

Exploring Occupational and Health Behavioral Causes of Firefighter Obesity: A Qualitative Study

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Background Firefighters, as an occupational group, have one of the highest prevalence rates of obesity. A qualitative study investigated occupational and health behavioral determinants of obesity among firefighters.

Methods Four focus groups were conducted with firefighters of every rank as Phase I of the FORWARD study which was designed to assess health behavioral and occupational characteristics related to obesity in firefighters.

Results Analysis revealed five main themes of central importance to firefighters: (1) fire station eating culture; (2) night calls and sleep interruption; (3) supervisor leadership and physical fitness; (4) sedentary work; and (5) age and generational influences.

Conclusion The results showed a strong interrelationship between occupational and health behavioral causes of obesity in firefighters. The relevance of these qualitative findings are discussed along with the implications for future obesity interventions with firefighters. Am. J. Ind. Med. © 2013 Wiley Periodicals, Inc.

KEY WORDS: obesity; firefighters; qualitative research; occupational health; health behaviors

INTRODUCTION

Obesity is a national health crisis in the United States (US) [Wang and Beydoun, 2007] and it is a significant risk factor for first responders such as firefighters where sudden cardiac death is consistently the leading cause of line-of-duty deaths [Kales et al., 2003, 2007; Fahy et al.,

2011]. Despite an initial strong healthy worker effect, firefighters have high rates of CVD risk factors [Kales et al., 1999; Soteriades et al., 2005] and rank third in obesity prevalence among 41 male occupations in the U.S. [Caban-Martinez et al., 2005; Choi et al., 2011]. There also appears to be an upward trend in obesity among firefighters and especially among already obese firefighters who exhibit a clustering of CVD risk factors [Kales et al., 1999; Soteriades et al., 2005].

However, there have only been a handful of studies [Gerace and George, 1996; Elliot et al., 2007; MacKinnon et al., 2010; Haddock et al., 2011; Ranby et al., 2011] examining health behaviors related to weight gain or obesity in firefighters. None of these studies have explicitly investigated adverse working conditions as possible causes of obesity in firefighters. Findings from a qualitative study on the obesity epidemic conducted for the National Volunteer Fire Council (NVFC) highlighted problems with the “nutrition environment of the firehouse” [Haddock et al., 2011]. The findings are informative but limited for

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understanding the multifactorial etiology of obesity. In addition, the focus groups in the NVFC qualitative study did not address possible interrelationships between working conditions, health behaviors and obesity. As a result, the nutrition recommendations for firefighters proposed in the NVFC report did not go beyond smart individual choices of healthy foods.

A recent firefighter health behavior intervention study, known as the PHLAME study, [Elliot et al., 2007; Ranby et al., 2011] assessed the effects of two health promotion interventions on BMI and eating behaviors and nutrition knowledge in 599 firefighters between 2000 and 2008. Elliot et al. [2007] showed some beneficial effects of the interventions on fruit and vegetable consumption, physical activity, and weight maintenance at the 1 year follow-up [Elliot et al., 2007]. However, results on subsequent waves of follow-up in this firefighter cohort revealed that the 12 month effect dissipated after 4 years [MacKinnon et al., 2010; Ranby et al., 2011]. The working conditions of firefighters were not considered in this study.

A growing epidemiological literature in other occupational groups has shown that working conditions including sedentary work [Ishizaki et al., 2004; Mummery et al., 2005; Ostry et al., 2006], shift work [van Amelsvoort et al., 1999; Morikawa et al., 2007; Scheer et al., 2009], long work hours [Shields, 2002; Lakdawalla and Philipson, 2007], and psychosocial stressors [Ishizaki et al., 2004, 2008; Kivimaki et al., 2006; Brunner et al., 2007; Block et al., 2009; Choi et al., 2010a] are associated with obesity. There is also evidence in firefighter and non-firefighter research that lifestyle risk factors such as diet and exercise behaviors may be affected by work characteristics [Murphy et al., 1999; Brisson et al., 2000; Schneider and Becker, 2005; Kouvonen et al., 2006; Atkinson et al., 2008; Morikawa et al., 2008; Devine et al., 2009; Nishitani et al., 2009; Choi et al., 2010b; Dobson et al., 2010]. Working conditions may play a role in the increasing obesity among firefighters.

Most firefighters work as first responders in a hierarchical organizational structure following a non-traditional work schedule (e.g., 10 or more 24 hr workdays per month), and often work additional shifts. Firefighters work in close-knit teams and share meals, sleep, train or participate in physical exercise together, suggesting social support may be an important factor. The highest proportion of emergency calls are for medical emergencies; fire calls have been decreasing nationally to only 4.7% of total calls [Karter, 2010]. Frequent emergency calls during the night can cause significant sleep disruption.

As part of the Firefighter Obesity Research: Workplace Assessment to Reduce Disease (FORWARD) project [Choi et al., 2011] this qualitative study investigates the interrelationship between occupational factors, health behaviors and obesity by drawing on the knowledge and expertise of firefighters themselves.

METHODS

Qualitative research methods (e.g., ethnographic field work, interviews, or focus groups), prioritize and privilege the knowledge of those living or working in their everyday worlds as an epistemological starting point [Smith, 1987, 2005]. The methods can provide rich, descriptive data that may be missed when using quantitative methods which tend to ask and answer questions related to “how often” or “how many,” rather than “what” or “why” [Schonfeld and Farrell, 2010]. Qualitative approaches are being used increasingly in occupational health either as exploratory stand-alone projects or integrated with broader quantitative epidemiological surveys [Mergler, 1987, 1999; Black, 1994; Needleman and Needleman, 1996; Ballard et al., 2004; Gordon et al., 2005; Schonfeld and Farrell, 2010]. In particular, qualitative approaches can: offer support for existing theoretical models [Black, 1994; Schonfeld and Farrell, 2010]; guide data analysis and interpretation of quantitative surveys (triangulation as part of mixed-methods approaches) [Mergler, 1999; Ballard et al., 2004; Gordon et al., 2005]; and importantly; enhance collaboration with working people by offering them a forum for discussing the particular problems of their workplaces and health; and for developing feasible intervention programs [Mergler, 1987; Needleman and Needleman, 1996; Goldenhar et al., 2001].

The FORWARD Project

The purpose of this project is to explore occupational and health behavioral risk factors for obesity in firefighters with the Orange County Fire Authority (OCFA) and the International Association of Fire Fighters (IAFF) Local 3631 [Choi et al., 2011]. Phase I of the FORWARD project involved collecting qualitative data using focus group discussions with two main goals: to explore firefighter perspectives on their working conditions and health behaviors as they perceive them to be related to weight gain and obesity, and to develop a firefighter-specific work and health questionnaire, with firefighter input. This questionnaire was administered to 365 firefighters as part of Phase II of the FORWARD study and was completed December 2012.

Population

The OCFA includes 62 fire stations which service 22 cities as well as unincorporated parts of a diverse, suburban county in Southern California. Structural fires are rare, comprising only 1.6% of calls in 2010 [OCFA, 2011]. Most calls are for emergency medical service (EMS; 69%), with 29% of calls classified as “other” (i.e., ruptures, hazmat, service calls, good intent, false alarms,

or miscellaneous) [OCFA, 2011]. Most firefighters are qualified paramedic first responders. Firefighters in this organization work a required ten or eleven 24 hr shifts per month. Most also work two or three additional shifts (some mandatory, some voluntary) often resulting in consecutive 24 hr shifts of 48, 72, or 96 hr. They work in a team-oriented environment made up of an Engineer and usually one or two Firefighters/Paramedics as well as a Captain. There is a hierarchical, rank structure where the Captains are ultimately responsible for organizing work tasks and monitoring the health and well-being of the crew. Captains report to Battalion Chiefs who oversee several stations. When they are not responding to emergency calls, firefighters eat meals together, exercise, participate in trainings, sleep, and maintain station facilities and equipment.

Over 800 firefighters in this organization have voluntarily participated in a Wellness–Fitness (WFI) evaluation at the UC Irvine Center for Occupational and Environmental Health (COEH), where various cardiovascular risk factors are assessed biennially, including, blood pressure, blood lipid profiles, body mass index (BMI), skin-fold based body fat %, and cardiorespiratory aerobic fitness (estimated VO_2 max) capacity. Firefighters attending these examinations were recruited for the survey study.

Focus Groups

Focus groups are one useful qualitative research method utilized mostly in the social sciences but increasingly in participatory action research (PAR) approaches in public health and occupational epidemiology [Mergler, 1987; Hugentobler et al., 1992; Laurell et al., 1992; De Koning and Martin, 1996; Farquhar et al., 2006; Roskam, 2009]. Focus group methodology is useful for exploring and developing new ideas and, compared with one-on-one interviews, can bring researchers in contact with a larger number of people in a short period of time [Morgan, 1993; Greenwood and Levin, 1998; Krueger and Casey, 2000; Fern, 2001]. Additionally, a focus group can create a group effect which produces data from a group setting where members are “listening to others’ verbalized experiences [which] stimulates memories, ideas and experiences in participants” [Lindlof and Taylor, 2002] (p. 182) Focus groups can lead to the discovery of shared meaning about experiences and enables the capture of a form of “native language” in order to understand a situation. However, group dynamics can serve to stifle the thoughts and beliefs of some members of the group, especially where there is an explicit hierarchy, as in the quasi-military rank-structure of a fire department. To help mitigate this possibility, these focus groups were conducted with individuals of similar rank with the intention of allowing individuals to feel more comfortable to speak freely.

A Research Advisory Committee (RAC) was convened, consisting of the research team and representatives of the firefighter organizations involved, including management (OCFA), the union (IAFF Local 3631), and the Battalion Chief Officers Association. This group reviewed materials developed for use with the focus groups as part of the FORWARD study project and also helped to recruit participants for the focus groups and continues to meet regularly. The intent of this phase of the FORWARD study was to generate firefighter ideas about work and health behaviors related to obesity so that these themes could also help to triangulate results from the survey. The focus groups were moderated by a member of the research team [MD] experienced in qualitative approaches. In each focus group, at least 30 min or more were set aside for an open-ended discussion with a question prompt that asked firefighters: “Can you share with us your ideas about why you think there might be a problem with obesity among firefighters in this organization?”

Four focus groups were conducted in January and February 2011 as part of Phase I of the FORWARD project (Table I). The majority of participants were men, which is not unexpected due to the low percentage of females in the organization (<2%). Two focus groups were conducted with only Firefighters and Engineers in order to attain their unique perspectives without a supervising officer (e.g., Captain) present. One group discussion with Firefighters and Engineers only occurred at a local station (Group 1, FF/Engineers: $n = 8$). A group with only Captains (all of whom had been out in field locations prior to taking staff positions at headquarters) formed another focus group (Group 2, Captains: $n = 4$). Another discussion with Firefighters and Engineers only was held at the University research conference room after a crew attended a WFI examination (Group 3, FF/Engineers: $n = 3$). The final focus group was held with Battalion Chiefs only (Group 4, Battalion Chiefs: $n = 5$) at a local station. Firefighter’s participating in the focus groups had a broad range of experience on the job, from 2 to 39 years and represented Firefighters, Paramedics, Engineers, Captains, and Battalion Chiefs (see Table I).

Written informed consent was not required as approved by the University of California, Irvine, Institutional Review Board (UCI-IRB), but all participants were given a UCI-IRB-approved study information sheet and were informed verbally of their rights and assured their information would be kept confidential. Names were not recorded and participants remain anonymous in this article. Sociodemographic information of the participants was not requested beyond years of experience and job title to further protect the identity of participants. Focus groups took, on average, between 90 and 120 min and were audio-recorded and later professionally transcribed. The accuracy of the transcription was checked against the

TABLE I. Characteristics of Firefighter Focus Group Participants

Job title	Years on job
Group 1—FF/Engineers	
Paramedic	8
Engineer	10
Paramedic	15
Paramedic	3
Paramedic	17
Firefighter	^a
Firefighter	^a
Firefighter	^a
Group 2—Captains	
Captain	25
Captain	20
Captain	20
Captain	21
Group 3—FF/Engineers	
Paramedic	2
Firefighter	2
Engineer	20
Group 4—Battalion Chiefs	
Battalion Chief	32
Battalion Chief	39
Battalion Chief	22
Battalion Chief	36
Battalion Chief	^a

^aThree firefighters participated in Focus Group 1 but were interrupted to attend to emergency calls at the station so data from these three firefighters was not collected. One Battalion Chief came to the focus group late so data was not collected.

original audio recordings by the first author. Notes were also taken by at least two researchers [MD and BC] attending the discussions.

Analysis of Focus Group Material

Grounded theory methodology allows for an inductive theory-building approach to qualitative methods which does not require a priori theory but provides a road-map through the process of analysis of qualitative data [Strauss and Corbin, 1990]. Since the focus group discussions were all guided by a main topic question, about the causes of obesity among firefighters, a shared language or certain ideas about firefighter obesity arose repeatedly across all four focus groups. Of particular interest to the FORWARD project, were the frequent discussions that described relationships between health behaviors such as eating habits and exercise or physical activity and occupational factors.

The moderator, an experienced qualitative methodologist, analyzed the transcripts, notes and audio-recordings

from the four focus groups and, using a heuristic or common-sense approach used in grounded theory and other qualitative analysis, coded the transcripts into frequently occurring themes [Strauss and Corbin, 1990]. In this way, all the relevant discussion that occurred during these focus groups was sorted into one of the major themes or sub-themes identified.

RESULTS

Five main themes were identified in discussions with firefighters about the causes of firefighter obesity including: (1) fire station eating culture (which contained six sub-themes); (2) night calls and sleep interruption; (3) supervisor leadership and physical fitness; (4) sedentary work; and (5) age and generational influences.

(1) Fire station eating culture

Nutrition and eating behaviors in the firehouse were the first and most vocally discussed issue after asking the question prompt about causes of obesity among firefighters.

(a) *Meal planning: “family style” or “eating out”:*

Firefighters reported that in bigger stations (usually over two or more crews) a family-style form of meal preparation was common. All members of a crew take turns preparing meals for an entire shift when they are on-duty, and each member contributes \$5–10 towards two group meals, lunch and dinner. In smaller, less busy stations where only three or four people are on-duty at a time, it is usually deemed more affordable to eat out at low-cost, family restaurants or fast-food chains on the way back from calls or between calls. Some discussion centered on the issue that there was less family-style eating-in “these days” and more eating-out at convenience, fast food restaurants, as one Captain summarized:

... instead of going to the market, spending the time shopping they [a crew] will occupy that time doing something else routine and then they will stop at a fast food restaurant coming back from a call or they will go out and get it and then bring it back to eat it. And I think that’s a big contributing factor [to obesity]... the fact that eating out has become more common place (Group 2, Captains).

There were mixed reports about the kind of foods purchased when eating out, some firefighters suggested people were beginning to choose healthier

options (e.g., sandwiches with salad versus fast-food burgers) but some pointed out that you often had to go along with the group. If the consensus was a fast-food burger location, healthier options might not be available.

- (b) *Portion size:* Much of the discussion about eating centered on problems encountered with the family-style eating in fire stations. Most felt that family-style meals led to preparing and eating larger quantities of food than necessary and eating when not hungry:

I think first of all it is portion size. . . . When you cook, and because we cook as a group, you have to make sure that you don't run out. Guys always go back for seconds. There's got to be a lot of it, and it's got to be cheap. (Group 1, FF/Engineers)

. . . . When you are the cook you never ever want to run short. If anything, you are going to have enough or extra, but never run short. So it's part of the cultural thing because if you run short and someone gets one bite less that they need to fill them up, you are going to hear about it for a long time! So the culture of 'always buy at least enough and then more' also adds into that [eating too much] (Group 2, Captains).

The idea that there "better be enough" arose repeatedly in every focus group and it became clear that an emphasis within the firefighter community was on quantity of food over quality. Primarily, because people wanted to get their money's worth and secondly, that a relatively small amount of money had to stretch to feed 15 people at a time for lunch and dinner (mostly firefighters were individually responsible for breakfast). Food choices had to include meat and carbohydrates first, and always dessert, then fresh vegetables if money allowed. The general consensus was that cheaper, leaner meat, such as fish, and salads were not as fulfilling to people, as these firefighters expressed: "I mean if you serve salad, you are going to hear about it. I mean that's just how the fire service is. . . ." and "We make salads but then to make a salad you got to add lots of pasta in the salad."

- (c) *Traditions and peer-pressure:* From the "rookie" (new recruits) stage people are trained to prepare foods that are filling; as one Firefighter joked "it better be hot, brown and plenty of it":

I mean it's better to be big and bland than small and concentrated and good flavor and all that. So that's how the mindset is that we

teach rookies, the environment that rookies are brought into when they are taught to cook. So you get these big heavy pasta meals and I mean there has to be meat. . . (Group 1, FF/Engineers)

The origins of these food preferences were discussed and there were an assortment of reasons given. Some said that it came from "old school" ideas about needing to "fuel up" for the possibility of busy, physically vigorous work demands.

Also discussed was a socialization process where new, younger Firefighters were encouraged to eat more to "prove" themselves and to win the respect of older firefighters. One Firefighter told the following story:

When I got hired and I went to this one station, there were 15 guys on and they were all 55 years old plus and they were all huge, like 6'5", 250 pounds; just big men. And so it's your first time at the fire station with all these big men, so you are kind of nervous about how much you are supposed to eat and when, and all that stuff. So one guy came over, he was the biggest guy. He said 'hey, you really want to impress all these guys? Eat as much food as you can, stuff it down as fast as you can, they will give you another plate and you will really impress these guys.' I said, really? Yeah. I started doing that and they said [he's alright] from day one. And I remember getting a call afterwards and I had to spit out all my food because it was almost twofold more than I [usually] eat. (Group 1, FF/Engineers)

- (d) *Call interruptions and eating habits:* While the eating culture of the fire station appears to be a possible hindrance to healthy eating, firefighters also discussed certain occupational factors, especially frequent call interruptions, which made eating appropriate meals difficult. Call interruptions, firefighters suggested, sometimes caused them to "eat too fast," or to miss meals because they were too busy responding to calls. Additionally, at stations where they cook family-style and groceries have already been bought for the lunchtime meal or dinner then crews will try and come back to cook and eat the meal but sometimes groceries or meals might go untouched in favor of fast food. Frequent call interruptions might also dictate the type of food that is bought and the way it is prepared because recipes have to be quick and hardy to withstand frequent interruptions:

That's a big thing too, if you try this big elaborate meal which takes a lot of time and we are in and out of this station all day. I mean we run X amount of calls ... if you don't have dinner on time and there's not enough of it, like I said, you are going to hear about it. So you keep it simple and make simple things and cheap things, like pastas (Group 1, FF/Engineers).

The combination of an eating culture with an emphasis on the quantity of food that "fills people up"; use of recipes with cheap, high-caloric ingredients (such as red meat or pasta) which can withstand frequent interruptions, and are quick to prepare between emergency calls; might be a source of higher calorie intake and will be investigated further using food-dairy and survey data from the FORWARD study.

- (e) *Influence of fire station eating culture on "making changes"*: Several firefighters admitted that they actually ate better at home than at the station, further reinforcing the possibility that health behaviors might be superseded at work by the eating culture of the fire station. One Battalion Chief admitted that if he could eat with his wife at home he would be "better off" but that "the job is not well suited for eating and sleeping in any kind of routine way." A few firefighters did admit that they had changed their lifestyle, including eating behaviors, at work and at home in response to weight gain and poor results on medical tests. For example, one Firefighter explained:

I don't eat crap. I don't go out to fast food. I don't. We even changed our dietary habits at home as far as when we did our big shopping three weeks ago it was nothing like what our grocery shop or cart looked like two months ago ... we are not buying anymore frozen lasagnas... (Group 1, FF/Engineers)

- (f) *High caloric snacking*: In addition to overeating at meals, snacking was repeatedly discussed as a part of the eating culture in the fire station. High caloric snacks are readily available, particularly because desserts are an informal requirement of meal preparation and because of offerings from the general public:

Another thing, alongside the portion size, is being a popular profession. You see a lot of people, especially around here because this is an elderly population – we get a lot of dessert stuff [from the community]. [Also] It's kind of been standard in the fire service

... that whenever you get a first, like your first fire or whatever, you bring in ice-cream. Well if you look in our refrigerators (there are always three shifts so there are three refrigerators), well usually there is always ice-cream in there. So naturally at night you sit down and you have ice-cream with the guys (Group 1, FF/Engineers).

As this Firefighter points out, snacking at night seems to be ubiquitous. It may also contribute to the camaraderie resulting from the close-knit working relationships among firefighter crews.

Use of high caloric, energy drinks to stay alert is also prevalent:

There is a big prevalence of firefighters using "monster" type drinks, these big 24 ounce [drinks] and they are just loaded with sugar ... but you see guys drinking those and again it's just empty calories. So they are eating normally like they always do and now you plop in two of those monsters and that adds 500 calories, now you multiply that over a course of the year and they have just added who knows how many calories to their diet and their activity level hasn't gone up (Group 1, FF/Engineers).

There appears to be an eating culture in the fire station which includes: peer pressure on new recruits to overeat, cooking more than enough food that is also cheap and filling and able to withstand frequent call interruptions, and snacking on high caloric foods to remain alert around the clock. These factors may be associated with higher caloric intake and where possible will be further investigated in the FORWARD sub-study and survey data analysis.

(2) Night calls and sleep interruption

Due to the 24 hr nature of a firefighter work shift, sleep interruption was discussed as a particularly difficult workplace issue and one that was also related to poor eating habits. Many discussed how this takes its toll, especially after a long time on the job. As one Battalion Chief explained:

The bottom line is, and I can remember this from our Paramedic days, I said "you know what? I am not going to go to bed because I am probably going to get a call." You know what? Half the time, maybe a third of the time, I didn't get a call. I could have gotten some more sleep but you

stayed up anyway. The sleep patterns in this job are terrible especially on the busier days. And if you are up, or you are up and between calls, you've got more of an opportunity to snack or whatever. And at Christmas time... you can't even see the bottom of our counters. I mean literally... everyday there are no less than five people that bring us stuff... and that's tough if you haven't been sleeping much and you are tired and like some sweets (Group 4, Battalion Chiefs)

As discussed, snacking appears to be part of the social support environment of firefighters but simultaneously it also may help firefighters cope with fatigue from sleep interruptions. Many of the firefighters mentioned they sometimes eat at night to try and get back to sleep, or use energy drinks or caffeine to stay awake if they are busy with calls. Use of energy drinks is related to the need to be alert at all times of the day, despite fatigue, in order to respond to emergencies appropriately. A consequence of this constant need for alertness might be hyper-vigilance which could also affect sleep quality, as one Battalion Chief pointed out:

There is a huge difference in people's quality of sleep because our job causes us to be hyper-vigilant, so most of us are extremely light sleepers to the point where the slightest little drop of sound wakes you up... I have never used an alarm clock to wake up (Group 4, Battalion Chiefs).

Most of the other firefighters concurred with this statement during this focus group suggesting that with time, the effect of sleep interruptions might be a serious hazard. In addition, this Battalion Chief also pointed out that whereas firefighters in the early stages of their careers have little control over their schedule, including frequent call interruptions at night, when they are promoted they have more opportunity to control their schedule:

It's not unlike being parents, you are not in control of your schedule [in early stages of career]. And don't get me wrong, there is a reason why someone was promoted. It wasn't for the fame and fortune and glory of it, it was because it was time to get a few less calls. It was time to be able to sleep a little bit more at night, maybe controlling your deal. (Group 4, Battalion Chiefs)

(3) Supervisor leadership and physical fitness

Exercise while on-duty is encouraged, but is not mandatory in the OCFA. However, it fosters a peer-fitness counseling program as part of the WFI that train

firefighters to encourage and work with their peers to increase physical fitness. Exercise while on-duty is also encouraged through access to fitness equipment at most stations. The OCFA's firefighter training academy also includes a physical fitness program for all new recruits. However, like many other fire departments nationwide, there are no required physical fitness standards to continue to perform the job. Instead, this concern is delegated to Captains' to maintain the fitness of his/her crew.

During the focus groups some significant constraints to exercising at the workplace were discussed. The higher ranks, Battalion Chiefs and Captains, also discussed how their jobs were similar to a regular desk job and that finding time to work out during a typical work day, with a heavy workload and pressing report deadlines, was very difficult even given the proximity of a workout space and equipment at headquarters. As one Staff Captain explained:

For most of us, our work can get in the way ... as much as you would like to work out, as much as they say you will have an hour to work out. If your deadline comes and you tell them, sorry I was at the gym, that doesn't carry. Most people tell you when you go onto staff, that people will gain 15 to 20 pounds... (Group 2, Captains)

On the other hand, lower rank firefighters discussed that participation in and adherence to on-duty exercise was based on the leadership of the crew's Captain. Some Captains, firefighters pointed out, adhered to a strict work schedule in the station in terms of maintenance of equipment, training, etc. before allowing the crew time to work out, whereas other Captains were more flexible. Firefighters also pointed out that if a Captain was lax with working out, it did not encourage individuals in the team to "break rank" and work out on their own:

The tone for the station is set by the Captain. I worked for Captains where fitness was not a priority... Some Captains sit on the rig when the guys work out and that puts pressure on the guys to hurry through their workout. There are Captains who participate and are supportive, Captains who don't participate and are neutral, and Captains who do not participate and are not supportive. It's a top down thing... (Group 3, FF/Engineers)

While it was generally offered that the culture of fitness within the organization had changed for the better over the years, for most firefighters it was still dependent on their Captain leading by example.

(4) Sedentary work

The relationship between working conditions and health behaviors is a continued element of the themes and discussion in these focus groups. As mentioned previously, discussion included how call interruptions impact the eating culture of the fire station, how sleep disturbance from night calls affects eating behaviors, and how leadership affects on-duty exercise among those they supervise. There were also lengthy discussions in nearly every focus group around the greater level of sedentary work involved in firefighting today.

Archival data from the organization shows that the number of calls responding to fires has declined from 2.6% of total calls in 2007 to 1.6% in 2010 [USFA, 2007; OCFA, 2011]. This reflects an overall trend in the fire service nationally (14.7% of all calls were fire-related in 1990 compared to 4.7% in 2010) [Karter, 2010; Fahy et al., 2011]. The vast majority of calls are for EMS and not the physically demanding work of fighting fires as this Captain pointed out:

I don't think we run the number of physically demanding jobs that we once did. I think that . . . running those types of calls we were physically exerting ourselves . . . I think - at least for me - working out as much as I do now didn't happen [then]. Early on I just got by being young and running calls and having a physically demanding job, [now] those calls have tapered off (Group 2, Captains)

Another Captain made the connection between an antiquated eating culture in the fire service that continues to emphasize the need to fuel up for a physically demanding job despite it being less physically demanding:

[The idea is that] I need to put fuel in the tank because you never know when the bell is going to ring and I am going to need all of those calories to be able to perform my job. So you stock up on food and as the call log goes down, but the culture of eating those meals stays, where there is less activity unless you are making it for yourself. So little by little that could explain part of why the levels [of obesity] have gone up because we are eating the same and we are not going to as many calls (Group 2, Captains)

Promotion into the higher ranks is accompanied by a change in required job tasks, increased responsibility and salary, but it also increases the amount of sedentary work. Lowered physical demands (less time in the field on calls), less time spent at on-duty exercise due to increasing responsibility and time constraints might represent risk

factors for weight gain and obesity among the higher ranks.

While sedentary work increases with the desk duties of the higher ranks, firefighters suggested that even in the lower ranks, where physical demands are potentially higher, sedentary work was increasing due to greater use of technology in the fire service:

Today we sit down in front of that computer screen regularly for a good portion of a day to do training, to do reports, research whatever it may be, and so the number of hours your ass is in a chair has increased. (Group 1, FF/Engineers)

One reason for this may be that more of the required training for the lower ranks has become computerized:

We still do an ample amount of training but there is a lot of training . . . that we provide on CD. Here, watch this CD and then take a test for continuing education [and] send it in Whereas I think it was different 15 years ago. . . We are going to take a look at different types of vegetation and how it's going to affect fire behavior during wild-fire season. Well now we will sit there . . . and we will look at a hill on videotape whereas before we would go out on the engine and we would have to climb that hill and actually look at the brush (Group 2, Captains)

There was discussion that firefighting work was generally not very physically demanding because structural fires were so infrequent and because training and use of technology further limited physical activity on the job. There was also discussion about whether this was different from the past, whether aging also affected physical activity levels, or whether there were generational differences that impacted physical activity and health behaviors in general.

(5) Age and generational influences

Many of the firefighters discussed a relationship between weight gain, obesity, and aging. Some felt that a combination of factors associated with being older could be responsible for poor health behaviors and obesity among older firefighters, including; increasing family responsibilities, less of a competitive attitude and focus on having a good physique, and more responsibilities at work as well as more sedentary work (as discussed above):

I am not the man I used to be 15 years ago. I am just not. Every day I tell myself, I want to be, I'd like to be, but it becomes less and less important as I go further and further in my career and as I get older in age. I used to run 10 miles a day. I

don't care about running 10 miles any more... I want to survive my career. I don't care if I am the fastest, the biggest, the best... I go much more into a self-preservation mode where I am far less concerned about being the most physically fit, or even how I look compared to other people. (Group 2, Captains)

However, another Captain disagreed with his colleague saying he is the opposite. He wants to be fit to prolong his career and that self-preservation to him means getting healthier:

When you are younger you get by on being young AND running a lot of calls. If you don't change your dietary habits or change your routine (add working out) it's easy to get hit with 30 extra pounds. (Group 2, Captains)

This Captain went on to explain how he had gained weight because his workload was high and he had two children who were pursuing athletic scholarships. His family was traveling so much that he didn't have time to take care of himself on his days off. His last WFI medical had shown he had high cholesterol and the death of a colleague in the fire service had motivated him to hit the gym. He brings his own lunch to work and he and his wife changed dietary habits at home. This example shows the importance of understanding both work and non-work characteristics as they relate to health behaviors (e.g., dieting) and weight gain or obesity among firefighters.

Discussion also emerged around the idea of generational differences in health behaviors and differences in hiring practices now as opposed to the past, though there were conflicting opinions. Some of the higher ranking firefighters, as well as some of the younger firefighters, believed that the culture of the fire service in terms of health had been getting better in the past 10 years. Generally, focus group participants commented that younger firefighters were more interested in health and fitness than the firefighters who had been hired 30 years ago, indicating a possible generational difference. This was also highlighted in an internal report within the organization [Moore, 2005]. However, many of the older firefighters also thought that the younger generation of firefighters was engaged in more sedentary activity because they are part of the "Facebook Generation," always on the computer checking the internet:

... the younger generation also spends a lot more time doing activities that are more stationary, whether it's checking Facebook or tweeting or all that stuff, whereas I couldn't figure out how to tweet if you threw the book at me ... So I am

wondering even with the younger guys ... where after hours we would go out and play basketball after dinner until dark or maybe play under the lights ... maybe that doesn't happen any longer, because somebody sits down on their laptop and then starts checking e-mail or checking their Facebook page... (Group 2, Captains)

It was not clear whether younger firefighters were more focused on physical fitness or were less active (than their predecessors) because of sedentary activities such as computer games, cell phones and the internet. However, most felt that the organization was encouraging greater attention to physical fitness when hiring new firefighters. Some of the Captains discussed that the academy had been producing more physically fit rookies as well as hiring younger individuals than in the past:

They are producing a far superior athletic specimen out of the academy than we were. If we were physically fit when we got to our academy it was largely important to who we were, not what we did while we were there. Today that's completely different. They have got a "full throttle, kick your ass, get you in shape or you are not going to get through the academy," physical fitness program that at least has you leave the academy at a high level of physical fitness. I also think we are hiring younger guys now. When I went to that academy the average age was 32. I was 32 when I went through, that was the average age in our academy, that's old for starting as a firefighter (Group 2, Captains).

DISCUSSION

This is the first study using qualitative research methodology to examine firefighters' perspectives on working conditions, health behaviors, and obesity. Findings suggest that obesity, eating behaviors, and exercise patterns may be not only a product of individual choice but are also influenced by the working conditions of firefighters, the culture of the fire station, and possible generational differences in the firefighter workforce.

These qualitative findings also offer support for the FORWARD study's theoretical model [Choi et al., 2011] which expands on current social-ecological models of health promotion [Stokols, 1992; Stokols, 1996; Golden and Earp, 2012] to posit direct effects of firefighter work on weight gain. Focus group findings reveal the possibility that the 24 hr nature of work (especially night calls), and the increasing sedentary nature of firefighter work may directly impact weight gain.

This qualitative analysis identified five thematic topics (and several sub-themes) which show an integration of individual, cultural, and occupational causes of obesity among firefighters: (1) fire station eating culture; (2) night calls and sleep interruption; (3) supervisor leadership and physical fitness; (4) sedentary work; (5) age and generational influences. The implications of these findings are discussed in each of these areas relative to recent qualitative and intervention studies involving firefighters [Elliot et al., 2007; Staley, 2009; MacKinnon et al., 2010; Haddock et al., 2011; Ranby et al., 2011].

Improving the Fire Station Eating Culture

First, confirming previous qualitative research [Haddock et al., 2011] the primary area of discussion in these focus groups revolved around nutrition at the fire station. Similar to the NVFC Report, firefighters, especially in large fire stations where family-style meal planning was common, complained of large portion sizes, over-eating, and high calorie food choices. Firefighters discussed their tendency towards over-eating and large portion sizes, as partly related to “eating like a man,” and as seen in the peer pressuring of new recruits to consume large portion sizes in order to prove themselves. The idea that firefighters need to eat large portions of calorie-rich foods to “fuel-up”, despite the declining physical demands of firefighting, may also be related to antiquated notions of firefighting as a physically demanding occupation.

This discussion suggests a gendered culture exists in many fire-stations, one that might be generationally specific. Masculinity and maleness is not just an individual attribute but has been linked to certain qualities such as toughness, strength and heroism, as well as to institutions, organizations or occupations, like firefighting or law enforcement, that embody these ideals [Reskin, 1988; Fraser, 1989; Acker, 1990; Connell, 1995; Connell and Messerschmidt, 2005]. Recently, some research has even suggested a cultural link between “maleness” and “meat” [Rozin et al., 2012]. While this eating culture continues—along with the family-style meal preparation where everyone must participate—healthier food choices may be limited for individuals.

There were other features of the firefighter work environment that might be an indirect cause of weight gain through firefighter eating behaviors. Higher call volume in bigger, busier stations, where emergency calls frequently interrupt meals, may cause firefighters to eat too fast, and also promotes a certain kind of meal preparation that may discourage healthier recipes. Gerace and George [1996] also found that firefighters reported eating too fast due to anticipating call interruptions, and discussed that this habit “can result in reduced awareness of the quantity eaten and

ingesting amounts that exceed the amount necessary for satiety” (p 598).

Similar to the NVFC report, firefighters identified snacking as a particular problem, partly related to the abundance of high-calorie treats brought to them by a grateful public, but also related to traditions that mark “firsts” (e.g., first fire) and involve eating together as a form of social support within a firefighter crew. Firefighters also mentioned that the accessibility of high-calorie snacks was detrimental to weight maintenance because snacking was a ubiquitous way of coping with job-related stress, particularly with emergencies, and to broken sleep at nights with accompanying fatigue.

A recent firefighter intervention study targeting firefighter nutrition, the PHLAME study, involved educating firefighters on the benefits of a healthy diet and regular exercise as well as fostering social norms and social support for healthy lifestyles [Elliot et al., 2007; Ranby et al., 2011]. The investigators credited the initial success of their health promotion interventions (increased consumption of fruits and vegetables after 1 year) to utilizing a team-based intervention. However, the effects of the interventions were not long-lasting [MacKinnon et al., 2010] and work-related effects (e.g., long working hours, interrupted sleep due to calls, etc.) were not assessed. Interventions were only introduced for the first 2 years, perhaps suggesting that ongoing changes to the fire station culture (e.g., to gendered eating behaviors), or within the firefighter community as a whole, are necessary to sustain changes to eating behaviors.

Currently OCFA has a peer-fitness trainer program to encourage ongoing physical fitness and weight loss. This program could be expanded to include a peer-nutrition trainer program. A cooking academy could also be included in the training of new recruits, thereby enhancing the capacity of the firefighting community to sustain changes in eating behaviors over the long term. Reducing mealtime call interruptions by rearranging shift schedules to cover meal times, might also lead to improvements in dietary practices and could be proposed as a dietary intervention that goes beyond individual food choices to include changes to the organization of work. Of course proposing changes to work schedules such as this may be more difficult than implementing changes to individual behavior.

Improving Access to Physical Fitness Activities

The majority of OCFA firefighters appear to embrace physical fitness as part of their job, however, they may not do enough physical activity to balance high caloric intake with lower expenditures in an increasingly sedentary job [Dobson et al., 2010; Choi et al., 2011]. It also remains to be seen whether the effects of the firefighter academy’s

recently enhanced physical fitness program will carry over and result in future generations of firefighters within this organization being more physically fit than previous generations.

In the “Get Firefighters Moving” intervention program, Staley [2009] designed a top-down health promotion physical fitness program which utilized a competitive team-sports approach, but that also involved firefighters in all elements of the planning and scheduling, as well as capitalizing on organizational norms and beliefs. Having management allow for time to be set aside, during non-emergency routine activities, for the team sports to take place showed an awareness of how the work environment can pose obstacles to physical fitness. Preliminary outcomes showed improvement in systolic blood pressure and body fat percent, but the long term effects were still uncertain [Staley, 2009]. However, an approach such as this might not work in all fire departments. OCFA, for example, has recently prohibited participation in team-sports while on-duty due to increased on-duty injuries and workers compensation costs, although all firefighters continue to have access to fitness equipment within the stations.

Some non-firefighter obesity intervention studies have shown some limited success by offering financial incentives for weight management or obesity reduction, including one study that returned \$5/month previously withheld by payroll for every positive step towards weight reduction [Jeffery, 2001]. Providing incentives to the firefighters who engage in physical activity at work and during off-days could be a possible intervention. However, given high salaries, the incentives would have to be high enough to have an impact. Incentivizing physical activity may be possible, but it will require discussions between OCFA and the IAFF regarding the current structure of the work environment that promotes or limits physical activity as well as when and for how long firefighters work out.

The importance of leadership by Captains in promoting the physical fitness of a crew was discussed as a potential problem contributing to obesity. OCFA Standard Operating Procedures (SOP) currently gives sole discretion to Captains to decide when and whether to initiate on-duty physical exercise for their crews. This appears to have resulted in inconsistency between crews in work-out time. Captains are required to take a leadership course as part of their promotion process; including a health promotion element in that process could be an important intervention plan in the future. Another possible organizational intervention could include instituting a policy that requires Captains to schedule physical fitness activities on a daily basis for their crew. This would encourage a more standardized approach to physical fitness across the organization rather than leaving it up to individual Captains (or individual firefighters) to motivate their

crews. Investigating the current role and effectiveness of peer-fitness trainers may also be an important future step.

Sedentary Work, Promotion, and Generational Differences in Activity

This study revealed issues related to obesity that went beyond nutrition and exercise behavior (which were also related to the work environment in many ways), to reveal possible direct influences in the firefighter work environment. Increasing sedentary work is an aspect of the firefighter work environment that firefighters believe may contribute to firefighter obesity. Less physical exertion on the job due to fewer fire-related calls, as well as increased sedentary activities due to increased reliance on computer technology for training and communications in general, were discussed as a new part of firefighting work that differed from work in the past.

Many firefighters suggested that younger firefighters were more health conscious than firefighters of the past. There was also a belief that health problems, such as obesity, would change with a younger cohort moving up the ranks, and as older firefighters, perhaps more associated with a masculine eating culture, begin to retire. However, there were mixed feelings about whether the younger generations were actually *more* sedentary than their older counterparts because they are considered part of the “Facebook Generation,” a generation brought up on TV, cell phones, video games, and computers.

On the other hand, sedentary work was also thought to increase with promotion into higher ranks. Captains and Battalion Chiefs spend more time behind a desk than in the field, and have far less physical demands placed on them which could contribute to an imbalance between caloric intake and expenditure, assuming there is no reduction in caloric intake among the higher ranks. While higher ranking firefighters have more control over their work schedules they may also have increased responsibilities and job demands which could serve as stressors and could inhibit (or limit) many from exercising during the work day. Given a positive association between aging and weight gain [Williams, 1997; Mozaffarian et al., 2011], it might be important to consider workplace policies that require, or incentivize, the higher ranks to engage in more frequent on-duty exercise. The FORWARD study is designed to assess physical activity and caloric intake in a sub-group of firefighters. Rank and generational effects will be assessed to see if there are any systematic differences in physical activity and caloric intake. Future intervention studies might need to stratify by rank, or design specific intervention programs for the different ranks, as a means to take into account the different work environments.

Effects of 24 Hr Shifts

Firefighters reported that sleep interruptions during a 24 hr shift, and having to be awake at night to respond to emergencies, can take its toll over time. Sleep interruption may encourage hyper-vigilance and permanently disturbed sleep patterns. Many firefighters discussed snacking and using caffeinated energy drinks to stay awake and alert during the day and night to respond to calls, which, over time, could affect weight. Moreover, sleep interruption, a structural feature of the 24 hr shift system, has been shown to be related to metabolic dysregulation [Knutson et al., 2007] perhaps contributing directly to obesity.

Firefighters at slower stations (with less frequent calls) may be more likely to get uninterrupted sleep; therefore research into differences in sleep quality between slower and busier stations is also being conducted as part of the FORWARD study. Future intervention studies should also focus on sleep patterns and health behaviors. For example, Takeyama et al. [2009] report on the effects of a modified night shift system on the fatigue levels of ambulance paramedics. A set amount of time was set aside for a crew to sleep while another crew covered all the calls and then they swap. If the FORWARD survey can confirm an association between sleep disruption and obesity, then a similar intervention to the one undertaken by Takeyama et al. could be considered.

Study Limitations

As is always the case with qualitative data, there are limitations to the generalizability of the findings. However, qualitative studies also provide a rich source of contextualized data from the standpoint of those being studied and situating the “researched” as experts in their own work worlds [Gordon et al., 2005; Smith, 2005; Schonfeld and Farrell, 2010]. After four focus groups it appeared that information saturation occurred, with most of the discussion overlapping between groups fairly quickly. While, focus groups were conducted in one regional fire authority in Southern California, the OCFA covers a large and diverse geographical region with over 62 stations which are responsible for coverage of rural, suburban and urban spaces perhaps increasing the generalizability of these qualitative data findings. In addition, the results of eating culture at the fire stations are very similar to those of the NVFC report from a national firefighter focus group study [Haddock et al., 2011]. Most importantly, this qualitative study has contributed to consolidating an on-going, collaborative relationship with the firefighters, the union and OCFA which will continue to build towards future intervention projects [De Koning and Martin, 1996; Goldenhar et al., 2001].

Future Intervention Projects

Individual behaviors are largely blamed for America’s obesity epidemic, and institutional factors that go beyond the individual—including constraints on food choices, leisure-time physical activity, and increasingly, sedentary work—are often ignored as causes. These findings provide evidence that controlling obesity among firefighters will require integrating firefighter perspectives about the work and health behavioral causes of obesity into a comprehensive program to fight obesity that goes beyond individual health promotion efforts. These findings are in concert with the current NIOSH *Total Worker Health*TM strategy, which recommends integrating workplace health promotion and occupational health [Dejoy and Southern, 1993; Murphy and Sauter, 2004; LaMontagne et al., 2007; Landsbergis, 2009; NIOSH, 2011] to recognize a synergy between individual health behaviors and occupational factors.

Results from the FORWARD study will also be presented first to firefighter focus groups for their reactions and recommendations, as well as to the OCFA and IAFF Local 3631. This approach will give both firefighters and management an opportunity to consider the findings and recommend feasible changes in the context of their working lives and the priorities of their organization(s). By building upon this collaboration with firefighters, feasible and relevant worksite interventions could be developed to integrate behavioral and workplace changes to help prevent weight gain and obesity among firefighters.

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REFERENCES

- Acker J. 1990. Hierarchies, jobs, and bodies: A theory of gendered organizations. *Gender Soc* 4:139–158.

- Atkinson G, Fullick S, Grindey C, Maclaren D. 2008. Exercise, energy balance and the shift worker. *Sports Med* 38:671–685.
- Ballard T, Corradi L, Lauria L, Mazzanti C, Scaravelli G, Sgorbissa F, Romito P, Verdecchia A. 2004. Integrating qualitative methods into occupational health research: A study of women flight attendants. *Occup Environ Med* 61:163–166.
- Black N. 1994. Why we need qualitative research. *J Epidemiol Community Health* 48:425–426.
- Block J, He Y, Zaslavsky A, Ding L, Ayanian J. 2009. Psychosocial stress and change in weight among US adults. *Am J Epidemiol* 170(2):181–192.
- Brisson C, Larocque B, Moisan J, Vézina M, Dagenais G. 2000. Psychosocial factors at work, smoking, sedentary behavior, and body mass index: A prevalence study among 6995 white collar workers. *J Occup Environ Med* 42:40–46.
- Brunner E, Chandola T, Marmot M. 2007. Prospective effect of job strain on general and central obesity in the Whitehall II study. *Am J Epidemiol* 165(7):828–837.
- Caban-Martinez A, Lee D, Fleming L, Gomez O, LeBlanc W, Pitman T. 2005. Obesity in US workers: The national health interview survey, 1986 to 2002. *Am J Public Health* 95(9):1–9.
- Choi B, Schnall P, Dobson M, Yang H, Landsbergis P, Baker D. 2010a. Job control and job demands as risk factors for central obesity in US workers: A 9-year follow-up study. 4th International Congress of Occupational Health on Psychosocial Factors at Work, Amsterdam, Netherlands.
- Choi B, Schnall P, Yang H, Dobson M, Landsbergis P, Israel L, Karasek R, Baker D. 2010b. Sedentary work, low physical job demand, and obesity in US workers. *Am J Ind Med* 53(11):1088–1101.
- Choi B, Schnall P, Dobson M, Israel L, Landsbergis P, Galassetti P, Pontello A, Kojaku S, Baker D. 2011. Exploring occupational and behavioral risk factors for obesity in Firefighters: A theoretical framework and study design. *Saf Health Work* 2:301–312.
- Connell R. 1995. *Masculinities*. Berkeley, CA: University of California Press.
- Connell R, Messerschmidt J. 2005. Hegemonic masculinity: Rethinking the concept. *Gender Soc* 19(6):829–859.
- De Koning K, Martin M, editors. 1996. *Participatory research in health: Issues and experiences*. London, UK: Zed Books.
- Dejoy D, Southern D. 1993. An integrative perspective on work site health promotion. *J Occup Med* 35(12):1221–1230.
- Devine C, Farrell T, Blake C, Jastran M, Wethington E, Bisogni C. 2009. Work conditions and the food choice coping strategies of employed parents. *J Nutr Educ Behav* 41:365–370.
- Dobson M, Schnall P, Choi B, Israel L, Baker D. 2010. Work, health behaviors and obesity in Firefighters: A pilot study. 4th International Congress of Occupational Health on Psychosocial Factors at Work. Amsterdam, Netherlands.
- Elliot D, Goldberg L, Kuehl K, Moe E, Breger R, Pickering M. 2007. The PHLAME (Promoting Healthy Lifestyles: Alternative Models' Effects) Firefighter study: Outcomes of two models of behavior change. *J Occup Environ Med* 49(2):204–213.
- Fahy R, LeBlanc P, Molis J. 2011. *Firefighter fatalities in the United States-2010*. National Fire Protection Association.
- Farquhar S, Parker E, Schulz A, Israel B. 2006. Application of qualitative methods in program planning for health promotion interventions. *Health Promot Pract* 7(2):234–242.
- Fern E. 2001. *Advanced focus group research*. Thousand Oaks, CA: Sage Publications.
- Fraser N. 1989. *Unruly practices: Power, discourse and gender in contemporary social theory*. Minneapolis: University of Minnesota Press.
- Gerace T, George V. 1996. Predictors of weight increases over 7 years in fire fighters and paramedics. *Prev Med* 25:593–600.
- Golden S, Earp J. 2012. Social ecological approaches to individuals and their contexts: Twenty years of health education & behavior health promotion interventions. *Health Educ Behav* 39:364–372.
- Goldenhar LM, LaMontagne AD, Katz T, Heaney C, Landsbergis P. 2001. The intervention research process in occupational safety and health: An overview from the national occupational research agenda intervention effectiveness research team. *J Occup Environ Med* 43(7):616–622.
- Gordon D, Ames G, Yen I, Gillen M, Aust B, Rugulies R, Frank J, Blanc P. 2005. Integrating qualitative research into occupational health: A case study among hospital workers. *J Occup Environ Med* 47(4):399–409.
- Greenwood D, Levin M. 1998. *Introduction to action research: Social research for social change*. Thousand Oaks, CA: Sage Publications.
- Haddock CK, Poston WSC, Jahnke SA. 2011. *Addressing the epidemic of obesity in the United States Fire Service—A report prepared by the National Volunteer Fire Council*. Greenbelt, MD, Center for Fire, Rescue, and EMS Health Research, National Development and Research Institutes, LLC, National Volunteer Fire Council.
- Hugentobler MK, Israel BA, Shurman SJ. 1992. An action research approach to workplace health: Integrating methods. *Health Educ Q* 19(1):55–76.
- Ishizaki M, Morikawa Y, Nakagawa H, Honda R, Kawakami N, Haratani T, Kobayashi F, Araki S, Yamada Y. 2004. The influence of work characteristics on body mass index and waist to hip ratio in Japanese employees. *Ind Health* 42(1):41–49.
- Ishizaki M, Nakagawa H, Morikawa Y, Honda R, Yamada Y, Kawakami N. 2008. Japan Work Stress and Health Cohort Study Group. Influence of job strain on changes in body mass index and waist circumference – 6-year longitudinal study. *Scand J Work Environ Health* 34(4):288–296.
- Jeffery RW. 2001. Public health strategies for obesity treatment and prevention. *Am J Health Behav* 25(3):252–259.
- Kales S, Polyhronopoulos G, Aldrich J, Leitao E, Christiani D. 1999. Correlates of body mass index in hazardous materials Firefighters. *J Occup Environ Med* 41:589–595.
- Kales S, Soteriades E, Christoudias S, Christiani D. 2003. Firefighters and on-duty deaths from coronary heart disease: A case control study. *Environ Health Global Access Sci Source* 2:14.
- Kales S, Soteriades E, Christophi C, Christiani D. 2007. Emergency duties and deaths from heart disease among firefighters in the United States. *New Engl J Med* 356:1207–1215.
- Karter MJ. 2010. *Fire loss in the United States 2010*. Retrieved 6/11/2012, 2012, from <http://www.nfpa.org/itemDetail.asp?categoryID=955&itemID=23850&URL=Research/Fire%20statistics/The%20U.S.%20fire%20service>
- Kivimaki M, Ferrie J, Shipley M, Brunner E, Vahtera J, Marmot M. 2006. Work stress, weight gain and weight loss: Evidence for bidirectional effects of job strain on body mass index in the Whitehall II study. *Int J Obes* 30:982–987.

- Knutson K, Spiegel K, Penev P, van Cauter E. 2007. The metabolic consequences of sleep deprivation. *Sleep Med Rev* 11:163–178.
- Kouvonen A, Kivimäki M, Elovainio M, Pentti J, Linna A, Virtanen M, Vahtera J. 2006. Effort/reward imbalance and sedentary lifestyle: An observational study in a large occupational cohort. *Occup Environ Med* 63:422–427.
- Krueger R, Casey M. 2000. *Focus groups: A practical guide for applied research*. 3rd edition. Thousand Oaks, CA: Sage Publications.
- Lakdawalla D, Philipson T. 2007. Labor supply and weight. *J Hum Resour* 41:85–116.
- LaMontagne A, Keegel T, Louie A, Ostry A, Landsbergis P. 2007. A systematic review of the job stress intervention evaluation literature: 1990–2005. *Int J Occup Environ Health* 13:268–280.
- Landsbergis P. 2009. Interventions to reduce job stress and improve work organization and worker health. In: Schnall P, Dobson M, Roskam E, editors. *Unhealthy work: Causes, consequences, cures*. New York: Baywood Publishing, Inc.
- Laurell A, Noriega M, Martínez S, Villegas J. 1992. Participatory research on workers' health. *Soc Sci Med* 34(6):603–613.
- Lindlof T, Taylor B. 2002. *Qualitative communication research methods*. 2nd edition. Thousand Oaks, CA: Sage Publications.
- MacKinnon DP, Elliot DL, Thoemmes F, Kuehl KS, Moe EL, Goldberg L, Burrell GL, Ranby KW. 2010. Long-term effects of a worksite health promotion program for firefighters. *Am J Health Behav* 34(6):695–706.
- Mergler D. 1987. Worker participation in occupational health research: Theory and practice. *Int J Health Serv* 17(1):151–167.
- Mergler D. 1999. Combining quantitative and qualitative approaches in occupational health for a better understanding of the impact of work-related disorders. *Scand J Work Environ Health* 25(s4):54–60.
- Moore MD. 2005. *Providing leadership between the various generations of the Orange county fire authority*. Irvine, CA.
- Morgan D, editor. 1993. *Successful focus groups: Advancing the state of the art*. Newbury Park, CA: Sage Publications.
- Morikawa Y, Nakagawa H, Miura K, Soyama Y, Ishizaki M, Kido T, Naruse Y, Naruse Y, Suwazono Y, Nogawa K. 2007. Effect of shift work on body mass index and metabolic parameters. *Scand J Work Environ Health* 33(1):45–50.
- Morikawa Y, Miura K, Sasaki S, Yoshita K, Yoneyama S, Sakurai M, Ishizaki M, Kido T, Naruse Y, Suwazono Y, Higashiyama M H N. 2008. Evaluation of the effects of shift work on nutrient intake: A cross-sectional study. *J Occup Health* 50:270–278.
- Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. 2011. Changes in diet and lifestyle and long-term weight gain in women and men. *New Engl J Med* 364(25):2392–2404.
- Mummery W, Schofield G, Steele R, Eakin E, Brown W. 2005. Occupational sitting time and overweight and obesity in Australian workers. *Am J Prev Med* 29(2):91–97.
- Murphy L, Sauter S. 2004. Work organization interventions: State of knowledge and future directions. *Soz-Praventivmed* 49:79–86.
- Murphy S, Beaton RD, Pike KC, Johnson LC. 1999. Occupational stressors, stress responses, and alcohol consumption among professional firefighters: A prospective, longitudinal analysis. *Int J Stress Manage* 6(3):179–196.
- Needleman C, Needleman M. 1996. Qualitative methods for intervention research. *Am J Ind Med* 29:1996.
- NIOSH. 2011. What is total Worker™ health? Retrieved 2/6/2012, from <http://www.cdc.gov/niosh/twh/totalhealth.html>
- Nishitani N, Sakakibara H, Akiyama I. 2009. Eating behavior related to obesity and job stress in male Japanese workers. *Nutrition* 25:45–50.
- OCFA. 2011. *Orange County Fire Authority 2010 Annual Report*.
- Ostry A, Radi S, Louie A, LaMontagne A. 2006. Psychosocial and other working conditions in relation to body mass index in a representative sample of Australian workers. *BMC Public Health* 6:53.
- Ranby K, MacKinnon D, Fairchild A, Elliot D, Kuehl K, Goldberg L. 2011. The PHLAME (Promoting Healthy Lifestyles Alternative Models' Effects) Firefighter Study: Testing mediating mechanisms. *J Occup Health Psychol* 16(4):501–513.
- Reskin B. 1988. Bringing the men back in: Sex differentiation and the devaluation of women's work. *Gender Soc* 7:58–81.
- Roskam E. 2009. Using participatory action research methodology to improve worker health. In: Schnall P, Dobson M, Roskam E, editors. *Unhealthy work: Causes, consequences, cures*. New York, NY: Baywood.
- Rozin P, Holmes JM, Faith MS, Wansink B. 2012. Is meat male? A quantitative multimethod framework to establish metaphoric relationships. *J Consum Res* 39(3):629–643.
- Scheer F, Hilton M, Mantzoros C, Shea S. 2009. Adverse metabolic and cardiovascular consequences of circadian misalignment. *Natl Acad Sci* 106(11):4453–4458.
- Schneider S, Becker S. 2005. Prevalence of physical activity among the working population and correlation with work-related factors: Results from the first German National Health Survey. *J Occup Health* 47:414–423.
- Schonfeld I, Farrell E. 2010. Qualitative methods can enrich quantitative research on occupational stress: An example from one occupational group. In: Ganster D, Perrewé P, editors. *Research in occupational stress and wellbeing series. New developments in theoretical and conceptual approaches to job stress*. Volume 8. Bingley, UK: Emerald, p 137–197.
- Shields M. 2002. Shift work and health. *Health Rep* 13:11–33.
- Smith D. 1987. *The everyday world as problematic: A feminist sociology*. Boston: Northeastern University Press.
- Smith D. 2005. *Institutional ethnography: A sociology for people*. Walnut Creek, CA: AltaMira Press.
- Soteriades ES, Hauser R, Kawachi I, Liarakis D, Christiani DC, Kales SN. 2005. Obesity and cardiovascular disease risk factors in firefighters: A prospective cohort study. *Obes Res* 13(10):1750–1763.
- Staley J. 2009. Get firefighters moving: Marketing a physical fitness intervention to reduce sudden cardiac death risk in full-time firefighters. *Soc Mark Q* 15:85–99.
- Stokols D. 1992. Establishing and maintaining healthy environments: Toward a social ecology of health promotion. *Am Psychol* 47:6–22.
- Stokols D. 1996. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot* 10:282–298.
- Strauss A, Corbin JM. 1990. *Basics of qualitative research: Grounded theory procedures and techniques*. Thousand Oaks, CA: Sage Publications.
- Takeyama H, Itani T, Tachi N, Sakamura O, Murata K, Inoue T, Takamishi T, Suzumura H, S. N. 2009. Effects of a modified ambulance

- night shift system on fatigue and physiological function among ambulance paramedics. *J Occup Health* 51(3):204–209.
- USFA. 2007. US Fire Administration. Retention and recruitment for volunteer emergency services: Challenges and solutions.
- van Amelsvoort L, Schouten E, Kok F. 1999. Duration of shiftwork related to body mass index and waist to hip ratio. *Int J Obes* 23:973–978.
- Wang Y, Beydoun M. 2007. The obesity epidemic in the United States—Gender, age, socioeconomic, racial/ethnic and geographic characteristics: A systematic review and meta-regression analysis. *Epidemiol Rev* 29:6–28.
- Williams PT. 1997. Evidence for the incompatibility of age-neutral overweight and age-neutral physical activity standards from runners. *Am J Clin Nutr* 65:1391–1396.