Accepted: 26 March 2017
DOI: 10.1002/ajim.22726

RESEARCH ARTICLE

WILEY AMERICAN JOURNAL OF INDUSTRIAL MEDICINE

Firefighter perceptions of cancer risk: Results of a qualitative study

David A. Anderson MA[1] | Tyler R. Harrison PhD[1] | Fan Yang MA[1] | Jessica Wendorf Muhamad PhD[2] | Susan E. Morgan PhD[1]

[1] School of Communication, University of Miami, Coral Gables, Florida

[2] Department of Public Health Sciences, University of Miami, Coral Gables, Florida

Correspondence
Tyler Harrison, PhD, School of Communication, University of Miami, 5100 Brunson Dr, Wolfson building, Coral Gables, FL 33146.
Email: harrison@miami.edu

Funding information
State of Florida, Grant number: 2382A

Background: Recent epidemiological research on firefighters indicates an increased incidence of specific types of cancer. Intervention is needed in the fire service yet little is known about how firefighters perceive their cancer risk.

Methods: Participant observation (150 h, $n = 100$) and focus group ($n = 17$) data were collected from 15 fire stations in South Florida. Firefighters had at least 3 years of experience, ranks included drivers, captains, lieutenants, and specialty captains, with a median age of 51 years.

Results: From the qualitative analysis, two major categories (direct and indirect factors) for cancer risks emerged based on participant notions of cancer risk and cancer prevention behaviors as they relate to firefighting.

Conclusions: Firefighters perceive cancer risks as the result of performing essential job tasks and from indirect job factors related to being a firefighter. The two categories of cancer risks suggest different points of entry for intervention.

KEYWORDS
cancer, firefighters, high reliability organizations, occupational health, qualitative methodology

1 | INTRODUCTION

Firefighters in the United States often are called America's heroes. Their work requires them to head into risky or uncertain situations to save the lives of community members and to reduce property damage. Traditionally, the occupational hazards faced by the fire service largely had been limited to consequences surrounding the performance of essential job functions (ie, falling building, smoke inhalation); however, today there is growing concern about the risk firefighters face from cancer. While heart disease historically has been the largest cause of morbidity and mortality for firefighters,[1] a number of local, national, and international cancer studies show significant correlations between being a firefighter and having higher risk of developing certain cancers such as digestive, oral, respiratory, and genitourinary system.[2–5] This increased cancer risk among firefighters may be the result of on-scene exposures, as well as exposure at the station from both diesel exhaust[6] and contaminated gear.[7] While research on the links between firefighters and cancer continue to advance, less is known about how firefighters perceive their cancer risk and how they are mitigating that risk through activities such as health promotion, changes in occupational practices, and other risk reducing behaviors. Practitioners and researchers are better able to develop interventions aimed at firefighters' attitudes and behaviors toward cancer when they understand how firefighters make sense of cancer within their organizational context and membership.

In response to the mounting evidence that occupational exposures increase cancer risk, at least 33 US states have adopted cancer presumptive laws.[8] Despite this concern, there are few studies that focus on how firefighters receive, process, and manage information on cancer risk. Jahnke et al[9] found that firefighters exhibit both general concerns about cancer, alongside concerns about cardiovascular disease, the food culture of the firehouse and sleep disruptions, and specific concerns about the cancer risk posed by newer burning materials and the dangers associated with bringing gear contaminated from an immediate danger to life and health incident (IDLH) back to the station. While there is a shift toward increased frequency and duration of PPE use,[9] the culture of the firehouse, including individual attitudes and beliefs about relevant issues, can be

influential in making decisions about PPE use. More junior firefighters likely look to more seasoned members when deciding when, where, and how to use PPE, with some being encouraged to engage in more risk oriented behaviors.[10] Further research is warranted on firefighter attitudes toward cancer risk and preventive behaviors as a way to improve the efficacy of health campaigns to increase cancer prevention behaviors.

The qualitative examinations found in this study provide a first step toward understanding the attitudes, beliefs, and perceptions of firefighters toward cancer risk, as well as the ways in which organizational shifts impact cancer risk prevention and health promotion among organizational members. To contribute to the literature on health promotion and occupational hazards, and specifically to the literature on firefighters' perceptions of their health risks, this study focused on the perceptions of cancer risk among firefighters. An examination of these factors will aid the designers of health campaigns and interventions that target the fire service and other high-risk work groups. This manuscript presents data collected via four focus groups and 150 h of direct participant observation.

2 | METHODS

2.1 | Design

IRB approved research (University of Miami, #20150761), was conducted in South Florida with the Palm Beach County Fire Rescue (PBCFR, named used with permission). Data were collected from four focus groups and observations (eg, field ride-alongs with both engine and rescue units) from 15 stations. Stations were chosen to ensure a mix of urban and rural areas, and a mix of high traffic (30+ calls a day) and low traffic (1-2 calls a day) stations. The ride-along consisted of a team member arriving early in the morning before shift change and leaving around dinnertime. Members of the study team introduced themselves, obtained consent, and proceeded to observe the daily activities at the assigned station. During the ride-along, interviews were conducted by comment and through informal questions. Immediately after field visits each team member engaged in detailed ethnographic journaling. Notes included observations on attitudes and behaviors, as well as built environment, potential barriers, and opportunities for change. Additionally, team members discussed observations to aid in understanding and to identify key areas for future observations and questions. These notes where then analyzed and emerging themes were used in the development of a focus group protocol to address research questions. Firefighters were asked a series of questions about typical daily work practices, perceived career related risks (including long-term cancer risk), cancer prevention and other risk prevention behaviors, and social factors around cancer and health. Four focus groups were conducted across four levels of occupational status to ensure diversity in the sample. Utilizing formal and informal channels, focus group participants were recruited via convenience sampling. For a more detailed review of the suitability of qualitative methods for inquiry into occupational health issues, see Dobson et al.[11]

2.2 | Sample

In total, members of the study team observed more than 100 firefighters over 150 h during ride-along and firehouse visits. Team members observed all ranks, from new recruits to district chiefs. In addition, 17 firefighters participated in one of four focus group discussions that lasted approximately 90 min each. Focus group participants ranged in age from 29 to 58 years, with an average age of 51 years; they included drivers (n = 3), firefighters (non-ranked) (n = 4), captains and lieutenants (n = 6), and specialty captains (n = 4). Based on demographics, the majority of the sample observed in both focus group and field visits had more than 3 years on the job. We estimate roughly 5% of the observational sample is comprised of rookies and/or probationary members.

2.3 | Analyses

Data were analyzed utilizing grounded theory approach.[12] Grounded theory is a methodological approach used to identify interpretive themes and meanings. Focus groups were transcribed and entered in NVivo10. Transcripts were then coded thematically with themes noted and collapsed where appropriate. The first three authors each coded one segment of field notes and transcripts and any disagreements were discussed and resolved to create the coding categories. Coding categories were fluid and continued to evolve as additional data were collected and analyzed. Individual utterances could be coded as multiple categories, with codes being used as the basis for analysis. Individual team members coded roughly 33% of the total sample each. From the coding, two major categories (direct factors and indirect factors) for cancer risk emerged based on participant notions of cancer risk and cancer prevention behaviors related to firefighting.

3 | RESULTS

Findings from this study, produced from analyses performed with NVivo software, indicated that firefighters perceive risk factors for cancer under two major categories: (1) direct factors related to work (eg, on-scene exposures, issues related to gear, exhaust from the trucks or engines) and (2) indirect factors related to their occupation, but not considered essential features of firefighting (eg, diet). It is important to note that due to the uniqueness of the profession, direct and indirect are not necessarily mutually exclusive categories. The firefighters in our study spend 24 h together when on shift, leading many of their personal behaviors to become work related. For example, communal meals are largely a result of the structure and nature of their work, and individual food preferences often, but not always, take a back seat to collective preferences.[11] Firefighters in this study identified what they perceived to be individual causes of cancer (eg, eating too much bacon, diesel exhaust), but many also believe cancer etiology is a combination of many of these individual factors, including occupation, genetics, and family history of cancer.

3.1 | Direct factors for cancer risk

Direct cancer risk factors are difficult for firefighters to avoid because these risks stem from the performance of essential occupational tasks. While difficult to avoid, firefighters in this study were cognizant of the risk posed by these factors and engaged in some health promotion activities to protect themselves prior to or after the events described below. Overall, firefighters in the study reported concern for their cancer risk from on-scene exposures, contaminated gear, and exhaust from engines and rescue trucks.

3.1.1 | On-scene exposures

During IDLH calls, firefighters can be exposed to burning materials that can produce toxic chemicals and particulates. Firefighters use personal protective equipment (PPE) to reduce risk in IDLH situations. Additional inhalation risks, however, still can occur from off-gassing PPE when firefighters remove their self-contained breathing apparatus (SCBA) immediately after a fire.[7] While PPE reduces immediate risk, even when wearing PPE appropriately, firefighters may show increased biomarkers of carcinogenic combustion products in their bodies.[13] This danger is compounded by findings that PPE is not consistently worn.[10] While firefighters in this study were aware of these exposures and believe they are linked to increased cancer risk, this knowledge and awareness appears to be a relatively recent development. Older firefighters expressed that they had not recognized this danger, nor had they taken precautions in their younger years.

> *But yet on the job, I'm sitting for 5–6 hours in a smoke filled environment of burning leaves and stuff which is what tobacco is. You know, I guess tobacco has added stuff in it to really hook you and stuff. But it's still basically leaves burning and we're sitting out on these [brush fires without full PPE]. – Jasper, firefighter*

> *Like you said, one hundred years ago, what was on fire? Tables, furniture with all natural stuff. That changes in 50s, 60s [to more plastics, for example] [. . .] As an industry, it just take forever to change anything, to change the mentality about something. – Harold, firefighter*

These quotes also fit with field observations where firefighters make judgments about the danger of burning materials and balance that with the actions necessary to perform the job. The team observed one brush fire that lasted for approximately 5 h (plus additional monitoring time), and firefighters wore different levels of PPE, from lighter brush fire gear to full turnout gear, while fighting the fire. While they were concerned with the heat of the fire, no firefighters wore SCBA. When asked, they replied it was a clean burn and it was just not feasible to wear air for that length of time, resulting in hours of assumed exposure to smoke and toxins.

At PBCFR there appears to be a general shift to more preventive personal measures among younger firefighters, new recruits, and even many of the more seasoned firefighters. This change is not universal; however, Harrison et al[14] found resistance among some of the older firefighters who may passively or actively resist some of the newer protocols on gear cleaning. Consequently, some personal safety behaviors are enacted less frequently than they should be, or are performed with reluctance.

> *I wear my mask. I'm usually on the outside, I'm not on the inside on fires. But even on some of the fires I go on, I've tried to make myself put my mask on. Because while I'm not in the true hot zone, I'm on the edge of it, I'm getting, I'll get smoke blown at me when I'm doing my 360s [checking the fire scene] [. . .] So I'm more cautious about trying to put my mask on. I hate it. I absolutely hate walking around with an air pack and a mask on the outside of a fire [. . .] you know it's hard to overcome that. – Jasper, firefighter*

While many firefighters are taking active steps to protect their health while at an IDLH, many firefighters still find themselves at risk due to off-gassing gear, which is transported back to the station in the enclosed cabs of the engines, and occasionally to their homes in personal vehicles.

3.1.2 | Contaminated gear

Firefighter's bunker gear—a vital tool to execute job responsibilities—can become severely contaminated through fighting fires, attending to car accidents, and/or performing other essential job tasks. Long-term exposure to harmful chemicals occurs when firefighters wear or transport contaminated gear in confined vehicles.[7] Firefighters, while knowledgeable of the contaminants on their gear and their potential harmful effects, also recognize specific occupational requirements that make it difficult to properly clean their gear in-between calls. As Aaron, a captain, explained:

> *Because there I am, putting my gear down. My toxins are still right there. And then what happens a few calls later, whether it be a car accident or even after a fire, I put that gear on, [without having a chance to clean it]and [I'm exposed to] smoke and flames. [A]ll that crap that came outta that fire is now on my body.*

Firefighters expressed they engaged in some preventive behaviors to mitigate the danger of cross contamination. This included storing gear that is still off-gassing away from the bunk house or living quarters, ideally in open air lockers in well ventilated areas. However, clean gear has not always been perceived favorably among firefighters,[14] resulting in great variance in the degree to which they clean gear and endorse a culture of clean gear.

> *I agree; the culture has changed. It is no longer a badge of honor [to have dirty gear] but I am not convinced that we're doing a better job as far as cleaning our gear. You're the first person that's told me that you require all your*

guys to clean their gear. I wash my gear after each fire. – Ellis, firefighter

While there is evidence in this study that individual firefighters are attempting to engage fellow firefighters in preventive behaviors, firefighters also believe that the culture is not changing quickly enough regarding cancer risks. Taylor commented "we are making changes, and the department is not making any change in my eyes. The gear, our gear in the bay, gets diesel covered all the time." Firefighters face many challenges engaging in risk prevention behaviors like cleaning gear. As a result, some firefighters engage in unconventional and potentially problematic solutions to gear cleaning such as taking dirty gear to Laundromats.

It worries me a lot [getting cancer], you know. I've only been [a firefighter for] 6 years, you know, and I don't want to die early of cancer. I want to go and live this life to its fullest. Yeah, It's big on my brain and if I don't run a fire, I don't want [to] wash my gear [regularly]. But if I do run a fire, every Kelly week [extra shift off every month to prevent regular overtime] I take it and I bring it to a laundromat and I wash my gear, every time. – Jamel, lieutenant

This example highlights the difficulty firefighters face in finding workable and efficacious solutions to cleaning their gear. Even when firefighters desire to take preventive actions such as cleaning gear, they may face cancer risk from additional occupational conditions such as truck or engine exhaust in the station.

3.1.3 | Exhaust

In addition to perceptions about high risks of susceptibility to cancer from IDLH incidents, many of the firefighters we observed were concerned about risk from daily exposures related to the work environment. During the observations, firefighters could identify specific areas within and around the fire stations that they believed contributed to toxic chemical exposure. At over 80% of the stations in our study, firefighters expressed concern about daily exposure to diesel exhaust. Diesel exposure occurs from engine and rescue vehicles in bays that do not have sufficient exhaust ventilation. When vehicles are started or idle in the bay, exhaust contaminates items within the bay. This is problematic as most stations store their gear in open lockers in the bay (often right next to the exhaust system), have ice machines in the bay, and have bunk rooms that open directly onto the bay, meaning that when firefighters are preparing to answer a call, there is an opportunity for exhaust to get into their sleeping quarters. While some stations have managed to get separate bunker gear rooms and several have moved ice machines, the problem of exposure to diesel exhaust is ongoing and of concern to firefighters as a cancer risk.

[Diesel fumes are] probably the ones we [are] most expose[d too]. Because it doesn't matter whether it's a fire, or a training, or just checking the truck at morning. Everybody in the department is exposed to the diesel. You can be at the slowest station at the county [and still be exposed to diesel fumes]. – Harold, a captain

Firefighters appear to be more aware of the dangers posed by diesel fumes and consequently have taken preventive actions, such as waiting to start vehicles and not running the vehicles in the bay when possible. Firefighters in this study have begun to see changes in the last 2 years alone.

And most people now a days aren't even starting the truck right when you get a call [. . .] a lot of people are more aware, just in the last two years . . . [In the past] you may be late to the truck because you are [taking a] shower, you [are] going to the bathroom, you are at dinner, whatever it is, you are on the phone, we start the truck and just sit there waiting [. . .] But now, I don't even start it until my captain says "get onto the truck. – Jacob, firefighter

3.2 | Indirect factors for cancer risk

Indirect factors are cancer risk factors that result from being a firefighter, but do not necessarily stem from the performance of essential tasks related to the occupation. Firefighters spend considerable time together at the station and what may be individual behaviors (eg, what I eat) often turn into social behavior (sharing meals). Firefighters in this study discussed their concerns over how their diet may influence their cancer risk and the difficulties associated with making changes considering the social nature of eating in the firehouse.

3.2.1 | Food

Food is an important part of the culture of firefighters.[9] Diet also can serve as a risk factor for cancer. Latino-Martel et al's[15] meta-analyses highlighted the connection between alcoholic beverages, red meat and processed meat, salt and salted foods, and cancer incidence. Further, being overweight or obese also may serve as a risk factor for cancer. This is particularly concerning for the fire service as it may experience rates of obesity higher than that found in the general population.[16] For many firefighters, mealtime is sacred—it is a communal experience where firefighters share stories and bond. Meals often are planned at the start of shift; with crews collecting money for meals, as well as grocery shopping together while on shift. The actual task of cooking is often designated to the firefighter with the most skill, but in stations without a seasoned chef, cooking responsibilities are shared and designated based on position during the shift. The chef of the day has a great deal of influence over how healthy the meal is. Firefighters seemed to be aware that their diets are not as healthy as they could be, and that this is partially due to the constraints of the occupation.[11] Still, many of the firefighters in the study could connect their diets to increased cancer risk.

Diet, you know. Still here, I'm happy. I'm not changing much. I'm the one [who] used to [eat poorly] . . . I love McDonald's. I'm really not changing much because I'm

> *running in 2000 different [directions]. So really it's not an excuse but that's what I got [. . .] But I still don't eat properly [. . .] You know, I wish I said I did [change my diet to something healthier], but I don't. We make a big pot of something [at the station], I will eat it . . . I really shouldn't, I don't know if I will regret it soon [but I haven't made significant changes to my diet] – Samuel, firefighter*

While some firefighters reported feeling constrained by their occupation (eg, eating quickly), others struggled due to individual motivation. Some firefighters have made attempts to eat healthier or to influence other health-conscious firefighters to become active in preparing meals rather than skipping unhealthy communal meals and eating alone. However, the demands of the job and the culture of firefighting often make sustained dietary change difficult.

> *I have tried [a] couple times reducing the calories, reducing the carb [. . .] [This diet] last[s] for a little [while, but it] never stays. I think it's my wife and probably the guys in my station [saying], "Dude, come on, what are you doing?" I'm lucky, knock on the wood, I'm 42 years old, I have a great job. But [the] shitty facts of our job, I probably drink a little bit more than I should, eat like shit, part of that is scheduling-wise. [I] run around with two kids. I got enough other crap, I'd rather deal with them. [...]. But I have been lucky, knock on wood, that I haven't found anything major for being overweight at my age" – Harold, firefighter*

While food and shared meals are important at all stations, some stations tend to eat healthier because they have people on shift willing to cook healthier meals for the station.

> *Well we have some guys in our station, we work at the same station just different shifts. And we have some health guys that are forcing more of the kale, and the, you know, the double vegetable and lack of potato kind of meal and things like that. So you know, like I said, I haven't made changes, but those guys [are eating healthier] – Demetrius, firefighter*

Overall, firefighters in our study expressed concerns about the relationship between their diets and potential increased cancer incidence in the fire service.

3.3 | Other significant findings

While not within the two major categories listed above, firefighters in this study thought carefully about their cancer risk. This often manifested as a duality where firefighters made fatalistic statements regarding their cancer risk (ie, resigned to getting cancer or referring to the cancer already being in them), yet were hopeful that something could be done for themselves or future generations of firefighters. Fatalism is often defined as viewing health issues and outcomes as outside of the individual's control. Definitions of fatalism also often include an element of predestination—viewing certain events (eg, getting cancer) in life as occurring no matter what we do.[17] While firefighting is an occupation known for being dangerous or risky, many firefighters in our study believe that cancer is what will ultimately end their lives. Harold commented "I already know I'm going to die of some kind of cancer. That's what gonna end my way. Unless I get hit by a bus or a car. If I die by natural causes, it's gonna be through cancer." Likewise, Tony reported "Like I said, it's not a matter of if, it's a matter of when... We're not gonna be able to [stop it] until somebody comes up with a Nobel prize in medicine that we found a cure for cancer, it won't stop." Although fatalistic, firefighters expressed they can still take actions to mitigate their risk of getting cancer. From field notes:

> *So I asked some of the older ones if it's too late, [if] there is anything to be done about it. They said "it's never too late, we can still do these things, we can still get the screening, we can still change our behaviors, and hopefully [we can reduce our cancer risk.]"*

The duality of these fatalistic statements in this sample is that believing with certainty that they will get cancer does not necessarily inhibit preventive or protective actions. This may be an ideal point of entry for thinking about health promotion campaigns aimed at firefighters.

4 | DISCUSSION

Health campaigns and health interventions can benefit from formative research that identifies barriers to action in the target population. Firefighters in this study were aware of the risks inherent to their job and believe that cancer is a fact of life for the occupation. In addition to individual behavior change, firefighters see changes to elements of their physical environment (ie, separate, ventilated rooms for gear storage away from diesel exhaust) as ways to reduce cancer risk. They identified cancer risks which are inherent to the occupation and essential job tasks (direct risk factors), as well as cancer risk factors which result from the occupation but which are not related to essential job or task features (indirect risk factors). While some firefighters struggle to perform protective health behaviors in the face of individual motivations and organizational or occupational challenges, firefighters in this study reported taking some steps toward mitigating their exposure risks from contaminated gear. Firefighters also discussed challenges to healthier living as evidenced in the section on food and diet.

The findings of this study have practical and theoretical value to practitioners and researchers. Firefighters perceive cancer risk as a result of factors related to their occupation at both direct and indirect levels. It is likely that these different types of factors require different types of interventions for health promotion and risk prevention. Direct factors, such as the threat posed by diesel exhaust or cross-contamination caused by the transportation of still off-gassing gear will require working closely with fire service members and

administration to affect work practices. Solutions and recommendations should be workable, cost-efficient, and speak to the local organizational practices and climates. While some changes are likely out of the hands of individual firefighters (ie, a second set of gear), clear information on where and how to clean gear may facilitate a reduction in exposure to cancer causing agents. Indirect factors, such as diet or rituals around food, require working with the fire service to shift or change the organizational cultures around meal times. Firefighters may face social repercussions when they want to change the foods they eat on shift, and some individuals may find it difficult to bring their own food as this also may trigger social sanctions. An intervention aimed at dietary practices must consider the cultural practices that surround food in the fire service. There is evidence that cultural changes are already happening in the fire service. Historically, burned or charred helmets have signified expertise and reliability in the fire service.[14] The dirtier the helmet, the harder one worked as a firefighter and the better one was at the job. At PBCFR, a cultural shift does appear to be happening in terms of practices and beliefs around dirty gear. Whereas previously, charred or blackened helmets were symbolic of hard work and experience with fires, newer generations of firefighters are resisting this narrative.[14] Overall, firefighters in this study recognized that they faced potential cancer risks in a wide range of situations and that risk mitigation is needed on both the part of individuals and the larger organization. While many firefighters may feel that cancer is inevitable, they still desire workable and scientifically sound solutions.

AUTHORS' CONTRIBUTIONS

DA was involved in the acquisition, analysis, interpretation, drafting, revising, and final approval of the version to be published. TH and FY were involved in acquisition and interpretation of the data, as well as drafting the work and revising it critically for important intellectual content. JW was involved in interpretation of the data, as well as drafting and revising of the work. SM was involved in the acquisition of the data.

ACKNOWLEDGMENTS

The authors would like to thank the firefighters, unions, and support groups of South Florida.

FUNDING

This work was supported by State of Florida appropriation #2382A (PI Kobetz) to Sylvester Comprehensive Cancer Center, subaward (PI Harrison) to the Center for Communication, Culture, and Change in the School of Communication at the University of Miami.

ETHICS APPROVAL AND INFORMED CONSENT

All observations were performed at the respective fire stations. Focus groups were conducted at a centralized location. Research approval was obtained through the University of Miami IRB system. Study 20150761 was approved on 9/9/2015. Focus group and observation consent was obtained through a verbal consent process.

DISCLOSURE (AUTHORS)

The authors report no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

Paul Landsbergis declares that he has no competing or conflicts of interest in the review and publication decision regarding this article.

DISCLAIMER

None.

REFERENCES

1. Kales SN, Elpidoforos SS, Costas AC, David CC. Emergency duties and deaths from heart disease among firefighters in the United States. *New Engl J Med*. 2007;356:1207–1215.
2. Daniels R, Kubale T, Yiin J, et al. Mortality and cancer incidence in a pooled cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950–2009). *Occup Environ Med*. 2014;71:388–397.
3. Fritschi L, Glass DC. Firefighters and cancer: where are we and where to now? *Occup Environ Med*. 2014;71:525–526.
4. Pukkala E, Martinsen J, Weiderpass E, et al. Cancer incidence among firefighters: 45 years of follow-up in five Nordic countries. *Occup Environ Med*. 2014;71:1–7.
5. Tsai RJ, Luckhaupt SE, Schumacher P, Cress RD, Deapen DM, Calvert GM. Risk of cancer among firefighters in California, 1988–2007. *Am J Ind Med*. 2015;58:715–729.
6. Michalak G. 2004. Diesel emissions in fire stations. Resource Information Center for Health, Technology, and Environmental Recovery Foundation.
7. Fent KW, Evans DE, Booher D, et al. Volatile organic compounds off-gassing from firefighters' personal protective equipment ensembles after use. *J Occup Environ Hyg*. 2015;12:404–414.
8. International Association of Firefighters. 2017. State presumptive disability laws. Available at: http://www.iaff.org/hs/phi/docs/PresumptiveDisabilityChart.pdf
9. Jahnke SA, Poston WSC, Jitnarin N, Haddock CK. Health concerns of the US fire service: perspectives from the firehouse. *Am J Health Promo*. 2012;27:111–118.
10. Maglio MA, Scott C, Andrea L, Allen J, Taylor JA. Situational pressure that influence firefighters' decision making about personal protective equipment: a qualitative analysis. *Am J Health Behav*. 2016;40:555–567.
11. Dobson M, Choi BK, Schnall PL, et al. Exploring occupational and health behavioral causes of firefighter obesity: a qualitative study. *Am J Ind Med*. 2013;56:776–790.
12. Glaser B, Strauss A. *The Discovery of Grounded Theory*. London: Weidenfeld and Nicholson; 1967.
13. Fent KW, Eisenberg J, Snawder J, et al. Systematic exposure to PAHs and benzene in firefighters suppressing controlled structure fires. *Ann Occup Hyg*. 2014;58:830–845.
14. Harrison TR, Yang F, Anderson DA, et al. Resilience, cultural change, and cancer risk reduction in a fire rescue organization: clean gear as the new badge of honor. *J Contingencies Crisis Manage*. in press.
15. Latino-Martel P, Cottet V, Druesne-Pecollo N, et al. Alcoholic beverages, obesity, physical activity and other nutritional factors, and cancer risk: a review of the evidence. *Crit Rev Oncol Hematol*. 2016;99:308–323.

16. Poston WS, Haddock CK, Jahnke SA, Jitnarin N, Tuley BC, Kales SN. The prevalence of overweight, obesity, and substandard fitness in the population-based firefighter cohort. *J Occup Environ Med*. 2011;53:266–273.
17. Straughan PT, Seow A. Fatalism reconceptualized: a concept to predict health screening behavior. *J Gender Cult Health*. 1998;3:85–100.

How to cite this article: Anderson DA, Harrison TR, Yang F, Wendorf Muhamad J, Morgan SE. Firefighter perceptions of cancer risk: Results of a qualitative study. *Am J Ind Med*. 2017;60:644–650. https://doi.org/10.1002/ajim.22726