
01 May 2024

Mental Health and Traumatic Occupational Exposure in Wildland Fire Dispatchers

Robin M. Verble

Missouri University of Science and Technology, verbler@mst.edu

Rachel Granberg

Seth Pearson

Charlene Rogers

et. al. For a complete list of authors, see https://scholarsmine.mst.edu/biosci_facwork/431

Follow this and additional works at: https://scholarsmine.mst.edu/biosci_facwork

 Part of the [Biology Commons](#)

Recommended Citation

R. M. Verble et al., "Mental Health and Traumatic Occupational Exposure in Wildland Fire Dispatchers," *Fire*, vol. 7, no. 5, article no. 157, MDPI, May 2024.

The definitive version is available at <https://doi.org/10.3390/fire7050157>



This work is licensed under a [Creative Commons Attribution 4.0 License](#).

This Article - Journal is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in Biological Sciences Faculty Research & Creative Works by an authorized administrator of Scholars' Mine. This work is protected by U. S. Copyright Law. Unauthorized use including reproduction for redistribution requires the permission of the copyright holder. For more information, please contact scholarsmine@mst.edu.

Article

Mental Health and Traumatic Occupational Exposure in Wildland Fire Dispatchers

Robin Verble^{1,*}, Rachel Granberg², Seth Pearson³, Charlene Rogers³ and Roman Watson³¹ Department of Biological Sciences, Missouri University of Science & Technology, Rolla, MO 65409, USA² Independent Researcher, Wenatchee, WA 98801, USA; rachelmgranberg@gmail.com³ Independent Researcher, Rolla, MO 65401, USA

* Correspondence: robinverble@mst.edu; Tel.: +1-573-341-7274

Abstract: Wildland fire dispatchers play a key role in wildland fire management and response organization; however, to date, wildland fire studies have largely focused on the physical hazards and, to a lesser extent, mental health hazards of wildland firefighting operational personnel, and dispatcher studies have primarily focused on 911 and police dispatchers. Studies of other dispatchers have provided some limited insight into potential strains impacting this workforce, including work-related fatigue, burnout, and traumatic exposure. However, the specific job hazards that are faced by wildland fire dispatchers are poorly understood. In 2023, we conducted a cross-sectional survey of 510 wildland fire dispatchers with questions about their occupational health, general health, and well-being. We used validated screening instruments to measure the rates of anxiety, depression, PTSD, and suicidal thoughts and ideation. Here, we also present the results of mental health and trauma exposure questions that were asked as part of a larger survey. We found that demographic factors were significant indicators of anxiety, depression, and binge/restrictive eating. Our data indicate that rates of anxiety, depression, PTSD, and suicidal thoughts and ideation are significantly higher for both the wildland fire dispatching workforce and other emergency responder populations than those of the general United States population.

Keywords: wildfire; firefighter; depression; anxiety; PTSD; stress; job hazards; suicide; survey



Citation: Verble, R.; Granberg, R.; Pearson, S.; Rogers, C.; Watson, R. Mental Health and Traumatic Occupational Exposure in Wildland Fire Dispatchers. *Fire* **2024**, *7*, 157. <https://doi.org/10.3390/fire7050157>

Academic Editor: Christine Eriksen

Received: 19 March 2024

Revised: 18 April 2024

Accepted: 22 April 2024

Published: 1 May 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Wildland firefighting careers encompass a broad range of duties and tasks, including field operations, logistics, communications, finance, and administration. As part of this team, wildland fire dispatchers are responsible for coordinating resources, personnel, and equipment to mobilize for and support wildland firefighting efforts. Previous studies of this workforce have focused nearly exclusively on operational wildland firefighters and have considered occupational hazards related to the physicality of the job (i.e., smoke, terrain, and extreme temperatures [1]). However, recent work on operational wildland firefighter mental health has found that aspects of the career can be emotionally and mentally detrimental, posited to be a result of several interacting factors including traumatic exposure, physical isolation, long irregular work schedules, low pay, and associated burnout [2]. To date, one single other study has specifically examined wildland fire dispatcher health and well-being: in a focus group of 11 wildland fire dispatchers, Palmer found that the three largest stressors that fire dispatchers experienced were balancing personal and professional lives, coping with job-related issues, and dealing with issues related to control [3].

There are well-established links between occupational factors and mental health outcomes. Postal workers [4], corrections officers [5], clerical and secretarial workers [6], health care workers [7], and teachers [8] exhibit links between detrimental occupational factors and poor mental health. Emergency dispatchers, including wildland fire dispatchers, have several unique occupational challenges that could negatively impact mental health,

including lack of physical activity, high rates of obesity, noisy and poorly lit working environments, and inadequate breaks [9]. In non-wildland fire emergency dispatcher populations (e.g., 911 dispatchers, police dispatchers, ambulance dispatchers), previous studies have characterized the working environment as being high-pressure and high-stress, lacking appropriate mental health training, and lacking adequate downtime [9,10]. Further, there is a high incidence of trauma (80%) [11] and vicarious trauma through both acute and cumulative exposure, perceived helplessness [12], and burnout [13]. Quantitative studies of emergency dispatchers have reported elevated stress [14] and estimated diagnosed levels of post-traumatic stress disorder ranging from 10% [11] to 15.5% [10,15]. However, personal history and individual differences play a role in determining the magnitude and type of responses that an individual exhibits. Individual differences such as personality [16] and doing regular exercise [17] have both been shown to play a role in coping with work-related stress in emergency responder populations.

Mental health screeners provide a rapid assessment of the mental health state of the respondent. Mental health screening tools are not diagnostic; rather, they indicate potential areas of concern, as well as changes and responses to the environment, and can be used to monitor symptoms. They are useful in providing snapshot data of a particular population at a particular time point. Using them in a cross-sectional survey is advantageous in that they are cost-effective and provide baseline data for further specific studies. However, this type of study is subject to cohort effects, which may be particularly strong when general environmental pressures are influencing the respondents' attitudes and experiences.

In this study, we examined wildland firefighter traumatic exposure, mental health, and overall well-being as part of a larger cross-sectional survey of wildland fire dispatchers. We focused on the prevalence of mental health disorders, occupational factors, and demographic factors and their interactions (Figure 1). Using data from other published studies as a comparison, we hypothesized that wildland fire dispatching careers would have a similar incidence of mental health disorders as other emergency responders, likely due to traumatic exposure, stress, and high-pressure environments.

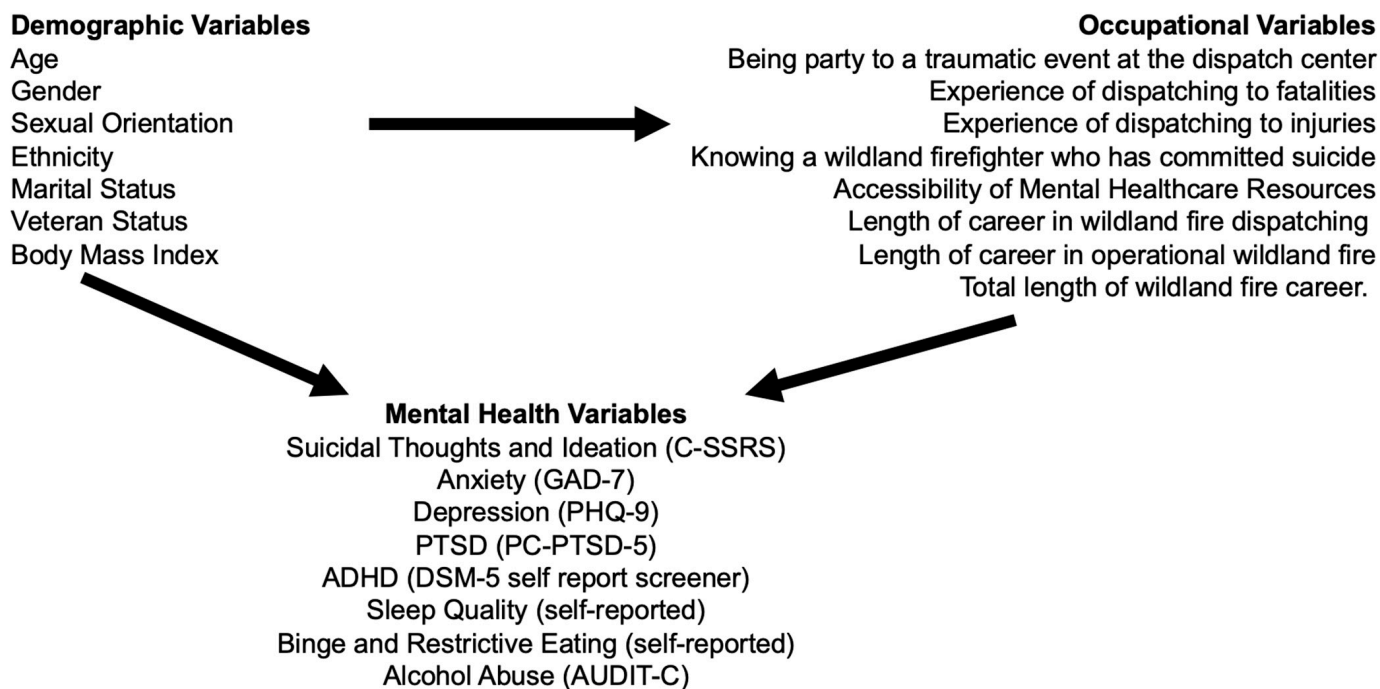


Figure 1. Theoretical framework of this study. The abbreviations used are indicated in parentheses and discussed more thoroughly in the text. Arrows indicate direction of influence.

2. Materials and Methods

These data were collected as part of a larger cross-sectional survey of United States wildland fire dispatchers that was conducted from 23 December 2022 to 1 March 2023. This larger survey contained a total of 234 questions that spanned issues related to occupational health, safety, morale, and workplace culture. Survey participants could elect to not respond to any question and continue with the remainder of the survey. A total of 643 responses were recorded, but after removing spam and those individuals who completed less than 5% of the survey, a total of 510 respondents remained, and these were used for analysis. Of these questions, this paper analyzes those related to mental health, traumatic exposure, and related behavioral interventions (i.e., accessing mental health care). We recruited participants via social media, e-mail, and word of mouth. Questionnaires were created using Qualtrics and accessed online by dispatchers via a QR code. Requirements for participation included being a current wildland fire dispatcher in the United States, signing an informed consent statement, and completing at least 5% of the survey questions. The demographic data and survey questions are briefly discussed here but can be found in full at www.wildlandfiresurvey.com. This work was approved by the University of Missouri System Institutional Research Board (permit no. 2094192). We used previously validated screening instruments to examine the prevalence of potential mental health disorders, and we asked survey questions about mental health care availability and utilization, traumatic exposure, and links to career stressors. Supplemental Table S1 reports the specific questions, respondent numbers, and question types.

Anxiety: We used the General Anxiety Disorder (GAD-7) seven-question screening instrument to evaluate anxiety levels and anxious behaviors. The seven questions are scored as 0 (not at all), 1 (several days), 2 (over half the days), or 3 (nearly every day). A score of 15 or above is indicative of severe anxiety, 10–14 is indicative of moderate anxiety, 5–9 is indicative of mild anxiety, and 0–4 is indicative of minimal anxiety [18].

Depression: To measure depressive behavior and depression, we utilized the Patient Health Questionnaire (PHQ-9), a nine-question screening instrument that asks respondents to rank the frequency of behaviors or feelings as 0 (not at all), 1 (several days), 2 (more than half the days), or 3 (nearly every day). A summative score is used to assess depressive behavior, with a score > 14 being indicative of depression-warranting treatment (sensitivity of 88%) [19].

Alcohol Abuse: We used the Alcohol Use Disorders Identification Test-Concise (AUDIT-C) screening instrument to examine heavy drinking and active alcohol abuse and dependence [20,21]. The screening instrument consists of three questions with five answer choices valued from zero to four points. A score of three was considered positive for women (90% sensitivity in detection of active alcohol abuse and dependence; 98% sensitivity for heavy drinking) and a score of four was considered positive for men (79% sensitivity for detection of active alcohol abuse and dependence; 91% sensitivity for heavy drinking). When gender was not identified by the respondent, a score of 4 was used for a positive indicator to maintain a conservative estimate.

Binge and Restrictive Eating: Binge and restrictive eating were evaluated by a single question that asked about the frequency of binge and restrictive eating behaviors. Response options included 'always', 'most of the time', 'sometimes', and 'never'.

Attention Deficit/Hyperactivity Disorder: We used the DSM-5 adult attention deficit/hyperactivity disorder (ADHD) self-report screening tool to screen for ADHD. The tool consists of six questions with the following responses: never (0), rarely (1), sometimes (2), often (3), and very often (4). A score of 14 or higher was used to suggest ADHD (91.4% sensitivity; 96.0% specificity) [22].

Suicidal Thoughts and Ideation: We used the Columbia-Suicide Severity Rating Scale (C-SSRS) to screen for suicide risk as it relates to suicidal ideation and behavior [23]. The screening instrument consists of six questions that indicate increasingly high risk. Risk is ranked as none, low, medium, or high based on responses, with positive responses to any question generating some level of risk.

Traumatic Exposure: We asked respondents a series of questions about their exposure to trauma, including personally knowing a wildland firefighter who died by suicide, being party to a traumatic event at the dispatch center (including via radio), being responsible for dispatching to an incident with mortalities, and being responsible for dispatching to an event with a severe injury. Respondents who responded affirmatively were then screened for post-traumatic stress disorder (PTSD). We only evaluated screening instruments for those that responded affirmatively. We used the five-question post-traumatic stress disorder (PC-PTSD-5) screening instrument, which consists of a yes/no series of questions [24]. Four 'yes' responses were indicative of post-traumatic stress disorder (PTSD), though this may underestimate positive results in female respondents [25].

Sleep: We used a single qualitative question to assess sleep quality among respondents. We asked them to select the frequency at which they awoke feeling rested (daily, multiple times per week, weekly, multiple times per month, and monthly) [26].

Health Care Access and Utilization: We asked participants whether they had sought treatment for ADHD, suicidal thoughts, PTSD, anxiety, and/or depression in the last 12 months. We also asked participants to respond to the following statements: The mental health care resources provided by my work are affordable. I am satisfied with the ease of accessibility of mental health resources provided by my work. I can seek mental health help even during peak fire season. I feel comfortable talking about mental health at work. I feel like I have the time and/or resources to seek mental health care if I want to do so. I can seek mental health help if I need it, even during peak season. For response variables, we used a Likert scale with 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree to assess the quality of mental health care resources and accessibility. All health care access and utilization questions were derived from Granberg et al.'s survey of operational wildland firefighters [2].

Demographics: For all questions and screening outcomes, we evaluated demographic variables individually and their relationship with screening responses using chi-squared (χ^2) tests, which are particularly useful when categorical variables and frequencies are being considered. The demographic variables considered were gender, ethnicity, veteran status, marital status, body mass index, length of career in wildland fire dispatching, length of career in operational wildland firefighting, and total length of wildland fire career. We pooled non-white (21%) ethnicities in our analyses to maintain participant anonymity.

Comorbidity: We calculated Pearson correlation coefficients to determine associations among mental health issues and health parameters with significance levels of $p < 0.05$ and $p < 0.0001$ (Table 1).

Open Response Themes: We asked one open-response question related to mental health and trauma. The open response question was 'If you'd like to provide additional details about how your career has impacted your mental health, please do so here.' The open response question was analyzed via word cloud to identify themes and then coded in vivo, conceptually and descriptively.

Table 1. Pearson correlation of the mental health factors examined in this study. * Correlation is significant at the <0.05 level. ** Correlation is significant at the <0.0001 level.

	Suicidal Thoughts and Ideation (High Risk)	Suicidal Thoughts and Ideation (Any Risk)	PTSD	Depression	Anxiety	Alcohol Abuse	BMI	Binge and/or Restrictive Eating	Poor Sleep	Traumatic Exposure
Suicidal Thoughts and Ideation (High Risk)	1.0000 **	0.8190 **	0.2103 **	0.3151 **	0.2709 **	0.0091	−0.0295	0.2034 **	0.0759	0.0682
Suicidal Thoughts and Ideation (Any Risk)	0.8190 **	1.0000 **	0.1808 **	0.2583 **	0.2183 **	0.0188	−0.0587	0.1466 *	0.0853	0.0758
PTSD	0.2103 **	0.1808 **	1.0000 **	0.4190 **	0.4552 **	0.0170	−0.0380	0.2497 **	0.1756 *	0.0181
Depression	0.3151 **	0.2583 **	0.4190 **	1.0000 **	0.7679 **	0.0710	0.0283	0.4325 **	0.4955 **	0.0517
Anxiety	0.2709 **	0.2183 **	0.4552 **	0.7679 **	1.0000 **	0.0623	−0.0708	0.3594 **	0.3960 **	0.0874
Alcohol Abuse	0.0091	0.0188	0.0170	0.0710	0.0623	1.0000 **	−0.0283	0.1100 *	0.0867	0.0328
BMI	−0.0295	−0.0587	−0.0380	0.0283	−0.0708	−0.0283	1.0000 **	0.2067 **	0.0251	−0.1539 *
Binge and/or Restrictive Eating	0.2034 **	0.1466 *	0.2497 **	0.4325 **	0.3594 **	0.1100 *	0.2067 **	1.0000 **	0.1502 *	0.0154
Poor Sleep	0.0759	0.0853	0.1756 **	0.4955 **	0.3960 **	0.0867	0.0251	0.1502 *	1.0000 **	0.0363
Traumatic Exposure	0.0553	0.0758	0.0936	0.0517	0.0874	0.0328	−0.1539 *	0.0154	0.0363	1.0000

3. Results

Our hypothesis that the incidence of mental health disorders among wildland fire dispatchers would be similar to that of other emergency responders was partially supported. Wildland fire dispatchers had a higher incidence of alcohol abuse, anxiety, binge and restrictive eating, and depression than those reported in other emergency responder studies but lower rates of ADHD and mental health service utilization. Further, they had similar (within 5%) incidences of PTSD, suicidal thoughts and ideation, active suicidal ideation, and traumatic experience (Table 2). Among all of the variables examined, wildland fire dispatchers had a higher incidence than the general United States population (Table 2).

Anxiety: Anxiety was observed in 61% of individuals who responded to the screening questions (N = 409). Severe anxiety was observed in 25% of respondents and moderate (11%) and mild levels (25%) were present in others. Non-white respondents screened with higher anxiety levels than white respondents (Figure 2a). A total of 71.8% of respondents that exhibited potential anxiety reported that they had sought treatment for anxiety and 100% reported that the stresses of their job worsened their anxiety.

Depression: In total, 73% of the 409 respondents to the depression screening questions exhibited at least mild depression. Approximately 25% of the study population screened positive for severe depression. Moderate depression levels were observed in 15% of respondents and 33% screened positive for mild depression. Depression levels differed between white (N = 308) and non-white (N = 88) respondents, with more non-white respondents exhibiting severe and moderate depression levels (Figure 2b). A total of 61.4% of respondents that met the criteria for depression reported that they had sought treatment for depression, and 56% reported that the stresses of their job worsened their depression. Depression levels also varied with marital status, with those experiencing multiple divorces exhibiting higher levels of severe and moderate depression (Figure 3a).

Alcohol Abuse: Potential for alcohol abuse was detected in 59% of the total respondents (N = 422). A total of 10.8% of respondents reported drinking six or more drinks on one occasion most of the time, and 69% of white respondents (N = 319) screened positive for alcohol use disorders compared to 58% of non-white respondents (N = 89; $\chi^2 = 3.496$; $p = 0.0615$).

Table 2. Here, we compare the prevalence of mental health disorders in the United States general population (% USA), non-wildland fire dispatcher emergency responders (% Emergency), and wildland fire dispatcher respondents (% Dispatchers). Dispatcher numbers are reported from this study. The data reported are percentages of the study population which report a positive result for the mental health disorder.

	% USA	% Emergency	% Dispatchers
ADHD	4 [27]	19 [28]	9
Alcohol Abuse	11 [29]	40 [30] 26 [31]	59
Anxiety	7 [32]	32 ** [33] 18 [34]	62
Binge and Restrictive Eating	2 * [35]	no data	64
Depression	8 [36]	31 ** [33] 47 [34]	73
PTSD	21 [37]	33 [34]	33
Suicidal Thoughts and Ideation	4 [38] 14 [27]	23–25	32 10
Active Suicidal Ideation, Past Year	3 [38]	9 [39]	10
Overweight/Obese	74 [40]	59 [34]	76
Experience of Traumatic Events	26 ^ [41]	>80% [11]	94
Utilized Mental Health Services in the Past 12 months	41 [42]	77 [43]	44

* Only includes binge eating in these data. ** Data for medical first responders during COVID-19 outbreak. ^ These data represent the rates compiled from 24 countries, not the United States exclusively.

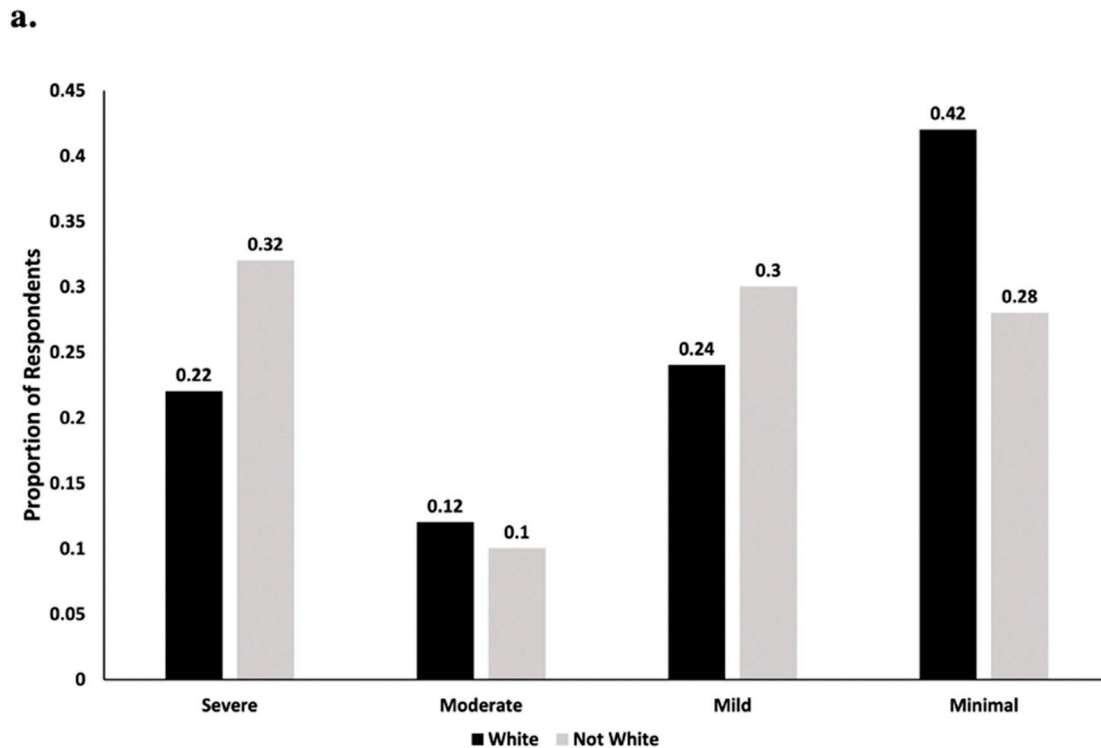


Figure 2. Cont.

b.

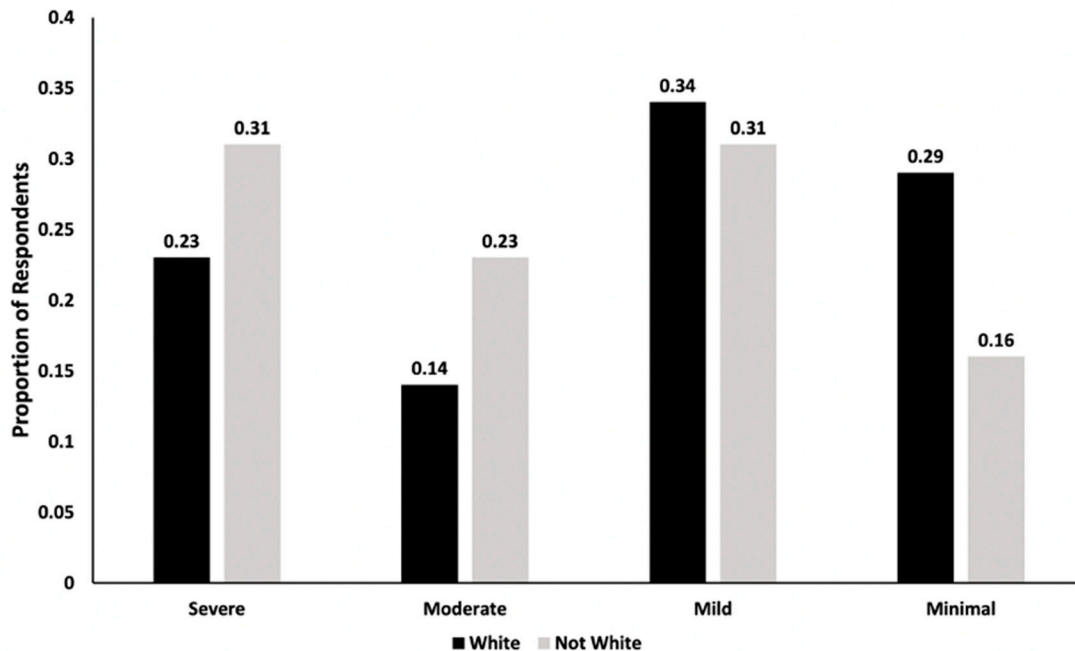


Figure 2. (a) Anxiety levels, as measured using the GAD-7 screener, differ between white (N = 307) and non-white (N = 88) respondents. $\chi^2 = 7.21$; $p = 0.065$. (b) Depression levels differ between white (N = 308) and non-white (N = 88) respondents, with more non-white respondents exhibiting severe and moderate depression levels, as measured using the PHQ-9. $\chi^2 = 10.25$; $p = 0.017$.

Binge and Restrictive Eating: Most respondents engaged in binge or restrictive eating 'sometimes' (64%, N = 424). Approximately 25% responded that they 'never' did and 7% reported that they did 'most of the time'. A total of 4% reported that they 'always' engaged in binge and restrictive eating. Frequent binge and restrictive eating behavior was reported by higher percentages of women than men (Figure 4A). Eleven percent of non-white respondents reported 'always' engaging in binge and restrictive behaviors compared to 1.6% of white respondents (Figure 4B).

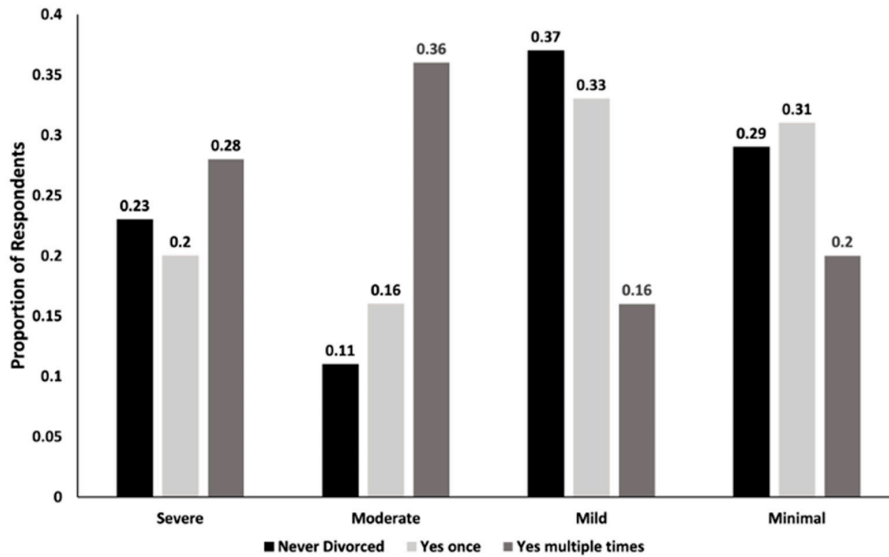
ADHD: Of the 413 respondents who completed the ADHD screening, 9% screened positive.

Suicide Risk: A total of 413 respondents completed the entire suicide risk screening. Of these, 32% had some risk level for suicide, with 15% being low-risk, 7% being moderate-risk, and 10% being at high risk. Of those respondents with some level of suicide risk, 27.3% had sought or were seeking treatment for suicidal thoughts and 30.3% said that their job had worsened their suicidal thoughts. Among ever-married individuals, those that reported divorces were more likely to have high and moderate suicide risk than those individuals who were married to one person (Figure 3b).

Traumatic Exposure: A total of 94% of respondents had experienced some type of work-related trauma (N = 430). In total, 80% had dispatched resources to an event with a severe injury, 57% had dispatched resources to an incident that resulted in a mortality, and 59% had personally known a wildland firefighter who died by suicide. In written comments, respondents described themes of worry about the safety of wildland firefighters, a sense of personal responsibility for wildland firefighter safety, guilt over not being able to prevent tragedies, and difficulty relaxing or high levels of vigilance (Supplemental Figure S1). Of the 409 individuals who completed the entire screening, 33% met the criteria for PTSD.

Sleep: Of the 432 respondents to this question, 50% reported rarely waking feeling rested. An additional 12% reported that they awoke rested monthly, and another 12% reported that they awoke rested multiple times per month. Approximately 9% reported waking feeling rested weekly, and 12% reported waking feeling rested multiple times per week. Finally, 4% reported waking feeling rested daily.

a.



b.

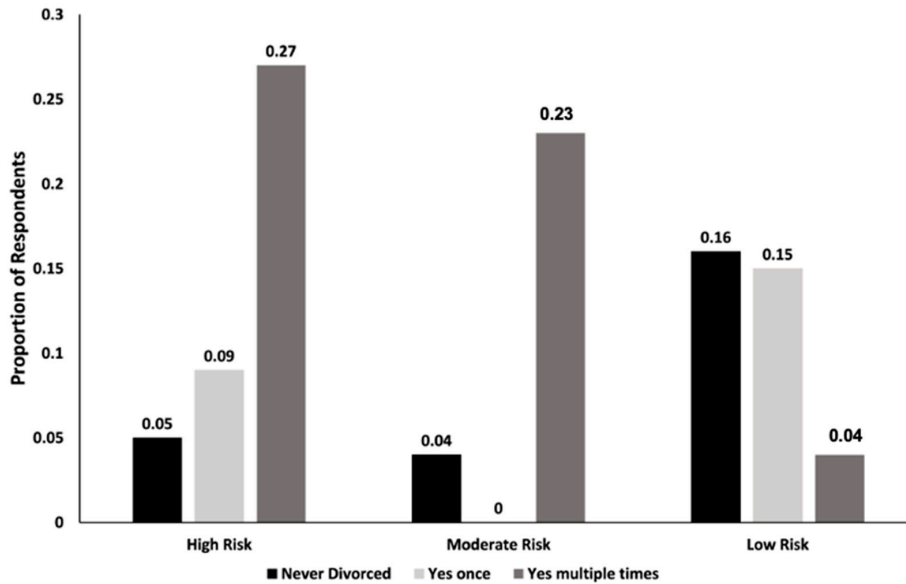


Figure 3. (a) Depression levels varied among married (N = 203), once-divorced (N = 75), and multiple-times-divorced (N = 25) respondents. $\chi^2 = 12.65$; $p = 0.049$. (b) High and moderate suicide risk increased in those individuals that had been divorced (N = 75) and those that were multiple-times-divorced (N = 26) compared to those individuals who were married to one person (N = 207). No-risk individuals are not shown for ease of visualization but were included in the total proportion data. $\chi^2 = 17.00$. $p = 0.009$.

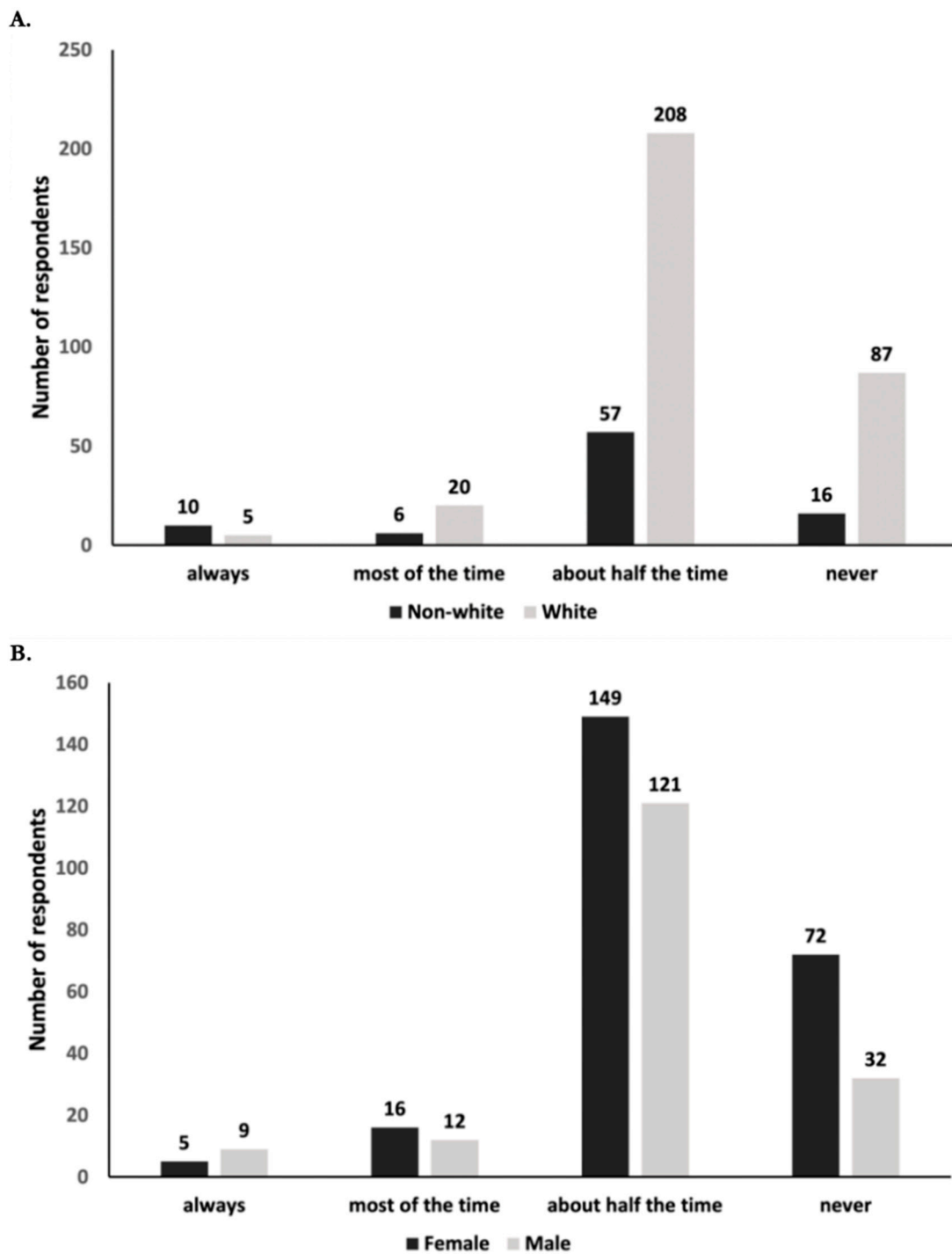


Figure 4. (A) Binge and restrictive eating behaviors differed between genders. $\chi^2 = 19.68; p = 0.012$. (B) Binge and restrictive eating behaviors differed between white and non-white respondents. $\chi^2 = 18.72; p = 0.001$.

Health Care Access and Utilization: Respondents were neutral as to whether they had the time and/or resources to seek mental health care if they wanted to do so ($M = 3.03$, $SD = 1.274$, $N = 424$) and whether they could do so during peak fire season ($M = 3.06$, $SD = 1.253$, $N = 412$). They were also neutral about whether they were comfortable talking about mental health at work ($M = 3.12$, $SD = 1.261$, $N = 413$). Respondents were relatively less positive about the accessibility of mental health resources ($M = 2.67$, $SD = 1.079$,

N = 403) and the affordability of work-provided mental health care resources (M = 2.89, SD = 0.895, N = 399).

Demographics: Within this survey, approximately 40% of respondents identified as men, 59% identified as women, and 1% identified as non-binary or another gender. We excluded non-binary and other genders from the analyses to maintain participant anonymity. The mean respondent age range was the range of 39–48 (we did not ask for participants' specific birth year but allowed the respondents to select from categorical age ranges). A total of 68% were married, 32% were currently unmarried, and 35% had been divorced at least once. A total of 9% of the sampled population were veterans. A plurality of respondents had 16–25 years of total firefighting experience (33%); however, most commonly, respondents had only 2–5 years of total dispatching experience (29%). A total of 93% of sampled wildland fire dispatchers had at least 90 days of operational wildland firefighting experience.

Comorbidity: Multiple mental health issues occurred concurrently with one another in our population (Table 1). Increasingly severe screening results for anxiety and depression were strongly correlated (0.7679). A positive PTSD screening result was also correlated with positive screening results for anxiety (0.4552) and depression (0.4190). Poor sleep scores correlated to high anxiety scores (0.3960) and depression scores (0.4955). Suicidal thoughts and ideation were the highest when anxiety and depression scores were elevated (0.2709 and 0.2583, respectively).

Open Response Themes: Respondents reported feelings of 'stress', 'anxiety', and 'worry' associated with their work. They reported feelings of helplessness associated with unknown outcomes of serious incidents, outcomes for individual firefighters, and situations to which they were party. They expressed the importance of their work and the closeness they felt to the people for whom they were dispatching and emphasized their connection to the operational wildland firefighters (sometimes as spouses, friends, or former operational colleagues). Secondary themes centered on the work atmosphere and space, indoor environments, poor ergonomics, and generally difficult working conditions. Work–life balance and chronic short-staffing were frequent themes that were connected to deteriorations in culture, increased feelings of stress, and decreased feelings of well-being (Supplemental Figure S1).

4. Discussion

This manuscript represents the first insights into the mental health and well-being of the American wildland fire dispatcher workforce. We found significantly higher rates of mental health disorders (as indicated by screening) than in the general United States population and, in some instances, other emergency responder populations (Table 2). One of the key differences between wildland fire dispatchers (and dispatchers, more broadly) and field-based emergency responders is physical separation. Thus, the trauma they experience through work is primarily vicarious. Vicarious trauma has been shown to be equally or more detrimental to mental health than direct trauma [44]. In addition, traumatic exposure for wildland fire dispatchers is often of a higher volume than field operators [12], since they are the center through which all information and communication flows.

We found disparities between white and non-white respondents, marital status, and genders in the proportion of positive screening results. The factors that interacted to create the results seen in this study are likely multifaceted and may result from a combination of occupational, environmental, socioeconomic, and cultural causes. For example, Lee-Winn et al. [35] documented that binge eating behaviors are more common among racial minorities and women. Our data support this assertion (Figure 3a), demonstrating that demographic factors interplay with occupational factors to determine mental health disorder risk. Further, we observed numerous comorbidities among mental health disorders (Table 1). Studies in other emergency responder populations have linked greater PTSD symptoms to suicidal ideation and risk [45]; however, our study found that depression was the highest comorbidity factor.

Our work supports previous studies that found higher levels of anxiety and depression in racial minorities [46,47]. Links between long working hours, which are reported by many

wildland fire dispatchers, and depression and anxiety have also been observed [48,49]. Marital status and divorce were significant factors influencing depression and suicidal thoughts in this study. Another study found increased depression and anxiety in married medical responders during the COVID-19 pandemic's initial phases [33], presumably due to the increased risk of exposing a loved one to illness due to their working environment. Approximately 22% of the dispatchers in our study were married to operational wildland firefighters, and an additional 16% had a spouse who had previously been an operational wildland firefighter. While we did not examine this directly, we hypothesize that a similar impact may be felt by these dispatchers.

While studies have documented significant links between alcohol-related problems and mental health symptoms, our study found minimal links between these. This may be due to the demographics of our population (i.e., young median age). Alternatively, high levels of alcohol use may not be persistent, but intermittent. Other studies have documented significant increases in alcohol use following critical incidents, with peaks at eight days post-incident but persisting for several months [50]. Our study population reported experiencing high levels of direct, vicarious, and secondary trauma through both their proximity to operational firefighters and their direct work in dispatching. The links between secondary trauma and alcohol use remain unclear [50] and further work is warranted.

Stigma may be a primary factor influencing a lack of utilization of mental health care resources, since these resources are directly linked to the workplace. Beliefs that mental health care issues may be associated with discrimination have been shown to decrease comfort in discussing and using resources in other studies [51]. Further, a need for self-reliance in the workplace was one of the strongest predictors of poor mental health in one study [52]. Emergency response dispatchers in other sectors have reported feelings of systemic alienation and lack of control about both their work and its impact [39].

The job demand–control–support model proposes that high-strain, low-control jobs have the greatest risk of mental illness and reduced well-being [53]. Further, high workplace psychological demands, independent of feelings of control, have been linked to increased mental health disorder risk [54]. Low levels of organizational justice (i.e., benefit distribution, complaint resolution, interpersonal rules) are also associated with additional workplace stress and stress-related illnesses [53]. Finally, factors such as temporary employment and atypical working hours have also been associated with poorer mental health outcomes [53]. Thus, institutional factors may explain at least some of the results that we observed, as wildland fire dispatchers report long atypical working hours, high-stress work environments, perceived lack of organizational justice, and feelings of disempowerment (R. Verble, unpublished data [55]).

This study did not examine work outcomes associated with decreased mental health; however, other studies have found causal links between the two. For example, PTSD is not directly associated with decreases in task performance, but acute stress levels are higher in individuals with PTSD, and acute stress is associated with performance deficits in complex cognitive tasks [56]. This study also did not explicitly examine intervention strategies; nonetheless, their consideration is a logical extension of this work. While few studies describe interventions, one study found that a seminar on coping and strength training helped to increase energy levels and avoidance-based coping [57], and another found that peer support groups were also an effective resource in mitigating the impacts of stress and trauma [58]. A third found that positive dispositional affect and increased self-efficacy were protective against the negative effects of the career [59]. Future studies should examine the mechanisms for and experiments with interventions that mitigate both risk and exposure. Given the unprecedented attrition of wildland firefighters and dispatchers from the workforce [60], this work should be of urgent and high priority.

5. Conclusions

This is one of the first studies to investigate wildland fire dispatchers' mental health. Based on the results of this study, mental health disorder risk is higher in this population than in other emergency responder populations and the United States civilian population. Over half the respondents screened positive for depression and anxiety and 10% screened at high risk of suicide. The demographic factors identified as risk factors in this study may help to identify vulnerable members of the workforce and create targeted intervention programs. Additional studies addressing the mechanisms behind these data and possible interventions and solutions are warranted.

6. Study Limitations

The study questions were developed, in part, by wildland fire dispatchers; therefore, there may be the potential for subject matter bias and interviewer bias that could have influenced the survey results. For anonymous self-administered and self-selected surveys, self-reporting bias is another possible concern [61]. This sample represents at least 25% of the total federal wildland fire dispatcher population; therefore, we feel confident that it is representative of the broader population. However, the potential for self-selection bias exists. Finally, screening instruments can produce false positives and overestimate the prevalence of a disease or disorder.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/fire7050157/s1>, Figure S1: Word cloud visualization of replies to open response question, 'Please share any additional detail about how worry and/or concern about emergency responders during emergency situations has impacted your job and/or personal life'. Word size corresponds to frequency of occurrence and word proximity indicates words that are used together more frequently; Table S1: Items, response, and categories of questions used in this publication. N = total number of respondents to the item. Responses are options presented. Category corresponds to the section of the methods and results in which this item was analyzed.

Author Contributions: Conceptualization, R.V., R.G., S.P., C.R. and R.W.; methodology, R.V., S.P., C.R. and R.W.; software, R.V.; validation, R.V. and R.W.; formal analysis, R.V.; investigation, R.V.; resources, R.G., C.R. and R.W.; data curation, R.V.; writing—original draft preparation, R.V.; writing—review and editing, R.V. and R.G.; visualization, R.V.; supervision, R.V.; project administration, R.V. and R.G.; funding acquisition, R.V. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This work was approved by the University of Missouri System Institutional Research Board (permit no. 2094192).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Please contact the corresponding author to discuss data availability.

Acknowledgments: The authors thank the wildland fire dispatching community for their frankness and candor in responding to the survey. M.B. Held and M. Ragland assisted with data organization. M. Thimgan, V.A. Samaranyake, D. Hier, S. Hercula, and J. Rhoades participated in insightful conversations that contributed to this work.

Conflicts of Interest: Two authors work as wildland fire dispatchers and two authors work as wildland firefighters. No other competing interests exist.

References

1. Held, M.B.; Ragland, M.R.; Wood, S.; Pearson, A.; Pearson, S.W.; Chenevert, O.; Granberg, R.M.; Verble, R.M. Environmental health of wildland firefighters: A scoping review. *Fire Ecol.* **2024**, *20*, 16. [CrossRef]
2. Granberg, R.M.; Shen, T.; Pearson, S.W.; Verble, R.M. Occupational and environmental factors influencing morale of United States federal wildland firefighters. *Int. J. Wildland Fire* **2023**, *12*, 1663–1676. [CrossRef]
3. Palmer, C.G. Stress and coping in wildland firefighting dispatchers. *J. Emerg. Manag.* **2014**, *12*, 303–314. [CrossRef] [PubMed]

4. Kovacs, M.; Muihy, G.; Szapary, A.; Nemeskeri, Z.; Varadi, I.; Kapus, K.; Tibold, A.; Zalayne, N.M.; Horvath, L.; Feher, G. The prevalence and risk factors of burnout and its association with mental issues and quality of life among Hungarian postal workers: A cross-sectional study. *BMC Public Health* **2023**, *23*, 75. [[CrossRef](#)] [[PubMed](#)]
5. Ghaddar, A.; Mateo, I.; Sanchez, P. Occupational stress and mental health among correctional officers: A cross-sectional study. *J. Occup. Health* **2008**, *50*, 92–98. [[CrossRef](#)] [[PubMed](#)]
6. Stansfeld, S.A.; Rasul, F.R.; Head, J.; Singleton, N. Occupation and mental health in a national UK survey. *Soc. Psychiatry Psychiatr. Epidemiol.* **2011**, *46*, 101–110. [[CrossRef](#)] [[PubMed](#)]
7. Blanchard, J.; Li, Y.; Bentley, S.K.; Lall, M.D.; Messman, A.M.; Liu, Y.T.; Diercks, D.B.; Merritt-Recchia, R.; Sorge, R.; Warchol, J.M.; et al. The perceived work environment and well-being: A survey of emergency health care workers during the COVID-19 pandemic. *Acad. Emerg. Med.* **2022**, *29*, 851–861. [[CrossRef](#)] [[PubMed](#)]
8. Borrelli, I.; Benevene, P.; Fiorilli, C.; D’Amelio, F.; Pozzi, G. Working conditions and mental health in teachers: A preliminary study. *Occup. Med.* **2014**, *64*, 530–532. [[CrossRef](#)] [[PubMed](#)]
9. Smith, E.C.; Holmes, L.; Burkle, F.M., Jr. Exploring the physical and mental health challenges associated with emergency service call-taking and dispatching: A review of the literature. *Prehospital Disaster Med.* **2019**, *34*, 619–624. [[CrossRef](#)]
10. Steinkopf, B.; Reddin, R.A.; Black, R.A.; Van Hasselt, V.B.; Couwels, J. Assessment of stress and resiliency in emergency dispatchers. *J. Police Crim. Psychol.* **2018**, *33*, 398–411. [[CrossRef](#)]
11. Klimley, K.E.; Van Hasselt, V.B.; Stripling, A.M. Posttraumatic stress disorder in police, firefighters, and emergency dispatchers. *Aggress. Violent Behav.* **2018**, *43*, 33–44. [[CrossRef](#)]
12. Adams, K.; Shakespeare-Finch, J.; Armstrong, D. An interpretative phenomenological analysis of stress and well-being in emergency medical dispatchers. *J. Loss Trauma* **2015**, *20*, 430–448. [[CrossRef](#)]
13. Roberg, R.R.; Hayhurst, D.L.; Allen, H.E. Job burnout in law enforcement dispatchers: A comparative analysis. *J. Crim. Justice* **1988**, *16*, 385–393. [[CrossRef](#)]
14. Bedini, S.; Braun, F.; Weibel, L.; Aussedat, M.; Pereira, B.; Duthel, F. Stress and salivary cortisol in emergency medical dispatchers: A randomized shifts control. *PLoS ONE* **2017**, *12*, e0177094. [[CrossRef](#)] [[PubMed](#)]
15. Kindermann, D.; Sanzenbacher, M.; Nagy, E.; Geinacher, A.; Cranz, A.; Nikendei, A.; Friederich, H.C.; Nikendei, C. Prevalence and risk factors of secondary traumatic stress in emergency call-takers and dispatchers—A cross-sectional study. *Eur. J. Psychotraumatol.* **2020**, *11*, 1799478. [[CrossRef](#)] [[PubMed](#)]
16. Kirmeyer, S.L. Coping with competing demands: Interruption and the Type A pattern. *J. Appl. Psychol.* **1988**, *73*, 621–629. [[CrossRef](#)]
17. Kobasa, S.C.; Maddi, S.R.; Puccetti, M.C. Personality and exercise as buffers in the stress-illness relationship. *J. Behav. Med.* **1982**, *5*, 391–404. [[CrossRef](#)] [[PubMed](#)]
18. Spitzer, R.L.; Kroenke, K.; Williams, J.B.W.; Lowe, B. A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch. Intern. Med.* **2006**, *166*, 1092–1097. [[CrossRef](#)]
19. Kroenke, K.; Spitzer, R.L.; Williams, J.B.W. The PHQ-9: Validity of a brief depression severity measure. *J. Gen. Intern. Med.* **2001**, *16*, 606–613. [[CrossRef](#)]
20. Bush, K.; Kivlahan, D.R.; McDonnell MBFihn, S.D.; Bradley, K.A. The AUDIT alcohol consumption questions (AUDIT-C): An effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). *Arch. Intern. Med.* **1998**, *158*, 1789–1795. [[CrossRef](#)]
21. Bradley, K.A.; Bush, K.R.; Epler, A.J.; Dobie, D.J.; Davis, T.M.; Sporleder, J.L.; Kivlahan, D.R. Two brief alcohol-screening tests from the alcohol use disorders identification test (AUDIT): Validation in a female Veterans Affairs patient population. *Arch. Intern. Med.* **2003**, *163*, 821–829. [[CrossRef](#)]
22. Ustun, B.; Adler, L.A.; Rudin, C.; Faraone, S.V.; Spencer, T.J.; Berglund, P.; Gruber, M.J.; Kessler, R.C. The World Health Organization adult attention-deficit/hyperactivity disorder self-report screening scale for DSM-5. *JAMA Psychiatry* **2017**, *74*, 520–527. [[CrossRef](#)] [[PubMed](#)]
23. Posner, K.; Brown, G.K.; Stanley, B.; Brent, D.A.; Yershova, K.V.; Oquendo, M.A.; Currier, G.W.; Melvin, G.A.; Greenhill, L.; Shen, S. The Columbia-Suicide Severity Rating Scale: Initial validity and internal consistency findings from three multisite studies with adolescents and adults. *Am. J. Psychiatry* **2011**, *168*, 1266–1277. [[CrossRef](#)]
24. Prins, A.; Bovin, M.J.; Kimerling, R.; Kaloupek, D.G.; Marx, B.P.; Pless Kaiser, A.; Schnurr, P.P. Primary Care PTSD Screen for DSM-5 (PC-PTSD-5). 2015. Available online: <https://www.ptsd.va.gov> (accessed on 12 January 2024).
25. Bovin, M.J.; Kimerling, R.; Weathers, F.W.; Prins, A.; Marx, B.P.; Post, E.; Schnurr, P.P. Diagnostic accuracy and acceptability of the primary care posttraumatic stress disorder screen for the *Diagnostic and Statistical Manual of Mental Disorders* (Fifth Edition) among US veterans. *JAMA Netw. Open* **2021**, *4*, e2036733. [[CrossRef](#)]
26. Ohayon, M.M.; Paskow, M.; Roach, A.; Filer, C.; Hillygus, D.S.; Chen, M.C.; Langer, G.; Hirshkowitz, M. The National Sleep Foundation’s sleep satisfaction tool. *Sleep Health* **2019**, *5*, 5–11. [[CrossRef](#)] [[PubMed](#)]
27. Kessler, R.C.; Adler, L.; Barkley, R.; Biederman, J.; Conners, C.K.; Demler, O.; Faraone, S.V.; Greenhill, L.L.; Howes, M.J.; Secnik, K.; et al. The prevalence and correlates of adult ADHD in the United States: Results from the national comorbidity survey replication. *Am. J. Psychiatry* **2006**, *163*, 716–723. [[CrossRef](#)]
28. Sachs, G. Dealing with Attention Deficit/Hyperactivity Disorder in the Emergency Services. National Fire Academy. 1997. Available online: <https://apps.usfa.fema.gov/pdf/efop/efo10644.pdf> (accessed on 21 April 2024).

29. SAMHSA, Center for Behavioral Health Statistics and Quality. 2022 National Survey on Drug Use and Health. Table 5.9A—Alcohol Use Disorder in Past Year: Among People Aged 12 or Older; By Age Group and Demographic Characteristics, Numbers in Thousands, 2021 and 2022. Available online: <https://www.samhsa.gov/data/sites/default/files/reports/rpt42728/NSDUHDetailedTabs2022/NSDUHDetailedTabs2022/NSDUHDefTabsSect5pe2022.htm#tab5.9a> (accessed on 12 January 2024).
30. Donnelly, E.; Sieberts, D. Occupational risk factors in the emergency medical services. *Prehospital Disaster Med.* **2009**, *24*, 422–429. [[CrossRef](#)]
31. Irizar, P.; Puddephatt, J.A.; Gage, S.H.; Fallon, V.; Goodwin, L. The prevalence of hazardous and harmful alcohol use across trauma-exposed occupations: A met-analysis and meta-regression. *Drug Alcohol Depend.* **2021**, *226*, 108858. [[CrossRef](#)]
32. Goodwin, R.D.; Weinberger, A.H.; Kim, J.H.; Wu, M.; Galea, S. Trends in anxiety among adults in the United States, 2008–2018: Rapid increases among young adults. *J. Psychiatr. Res.* **2020**, *130*, 441–446. [[CrossRef](#)]
33. Huang, G.; Chu, H.; Chen, R.; Liu, D.; Banda, K.J.; O'Brien, A.P.; Jen, H.J.; Chiang, K.J.; Chious, J.F.; Chou, K.R. Prevalence of depression, anxiety, and stress among first responders for medical emergencies during COVID-19 pandemic: A meta-analysis. *J. Glob. Health* **2022**, *12*, 05028. [[CrossRef](#)]
34. Bergen-Cico, D.; Lane, S.D.; Thompson, M.L. Examining the impact of posttraumatic stress on first responders: Analysis of cortisol, anxiety, sleep impairment and pain. *Paramed. Pract.* **2015**, *5*, 78–87. [[CrossRef](#)]
35. Lee-Winn, A.E.; Reinblatt, S.P.; Mojtabai, R.; Mendelson, T. Gender and racial/ethnic differences in binge eating symptoms in a nationally representative sample of adolescents in the United States. *Eat. Behav.* **2016**, *22*, 27–33. [[CrossRef](#)] [[PubMed](#)]
36. Brody, D.J.; Pratt, L.A.; Hughes, J.P. Prevalence of Depression among Adults 18 and over: United States, 2013–2016. NCHS Data Brief No. 303. 2018. Available online: <https://www.cdc.gov/nchs/products/databriefs/db303.htm> (accessed on 12 January 2024).
37. Norris, F.H.; Slone, L.B. Chapter 5: The epidemiology of trauma and PTSD. In *Handbook of PTSD, First Edition: Science and Practice*; Friedman, M.J., Keane, T.M., Resick, P.A., Eds.; Guilford Press: New York, NY, USA, 2007; pp. 78–98.
38. Ivey-Stephenson, A.Z.; Crosby, A.E.; Hoenig, J.M.; Gyawali, S.; Park-Lee, E.; Hedden, S.L. Suicidal thoughts and behaviors among adults >18 years- United States, 2015–2019. *MMWR Surveill. Summ.* **2022**, *71*, 1–19. [[CrossRef](#)] [[PubMed](#)]
39. Gardett, I.; Trefts, E.; Olola, C.; Scott, G. Chapter 4: Unique job roles and mental health risk factors among emergency dispatchers. In *Mental Health Intervention and Treatment of First Responders and Emergency Workers*; IGI Global: Hershey, PA, USA, 2020; pp. 49–62.
40. Stierman, B.; Afful, J.; Carroll, M.D.; Chen, T.C.; Davy, O.; Fink, S.; Fryar, C.D.; Gu, Q.; Hales, C.M.; Hughes, J.P.; et al. National Health and Nutrition Examination Survey 2017—March 2020 Prepandemic Data Files—Development of Files and Prevalence Estimates for Selected Health Outcomes. National Health Statistics Reports No. 158. United States Department of Health and Human Services Centers for Disease Control and Prevention National Center for Health Statistics. 2021. Available online: <https://www.cdc.gov/nchs/data/nhsr/nhsr158-508.pdf> (accessed on 21 April 2024).
41. Benjet, C.; Bromet, E.; Karam, E.G.; Kessler, R.C.; McLaughlin, K.A.; Ruscio, A.M.; Shahly, V.; Stein, D.J.; Petukhova, M.; Hill, E.; et al. The epidemiology of traumatic event exposure worldwide: Results from the World Mental Health Survey Consortium. *Psychol. Med.* **2016**, *46*, 327–343. [[CrossRef](#)] [[PubMed](#)]
42. Wang, P.S.; Lane, M.L.; Olfson, M.; Pincus, H.A.; Wells, K.B.; Kessler, R.C. Twelve-month use of mental health services in the United States: Results from the national comorbidity survey replication. *Arch. Gen. Psychiatry* **2005**, *62*, 629–640. [[CrossRef](#)] [[PubMed](#)]
43. Stanley, I.H.; Hom, M.A.; Joiner, T.E. A systematic review of suicidal thoughts and behaviors among police officers, firefighters, EMTs, and paramedics. *Clin. Psychol. Rev.* **2016**, *44*, 25–44. [[CrossRef](#)] [[PubMed](#)]
44. Cohen, K.; Collens, P. The impact of trauma work on trauma workers: A metasynthesis on vicarious trauma and vicarious posttraumatic growth. *Psychol. Trauma Theory Res. Pract. Policy* **2013**, *5*, 570–580. [[CrossRef](#)]
45. Boffa, J.W.; Stanley, I.H.; Hom, M.A.; Norr, A.M.; Joiner, T.E.; Schmidt, N.B. PTSD symptoms and suicidal thoughts and behaviors among firefighters. *J. Psychiatr. Res.* **2017**, *84*, 277–283. [[CrossRef](#)] [[PubMed](#)]
46. Budhwani, H.; Hearld, K.R.; Chavez-Yenter, D. Depression in racial and ethnic minorities: The impact of nativity and discrimination. *J. Racial Ethn. Health Disparities* **2015**, *2*, 34–42. [[CrossRef](#)]
47. Budhwani, H.; Hearld, K.R.; Chavez-Yenter, D. Generalized anxiety disorder in racial and ethnic minorities: A case of nativity and contextual factors. *J. Affect. Disord.* **2015**, *175*, 275–280. [[CrossRef](#)]
48. Theorell, T.; Hammarström, A.; Aronsson, G.; Träskman Bendz, L.; Grape, T.; Hogstedt, C.; Hall, C. A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health* **2015**, *15*, 738. [[CrossRef](#)] [[PubMed](#)]
49. Bannai, A.; Tamakoshi, A. The association between long working hours and health: A systematic review of epidemiological evidence. *Scandinavian Journal Work Environ. Health* **2014**, *40*, 5–18. [[CrossRef](#)] [[PubMed](#)]
50. Homish, G.G.; Frazer, B.S.; Carey, M.G. The influence of indirect collective trauma on first responders' alcohol use. *Int. J. Emerg. Ment. Health* **2012**, *14*, 21–28.
51. Brohan, E.; Henderson, C.; Wheat, K.; Malcom, E.; Clement SBarley, E.A.; Slade, M.; Thornicroft, G. Systematic review of beliefs, behaviours and influencing factors associated with disclosure of a mental health problem in the workplace. *BMC Psychiatry* **2012**, *12*, 11. [[CrossRef](#)]
52. Milner, A.; Kavanagh, A.; King, T.; Currier, D. The influence of masculine norms and occupational factors on mental health: Evidence from the baseline of the Australian longitudinal study on male health. *Am. J. Men's Health* **2018**, *12*, 696–705. [[CrossRef](#)]

53. Harvey, S.B.; Modini, M.; Joyce, S.; Milligan-Saville, J.S.; Tan, L.; Mykletun, A.; Bryant, R.A.; Christensen, H.; Mitchell, P.B. Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occup. Environ. Med.* **2017**, *74*, 301–310. [[CrossRef](#)] [[PubMed](#)]
54. Stansfeld, S.; Candy, B. Psychosocial work environment and mental health- a meta-analytical review. *Scandinavian J. Work. Environ. Health* **2006**, *32*, 443–462. [[CrossRef](#)]
55. Verble, R.M. Missouri University of Science & Technology, Rolla, MO, USA. Survey data. Unpublished work.
56. Regehr, C.; LeBlanc, V.R. PTSD, acute stress, performance, and decision-making in emergency workers. *J. Am. Acad. Psychiatry Law* **2017**, *45*, 184–192. [[PubMed](#)]
57. Anshel, M.H.; Umscheid, D.; Brinthaup, T.M. Effect of a combined coping skills and wellness program on perceived stress and physical energy among police emergency dispatchers: An exploratory study. *J. Police Crim. Psychol.* **2013**, *28*, 1–14. [[CrossRef](#)]
58. Scully, P.J. Taking care of staff: A comprehensive model of support for paramedics and emergency medical dispatchers. *Traumatology* **2011**, *17*, 35–42. [[CrossRef](#)]
59. Shakespeare-Finch, J.; Rees, A.; Armstrong, D. Social support, self-efficacy, trauma and well-being in emergency medical dispatchers. *Soc. Indic. Res.* **2014**, *123*, 549–565. [[CrossRef](#)]
60. United States Government Accountability Office. Wildland Fire: Federal Agencies Face Barriers to Recruiting and Retaining Firefighters. GAO-23-106888. 2023. Available online: <https://www.gao.gov/products/gao-23-106888> (accessed on 20 February 2024).
61. Althubaiti, A. Information bias in health research: Definitions, pitfalls, and adjustment methods. *J. Multidiscip. Healthc.* **2016**, *9*, 11–217. [[CrossRef](#)] [[PubMed](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.