



Pre-existing depression, anxiety and trauma as risk factors for the development of post-traumatic stress disorder symptoms following wildfires

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ABSTRACT

The trauma of wildfires leads to one of the most challenging and treatment resistant mental health conditions—namely post-traumatic stress disorder (PTSD). Research addressing the contribution of pre-existing mental health conditions to the development of PTSD symptoms following traumatization by wildfires is limited. This study examined whether people with pre-existing diagnoses of anxiety, depression, PTSD, insomnia and nightmares, by a mental health professional, are more likely to develop symptoms of PTSD than those with no previous diagnosis following the trauma of wildfires. A total of 126 wildfire survivors from Australia, Canada and the United States of America completed an online survey. An independent sample *t*-tests revealed that pre-existing diagnosed conditions of depression, an anxiety disorder and PTSD significantly increased the likelihood of developing PTSD symptoms following traumatization by wildfires ($t = -2.51, p = 0.014, 95\% \text{ CI } [-18.91 \text{ to } -2.20], t = -2.61, p = 0.01, 95\% \text{ CI } [-18.91 \text{ to } -2.57], t = -2.57, p = 0.012, 95\% \text{ CI } [-22.36 \text{ to } -2.87]$ respectively). Practitioners working in communities subjected to wildfires need to run a thorough screening of their patients' pre-existing mental health conditions to provide the right treatment and referral pathways to those affected by the trauma of wildfires.

1. Introduction

There has been a tenfold increase in natural disasters since 1960, with a further predicted and inevitable increase over the next two decades (The Royal Commission, 2020; Vision of Humanity, 2020). Wildfires severely and negatively impact infrastructure, agriculture, forestry and wildlife, and have deleterious effects on people's lives (The Royal Commission, 2020). More specifically, the impact of fires on mental health is palpable, with many survivors reporting multiple mental health conditions following wildfires such as depression, anxiety, alcohol and substance use, sleep difficulties, and post-traumatic stress disorder (PTSD) (Bryant et al., 2014; Isaac et al., 2023; To et al., 2021).

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines PTSD as any event that involves exposure to and/or witnessing a life-threatening event where a person's life and/or their physical integrity is severely threatened leading to physical and/or psychological injuries (APA, 2013). Reactions during traumatic events include but are not limited to extreme fear, horror and feeling of helplessness. A diagnosis of PTSD is warranted if the following symptoms are present: (1) re-experiencing or reliving the traumatic event; (2) deliberate avoidance of cues or stimuli associated with the traumatic event and emotional numbness; and (3) prominent arousal state. The symptoms must be present for at least one month and must lead to significant disruptions in daily functioning (APA, 2013).

Post-traumatic stress disorder is highly prevalent in wildfire

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survivors, ranging between 39.6% and 77.88%, leading to major challenges in managing and treating the disorder (Belleville et al., 2019; Isaac et al., 2023; Mao et al., 2022). The negative impact of PTSD is far-reaching with studies indicating negative effects to both physical and psychological health. For example, those with PTSD diagnosis are significantly more likely to experience stroke, heart attacks, coronary disease, bodily pain, renal disease, asthma, arthritis, interpersonal difficulties, income reduction, increased stress levels and increased risk of suicide (Asnaani et al., 2014; Glaesmer et al., 2011; Maia et al., 2011; Sareen, 2014; Sareen et al., 2011; Spitzer et al., 2009).

There is consensus among researchers that pre-trauma experiences such as childhood abuse, family history of psychopathology, prior diagnosis of depression, anxiety, and sleep conditions such as insomnia and nightmares are significant risk factors in the development of PTSD following traumatic events (Agyapong et al., 2021; Brewin et al., 2000; Mao et al., 2022; Ozer et al., 2003; Weber and Wetter, 2022). Additionally, other factors taking place during and immediately after the traumatic event such as lack of social support, negative appraisal of the trauma and its sequelae, and additional stressors equally contribute to the development of PTSD (Ehlers & Clark, 2000; Heron Delaney et al., 2013; Sareen, 2014). The combination of both pre-and-post-trauma experiences clearly play a role in the development of psychopathology in survivors of wildfires. However, there is particularly limited research on the type of risk factors preceding the trauma of wildfires on the development of PTSD in fire survivors. Since, the development of PTSD can be unique to the actual characteristics of the trauma of wildfires (To et al., 2021), there is a need for acquiring more knowledge about the risk factors that may contribute to the development of PTSD in this cohort. Gaining an insight on which risk factors play a role in the development of PTSD, may lead to better and more tailored treatment plans addressing the needs of wildfire survivors. This in turn, may lead to better treatment outcomes, and more rapid recovery for survivors. In addition, advances in wildfire research can help shape current and future policies and procedures related to prevention, mitigation, and recovery from mental health conditions/PTSD in affected communities (Montesanti et al., 2022).

This study investigated some key risk factors such as pre-existing depression, anxiety, PTSD, insomnia and nightmares in the emergence of PTSD symptoms following the trauma of wildfires.

1.1. Aims of the study

The first aim of this study was to explore whether wildfire survivors with pre-existing diagnoses of anxiety, depression, PTSD, insomnia and nightmares, are significantly more likely to develop symptoms of PTSD than those with no previous diagnoses following the trauma of wildfires. The second aim was to compare the mean score for PTSD in the current study with the mean score reported in other studies of wildfire survivors.

2. Method

2.1. Participants

The sample was 126 survivors of wildfires from Australia, Canada and United States of America. Twenty-three males (18.3%), 102 females (81%), and one nonbinary (0.8%) participant took part in an online survey. Ages in the sample ranged from 20 to 92 years ($M = 52$ years, $SD = 14.4$). Demographic information collected in the survey included sex, education, employment, marital status, country of residence, and diagnosis of mental health condition/s by a health professional prior to the experience of wildfires.

2.2. Measures

The Insomnia Severity Index Scale (ISI): the ISI is a seven-item scale that is used to measure the severity of insomnia symptoms (Bastien

et al., 2001). In the current study Cronbach's alpha for the ISI was 0.92. A cut-off score of 14 provides 82.4% sensitivity, and 82.1% specificity for detecting clinical insomnia (Gagnon et al., 2013).

Generalized Anxiety Disorder Questionnaire (GAD-7): is a seven-item self-report scale that is used to measure the presence and severity of anxiety symptoms (Spitzer et al., 2006). In this study, Cronbach's alpha was 0.95. A cut-off score of 10 is identified as the optimal point for sensitivity of (89%) and specificity of (82%) for detecting clinical anxiety (Spitzer et al., 2006).

The Patient Health Questionnaire (PHQ-9): the scale consists of nine items. It is used to measure the presence of depression, with scores higher than 10 indicating the presence of depressive disorder (Kroenke et al., 2001). In this study Cronbach's alpha for the PHQ-9 was 0.91.

PTSD Checklist for DSM-5 Scale (PCL-5 – Civilian Version): seventeen self-report items make up the PCL-5. The scale provides provisional diagnosis of PTSD (Weathers et al., 2013). A cut-off score of 31–33 discriminates between people with or without provisional diagnosis of PTSD (Weathers et al., 2013). In this study, Cronbach's alpha was .95.

Disturbing Dream and Nightmare Severity Index DDNSI: the DDNSI is a five-item-scale that measures the frequency and severity of disturbing nightmares and dreams. Scores greater than 10 reflects the presence of nightmare disorder (Krakow et al., 2002).

2.3. Procedure

A URL link about the online study was advertised following ethics approval from (Federation University Ethics Committee, approval number: A21–124) via social media and Facebook campaigns between October of 2021 and March of 2022. Adult participants who were fluent in English and experienced wildfires within the previous 10 years, were eligible to participate. A plain language statement was presented and participants who wished to take part in the study selected an "I agree" button after reading the plain language statement.

2.4. Data analysis

Means and standard deviations were calculated for all dependent variables. Independent groups *t*-tests were used to compare participants who reported having or not having diagnoses of mental health conditions prior to the occurrence of wildfire trauma on each of the dependent variables.

3. Results

3.1. Descriptive statistics for the groups

Using the cut-off scores reported in section 2.2, Table 1 shows the number and percentage of participants diagnosed with or without, depression, anxiety, PTSD, insomnia and nightmare disorders prior to the trauma of wildfires. Approximately, around 15%–20% of participants reported pre-existing anxiety, depression and insomnia, while 11.9% and 9.5% reported pre-existing PTSD and nightmares respectively.

Table 1

Frequencies and percentages of diagnosis of depression, anxiety, PTSD, insomnia and nightmare disorders prior to wildfires.

Variables	Yes n (%)	No n (%)
Anxiety disorder before fires	22 (17.5%)	104 (82.5%)
Depression before fires	25 (19.8%)	101 (80.2%)
Insomnia before fires	19 (15.1%)	107 (84.9%)
Nightmares before fires	12 (9.5%)	114 (90.5%)
PTSD before fires	15 (11.9%)	111 (88.1%)

Note. $N = 126$ for all variables.

Table 2

Comparison of the PCL-5 mean scores for groups based on previous diagnosis of depression, anxiety, PTSD, insomnia and nightmare disorders.

Variable	No <i>M(SD)</i>	Yes <i>M(SD)</i>	<i>t(df)</i>	<i>p</i>	95% CI
Pre-Anxiety	44.36 (17.00)	55.10 (14.45)	-2.61 (102)	0.01	[-18.91 to -2.57]
Pre-Depression	44.49 (16.64)	55.05 (16.41)	-2.51 (102)	0.01	[-18.91 to -2.20]
Pre-ISI	45.70 (17.49)	50.37 (13.99)	-1.01 (102)	0.32	[-13.84 - 4.50]
Pre-NTM	45.59 (16.42)	54.30 (21.29)	-1.55 (102)	0.12	[-19.87 - 2.44]
Pre-PTSD	44.85 (16.94)	57.46 (13.48)	-2.57 (102)	0.01	[-22.36 to -2.87]

Note. Pre-Anxiety = previous diagnosis of anxiety prior to wildfires; Pre-Depression = previous diagnosis of depression prior to wildfires; Pre-ISI = previous diagnosis of insomnia prior to wildfires; Pre-NTM = previous diagnosis of nightmares prior to wildfires; Pre-PTSD = previous diagnosis of PTSD prior to wildfires; CI = confidence intervals.

3.2. Mean differences among groups

Table 2 shows means and standard deviations for those who reported being diagnosed by a mental health professional, prior to the trauma of fires with depression, anxiety disorder, PTSD, insomnia and nightmare disorders. Independent groups *t*-tests showed that the PCL-5 scores were significantly higher in those with previous diagnoses of depression, anxiety and PTSD than participants with no previous diagnoses. There were no significant differences between participants with or without previous diagnoses of insomnia and nightmares on the PCL-5 scores prior to the trauma of wildfires.

3.3. Prevalence of PTSD and means comparison between the current sample and a representative sample of wildfire survivors

A total of 104 participants provided data on the PCL-5; using a cut-off score of 33, 29 (27.9%) participants reported no PTSD symptoms, and 75 (72.1%) participants reported symptoms of PTSD. To examine whether PTSD symptoms were higher in the present study than those reported in a representative sample of wildfire survivors, a single sample *t*-test was used and showed that the mean score for the PCL-5 ($M = 46.42$, $SD = 17.02$) in the present study was significantly higher than the mean score reported in Silveira et al.'s (2021) sample ($N = 725$) ($M = 26.68$, $SD = 19.50$), $t = 11.83$, $p < 0.001$ (95% CI, 16.43–23.05).

4. Discussion

The first aim of this study was to establish whether pre-existing diagnosis of anxiety disorders, depression, PTSD, insomnia and nightmares posed risks to the development of PTSD symptoms following the trauma of wildfires.

4.1. Anxiety disorders and the emergence of PTSD symptoms

The current results showed that those with a previous anxiety diagnosis were significantly more likely to report PTSD symptoms following the trauma of wildfires as measured by the PCL-5 (Weathers et al., 2013). This finding is consistent with previous cross-sectional research. For example, in a sample of 486 wildfire survivors, Agyapong et al. (2021) found that prior diagnosis of anxiety increased the risk ($p = 0.01$) for developing PTSD six months following wildfires. A more recent study by Mao et al. (2022) found that survivors with a history of anxiety (59.45%, $N = 186$) disorders prior to the trauma of wildfires were significantly more likely to develop PTSD than those with no previous diagnosis of anxiety (25.3%, $p < .001$).

4.2. Depression and the emergence of PTSD symptoms

The current results also revealed that survivors with a history of depression were significantly more likely to develop PTSD symptoms following the trauma of fires. The current results lend support to previous research in this field. A study of 186 survivors of the Fort McMurray fires found that those who received a diagnosis of depression

from a mental health professional (67.3%) were five times more likely to develop PTSD than those without a history of depression (26.8%) (Mao et al., 2022). Researchers suggest that people with depression are more susceptible to experience traumatic experiences than those without depression leading to the development of other disorders such as PTSD (Mao et al., 2022). This link between depression and PTSD is based on cross sectional designs. Therefore, it is not well known whether those who receive diagnosis of depression in adulthood are individuals that have been subjected to trauma in early childhood, and as such, are more likely to report more trauma and higher rates of PTSD, or whether individuals with depression are more likely to report the severity of events as more traumatic than their counterparts without depression (Withers et al., 2013). It is evident that the two disorders have a bidirectional relationship (Withers et al., 2013).

Another line of research of 2085 individuals found that diagnosis of anxiety disorders and depression prior to the trauma of fires significantly predicted diagnosis of PTSD following the trauma (Parslow et al., 2006). Research shows that depression, anxiety, and PTSD share a biological underpinning. Perhaps this overlap provides the basis for the likelihood of participants with previous history of depression and anxiety to develop PTSD following the trauma of wildfires (Smoller, 2016; Withers et al., 2013).

4.3. Insomnia, nightmares and the emergence of PTSD symptoms

The current results showed that previous diagnosis of insomnia and nightmares did not increase survivors' chances of developing PTSD symptoms following the experience of wildfires. The current results contradict previous research findings whereby previous sleep disorders predicted PTSD (Belleville et al., 2019).

In a study of 30 individuals diagnosed with clinical PTSD, Short et al. (2018) found that PTSD related fear of sleep, PTSD, depression, anxiety severity and daytime nightmares significantly predicted poor sleep, and reduced efficiency of sleep; and daily PTSD symptoms and fear of sleep significantly predicted the occurrence of nightmares. Fear of sleep has also been confirmed as a significant predictor of poor sleep quality in individuals with trauma (Pruiksma et al., 2014). It is possible that fear of sleep, daytime nightmares, and PTSD related symptoms, can lead to insomnia, which in turn may lead to PTSD (Pruiksma et al., 2014; Short et al., 2018). However, the current study did not take into account fear of sleep or daytime nightmares and therefore, future research can investigate the association between such factors and the development of PTSD. It is also possible that PTSD may proceed sleep disorders.

4.4. Previous PTSD diagnosis and the emergence of PTSD symptoms following the fires

Similarly, the current results showed that survivors with a history of PTSD, diagnosed by a mental health professional prior to the fires, were significantly more likely to develop symptoms of PTSD following the trauma of wildfires. Stress sensitization theory suggests that severity level of trauma plays a significant role in determining how survivors respond to stress following a traumatic event (Schoedl et al., 2014).

Research affirms that trauma is linearly associated with an increase in PTSD symptoms ($F(4,912) = 7.60, p = 0.001, N = 922$) (Suliman, et al., 2009). People who experience greater loss following a trauma such as losing loved ones and belongings are more likely to feel vulnerable especially in the first year following a disaster (Isaac et al., 2023; Smid et al., 2012). It is possible that cumulative trauma may make survivors more vulnerable and reactive, intensifying their reactions to subsequent trauma rather than enhancing their resilience to stressful factors (Schoedl et al., 2008; Smith et al., 2008).

The second aim examined whether the mean score of PTSD symptoms as measured by the PCL-5 (Weathers et al., 2013) in the present study was higher than the mean score reported in a representative sample of wildfire survivors.

4.5. Comparing the means on the PCL-5

The mean score in the current study was significantly higher than that reported by Silveira et al. (2021). It is noteworthy to highlight that prior to the commencement of data collection for this survey, multiple states in the USA and Canada were affected by wildfires of a severe nature including California, Oregon, Nevada, Alberta, and British Columbia. Given the recency of wildfire experience, this may explain why the mean score of PTSD symptoms in the current study was significantly higher than that reported by Silveira et al. (2021). In addition, the first few years after a disaster, stress sensitization may occur in survivors who experienced extreme disaster exposure. In turn, increased response to stress is expected in survivors, providing a rationale for the current high prevalence of PTSD in our study sample (Smid et al., 2012).

5. Implications

Clinicians working in communities subjected to wildfires may need to make screening for PTSD, depression and anxiety disorders a standard practice. Having a thorough understanding of a survivor's mental health can guide the provision of a more tailored treatment plans for those affected by wildfires. This, as a result, may lead to a more successful treatment outcomes and better recovery rate for survivors. Preparing and training aid workers to also pay attention to early signs of stress and provide pathways for early intervention is also warranted.

6. Limitations

This study is not without its limitations. It is a retrospective study, and previous diagnosis of depression, anxiety and PTSD are based on survivors' accounts. Therefore, longitudinal studies are needed whereby regular assessments of mental health conditions in the pre, peri and post periods of wildfires may provide a better understanding about the nature of the relationship between different risk factors and the development of PTSD. Furthermore, a proportion of the current sample may have had pre-existing mental health conditions such as depression, anxiety disorders, PTSD and sleep disorders that were not formally diagnosed prior to the trauma of wildfires leading to an under-representation of the current findings. Another major limitation of the study is the over-representation of females in the current sample in comparison to males. Not only females are twice as likely as males to develop PTSD (Perrin et al., 2014), they are also more likely to report depression and anxiety symptoms (Borooah, 2010). The unequal proportion of males to females in the current sample maybe due to our recruitment method. While online data collection methods are becoming increasingly more popular in research, they introduce an unconstrained selection bias in relation to age and gender (Haddad et al., 2022). Finally, the absence of a measure for substance abuse was another major limitation in the current study. Both depression and anxiety can be co-morbid conditions with substance abuse (Garey et al., 2020), which in turn, can lead to the development of PTSD.

7. Conclusion

The current findings suggest that pre-existing diagnosis of depression, anxiety disorders, and PTSD prior to the trauma of wildfires may increase the risk of developing PTSD symptoms following the trauma of wildfires.

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CRedit authorship contribution statement

Fadia Isaac: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Samia R. Toukhsati:** Conceptualization, Supervision, Visualization. **Britt Klein:** Conceptualization, Supervision, Visualization, Writing – review & editing. **Mirella Di Benedetto:** Supervision, Writing – review & editing. **Gerard A. Kennedy:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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