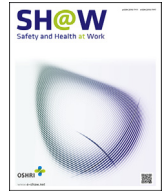




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Original article

Examination of Stress Among Recruit and Incumbent Women Firefighters



Brittany S. Hollerbach^{1,*}, Nattinee Jitnarin¹, Maria D.H. Koeppel¹, Michelle Valenti², Shawn Beitel², Jaclyn M. Goodrich³, Jefferey L. Burgess², Sara A. Jahnke¹

¹ Center for Fire, Rescue & EMS Health Research, NDRI-USA, Inc. 1920 W 143rd Street, Leawood, KS 66224, USA

² Mel & Enid Zuckerman College of Public Health, University of Arizona, 1295 N. Martin Ave., Tucson, AZ 85724, USA

³ School of Public Health, University of Michigan, 1415 Washington Heights, Ann Arbor, MI 48109, USA

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ABSTRACT

Background: Firefighting is risky and impacts the mental and physical health of personnel. While most research focuses on men firefighters, recent work has highlighted mental health concerns among women including depression, anxiety, and post-traumatic stress disorder (PTSD). Social support is a known protective factor for mental health; however, women may be excluded from the supportive peer network of the firehouse.

Methods: This cross-sectional study compared the prevalence of perceived stress, peer (functional) support, anxiety, depression, PTSD, chronic work discrimination and harassment, resilience, and job satisfaction in recruit (n=184) and incumbent (n=200) career women firefighters.

Results: While depression and perceived stress did not differ between recruits and incumbents, recruits were more likely to score in the range of concern for anxiety (26.1% and 15.5%, respectively). Incumbents were more likely to score at risk for PTSD (16.5% and 10.3%, respectively) and more likely to report sex discrimination, sexual harassment, and sexist behaviors in the workplace. Compared to the low stress group, those who reported moderate or high stress were more likely to score in the range of concern for anxiety (OR=3.86, CI=1.76–8.89) and PTSD (OR=1.30, CI=1.15–1.47), and report poor organizational cohesion (OR=1.13, CI=1.02–1.25).

Conclusion: Addressing mental health in the context of women firefighters requires a comprehensive and multi-faceted approach including collaboration between fire departments, mental health professionals, advocacy groups, and the broader community.

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1. Introduction

The inherently hazardous nature of firefighting extends beyond the physical demands to encompass significant mental health challenges [1,2]. Although firefighters are remarkably resilient, many suffer adverse psychological consequences from their experiences and job stress [1,3,4]. Historically, research has predominantly focused on men firefighters [1,3–5], leaving a gap in understanding the unique impacts on women firefighters. In one

study within a large urban United States (US) department, 20% of women firefighters reported post-traumatic stress disorder (PTSD) symptoms, higher than the 12% rate among their men counterparts in the same department [6] and the 5.2% one-year prevalence rate in the US population [7]. Furthermore, women firefighters exhibit a high prevalence of depression (15.1%; based on the Center for the Epidemiological Studies of Depression Short Form (CES-D 10) score ≥ 4) [8], nearly double the rate observed in the US adult women population (8.1%–10.0%) [9,10]. Stress-related behaviors such as

Brittany S. Hollerbach: <https://orcid.org/0000-0002-6350-8210>; Nattinee Jitnarin: <https://orcid.org/0000-0001-6010-773X>; Michelle Valenti: <https://orcid.org/0009-0007-4749-5302>; Jaclyn M. Goodrich: <https://orcid.org/0000-0002-8289-9253>

* Corresponding author. Center for Fire, Rescue & EMS Health Research, NDRI-USA, Inc. 1920 W 143rd Street, Leawood, KS 66224, USA.

E-mail address: hollerbach@ndi-usa.org (B.S. Hollerbach).

binge drinking and any alcohol use disorder are also notably higher among women firefighters (39.5% and 16.5%) [11] compared with US adult women (18.2% and 9.1%) [12,13].

Qualitative data also suggest that discrimination and harassment in the workplace may contribute to more negative behavioral health outcomes among women firefighters [14]. An analysis of data from over 2,000 career women firefighters revealed a significantly increased risk for behavioral health issues with increasing levels of negative experiences [8]. Women who reported low levels of discrimination and harassment had rates for depression (15.1%), post-traumatic stress symptoms (6.9%), and problem drinking (13.4%) similar to those found among men firefighters. Conversely, those who reported high levels of discrimination and harassment had clinically and statistically significantly higher rates of depressive symptoms (43.3%), post-traumatic stress symptoms (16.5%), and problem drinking (19.2%). Theories such as the person-environment fit model posit that a “mismatch” between job demands and an employee’s capabilities or values can lead to excessive burden, role uncertainty, and conflicting role expectations [15], potentially resulting in a range of detrimental behavioral outcomes, including reduced productivity, increased absenteeism, higher turnover rates, employee burnout, and mental and physical health-related issues [15].

Social support improves resilience and decreases the likelihood of developing PTSD [16], while life stress increases that risk [17]. The previous research has documented that the fire service “family” and the bonding around the kitchen table are incredibly protective for firefighters and build resilience [18]. The previous work suggests that women excluded from the bonding and supportive peer network of the firehouse face very real and quantifiable behavioral health consequences [8]. Recruit firefighters prior to live-fire training represent a unique comparison group for incumbent firefighters, with potentially similar characteristics except for age and firefighting exposure. Few studies have examined the experience and mental health of recruit firefighters [19–21], and none have examined these among women recruits, specifically. The present study sought to examine if there were differences in the prevalence of perceived stress, peer (functional) support, anxiety, depression, PTSD, chronic work discrimination and harassment, resilience, and job satisfaction between recruit and incumbent career women firefighters.

2. Materials and methods

2.1. Research setting and participants

The Fire Fighter Cancer Cohort Study, initiated in July 2016, aims to create a comprehensive national database by collecting and integrating data on firefighters’ epidemiologic surveys, biomarkers, and exposure, focusing on carcinogenic exposures and their health impacts. The ultimate objective is to monitor 10,000 firefighters over a 30-year observation period. The analysis comprised participants from the Federal Emergency Management Agency (FEMA) funded Women Firefighter Study, with all procedures receiving approval from the relevant institutional review board committees. Both newly employed (currently in the fire academy; “recruit”) and experienced (“incumbent”) firefighters from 26 departments across the US were enrolled after providing informed consent and having been informed about the study information and potential risks.

2.2. Data collection

1. Demographics, personal lifestyle, and work characteristics

The participants completed online surveys programmed in REDCap, covering demographic information, cancer risk factors,

and occupational history. In the US, it is common to report race and ethnicity for participants, particularly in fields such as social sciences and public health research. However, due to the small number of women firefighters, the authors limited the display of data involving fewer than 11 participants to protect participant confidentiality by preventing the identification of individual firefighters. Hence, racial categories are combined.

2. Perceived stress, functional support, mental health, work discrimination and harassment, and job satisfaction questions

Questions on stress were derived from previously established surveys [8,22]. The Perceived Stress Scale [23,24], a vital tool in this study, assesses stress levels, including feelings and thoughts during the past 30 days. Individual scores can range from 0–40, with higher scores indicative of higher perceived stress. Scores between 0–13 indicate low stress, whereas scores between 14–26 and 27–40 correspond to moderate and high perceived stress, respectively.

The DUKE-UNC Functional Support Questionnaire [25] is an eight-item multidimensional measure of functional support that assesses the level of support participants receive from friends and family (i.e., their social network). The respondents categorized the amount of support they received for each item relative to their ideal. The responses were scored on a 1–5 scale and tallied to create a total score with higher values indicating greater social support. The range of possible values is 8–40.

The Patient Health Questionnaire-4 [26] is an abbreviated version of the Patient Health Questionnaire that has been validated as a brief screener with two discrete factors (depression and anxiety), and has been associated with disability days, healthcare use, and functional impairment [26]. The previous research [27,28] has established that a score of three or greater on the depression or anxiety subscale represents a reasonable cut-off point for identifying potential cases of depression or anxiety, respectively. The total score ranges from 0–12, with the categories of psychological distress delineated as follows: normal (0–2), mild (3–5), moderate (6–8), and severe (9–12).

The PTSD Checklist-Civilian [29] is a six-item questionnaire that assesses symptoms of PTSD that correspond to stressful life experiences [30]. A score of 14 or more is suggestive of difficulties with post-traumatic stress. The Connor-Davidson Resilience Scale is a brief, two-item scale that provides a reliable measure of resilience [31]. The possible values range from 0–8 with lower scores indicative of lower levels of resilience. A past diagnosis of depression, anxiety, and post-traumatic stress disorder was assessed by previously published questions used with firefighter populations [32]. The questions adapted from the Department of Defense Organizational Climate Survey measured Chronic Work Discrimination and Harassment. The Department of Defense Organizational Climate Survey is a confidential survey designed to assess various organizational factors, including risk and protective elements that impact the workplace environment [33]. Based on the previous research [34,35], four items evaluated job satisfaction and morale: (1) I like my job; (2) I feel satisfied with my present job; (3) Most days I am enthusiastic about my work; and (4) I find real enjoyment in my work. Each question is answered based on a 5-point Likert-type scale [36].

2.3. Statistical analysis

The team conducted statistical analyses using the R statistical software (version 2023.06.0.421, Posit team 2023), assessing all the relevant variables for normality and missing data. Part of the analysis included basic descriptive statistics for all measures, including mean, standard deviation (SD) and percentages. To

compare demographics and enrollment status between recruits and incumbents, the research team utilized a Chi-square or *t* test as appropriate. The analysis used the Brown-Forsythe test to assess the homogeneity of variance, applying Welch's *t* test as an alternative to the *F* test in cases where variances were unequal and group sizes varied. Researchers used the Tukey-Kramer method to mitigate the risk of Type-1 errors resulting from multiple comparisons. Calculating Cronbach α coefficients evaluated the internal consistency of each scale used within the study. Additionally, logistic regression analyses examined the relationship between firefighters' enrollment status, demographics, and differences in occupational health outcomes adjusted for the participants' age. Odds ratios (OR) and 95% confidence intervals (CI) were reported with the statistical significance set at $p < 0.05$.

Descriptive statistical outcomes, including means and SDs, were presented. Through statistical modeling, we investigated whether perceived stress levels differed between recruits and incumbents and how these stress levels (categorized as low, moderate, or high) correlated with other health-related outcomes. The participants were initially divided into three categories based on their total perceived stress scores: low (0–13), moderate (14–26), and high (27–40). The moderate- and high-stress groups were combined and compared against the referent group (low-stress levels).

3. Results

Of the 400 women who enrolled and provided consent for participation, 384 (96%) had comprehensive data regarding demographics and occupational characteristics. This cohort included 200 incumbent firefighters, with an average age of 39.0 ± 7.8 years, and 184 recruits, with an average age of 28.8 ± 5.4 years. In our sample, recruits were significantly younger, had a lower percentage identifying as non-Hispanic White (54.9% vs 69.5%), were less likely to be married or living with a partner (17.6% vs 47.2%), and had a lower prevalence of overweight or obesity. The geographic distribution of participants mirrored the four US census regions: northeast, midwest, south, and west [37], ensuring a diverse representation across the country as detailed in Table 1. It is worth noting that a significant portion of recruits (45.9%) selected the "other" option when asked about their current rank and provided text responses such as cadet, probationary firefighter, and firefighter trainee, which align with typical designations for recruit firefighters.

Recruits displayed a higher incidence of anxiety concerns compared with incumbents (26.1% vs. 15.5%), which is notably higher than the 7.7% diagnosis rate for generalized anxiety among US women [38]. Conversely, recruits were less likely than incumbents to be considered "at risk" for PTSD (10.3% vs. 16.5%). These figures exceed the 8% PTSD prevalence in the adult female US population [39] but are comparable with the 12.9% average among military women [40].

There were no significant differences between recruits and incumbents in terms of depression concerns or perceived stress levels, as detailed in Table 2. However, responses to questions about chronic work discrimination and harassment, as shown in Table 3, revealed significant discrepancies. The incumbents reported higher instances of gender-based discrimination, sexual harassment, and sexist behavior in the workplace. Differences also include perceptions of organizational cohesion, with 97.6% of recruits agreeing or strongly agreeing that members trust each other, compared with 84.8% of incumbents. Job satisfaction rates were high across both groups, with 94.3% of incumbents and 98.4% of recruits expressing satisfaction with their current job, as shown in Table 4.

When categorizing participants by perceived stress levels (low, moderate, and high), there was no significant difference in distribution among the groups. However, compared with the low-stress

Table 1
Participant characteristics

	Recruit (n = 184)	Incumbent (n = 200)
Demographic variables	M $\pm$ SD or N (%)	
Age (years)*	28.8 $\pm$ 5.4	39.0 $\pm$ 7.8
Race and ethnicity*		
• Non-Hispanic White	101 (57.4)	139 (69.9)
• Non-Hispanic other	21 (11.9)	17 (8.5)
• Hispanic	54 (30.7)	43 (21.6)
Education (%)		
• High school graduate	10 (5.7)	5 (2.5)
• Some college	68 (38.6)	76 (38.2)
• College graduate	98 (55.7)	118 (59.3)
Marital status (% married or living with partner)*	31 (17.6)	94 (47.2)
Rank (%)		
• Firefighter	92 (54.1)	141 (70.9)
• Officer	0	45 (22.6)
• Chief	0	7 (3.5)
• Other	78 (45.9)	6 (3.0)
Location (%)		
• Northeast	27 (14.7)	37 (18.5)
• Midwest	17 (9.2)	16 (8.0)
• South	35 (19.0)	48 (24.0)
• West	105 (57.1)	99 (49.5)
BMI (kg/m²)	23.6 $\pm$ 5.3	24.5 $\pm$ 6.4
% Overweight & Obese (BMI > 25 kg/m²)*	66 (37.5)	104 (52.3)

BMI, body mass index

* Indicates a statistically significant difference between incumbent and recruit ($p < 0.05$). Totals may not add up to 100 due to rounding. We reviewed the high proportion of "other" text responses and found them consistent with recruit firefighters.

Table 2
Baseline stress survey responses

	Recruit (n = 184)	Incumbent (n = 200)
Variables	M $\pm$ SD or N (%)	
Perceived Stress Scale (total scores)	9.8 $\pm$ 8.9	10.7 $\pm$ 7.9
• Low stress (0–13)	119 (64.7)	127 (63.5)
• Moderate stress (14–26)	56 (30.4)	70 (35.0)
• High stress (27–40)	9 (4.9)	3 (1.5)
Social support (total scores)	23.4 $\pm$ 16.7	26.3 $\pm$ 14.6
Depression/anxiety screening (total scores)	2.2 $\pm$ 2.8	1.7 $\pm$ 2.2
• No distress (0–2)	129 (70.1)	140 (70.0)
• Mild distress (3–5)	23 (12.5)	47 (23.5)
• Moderate distress (6–8)	26 (14.1)	11 (5.5)
• Severe distress (9–12)	6 (3.3)	2 (1.0)
Depression subscale (total scores)	0.6 $\pm$ 1.1	0.5 $\pm$ 1.0
• Within range of concern for depression	9 (4.9)	11 (5.5)
Anxiety subscale (total scores)*	1.6 $\pm$ 2.0	1.2 $\pm$ 1.5
• Within range of concern for anxiety	48 (26.1)	31 (15.5)
Self-reported clinical diagnosis of depression	23 (18.0)	22 (13.8)
Self-reported clinical diagnosis of anxiety	30 (23.4)	26 (16.4)
PCL-C Scale total scores*	6.9 $\pm$ 5.8	8.3 $\pm$ 5.5
• Within range of concern for PTSD	19 (10.3)	33 (16.5)
Self-reported clinical diagnosis of PTSD	8 (6.3)	19 (12.0)
Resilience Scale total scores	5.0 $\pm$ 3.5	5.4 $\pm$ 2.9

PCL-C, PTSD Checklist-Civilian; PTSD, post-traumatic stress disorder

* Indicates a statistically significant difference between incumbent and recruit ($p < 0.05$). Totals may not add up to 100 due to rounding. For Anxiety Subscale, a score of 3 or more represents concern for anxiety. For PCL-C, a score of 14 or more is suggestive of difficulties with post-traumatic stress.

Table 3
Chronic work discrimination and harassment (M±SD; N (%))

Variables	Recruit (n = 184)	Incumbent (n = 200)
M±SD or N (%)		
Sex discrimination		
Qualified members of both genders can expect the same training opportunities*		
• Strongly disagree	1 (0.8)	8 (5.1)
• Disagree	11 (8.7)	24 (15.2)
• Agree	49 (38.6)	68 (43.0)
• Strongly agree	66 (52.0)	58 (36.7)
Qualified members of both genders can expect similar job assignments*		
• Strongly disagree	1 (0.8)	9 (5.7)
• Disagree	16 (12.6)	32 (20.3)
• Agree	49 (38.6)	66 (41.8)
• Strongly agree	61 (48.0)	51 (32.3)
Qualified members of both genders can expect to be treated with the same level of professionalism*		
• Strongly disagree	4 (3.2)	18 (11.4)
• Disagree	19 (15.1)	40 (25.3)
• Agree	41 (32.5)	58 (36.7)
• Strongly agree	62 (49.2)	42 (26.6)
Sexual harassment		
Sexual harassment does not occur in my work area*		
• Strongly disagree	6 (4.7)	13 (8.2)
• Disagree	22 (17.3)	55 (34.6)
• Agree	52 (40.9)	54 (34.0)
• Strongly agree	47 (37.0)	37 (23.3)
Leaders in my organization adequately respond to allegations of sexual harassment*		
• Strongly disagree	3 (2.4)	9 (5.7)
• Disagree	7 (5.5)	23 (14.5)
• Agree	59 (46.5)	80 (50.3)
• Strongly agree	58 (45.7)	47 (29.6)
Leaders play an active role in the prevention of sexual harassment*		
• Strongly disagree	2 (1.6)	10 (6.3)
• Disagree	6 (4.8)	19 (12.0)
• Agree	53 (42.1)	81 (51.3)
• Strongly agree	65 (51.6)	48 (30.4)
Sexist behaviors		
Sexist slurs are not used in my work area*		
• Strongly disagree	9 (7.1)	25 (15.8)
• Disagree	18 (14.3)	62 (39.2)
• Agree	49 (38.9)	45 (28.5)
• Strongly agree	50 (39.7)	26 (16.5)
Sexist comments are not used in my work area*		
• Strongly disagree	9 (7.1)	23 (14.5)
• Disagree	20 (15.9)	72 (45.3)
• Agree	50 (39.7)	39 (24.5)
• Strongly agree	47 (37.3)	25 (15.7)
Sexist jokes are not used in my work area*		
• Strongly disagree	11 (8.7)	28 (17.9)
• Disagree	21 (16.7)	67 (45.9)
• Agree	47 (37.3)	39 (25.0)
• Strongly agree	47 (37.3)	22 (14.1)

* Indicates a statistically significant difference between incumbent and recruit ($p < 0.05$). Totals may not add to 100 due to rounding.

group, individuals reporting moderate or high stress were more likely to exhibit anxiety concerns (OR = 3.86, CI = 1.76–8.89), be at risk for PTSD (OR = 1.30, CI = 1.15–1.47), encounter sexist behavior (OR = 1.02, CI = 0.90–1.16), perceive poor organizational cohesion (OR = 1.13, CI = 1.02–1.25), and express lower job satisfaction (OR = 1.04, CI = 0.94–1.15). Table 5 summarizes these findings.

Table 4
Organizational variables (M±SD; N (%))

Variables	Recruit (n = 184)	Incumbent (n = 200)
M±SD or N (%)		
Organization cohesion		
Members look out for each other's welfare*		
• Strongly disagree	1 (0.8)	3 (1.9)
• Disagree	0	11 (7.0)
• Agree	51 (40.2)	89 (56.3)
• Strongly agree	75 (59.1)	55 (34.8)
Members support each other to get the job done*		
• Strongly disagree	0	2 (1.3)
• Disagree	0	6 (3.8)
• Agree	48 (37.8)	86 (54.1)
• Strongly agree	79 (62.2)	65 (40.9)
Members work well together as a team		
• Strongly disagree	0	2 (1.3)
• Disagree	1 (0.8)	5 (3.2)
• Agree	58 (45.7)	84 (53.2)
• Strongly agree	68 (53.5)	67 (42.4)
Members trust each other*		
• Strongly disagree	0	5 (3.2)
• Disagree	3 (2.4)	19 (12.1)
• Agree	65 (51.6)	88 (56.1)
• Strongly agree	58 (46.0)	45 (28.7)
Job satisfaction		
I like my job		
• Strongly disagree	0	2 (1.3)
• Disagree	0	4 (2.5)
• Agree	41 (32.5)	57 (35.8)
• Strongly agree	85 (67.5)	96 (60.4)
I feel satisfied with my present job		
• Strongly disagree	0	3 (1.9)
• Disagree	2 (1.6)	6 (3.8)
• Agree	40 (31.7)	60 (37.7)
• Strongly agree	84 (66.7)	90 (56.6)
Most days I am enthusiastic about my work		
• Strongly disagree	0	3 (1.9)
• Disagree	4 (3.2)	11 (6.9)
• Agree	49 (39.2)	72 (45.3)
• Strongly agree	72 (57.6)	73 (45.9)
I find real enjoyment in my work*		
• Strongly Disagree	0	4 (2.5)
• Disagree	3 (2.4)	10 (6.3)
• Agree	41 (33.3)	65 (40.9)
• Strongly Agree	79 (64.2)	80 (50.3)

* Indicates a statistically significant difference between incumbent and recruit ($p < 0.05$). Totals may not add to 100 due to rounding.

4. Discussion

This study identified significant differences between recruit and incumbent women firefighters. The recruits were notably younger, exhibited greater racial and ethnic diversity, were less likely to be married or living with a partner, displayed higher instances of anxiety, and had a lower likelihood of being categorized as “at risk” for PTSD symptoms. These findings align with Wagner et al [20] on male firefighter recruits. Differences such as age and marital status among recruits and incumbents could reflect life stage variations as women embark on their careers in firefighting. The rising median age of first marriage for American women, currently just over 28 years [41], explains the decreased likelihood of recruits being married upon entering the fire service. The decreased likelihood of

Table 5
Variables by perceived stress group

Variables	OR	95% CI
Emotional Health		
Social support	0.90	0.85–0.96
Anxiety (PHQ-4)	3.86	1.76–8.89
PTSD (PCL-C total score)	1.30	1.15–1.47
Resilience (total score)	0.70	0.51–0.95
Work discrimination and harassment		
Sex discrimination	0.93	0.82–1.05
Sexual harassment	0.79	0.66–0.95
Sexist behaviors	1.02	0.90–1.16
Organizational outcomes		
Organization cohesion	1.13	1.02–1.25
Job satisfaction	1.04	0.94–1.15

PHQ-4: Patient Health Questionnaire-4; PTSD: post-traumatic stress disorder; PCL-C: PTSD Checklist-Civilian; OR: odds ratio; CI: confidence interval

Notes: Odds ratios are adjusted for participant age and minority status (Hispanic/non-White). ORs >1.0 indicate increased odds for those who screened moderate or high stress on the PSS scale relative to those who screened low stress (reference group).

scoring “at risk” for PTSD symptoms could be due to decreased exposure to trauma prior to entering the fire service; this concept mirrors previous research [42–44]. While it might seem of interest that recruits were more likely to report higher anxiety than incumbents, this is in line with the trends among the general population where age has a negative correlation with anxiety levels [45–47]. Notably, data collection occurred while recruits were in the midst of their intense and stressful training academy. The increase in racial and ethnic diversity among recruits may be empirical evidence supporting increased efforts to diversify the fire service [48–50].

The study also found that recruits are less likely to report sex discrimination, sexual harassment, and sexist behaviors, possibly due to their brief occupational exposure. However, this could also be influenced by a hesitance to report such incidents given the fire service’s deeply ingrained traditional culture [51]. Higher perceived stress levels were associated with an increased risk of anxiety and PTSD. Furthermore, sexist behaviors, organizational cohesion, and job satisfaction contribute to worse outcomes. These findings are similar to Jahnke et al [8], who observed deteriorating physical and mental health outcomes with increased levels of discrimination and harassment. Essentially, high-stress levels and exposure to mistreatment significantly compromise individuals’ mental and physical well-being. Despite these challenges, both recruit and incumbent women firefighters reported high job satisfaction levels. Identifying effective support mechanisms for fire service personnel remains crucial to ensuring their career longevity and well-being. Further, examining the necessity for gender-specific peer support for women in the fire service may be critical to closing the gender gap and encouraging more women to join the fire service.

4.1. Strengths and limitations

This study is pioneering in comparing recruit and incumbent women firefighters and is among the few to examine the mental health impacts of firefighting on women. It is essential to acknowledge the cross-sectional nature of these results, which precludes establishing causality or temporal relationships. As with any human participants’ research, participation is voluntary, potentially introducing selection bias that might not reflect the broader women firefighter population. Nevertheless, these findings are consistent with other studies [8,19,52]. Self-reported data carry

the risk of recall bias, although previous research has validated the accuracy of self-reporting methods [8,11,53]. Additionally, offering “recruit firefighter” as an alternative rank option in surveys could provide clearer insights into the experiences of new firefighters.

5. Conclusion

This study provides important detail regarding the health and experiences of recruit and incumbent women firefighters. Future research will be essential in examining changes over time. As evidenced by our results, years of fire service experience likely impact perceptions of the job, experiences of discrimination and harassment, and increase the risk of PTSD. Identifying and addressing firefighters experiencing high levels of stress is essential to maintaining a healthy and resilient workforce. Though women and men firefighters face the same occupational exposures, there is perhaps a need for specific outreach and support networks for women specifically as women in this and the previous studies [8,] [51,52] noted sex discrimination, sexual harassment, and experiencing sexist behaviors in the fire service. As an evolving area of concern, it is important to recognize that addressing mental health in the context of women firefighters requires a comprehensive and multifaceted approach that involves collaboration among fire departments, mental health professionals, advocacy groups, and the broader community. This approach should aim to create a supportive and inclusive environment that prioritizes all firefighters’ well-being, regardless of their gender.

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CRediT authorship contribution statement

Brittany S. Hollerbach: Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review & editing. **Nattinee Jitnarin:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Maria D.H. Koepfel:** Investigation, Writing – original draft, Writing – review & editing. **Michelle Valenti:** Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review & editing. **Shawn Beitel:** Conceptualization, Data curation, Investigation, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Jaclyn M. Goodrich:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Jefferey L. Burgess:** Conceptualization, Data curation, Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – original draft. **Sara A. Jahnke:** Conceptualization, Data curation, Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing.

Conflicts of interest

The authors report no conflict of interest.

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