.8)	
College Graduate	35 (71.4)	6 (85.7)	29 (23.8)	
Have children				
Yes	27 (57.4)	4 (57.1)	23 (57.5)	.648
No	20 (42.6)	3 (42.9)	17 (42.5)	
Smoker Status				
Current	2 (4.1)	0 ()	2 ()	.772
Former	10 (20.4)	1 ()	9 ()	
Never	37 (75.5)	6 ()	31 ()	
Currently Chew Tobacco/Snuff				
Yes	2 (4.2)	0 (0.0)	2 (4.9)	.727
No	46 (95.8)	7 (100.0)	39 (95.1)	
Fire Department State				
California	35 (71.4)	4 (57.1)	31 (73.8)	.153
Delaware	2 (4.1)	1 (14.3)	1 (2.4)	
Florida	10 (20.4)	1 (14.3)	9 (21.4)	
New Jersey	2 (4.1)	1 (14.3)	1 (2.4)	

Characteristics	Total Sample N (%)	Yes Cancer History n (%)	No Cancer History n (%)	p-value
Total Sample	**49 (100.0)**	**7 (14.3)**	**42 (85.7)**	
Tenure as Firefighter	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	.478
Years	14.9 ± 9.5	21.3 ± 6.8	13.8 ± 9.5	
Rank				.182
Captain	4 (8.2)	0 (0.0)	4 (9.5)	
Chief (Assist/Battalion)	4 (8.2)	2 (28.6)	2 (4.8)	
Driver/Operator	5 (10.2)	0 (0.0)	5 (11.9)	
Fire Investigator	5 (10.2)	2 (28.6)	3 (7.1)	
Fire Marshal	2 (4.1)	0 (0.0)	2 (4.8)	
Firefighter/Paramedic	22 (44.9)	2 (28.6)	20 (47.6)	
Lieutenant	7 (14.3)	1 (14.3)	6 (14.3)	
Has Second Job				.660
Yes	15 (30.6)	3 (42.9)	12 (28.6)	
No	34 (69.4)	4 (57.1)	30 (71.4)	

[†]Differences in sub-total population sample due to item non-response or missing; SD=Standard Deviation