

Occupational and environmental factors influencing morale of United States federal wildland firefighters

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ABSTRACT

Background. Wildland firefighters have physically and psychologically demanding jobs that can result in social, economic and health-related stress. Previous studies have examined the physiological and physical effects of a career in wildland fire, but fewer studies have addressed psychological effects, and to date, none have directly analysed the hiring and work experiences of wildland firefighters. **Aims.** We surveyed work experiences, health and well-being, and morale of wildland firefighters, explored factors that can improve recruitment and retention, and summarised broad patterns. **Methods.** We conducted a voluntary anonymous survey of 708 federal wildland firefighters via an online platform over 2 months in 2022. **Key results.** Respondents reported dissatisfaction with recruitment and hiring processes, low base salaries, poor mental health outcomes, and health and safety concerns. Respondents also reported the high importance of training, performance feedback and work environment to their retention in the field. We found significant effects of wildland firefighting on family status. **Conclusions.** Wildland firefighters report experiencing low morale, financial stress, personal life strain and poor mental health outcomes. **Implications.** These data provide a framework to establish future policy and research priorities and highlight the need for organisational actions and change.

Keywords: employment, firefighter, Forest Service, forestry technician, health, hiring, mental health, morale, prescribed burn, recruitment, retention, safety, survey.

Introduction

Federal wildland firefighters (hereafter WFFs) are the primary responders to wildland fires on United States federal lands and protection zones. In 2021, there were a total of 13 796 fires in federal protection zones (23.5% of total US fires) accounting for 2.07 million hectares of burned land (71.8% of total burned area nationally; NIFC 2022). Alone, the United States Department of Agriculture Forest Service (hereafter USDA FS) responded to 58% of all wildfire areas in the United States in 2021 (NIFC 2022). Owing to the nature of their jobs, WFFs are exposed to volatile and high-stress environments for prolonged periods of time (McLennan *et al.* 2014). Thus, they may experience injury (Britton *et al.* 2013), illness (Moody *et al.* 2019) and cognitive impairment (Vincent *et al.* 2018) on the job. Additionally, these jobs often require extended periods of time in remote and isolated environments and have a history of masculine culture, both of which have been previously shown to be situations that pose heightened safety risks for women (Saunders and Easteal 2013, Durana *et al.* 2018), and may pose increased risk of suicide (Stanley *et al.* 2018).

In addition, federal WFFs face potential socioeconomic stressors. In a survey of WFF spouses, almost half (49.3%) of WFFs' spouses have considered separating from their partner owing to the strain on the relationship caused by the job, and 88% of spouses of WFFs report that increased pay would help support their families (Grassroots Wildland Firefighters 2021). Pay can be a primary determinant of motivation: in one study, paid firefighters were more committed to their work than volunteer firefighters (Lee and Olshfski 2002). Synthesised global data show that the negative job assets of low-paying

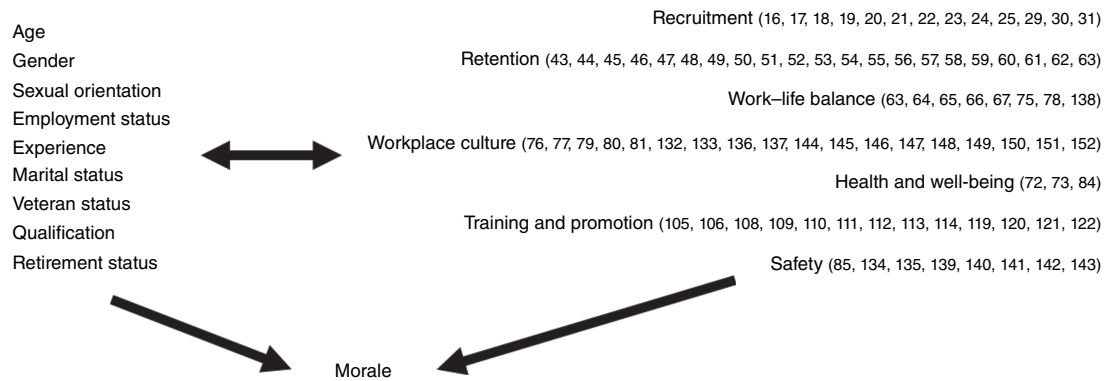


Fig. 1. Theoretical framework of study. Numbers in parentheses correspond to question numbers associated with indices calculated for each construct.

jobs (e.g. working long hours to compensate for low pay) do not facilitate healthy social interactions, and high health and safety risks compound the detriments of low-paying jobs (Grimshaw 2011), and these detriments may be disproportionately compounded for working mothers and minorities (Boushey et al. 2007). Further, a career in wildland fire may disrupt home life: partners of wildland firefighters report significant stress due to their partner's absence (78.1%), that their partner is engaged in work activities while at home (56.5%), that their partner expresses anger or frustration about work at home (51.3%), and that they feel that they are secondary to the commitments of their partner's job (59.9%; Grassroots Wildland Firefighters 2021).

In addition to financial and familial stress, WFFs may experience cumulative trauma resulting in elevated rates of poor mental health (Cherry et al. 2021). Work by Stanley et al. (2018) examined the potential role of thwarted belongingness in a sample of WFFs and found that, relative to structural firefighting crews that tend to be relatively stable in location and composition, wildland firefighting crews exhibit higher levels of thwarted belongingness, a potential risk factor for suicide. Pruitt et al. (2017) suggest that structural analogies between federal WFF crews and the United States Army National Guard, i.e. inconsistency of crew composition and intermittent deployment to and from home units, may explain why both units have higher suicide rates relative to similar units within their respective disciplines (e.g. structural firefighters and United States Army).

Surveys measuring cross-season and individualised long-term impacts of wildland firefighting on health are scarce (Semmens et al. 2006; Koopmans et al. 2022). In a survey measuring stakeholder research priorities, WFFs expressed concerns about physical health with their prioritised concerns relating primarily to respiratory (89%), fatigue (80%) and exposure-related disease (67%; Pelletier et al. 2022). Occupational hazards and stressors are often compounded in wildland firefighting settings (e.g. sleep deprivation plus hot, smoky conditions, Aisbett et al. 2012), which may exacerbate the potential for physical and cognitive impairment and

increase the potential for workplace injuries. Further, they can impair sleep, which can further decrease firefighter readiness and cognitive preparedness, eroding safety further (Cuddy et al. 2015). Still further, cultural norms that promote conformity and organisational loyalty (Thackaberry 2004) above self-advocacy may limit firefighters' perceived ability to effect positive professional change.

This combination of cultural, physical, physiological, psychological and socioeconomic stressors and risk factors makes the need for data on the morale, attitudes, hiring, retention and work experiences of this population even more urgent. To our knowledge, there are no published studies addressing morale and working conditions that rely directly on first-hand hiring and work experiences and attitudes from federal WFFs, despite recent calls for additional research into the effects of occupational exposure on this population (Koopmans et al. 2022). In combination with limited other data that exist on environmental factors and occupational hazards, these data will provide first-hand information to inform operations and policy.

Aims and hypotheses

For our purposes, morale is the degree to which a worker maintains a positive outlook and/or motivation toward their work, although numerous other definitions have been proposed (see McFadzean and McFadzean 2005 for an exploration of alternatives); Baehr and Renck identified five primary factors influencing morale, namely organisation management, immediate supervision, material rewards (pay and benefits, status and recognition), fellow employees and job satisfaction (demands and working conditions; Baehr and Renck 1958). We conceptualised that these and other components of the wildland firefighting profession may be contributing to WFF morale and well-being (Fig. 1). We recognised that there are other factors outside the working environment that may explain patterns in well-being and morale among firefighters; however, the current study only examined work-related factors. Further, although

Baehr and Renck (1958) employed a large sample size and examined morale across multiple employment sectors, the existing instruments that measure job satisfaction and other occupational factors are not sample-specific and may not identify key considerations that are important to the wildland firefighting job field. We believe that wildland firefighting is a sufficiently unique career with unique attributes (short-term and frequent away-from-home deployment, long working hours, intermittent workload intensities) that it warrants individual examination. We created a survey instrument to measure environmental and occupational factors that may influence recruitment, retention, work–life balance, workplace culture, health and well-being, training and promotion, and safety in US federal WFFs and then examined the relationship between these constructs and demographic factors. Here, we defined morale as a summative measurement of seven equally weighted constructs identified above (recruitment, retention, work–life balance, workplace culture, health and well-being, training and promotion, and safety).

Research question and objectives

The objectives of this survey were to identify common barriers to recruiting and retaining federal WFFs, assess morale of WFFs and explore relationships with safety, workplace culture, training and promotion, and work–life balance. Our research questions were:

1. How do occupational constructs influence the morale of our study population?
2. What is the influence of demographic variables on individual occupational constructs and overall morale of our study population?

Materials and methods

Survey design, distribution and recruitment

Constructs were selected through informal interviews with current and former federal WFFs and a search of previously published literature on topics of workplace safety, WFFs, and employee recruitment and retention. The survey items were designed by an author (Granberg) and included 152 items with a range of response types (Supplementary Table S1). Two items were used to validate the survey response fidelity and as a measure of cognitive saturation (items 67 and 139, Supplementary Table S1; Lievens *et al.* 2012). On most items, participants were limited to defined responses, but were given an ‘other’ option where they could insert their own response. Of the 152 items, nine were open response that allowed detailed comments by respondents (Supplementary Table S1). Respondents could opt out of any question and move backwards and forwards among items and modify answers as they wished prior to

submission of the survey. We excluded the nine open-response items from the quantitative analyses presented here (see Ragland *et al.* 2023).

Constructs that may impact morale that were examined in this study included demography, recruitment, retention, work–life balance, workplace culture, health and well-being, training and promotion, and safety. In addition, we collected voluntarily disclosed demographics about respondents, including age, ethnicity, gender identity, sexual orientation, veteran status, Americans with Disabilities Protection Act (ADA) status, formal education level, current employer, employment status, family and marital status, National Wildfire Coordinating Group (NWCG) fire qualifications, federal grade (General Schedule or GS) level, and self-reported mental health and neurodivergent diagnosis status (Table 1). The questionnaire was reviewed by three WFFs for clarity, ease of response and breadth of coverage prior to distribution.

All respondents self-administered the survey instrument voluntarily and anonymously with no incentives after reading a brief statement about the purpose of the survey. The survey was available on an anonymous Google form from 1 January through 1 March 2022. Survey participants were recruited via internet, primarily through social media (Facebook, Reddit, Twitter), email and through professional networks. Criteria for inclusion in the survey were current or previous employment as a federal WFF or in a federal role that had significant time spent in wildland firefighting duties (e.g. US federal secondary fire retirement) and completion of at least 70% of items. Respondents had the option of entering an email address to which they wanted survey updates sent at the completion of the survey. Email addresses were decoupled from survey responses, and no names or other personal identifying information were collected in the response data. This survey was not sponsored by an organisation or university affiliated at the time of its distribution; thus, the University of Missouri System’s Institutional Research Board deemed approval for analysis of previously collected data unnecessary.

Table 1. Indices for each construct. Fig. 1 indicates which items were used to create index values.

Construct	Index	s.d.	N	Effect on morale
Recruitment	2.64	0.486	13	–/0
Retention potential	4.28	0.306	20	+
Work–life balance	2.02	0.447	8	–
Health and well-being	2.80	0.225	3	–/0
Training and promotion	3.55	0.395	13	0/+
Safety	3.63	0.241	8	0/+
Workplace culture	3.26	0.627	18	0

s.d., standard deviation; N, total number of items included in each index.

Data analysis

We excluded all respondents who did not meet survey criteria prior to analysis. We also excluded or clumped responses in formal analyses when small samples ($N < 5$) made it impossible to protect respondent anonymity. Likert scale data were analysed as continuous variables (Robitzsch 2020), with 1 = strongly disagree and 5 = strongly agree. Distributions, mean Likert scores (m) and standard deviations were calculated for all items prior to cleaning data (Supplementary Table S1). The impact of demographic predictors on individual items was analysed using multivariate analysis of variance (MANOVA) where demographic predictors were assigned as independent interacting variables and items were assigned as response variables. Data were then cleaned, and items were assigned to constructs. Construct statistical analyses were run on the cleaned dataset. We averaged Likert scores and s.d. within constructs to create indices for each construct (Fig. 2). Demographic predictors examined were age class (year born: before 1975; 1975–1984; 1985–1994; after 1994), gender (male, female), ethnicity (white, not white; non-white respondents were pooled to maintain respondent anonymity), GS level (US federal employment grade 3, 4, 5, 6, 7, 8, 9+; Office of Personnel Management 2022), marital status, veteran status and job status (temporary seasonal, permanent seasonal, permanent full time, other).

We used MANOVA and assigned demographic predictors as interacting independent variables and constructed Likert scores as response variables to examine ($\alpha = 0.05$). Each construct was analysed separately. We checked for correlations among constructs and demographic variables using Pearson’s r with 95% confidence intervals (CI). We analysed items with binary and categorical responses by calculating the proportion of respondents that selected each. Demographic predictors were compared with responses using chi-square

analyses ($P < 0.05$) for each item independently. Data were analysed in Excel and JMP 16.0 (SAS 2022).

Results

A total of 736 individuals participated in the survey. We excluded 28 participants who did not meet the criteria for survey participation and analysed data for $N = 708$ individuals.

Respondents took a mean of 20 min to complete the survey. On average, respondents completed 92% of survey questions with no individual completing less than 84% of questions.

Demographics

Respondents were primarily straight (89%), white (82%) and male (80%; Table 2). Most respondents had completed some type of post-secondary degree (76.3%), and 48.3% had a Bachelor’s degree or higher. Of all federal organisations represented in the survey population, most respondents were current WFFs with the USDA FS (75.0%). A total of 7.7% of respondents had left the federal workforce but had worked as a federal WFF previously. Respondents had previously or currently worked in positions in 40 states representing five United States federal agencies (Bureau of Indian Affairs, Bureau of Land Management, National Park Service, US Fish and Wildlife Service, USDA FS). They ranged in grade from 3 to 9+ and were primarily distributed among permanent seasonal (39.1%), permanent full-time (37.9%) and temporary seasonal employment statuses (27.4%). Our analyses did not account for whether WFFs had worked for multiple federal agencies.

Demographic predictors were rarely a significant factor influencing Likert scores or chi-square analyses for

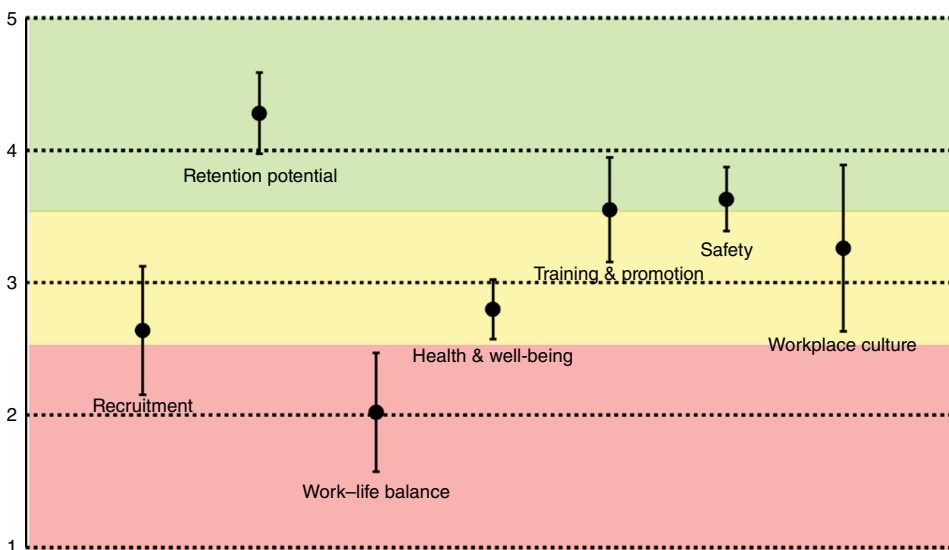


Fig. 2. Construct indices with standard deviations. Green, yellow and red backgrounds are superimposed to correspond to positive impacts on morale (green, Likert score >3), neutral impacts on morale (yellow, Likert score ~ 3), and negative impacts on morale (red, Likert score <3).

Table 2. Demographics.

Demographic	N	Prop. population
Ethnicity		
White	583	0.82
Hispanic	64	0.09
Native American	27	0.04
Asian	15	0.02
Black	8	0.01
Age (years)		
<27	151	0.21
28–37	370	0.52
38–47	131	0.19
48–57	43	0.06
>57	12	0.02
Gender identity		
Female	139	0.19
Male	554	0.80
Non-binary	2	<0.01
Sexual orientation		
LGBTQIA+	44	0.06
Straight	633	0.89
Veteran	90	0.13
ADA protected	30	0.04
Education		
HS/GED	168	0.24
Technical school	67	0.10
Associate degree	131	0.18
Bachelor's degree	304	0.43
Graduate degree	38	0.05
Current employer		
US Forest Service	523	0.74
US Fish and Wildlife Service	9	0.01
Bureau of Indian Affairs	3	< 0.01
Bureau of Land Management	83	0.12
National Park Service	23	0.03
No longer in fire at all	25	0.03
Permanent full-time employee	232	0.33
Permanent seasonal employee	270	0.38
Temporary seasonal employee	189	0.27
Primary fire retirement	594	0.84
Secondary fire retirement	75	0.11

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Table 2. (Continued)

Demographic	N	Prop. population
Mental health/neurodivergence		
Autism	14	0.02
ADHD	117	0.17
Bipolar	13	0.02
Dyslexia	19	0.03
Depression	301	0.43
Anxiety	342	0.48
Substance abuse	157	0.22
PTSD	158	0.22
Suicidal thoughts	114	0.16
Married	293	0.41
Divorced	29	0.04
Single	412	0.58
Have children	209	0.30
Qualifications		
Above DIVS	30	0.04
DIVS/IC3	61	0.09
FFT1/IC5	256	0.36
Single resource	217	0.31
TFLD	80	0.11
Grade		
GS-3	28	0.04
GS-4	152	0.21
GS-5	163	0.23
GS-6	88	0.12
GS-7	112	0.16
GS-8	78	0.11
GS-9+	83	0.12

LGBTQIA+, lesbian, gay, bisexual, transgender, queer, intersex, asexual and others; ADHD, attention deficit hyperactivity disorder; HS/GED, high school diploma or equivalent; PTSD, post traumatic stress disorder; DIVS, division supervisor; IC, incident commander; FFT, firefighter; TFLD, task force leader. N = total number of respondents identifying as member of a demography. Prop. population, proportion of the total survey population represented by the demography.

individual items: grade, marital status, veteran status, family status and retirement status were non-significant for all questions we posed in the survey ($P > 0.05$; Supplementary Table S1). When a predictor was significant, the P -value and F or chi-square statistics are reported in the text. The question list, mean Likert scores, sample sizes and standard deviations for all questions can be found in Supplementary Table S1.

We defined morale as a summative metric composed of seven occupational constructs: recruitment, retention,

work–life balance, workplace culture, health and well-being, training and promotion, and safety. For an individual construct, an index of 3.0 would indicate an entirely neutral impact on morale. Our construct indices ranged from 2.02 (Work–life balance; s.d. 0.447) to 4.28 (Retention potential; s.d. 0.306; Table 2), indicating that items associated with work–life balance most negatively impact respondent morale in our survey. Constructs that included factors that may extend outside the immediate work environment (e.g. family life, recruitment into the workplace, health, well-being) tended to have negative effects on morale, whereas constructs that considered only the immediate working environment had a neutral effect on morale (e.g. safety, workplace culture, training).

Each occupational construct was impacted by a unique set of demographic variables (Table 3): most common were gender ($N = 5$) and GS level ($N = 4$) followed by sexual orientation, retirement status and ethnicity ($N = 3$ each). Items such as safety and work–life balance were impacted by the largest numbers of demographic factors, and recruitment was impacted by only a single factor (veteran status).

Recruitment

Veteran status impacted respondent experiences with recruitment positively (Table 3). A total of 67.9% of respondents reported missing out on jobs because they misunderstood the application process, or the application process was not clear; 58.1% had missed out on jobs because of mistakes made by Human Resources. Female respondents reported that they received a job or promotion based on application alone less frequently than male respondents ($X^2_{(1, N = 693)} = 16.27, P = 0.0062$; Supplementary Fig. S7). Respondents indicated issues throughout with the hiring process; they disagreed that they knew when jobs were going to be open ($m = 1.96, s.d. 0.90$), that jobs were not open long enough for them to apply ($m = 2.58, s.d. 1.09$) and open at a time of year when they could easily access a computer to apply ($m = 1.92, s.d. = 1.04$). Further, they tended to disagree that firefighter resumes were straightforward to create ($m = 2.68, s.d. 1.17$), and that they understood how their resume was assessed ($m = 2.57, s.d. 1.22$).

Health and well-being

For the overall construct, GS level and age both significantly impacted health and well-being (Table 3): despite their potential linkage, the interaction between these terms was non-significant ($P > 0.05$). Temporary and seasonal employees reported lower levels of health and well-being than permanent and full-time employees, male respondents reported lower levels than female respondents.

A total of 78% of respondents reported that they experienced mental health issues related to or exacerbated by their work, but only 4.2% of our respondents identified as

someone who could be protected by the Americans with Disabilities Act. Respondents reported that suicidal thoughts and ideation increased or were exacerbated owing to the stress of their jobs (16.5%). Almost half indicated depression (43.6%) or anxiety (48.9%). Whereas a smaller portion reported substance abuse (22.7%), ADHD (16.6%), or suicidal thoughts or ideation (16.5%), the fact that almost a fifth of our respondents reported these concerns merits attention. We found no correlation among any demographic predictors, experience of sexual assault and/or sexual violence in the workplace, positive or negative reports of work–life balance, the ability to talk about mental health at work, feeling physically safe at work, access to mental health care and a feeling that one's work has meaningful impact with suicidal ideation, presence of PTSD, anxiety, depression, or substance abuse (for all pairs: $r < 0.01$).

Safety

Female, LGBTQIAA+ (lesbian, gay, bisexual, transgender, queer, intersex, asexual, aromantic, and others), and/or non-white respondents had lower safety construct indices than male, straight and/or white respondents (Table 3). Respondents who reported that they were ADA-protected had higher safety construct indices than non-ADA protected individuals (Table 3). Respondents mostly strongly disagreed with the statement that they were 'fairly compensated for the level of risk their work entails' ($m = 1.39, s.d. 0.69$). A total of 67.1% of respondents reported that they have experienced an injury or illness as a result of their work in wildland fire. Non-white respondents reported injuries and illnesses directly related to work more often than white respondents (71% versus 68%, $X^2_{(1, N = 697)} = 20.83, P = 0.0018$, Supplementary Table S2). Most respondents reported their injury to their supervisor (80.2%); however, respondents reported mixed satisfaction with the way their injury or illness was handled ($m = 2.57, s.d. 1.23$).

A total of 13.7% of respondents reported unwanted sexual touching or sexual assault/violence while working in a federal wildland fire job; of the assaults that occurred, 45.3% were perpetrated by a peer, 33.7% by a supervisor and 21.1% by a subordinate. Experiences of threatening or hostile behaviour (not including sexual assault/violence) while working in wildland fire increased with age ($X^2_{(1, N = 707)} = 28.80, P = 0.033$; Supplementary Fig. S1). Approximately 19.9% of women and 11.3% of men reported that they had experienced threatening or hostile behaviour that included physical contact (e.g. fighting, but not sexual violence) at work ($X^2_{(1, N = 693)} = 21.25, P = 0.0179$, Supplementary Fig. S2); of these incidents, 62.6% were perpetrated by a peer, 27.0% by a superior and 10.4% by a subordinate. Non-white respondents were more likely to report that uncomfortable jokes and/or comments were made in the workplace by a supervisor as compared with a peer or subordinate ($X^2_{(1, N = 691)} = 45.04, P = 0.0489$;

Table 3. Significant demographic factors for each construct.

Construct	Item	P	Options	m	s.d.	
Health and well-being	Gender	0.0023	Female	2.94	0.364	
			Male	2.74	0.204	
	GS level	0.00279	GS-3	2.67	0.764	
			GS-4	2.25	0.368	
			GS-5	2.51	0.120	
			GS-6	2.95	0.435	
			GS-7	3.04	0.592	
			GS-8	2.88	0.538	
			GS-9+	3.29	0.594	
	Employment status	<0.0001	Permanent full-time	3.05	0.554	
			Permanent seasonal	2.92	0.350	
			Temporary seasonal	2.10	0.444	
			None of these	2.80	0.346	
	Age	0.00910	58–77	3.43	0.285	
			48–57	2.80	0.503	
38–47			3.14	0.662		
28–37			2.76	0.165		
18–27			2.29	0.211		
Retention	GS level	0.0040	GS-3	4.23	0.347	
			GS-4	4.31	0.409	
			GS-5	4.33	0.335	
			GS-6	4.35	0.357	
			GS-7	4.34	0.272	
			GS-8	4.20	0.366	
	Age	0.00392	GS-9+	4.04	0.322	
			58–77	4.23	0.357	
			48–57	4.26	0.418	
			38–47	4.19	0.291	
Recruitment	Veteran status	0.0312	28–37	4.32	0.320	
			18–27	4.28	0.372	
			Civilian	2.83	0.613	
			Veteran	2.88	0.658	
			Work–life balance	Gender	0.0269	Female
Male	2.11	0.543				
Sexual orientation	0.0309	LGBTQ+	1.71			0.439
		Straight	2.11			0.533
Ethnicity	0.0327	Not white	1.98			0.466
		White	2.13			0.544
	Employment status	0.0073	Permanent full-time	2.24	0.506	

(Continued on next page)

Table 3. (Continued)

Construct	Item	P	Options	m	s.d.
			Permanent seasonal	2.00	0.589
			Temporary seasonal	1.93	0.486
			None of these	1.98	0.545
	GS level	0.0076	GS-3	2.21	1.083
			GS-4	2.04	0.496
			GS-5	1.95	0.542
			GS-6	1.94	0.614
			GS-7	1.91	0.462
			GS-8	2.21	0.560
			GS-9+	2.57	0.597
Workplace culture	Employment status	0.01020	Permanent full-time	3.24	0.825
			Permanent seasonal	3.25	0.622
			Temporary seasonal	3.39	0.656
			None of these	3.21	0.733
Safety	Sexual orientation	0.0027	LGBTQ+	3.37	0.307
			Straight	3.66	0.232
	Gender	0.0080	Female	3.43	0.300
			Male	3.70	0.223
	Disability status	0.0177	ADA-protected	3.63	0.234
			Not ADA-protected	3.77	0.295
	Ethnicity	0.0247	Not white	3.63	0.331
			White	3.64	0.221
Training and promotion	Sexual orientation	0.0168	LGBTQ+	3.44	0.354
			Straight	3.57	0.407
	Ethnicity	0.0172	Not white	3.51	0.395
			White	3.57	0.399
	GS level	0.037	GS-3	3.31	0.619
			GS-4	3.34	0.492
			GS-5	3.52	0.449
			GS-6	3.56	0.367
			GS-7	3.68	0.339
			GS-8	3.80	0.350
			GS-9+	3.84	0.379

Alpha = 0.05; m = mean Likert score.

Supplementary Fig. S3). Formal complaints about all issues were more likely to be filed by female respondents (31%) than male respondents (22.4%), and by white respondents (25.6%) than non-white respondents (16.4%; $X^2_{(1, N = 691)} = 20.83$, $P = 0.0208$ ethnicity, $P = 0.0468$ gender; Supplementary Fig. S4). Respondents reported high levels of dissatisfaction

about the resolution of their complaints, with only 14.1% reporting that a satisfactory resolution was reached.

Work-life balance

Overall, participants were neutral to negative in their level of agreement to 'My work-life balance is healthy' with a

mean Likert score of 2.43 (s.d. = 1.14). Higher levels of agreement about healthy work–life balance correlated moderately with feeling like a respected and valued employee ($r = 0.34$, CI = 0.27–0.40), and a flexible schedule when not on a fire assignment ($r = 0.37$, CI = 0.31–0.43). Survey respondents who were permanent or full-time employees, straight, white, male and/or worked at higher GS levels (as compared with those who were seasonal or temporary employees, LGBTQIAA+, non-white, female, and/or worked at lower GS levels) had a more positive work–life balance (Table 3).

When asked the total number of overtime hours they needed to work to pay their bills annually, 91.9% of study respondents stated that they needed >300 h, and 26.7% of respondents needed >900 h. A total of 67.4% of respondents had broken the 16:8 work to rest ratio more than three times in the last year (worked more than 16 consecutive hours without taking at least an 8-h break), 24.6% had broken it 10 or more times, and 8.4% had broken it 20 or more times.

Female respondents were significantly less likely to have children than male respondents (81.3% childless female versus 68.2% childless men; $X^2_{(1, N = 139)} = 11.20$, $P = 0.0037$), and were also significantly more likely to be single than male respondents (67.6% versus 56.6%; $X^2_{(1, N = 554)} = 7.82$, $P = 0.0201$). Female respondents were more likely to report a lack of affordable childcare options than male respondents ($F = 2.32$, $P = 0.0048$; m female = 1.78, s.d. 0.92; m male = 2.10, s.d. 1.56). Most respondents agreed with the statement that paid parental leave would be a factor in retaining them in the profession ($m = 4.10$, s.d. 1.03).

Training and promotion

Broadly, respondents indicated higher levels of satisfaction with training and promotion potential as GS level increased, and non-white and LGBTQIAA+ respondents indicated lower levels of satisfaction with training and promotion potential (Table 3). Respondents often identified lack of access to courses and training assignments as a key limitation in their career advancement (Supplementary Fig. S5). To this end, 44.4% of respondents paid for training on their own without reimbursement, and 61.6% attended training on an unpaid basis. Half (48.5%) of respondents reported that they were aware of training opportunities that might benefit them and 55% reported that they had the same opportunities as their peers to attend training; however, barriers such as classes filling up (53.0%), staffing shortages (56.7%), priority lists limiting attendance (52.3%) and costs of classes (36.4%) were also identified by respondents. Respondents indicated that home units' support for training (68.9%), supervisors' support for training (78.7%) and supervisors' support for overall success (75.0%) were generally high; however, they felt a middling level of potential for career advancement in their fields. A total of 41.3%

indicated a belief that they saw a clear path forward for career advancement.

Retention potential

Age and GS level impacted response to retention incentives (Table 3). Overall, respondents indicated that improvements in workplace safety and equitability would help retain them in the career field ($m = 4.24$, s.d. 0.85). Additionally, respondents tended to agree that improving pay would improve their retention in the field ($m = 4.80$, s.d. 0.48). Also, respondents reported high levels of agreement that portal-to-portal pay ($m = 4.36$, s.d. 0.90), accurate locality pay ($m = 4.67$, s.d. 0.64), paid parental leave ($m = 4.10$, s.d. 1.03), reduced government housing costs ($m = 4.18$, s.d. 0.98), affordable health insurance ($m = 4.66$, s.d. 0.64), retirement buy-back programs ($m = 4.24$, s.d. 0.88) and improved retirement benefits ($m = 4.65$, s.d. 0.62) were incentives that would help retain them in the profession.

Workplace culture

Respondents reported mixed attitudes about workplace culture and whether their senior leadership ($m = 2.69$, s.d. 1.31) and local leadership ($m = 2.69$, s.d. 1.34) 'have low understanding of the challenges faced by wildland firefighters'. Respondents reported that direct supervisors who cared about their work ($m = 3.97$, s.d. 1.01) and who supported their success in the field ($m = 4.05$, s.d. 1.04) were important to their perception of leadership efficacy.

For questions related to supervisor actions, the statement that correlated the most with believing that one's supervisor was supporting their career success was a supervisor allowing the respondent to have ownership in their roles and responsibilities ($r = 0.76$, CI = 0.73–0.79), followed by the supervisor supporting pursuit of training and classes ($r = 0.63$, CI = 0.58–0.67), trying to prevent inappropriate behaviour ($r = 0.58$, CI = 0.52–0.62) and caring about their own work ($r = 0.55$, CI = 0.49–0.60). Respondents reported feeling valued and respected as employees when they worked in an environment where they had a supervisor who supported their success ($r = 0.55$, CI = 0.49–0.60), where people were recognised for accomplishments large and small ($r = 0.52$, CI = 0.46–0.57) and where they received regular feedback on their job performance ($r = 0.44$, CI = 0.38–0.50). Respondents stated that their retention in the field could be improved with better access to training opportunities ($m = 4.31$, s.d. = 0.77) and clearer career development paths ($m = 4.36$, s.d. = 0.77).

In workplaces, respondents reported that their colleagues pronounced their names correctly ($m = 4.25$, s.d. 0.74) and that they had access to safe bathrooms ($m = 3.99$, s.d. 0.93); however, they were more neutral about whether their co-workers were genuinely interested in them ($m = 3.33$, s.d. 1.03), they felt mentally and physically

safe in the workplace ($m = 3.26$, $s.d. 1.01$), efforts were made to prevent inappropriate behaviour by peers ($m = 3.77$, $s.d. = 0.89$), inappropriate behaviour was addressed in an appropriate or timely manner by peers ($m = 3.44$, $s.d. 1.06$), they could talk about mental health at work ($m = 3.27$, $s.d. 1.14$), and they were treated as a valued and respected employee ($m = 3.19$, $s.d. 1.22$). They were also neutral as to whether supervisors tried to prevent ($m = 3.79$, $s.d. 1.01$) or address ($m = 3.41$, $s.d. 1.11$) inappropriate behaviour in a timely and appropriate manner.

Discussion

Our survey population was generally less diverse than the broader US population. Black, Hispanic/Latinx and Asian Americans were all significantly under-represented in the respondent population relative to the US population (1.1, 9.2 and 2.2% respectively in the respondent population relative to 13.4, 18.7 and 7% nationally; [United States Census Bureau 2012](#); [Table 2](#)). In contrast, Native and indigenous groups were over-represented relative to the US population by a factor of 2 (4.0% in wildland fire relative to 2.0% nationally; [United States Census Bureau 2012](#)), and 6.5% of the respondents identified as LGBTQIAA+, as compared with 5.6% nationally ([Jones 2021](#)). Military service was also higher than the national average (7%, [Vespa 2020](#)) with 12.7% of respondents indicating that they were an Armed Forces veteran. Rates of childlessness in female respondents were also significantly above the national average for adult women of all ages (81.3% versus 54.9%, [Martinez et al. 2018](#)).

Responses indicated that there are multiple factors that impact WFF work–life balance, health, personal lives and careers. They also reported safety concerns about working environments and a desire for training and increased supervisor feedback. Negative experiences with recruitment and hiring were reported by high percentages of respondents. Post-hire, respondents reported high numbers of overtime hours were required to pay bills.

Mental health

Overall, our results aligned with [O'Brien and Campbell \(2021\)](#) who examined psychological and behavioural health in current and former WFFs and found similar percentages of suicidal ideation (20.1%) and substance abuse (36.9%), but considerably lower rates of depression and anxiety (17.3 and 13.7%, respectively). Our study found PTSD rates (22.3%) similar to those observed in previous studies of wildland firefighters (12.3%, [Leykin et al. 2013](#); 18.6%, [Psarros et al. 2018](#); [Theleritis et al. 2020](#); 21%, [McFarlane 1986](#)). Rates of anxiety and depression were also similar to the limited previous literature available ([Cherry et al. 2021](#)). In terms of voluntary disclosure of ADHD, our study also

found similar numbers to other published work (16.6% versus 19.5%, [Palmer et al. 2011](#); approximately four times the national rate of 4.4%, [Kessler 2004](#)). Although neither we nor [Palmer et al. \(2011\)](#) can offer a causal mechanism for these trends, the numbers are a concern as ADHD can have important consequences for training, interpersonal dynamics and situational awareness ([Palmer et al. 2011](#)).

A recent study found that WFFs prioritise mental health (78%) and stress-related (76%) research as occupational health research priorities in their career field ([Pelletier et al. 2022](#)). However, the few studies to date have examined methods to improve WFF mental health or studied how the effects of mental illness might be mitigated by experience, personal factors, or training. One study that examined the impact of resiliency training and peer support on outcomes for mental wellness and PTSD for WFFs found that the presence of peer support was effective in reducing anxiety and depression rates, but PTSD rates were less responsive ([Cherry et al. 2021](#)). Researchers should therefore prioritise a better understanding of occupational and environmental factors contributing to mental health in wildland firefighters.

On-the-job safety and harassment

A similar proportion of study respondents reported unwanted sexual touching and assault of irrespective of gender (13.7%), which is significantly higher than the national average rate of workplace-related sexual violence (5.6% against women, 2.5% against men; [Basile et al. 2020](#)). That approximately a third of these assaults were perpetrated by supervisors highlights the need for cultural and leadership-level improvements in the safety climate of the organisation. Although leadership-initiated safety programs alone are not enough to effect change, incorporating specific programmatic elements can improve outcomes ([Adamschick 2007](#)). Programs that focus on accountability, transparency and personal responsibility can make a disproportionately larger impact than those that simply inform participants of safety risks.

Respondents reported mixed dissatisfaction with the way their reports of injury, illness and harassment were handled. Improved resolution of complaints has the potential to improve morale and increase feelings of equity ([Blomgren Bingham et al. 2009](#)). Strategies for the most effective ways to resolve workplace complaints are still a source of study, but those that balance efficiency, equity and voice are those the ones that have the most potential impact ([Budd and Colvin 2008](#)).

Financial strain, life balance and family

Respondents reported difficulties managing work–life balance and missing major family or personal events because of wildland fire duties. We found that during-season scheduling flexibility was important in increasing balance. Female

respondents had overall higher rates of childlessness and were less likely to be married than an average US woman. Female respondents were more likely to report that they did not have affordable childcare, though male respondents also reported lack of affordable childcare options. Although not surveyed directly here, the unique challenges associated with pregnancy, maternity leave and lactation in temporary working environments necessarily will disproportionately impact firefighters who choose to give birth and have cascading effects on retention. These effects should be studied further. Respondents reported working high numbers of overtime hours, and increasing pay was cited by respondents as one change that could improve retention, recruitment and morale.

Workplace culture

Respondents reported positive to mixed institutional culture and peer relationships. They viewed local (direct supervisor) leadership in a more positive light than higher levels of leadership. They cited access to professional development and training as important ways to improve morale and overall working environment and placed a high value on training opportunities, feedback and the quality of their working environment. They selected respect and recognition as factors that positively impacted their work morale. It improved their perception of work–life balance when they felt like their work was respected, and they felt most supported when they were recognised for their accomplishments. In 2022, the US Office of Personnel Management redefined the job titles of federal WFFs to reflect their duties more accurately and is in the process of implementing these changes. Once this change is fully implemented, follow-up surveys should measure its impact.

Outreach, recruitment and hiring

Respondents evaluated all parts of outreach, recruitment, application and hiring with low scores. A 2011 United States Congressional hearing entitled ‘Major Management Challenges at the USFS’ called the Albuquerque Service Center, the primary centralised hiring body for wildland firefighters, ‘problematic and ... demoralizing’ for employees (Fong 2011). All respondents to our survey were current or former wildland firefighters, meaning they had successfully navigated this system at least once; therefore, our data likely under-represent the difficulty and obfuscation faced by individuals attempting to apply for positions in wildland firefighting. The 2022 United States wildland firefighting season had record levels of unfilled positions, particularly in western states where costs of living are too high to be offset by low wages (Gabbert 2022); 10% of positions nationally and 50% of positions in high cost-of-living areas went unfilled (Moore 2022). Based on responses to this survey, a critical examination of the outreach and hiring process is warranted.

Bias, discrimination, and institutional racism and sexism

Further examination of the United States federal policies and practices managing and overseeing wildland firefighting is warranted by this report. Our data revealed multiple instances where sex-based or ethnicity-based differences in experience resulted in disproportionate harm to minority groups. For example, female respondents were less likely to believe that they can obtain employment based on application materials alone (Supplementary Fig. S6). Our data also revealed that minority groups were more likely to report that their supervisor, in contrast to a peer or subordinate, was the person who perpetuated harmful behaviours in their workplace. Reporting discrepancies also existed among genders, suggesting that institutional policies may be unevenly applied. Future studies should examine causal relationships and mechanisms by which the trends we elucidate here are being established and maintained.

Methodological constraints

Experiences with recruiting and retention are biased (likely a positive skew) by the sample population being entirely composed of individuals who have successfully navigated the federal hiring process. Addition of individuals who did not successfully gain employment in wildland fire would help eliminate this bias. We could not locate direct demographic comparisons. The demographic data we report herein is similar to that from a survey of another North American (Canadian) federal wildland fire management agency, which increases our confidence in the representative nature of the sample (Grahame Gordon Wildfire Management Services 2014); however, the possibility that this survey was disproportionately completed by individuals with higher incidences of particular experiences cannot be entirely removed. It is also possible that the Canadian wildland firefighting workforce differ in their demographic compositions from the USA wildland firefighting workforce.

There is the potential that loaded or leading questions influenced the survey outcome. Freedman *et al.* observed that asking questions using a leading approach increased their overall estimates of occurrence (2003). Some of our survey questions included phrasing such as ‘challenging work life balance’ or ‘caused or worsened by my career in wildland fire’, which may have led participants toward specific outcomes. Survey question themes were chosen based on interviewer knowledge of workforce issues, and questions were reviewed by other WFFs who determined them to be comprehensive; however, specific checks for question bias were not conducted at the outset of this survey. Thus, it is possible that interviewer bias may have influenced our survey results. The use of jargon and field-specific language in this survey may have also reduced comprehension by participants for some questions.

Finally for anonymous self-administered and self-selected surveys, self-reporting bias is a possible concern (Althubaiti 2016). The sample size represents >5% of the ~14 000 federal WFFs (NIFC 2022), though some individuals participating in the survey were no longer federal WFFs (7.7% of survey participants), so this number may be inflated. The total WFF workforce is also a number that fluctuates seasonally and that has historically been poorly defined owing to categorisation under other job titles by the US Office of Personnel Management.

Conclusions

In 2022, the United States Congress passed funding to reclassify and overhaul the job series and pay rates of federal WFFs; this reclassification has the potential to help alleviate some of the problems identified in this survey; however, salary and job classification problems are still unresolved and ongoing (August 2023). In addition, the US Congress established a Wildland Fire Mitigation and Management Commission (P.L. 117-58), which is tasked with recommending federal policies and strategies to manage, suppress and mitigate wildland fires more effectively. Despite this, 2022 saw historically low levels of recruitment for federal WFF positions, with application rate declines of over 50% in some regions (Bustillo 2022). Given the ever-increasing length, extent and intensity of wildfire season (Scasta et al. 2016), highlighted by 2023's Canadian wildfire season (Shakoor et al. 2023), recruitment and retention of qualified WFFs is a critical issue for international security. Our survey provides insight into the perceptions and work experiences of WFFs and establishes a framework through which efforts can be made to improve retention and recruitment by addressing issues prioritised by individuals experienced in the United States wildland firefighting workforce. Further, our study underlines the consequences of the impending US Office of Personnel Management decisions about wildland firefighter job classifications and Congressional actions regarding pay, benefits and policy for the existing and future workforce.

Supplementary material

Supplementary material is available [online](#).

References

- Adamschick M (2007) Leadership and safety climate in high-risk military organizations. PhD Dissertation, University of Maryland, MD, USA.
- Aisbett B, Wolkow A, Sprajcer M, Ferguson SA (2012) 'Awake, smoky and hot': providing an evidence-base for managing the risks associated with occupational stressors encountered by wildland firefighters. *Applied Ergonomics* 43, 916–925. doi:10.1016/j.apergo.2011.12.013
- Althubaiti A (2016) Information bias in health research: definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare* 9, 211–217. doi:10.2147/JMDH.S104807
- Baehr ME, Renck R (1958) The definition and measurement of employee morale. *Administrative Science Quarterly* 3, 157–184. doi:10.2307/2391015
- Basile KC, D'Inverno AS, Wang J (2020) National prevalence of sexual violence by a workplace-related perpetrator. *American Journal of Preventive Medicine* 58, 216–223. doi:10.1016/j.amepre.2019.09.011
- Blomgren Bingham L, Hallberlin CJ, Walker DA, Chung WT (2009) Dispute system design and justice in employment dispute resolution: mediation at the workplace. *Harvard Negotiation Law Review* 14, 1–50.
- Boushey H, Fremstad H, Gragg R, Waller M (2007) 'Understanding low wage work in the United States.' 22 p. (Center for Economic Policy)
- Britton C, Ramirez M, Lynch CF, Torner J, Peek-Asa C (2013) Risk of injury by job assignment among federal wildland firefighters, United States, 2003–2007. *International Journal of Occupational and Environmental Health* 19, 77–84. doi:10.1179/2049396713Y.0000000019
- Budd JW, Colvin AJS (2008) Improved metrics for workplace dispute resolution procedures: efficiency, equity and voice. *Industrial Relations* 47, 460–479. doi:10.1111/j.1468-232X.2008.00529.x
- Bustillo X (2022) 'Pretty brutal': Hiring woes plague Biden efforts to contain wildfires. Politico. Available at <https://www.politico.com/news/2022/03/15/bidens-effort-to-contain-wildfires-threatened-by-staffing-woes-00016419>
- Cherry N, Galarneau JM, Haynes W, Sluggett B (2021) The role of organizational supports in mitigating mental ill health in firefighters: a cohort study in Alberta, Canada. *American Journal of Industrial Medicine* 64, 593–601. doi:10.1002/ajim.23249
- Cuddy JS, Sol JA, Hailes WS, Ruby BC (2015) Work patterns dictate energy demands and thermal strain during wildland firefighting. *Wilderness & Environmental Medicine* 26, 221–226. doi:10.1016/j.wem.2014.12.010
- Durana A, Lenhart A, Miller R, Schulte B, Weingarten E (2018) Sexual harassment: a severe and pervasive problem. *New America Reports*. 58 p. (Washington, DC). Available at <https://www.newamerica.org/better-life-lab/reports/sexual-harassment-severe-and-pervasive-problem/summary-of-findings/>
- Freedman VA, Aykan H, Kleban MH (2003) Asking neutral versus leading questions: implications for functional limitation measurement. *Journal of Aging and Health* 15, 661–687. doi:10.1177/0898264303256250
- Fong P (2011) Congressional Hearing: Major Management Challenges at the U.S. Forest Service, ASC. Office of the USDA Inspector General. Transcript. Available at <https://appropriations.house.gov/legislation/hearings/major-management-challenges-us-forest-service>
- Gabbert B (7 May 2022) Analysis finds that federal wildland firefighters can't afford to live in most Western counties. *Wildfire Today*. Available at <https://wildfiretoday.com/2022/05/07/analysis-finds-that-federal-wildland-firefighters-cant-afford-to-live-in-most-western-counties/> [accessed 28 September 2022]
- Grahame Gordon Wildfire Management Services (2014) Workforce demographic issues in Canada's wildland fire management agencies. Executive report. Available at <https://www.ccmf.org/wp-content/uploads/2020/08/Workforce-Demographic-Issues-in-Canada's-Wildland-Fire-Management-Agencies.pdf>
- Grassroots Wildland Firefighters (2021) Impacts of profession as recognized by partners/spouses. Available at <https://www.grassrootswildlandfirefighters.com/partnerspouse-survey> [accessed 11 May 2022]
- Grimshaw D (2011) Conditions of Work and Employment Series No. 28: What do we know about low-wage work and low-wage workers? Analyzing the definitions, patterns, causes and consequences in international perspective. International Labor Organization, Geneva, Switzerland. 62 p.
- Jones JM (2021) LGBT identification rises to 5.6% in latest US estimate. Gallup. Available at <https://news.gallup.com/poll/329708/lgbt-identification-rises-latest-estimate.aspx>
- Kessler RC (2004) 'The US national comorbidity survey replication (NCS-R).' (Harvard University) Available at <https://www.hcp.med.harvard.edu/ncs/>
- Koopmans E, Cornish K, Fyfe TM, Bailey K, Pelletier CA (2022) Health risks and mitigation strategies from occupational exposure to wildland fire: a scoping review. *Journal of Occupational Medicine and Toxicology* 17, 17. doi:10.1186/s12995-021-00328-w

- Lee SH, Olshfski D (2002) An examination of variations in the nature of employee commitment: the case of paid and volunteer firefighters. *International Review of Public Administration* 7, 29–38. doi:10.1080/12294659.2002.10804990
- Leykin D, Lahad M, Bonne N (2013) Post-traumatic symptoms and post-traumatic growth of Israeli firefighters, at one month following the Carmel Fire Disaster. *Psychiatry Journal* 2013, 274121. doi:10.1155/2013/274121
- Lievens F, Decorate W, Westerveld L (2012) Understanding the building blocks of selection procedures: effects of response fidelity on performance and validity. *Journal of Management* 41, 1604–1627. doi:10.1177/0149206312463941
- Martinez GM, Daniels K, Febo-Vasquez I (2018) Fertility of men and women aged 15–44 in the United States: national survey of family growth 2011–2015. Centers for Disease Control National Health Statistics Report 113. 16 p. (National Health Statistics Reports: Hyattsville, MD, USA.)
- McFarlane AC (1986) Long term psychiatric morbidity after a natural disaster: implications for disaster planners and emergency services. *Medical Journal of Australia* 145, 561–563.
- McFadzean F, McFadzean E (2005) Riding the emotional roller coaster: a framework for improving nursing morale. *Journal of Health Organization and Management* 19, 318–339. doi:10.1108/14777260510615378
- McLennan J, Strickland R, Omodei M, Suss J (2014) Stress and wildland firefighter safety-related decisions and actions. In 'Human Factors Challenges in Emergency Management'. 1st edn. (Ed. C Owen) pp. 19–31. (CRC Press)
- Moody VJ, Purchio TJ, Palmer CG (2019) Descriptive analysis of injuries and illnesses self-reported by wildland firefighters. *International Journal of Wildland Fire* 28, 412–419. doi:10.1071/WF18132
- Moore R (2022) Testimony to the Subcommittee on the Interior, 4 May 2022. Available at <https://www.appropriations.senate.gov/download/moore-testimony-2022>
- National Interagency Coordination Center (2022) 2021 Statistics and Summary. Available at https://www.predictiveservices.nifc.gov/intelligence/2021_statsumm/2021Stats&Summ.html [accessed on 4 October 2022]
- O'Brien P, Campbell D (2021) Wildland firefighter psychological and behavioral health: preliminary data from a national sample of current and former wildland firefighters in the United States. In 'Proceedings of the International Association of Wildland Fire 6th Annual Human Dimensions Conference'. Available at <https://firesafety-humandimensions2021.com/>
- Office of Personnel Management (2022) Policy Data, Oversight: Pay and Leave. Available at <https://www.opm.gov/policy-data-oversight/pay-leave/pay-systems/general-schedule/> [accessed on 25 September 2022]
- Palmer CG, Gaskell S, Domitrovich J, McNamara M, Knutson B and Spear A (2011) Wildland firefighters and attention deficit hyperactivity disorder (ADHD). In '2011 Proceedings of the second conference on the human dimensions of wildland fire'. Gen Tech Rep NRS-P-84. Newtown Square, PA. (Eds SM McCaffrey, CL Fisher) pp. 9–13. (United States Department of Agriculture, Forest Service Northern Research Station)
- Pelletier C, Ross C, Bailey K, Fyfe TM, Cornish K, Koopmans E (2022) Health research priorities for wildland firefighters: a modified Delphi study with stakeholder interviews. *BMJ Open* 12, e051227. doi:10.1136/bmjopen-2021-051227
- Pruitt LD, Smolenski DJ, Bush NE, Skopp NA, Hoyt TV, Grady BJ (2017) Department of Defense Suicide Event Report: CY 2015 Annual Report. (United States Department of Defense)
- Psarros C, Theleritis C, Kokras N, Lyrakos D, Koborozos A, Kakabakou O, Tzanoulinos G, Katsiki P, Bergiannaki JD (2018) Personality characteristics and individual factors associated with PTSD in firefighters one month after extended wildfires. *Nordic Journal of Psychiatry* 72, 17–23. doi:10.1080/08039488.2017.1368703
- Ragland M, Harrell J, Ripper M, Pearson S, Granberg R, Verble R (2023) Gender, sexual orientation, and ethnicity and socioeconomic factors influence how wildland firefighters communicate their work experiences. *Frontiers in Communication* 8, 1021914. doi:10.3389/fcomm.2023.1021914
- Robitzsch A (2020) Why ordinal variables can (almost) always be treated as continuous variables: clarifying assumptions of robust continuous and ordinal factor analysis estimation methods. *Frontiers in Education* 5, 589965. doi:10.3389/feduc.2020.589965
- SAS. JMP®, Version 16. SAS Institute, Cary, NC; 1989–2023
- Saunders S, Eastale P (2013) The nature, pervasiveness and manifestations of sexual harassment in rural Australia: does 'masculinity' of workplace make a difference? *Women's Studies International Forum* 40, 121–131. doi:10.1016/j.wsif.2013.05.013
- Scasta JD, Weir JR, Stambaugh MC (2016) Droughts and wildfires in western US rangelands. *Rangelands* 38, 197–203. doi:10.1016/j.rala.2016.06.003
- Semmens EO, Domitrovich J, Conway K, Noonan CW (2006) A cross-sectional survey of occupational history as a wildland firefighter and health. *American Journal of Industrial Medicine* 58, 33–335.
- Shakoor A, Farooq TH, Arif MS, Shahzad SM (2023) Unprecedented wildfires in Canada and transboundary effects of carbon monoxide pollution. *Natural Hazards* 118, 2711–2713. doi:10.1007/s11069-023-06117-4
- Stanley IH, Hom MA, Gai AR, Joiner TE (2018) Wildland firefighters and suicide risk: examining the role of social disconnectedness. *Psychiatry Research* 266, 269–274. doi:10.1016/j.psychres.2018.03.017
- Thackaberry JA (2004) 'Discursive opening' and closing in organisational self-study: culture as trap and tool in wildland firefighting safety. *Management Communication Quarterly* 17, 319–359. doi:10.1177/0893318903259402
- Theleritis C, Psarros C, Mantonakis L, Roukas D, Papaioannou A, Paparrigopoulos T, Bergiannaki JD (2020) Coping and its relation to PTSD in Greek firefighters. *Journal of Nervous and Mental Disorders* 208, 252–259. doi:10.1097/NMD.0000000000001103
- United States Census Bureau (2012) 'Statistical Abstract of the United States.' 131st edn. (United States Department of Commerce)
- Vespa JE (2020) Those who served: America's veterans from World War II to the War on Terror. US Census Bureau Report ACS-43. (United States Department of Commerce)
- Vincent GE, Aisbett B, Wolkow A, Jay SM, Ridgers ND, Ferguson SA (2018) Sleep in wildland firefighters: what do we know and why does it matter? *International Journal of Wildland Fire* 27, 73–84. doi:10.1071/WF17109

Data availability. A large amount of data are available at wildlandfiresurvey.com. Additional data will be made available on a case-by-case basis by contacting the corresponding author. We strongly support research requests whenever possible. Survey questions are available free to non-profit and educational researchers. For all parties, permission from the corresponding author should be obtained prior to use of survey questions.

Conflicts of interest. Granberg and Pearson are employed as full-time wildland firefighters. Verble has previously worked in wildland fire and fire training.

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Author contributions. Granberg designed and executed the survey. Verble and Pearson analysed data. Verble wrote the manuscript. Shen assisted with data analysis and revision. All authors edited and provided comment prior to submission.

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