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Psychological mechanisms and mental health in the face of current conflicts and crises

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Psychological mechanisms and mental health in the face of current conflicts and crises

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Editorial: Psychological mechanisms and mental health in the face of current conflicts and crises

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KEYWORDS

crisis, crisis management, intervention, resilience, support mechanisms

Editorial on the Research Topic
Psychological mechanisms and mental health in the face of current conflicts and crises

Introduction

Recent years have been marked by a confluence of global crises, such as pandemics, war, and ecological threats, that have reshaped psychological landscapes for individuals and communities worldwide. These multifaceted challenges have not only threatened public health and safety but have also profoundly tested emotional resilience, strained moral values, and revealed systemic vulnerabilities in mental health support. The present Research Topic, *"Psychological Responses to Conflict and Crisis,"* brings together a diverse set of investigations that collectively explore how people experience, respond to, and adapt to extraordinary adversity.

This collection of 11 articles spans a rich array of contexts and underscores the importance of multidisciplinary approaches to crisis psychology. Together, these contributions provide fresh insights into protective mechanisms, psychosocial risk factors, and the complex interplay between individual agency and institutional environments.

Crisis contexts: refugee experience, conflict zones, and global anxiety

Several studies examine how geopolitical upheaval and global threats affect mental health, especially in populations indirectly or directly exposed to conflict. Kovács et al. explore the psychological outcomes of Ukrainian refugees in Hungary and Poland. Their findings highlight the buffering role of social support in shaping attitudes and acculturation among displaced individuals, even when trauma exposure is high. Similarly, Prazeres et al. investigate anxiety in the Portuguese population, comparing fears related to COVID-19 and nuclear war. Their work illustrates how distant crises can nonetheless provoke significant psychological distress in non-combat populations.

Stieger et al. offer a rare, *in situ* analysis of war exposure in Ukraine using an experience-sampling approach. They show that civilians frequently exposed to sirens

and explosions continue to experience heightened anxiety and somatic distress, thus confirming the persistent toll of existential threat and the limited protective effects of habituation.

Adding to the understanding of individual responses to war, Wójtowicz-Szefler et al. explore resilience and value changes in Polish volunteers assisting Ukrainian refugees. Their work uncovers that volunteering during the war reinforces personal values and fosters resilience, highlighting a reciprocal relationship between prosocial action and psychological adaptation.

Mental health in uniformed services: moral injury, combat exposure, and compassion fatigue

Military contexts are prominently represented in this Research Topic. Wesemann et al. conduct a quasi-experimental study on German soldiers deployed to Afghanistan, finding significantly elevated rates of PTSD, anxiety, and depression among those exposed to life-threatening incidents. These findings stress the need to distinguish between general deployment stress and the acute psychological consequences of traumatic threat.

Levy and Gross contribute a qualitative exploration of Israeli veterans' post-combat identity reconstruction. They distinguish between two narratives, namely humanitarian and national security, that shape the trajectory of moral injury and civic engagement. Veterans expressing humanitarian guilt often seek amends through peace advocacy, while those embedded in a national security frame may engage in activism from a critical stance. This study broadens our understanding of moral injury beyond clinical symptomatology, illuminating its transformative social potential.

Valladares-Garrido et al. explore fear of COVID-19 among Peruvian military personnel, revealing that younger age, sleep deprivation, and pre-existing mental health challenges predict heightened distress. These findings signal the compounded psychological risk faced by military personnel tasked with public health duties during crises.

Healthcare workers and the frontlines of emotional burden

The COVID-19 pandemic has placed extraordinary pressure on healthcare systems, particularly frontline personnel. Zhang et al. examine the role of role stress in generating compassion fatigue among nurses in China and identify perceived social support and emotion regulation efficacy as key mediators. With 94.2% of nurses experiencing some level of compassion fatigue, this study highlights the urgent need for systemic support structures and targeted interventions.

Neil-Sztramko et al. provide a systematic review of mental health interventions for frontline healthcare workers during public health emergencies. Their findings point to the effectiveness of interventions such as psychotherapy, psychoeducation, and mind-body practices, underscoring the necessity of proactive institutional planning in crisis preparedness.

Civilians under stress: preparedness, perception, and resilience

Outside direct combat and healthcare contexts, two contributions emphasize civilian responses to crises. Faryabi et al. apply Protection Motivation Theory to examine disaster preparedness in Iranian households. Their study identifies fear and perceived vulnerability as strong motivators for adopting protective behaviors, providing actionable insight for public risk communication strategies.

Massag et al. trace psychological distress in Germany during the Ukraine war, revealing that although overall distress levels declined over time, a notable proportion of respondents continued to experience clinically significant symptoms. The study illustrates the ripple effects of distant wars on populations psychologically proximate through media exposure and geopolitical concerns.

Synthesizing insights: moral, emotional, and structural dimensions

Several cross-cutting themes emerge across this volume. First, the significance of moral reasoning and identity in shaping crisis responses, particularly in contexts involving conflict, caregiving, and trauma, underscores the need for frameworks that integrate ethical, psychological, and sociocultural dimensions of resilience.

Second, the recurring role of social support and emotional regulation across diverse populations, from nurses and veterans to civilians and volunteers, reinforces the universality of these protective factors. Whether explicitly measured (as in Zhang et al. and Kovács et al.) or implicitly noted (as in Wójtowicz-Szefler et al.), these elements are crucial levers for psychological interventions.

Finally, the studies collectively emphasize that crisis-related distress is neither evenly distributed nor inevitable. Institutional, social, and personal resources play mediating roles in shaping individual outcomes. This insight shifts the focus from passive coping to active, policy-informed engagement with mental health support, especially among at-risk populations like refugees, healthcare workers, and soldiers.

Conclusion

The articles in this Research Topic collectively advance our understanding of how individuals and groups navigate crises, for instance, through suffering, adaptation, meaning-making, and, in many cases, growth. As global uncertainties persist, these insights offer not only diagnostic clarity but also hope: that resilience can be cultivated, that moral strain can lead to action, and that even in the darkest moments of collective experience, psychological science can offer paths to recovery, connection, and renewed purpose. The work represented here reminds us that while crises expose the limits of our systems and the fragility of our lives, they also illuminate the extraordinary human capacity to adapt and to care. Moving forward, it will be

critical for researchers, policymakers, and practitioners to translate these findings into tangible frameworks for prevention, early intervention, and long-term support. Only by combining scientific understanding with collective responsibility can we ensure that the psychological consequences of conflict and crisis do not define us—but rather, that our responses to them shape a more resilient, compassionate future.

Author contributions

HA: Writing – original draft, Writing – review & editing.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Anxiety, depressive symptoms, and distress over the course of the war in Ukraine in three federal states in Germany

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Introduction: The Russian invasion of Ukraine and the resulting consequences are in the center of political discussions, media, and likely individual thinking of the population in Germany. Yet, the impact of this prolonged exposure on mental health is not known hitherto.

Methods: Using the population based cohort study DigiHero from three federal states (Saxony-Anhalt, Saxony, and Bavaria), we assessed anxiety levels (GAD-7), depressive symptoms (PHQ-9), and distress (modified PDI) in the first weeks of war and 6 months later.

Results: Of those 19,432, who responded in the first weeks of war, 13,934 (71.1%) responded also 6 months later. While anxiety and emotional distress decreased during the 6 months, their average scores were still elevated, and a substantial fraction of respondents displayed clinically relevant sequelae. Persons from low-income households were especially affected, specifically by fears related to the personal financial situation. Those who reacted with a particularly strong fear in the beginning of war were more likely to have persistent clinically relevant symptoms of depression and anxiety also 6 months later.

Discussion: The Russian invasion of Ukraine is accompanied by continuing impairment of mental health in the German population. Fears surrounding the personal financial situation are a strong determinant.

KEYWORDS

anxiety, armed conflicts, cohort studies, depression, psychological distress

1. Introduction

Mass traumatic events, such as wars, have extensive mental health implications especially on those immediately affected (1). A war has been shown to lead to higher prevalence of anxiety, mood disorders and posttraumatic stress disorder (PTSD) in the general population of the affected country during and for years post-war (2, 3). The ongoing war in Ukraine has already been shown to have detrimental impacts on the mental health of Ukrainian military and civilian combatants (4) and the Ukrainian general population (5) with nearly half of the participants in both studies displaying clinically relevant symptoms of depression and anxiety. Persons who are internally displaced due to the ongoing conflict between Russia and Ukraine are at an especially high risk for mental health sequelae (6, 7).

Additionally, evidence suggests an impact of mass traumatic events on the mental health of individuals and populations not directly involved. However, published studies were mostly focused on short-term events such as mass shootings and terror attacks. Furthermore, studies suggested that exposure through traditional and social media leads to increased symptoms of distress (8, 9).

Due to the prolonged duration, compared to punctual events, the consequences of war can be more severe and extensive and aggravate over time. Beyond immediate conflict, the trauma can include flight experiences. Moreover, economic changes, such as inflation, can result, with global impact. These aspects might be pathways through which the mental health of populations not immediately involved in the war might suffer (10, 11).

In a previous study, we found that the invasion of Ukraine by Russia had a strong impact on the mental health of the general population in Germany in the first days and weeks (12). The effect of the early stages of the war on mental health has also been shown in other countries not directly involved in the war. Taiwanese and Polish participants in a study by Chudzicka-Czupała et al. showed high levels of distress caused by media war scenes (5). Another study found high proportions of moderate to severe levels of anxiety and depression among college students in Czech Republic in the month after the invasion and symptoms were positively correlated to feeling concerned about the war (13). Fear of the war was also found to be negatively correlated with Quality of Life in the Romanian general population (14). The war also seems to be correlated with a worsening of symptoms of people already dealing with mental health issues in Denmark (15). The effects of the prolonged exposure to the war have not yet been studied.

Earlier work suggests the possibility of habituation to traumatic stress, leading to a decrease in negative emotional reactions (16, 17). This habituation could reduce the burden on mental health but also decrease the engagement. Specifically, charities have reported a decrease of donations related to war in the German population (18). Still, it is not known how fast the decrease of emotional burden occurs, to what extent it happens, and which variables are associated with specific patterns.

Therefore, the aim of this study was to assess mental health in the German population 6 months after the Russian invasion in Ukraine in comparison to the early weeks of the war.

2. Methods

We use data from the prospective cohort for digital health research in Germany (DigiHero, DRKS Registration-ID: DRKS00025600). The cohort was initiated in January 2021 in Halle (Saale) and since then expanded to 10 German federal states, with a total sample currently approaching 70,000 households.[1] In the randomly selected districts, samples are derived from resident registries, and we invite persons aged 18 to 85 years from *ca.* 1/3 households. In cities above 100,000 inhabitants, we restrict the invited sample to 30,000. The response is regionally differing between 3 and 5%. The registration for the study and the subsequent questionnaires are offered online. Immediately after registration, participants receive a baseline questionnaire. The cohort employs three to four questionnaires or other data collection events per year and will become part of the newly established German Center for Mental Health.

The baseline assessment contains questions about age, sex, if participants were born within the current boarders of Germany, relationship status, net household income, and household composition (number, age and relation of all household members). Further, we ask for school, higher and vocational training and categorize education by the ISCED criteria from 1997 (19). Information on the state and area of residence is derived from recruitment information.

In the beginning of March 2022, 1 week after the Russian invasion of Ukraine the by then recruited 27,509 cohort participants from Saxony-Anhalt, Saxony, and Bavaria received a questionnaire on mental health and fears related to the impact of the war (T1). Six months later, from 5th of September to the 4th of October, the 19,432 participants who participated in the first survey received a follow-up questionnaire (T2), assessing the same aspects.

The T1 and T2 questionnaire measured anxiety and depressive symptoms with the respective modules of the Patient Health Questionnaire. The anxiety module (GAD-7) consists of seven items (e.g., "Feeling nervous, anxious or on edge," "Not being able to stop or control worrying") measuring symptom severity over the last 2 weeks on a scale from 0 (not at all) to 3 (nearly every day), leading to a score ranging from 0 to 21, with higher scores indicating higher symptom severity. The internal consistency of the instrument is excellent with a Cronbach alpha of 0.92 (20). The depression module (PHQ-9) uses the same scale and time reference for nine items (e.g., "Little interest or pleasure doing things," "Feeling down, depressed, or hopeless") leading to a score from 0 to 27. The PHQ-9 shows good internal consistency (Cronbach alpha = 0.89) (21). For both scales, a cut-off indicating clinically relevant symptoms has been established at a score of $\geq$10 (21, 22). The questionnaires are widely used in psychiatric and epidemiological studies.

Emotional and physical distress was measured with an adapted version of the Peritraumatic Distress Inventory (PDI) (23). The adaption is described elsewhere (12). In brief, the instrument has five items for emotional (e.g., "I feel helpless," "I feel frustrated and angry about not being able to do more") and four items for physical distress (e.g., "I have trouble concentrating," "I have physical reactions like sweating, shaking, and my heart pounding") each measured on 5-point Likert scale from not at all (0) to extremely true (4) scale. The

1 www.medizin.uni-halle.de/digihero

10.3389/fpsyt.2023.1167615

Cronbach alpha for the emotional distress subscale is 0.85 and 0.79 for the physical distress subscale. The scores for emotional and physical distress are calculated by the mean across the items.

To measure the fears related to the impact of war, we modified an instrument assessing fear of different life events used in the German National Cohort, adding the fear of consequences of war and using a scaled response instead of dichotomous. Fear is measured on a 4-point scale from 0 (not at all) to 3 (very strong). In the follow-up questionnaire (T2) at 6 months, we added a question specifying the consequences of war participants are afraid of, including worsening of individual financial situation, expansion of military conflict to other countries, economic crisis, and the exacerbation of consequences of the climate crisis. This follow up question was asked only among participants who indicated any fears of war consequences.

We report the proportion of participants with clinically relevant symptoms of depression and anxiety at both time points and proportion of different aspects of fears. In addition, we studied how anxiety, depression, and distress were associated with age (stratified by sex) for both time points using generalized additive models as implemented in the R-package *mgcv* (24). To identify characteristics associated with fear of specific consequences of the war, multiple ordinal regression was used after proportional odds assumption was confirmed. Univariable and multivariable logistic regression models were employed to determine risk factors for persistent clinical relevant symptoms of depression and anxiety. Sociodemographic variables such as age, sex, migration background, education and region and characteristics of residence, which might affect the reaction to the events, as well as the fear of war at T1 were chosen as possible predictors for persistent clinically relevant symptoms.

The study adheres to the Helsinki Declaration and was approved by the Ethics Committee of the Martin Luther University Halle-Wittenberg. All participants of DigiHero provided informed consent for study participation.

3. Results

Out of the 19,432 respondents of the first survey, 13,934 (71.7%) answered the same questions 6 months later. Their characteristics are displayed in Table 1. Younger individuals, males, and participants with lower education were less likely to participate in the second survey, but the differences were minor (Supplementary Table S1). There were no substantial differences in mental health and fear at T1 between responders and non-responders to T2.

While there was a decrease of anxiety and emotional distress from T1 to T2, a substantial level of mental health impairment persisted (Figure 1). The proportion of participants reporting clinically relevant symptoms of anxiety decreased by 11.3 percentage points from the measurement in early weeks of war (27.3%) to 6 months later (16%). The decrease in percentage of participants reporting clinically relevant symptoms of depression was not as pronounced (from 19.5% in the early weeks to 16.4% 6 months later).

The persistent clinically relevant symptoms of anxiety and depression were more common in women, persons with migration background, singles, for those living in households with children, and those with low income (Table 2). Fear of war at T1 was the strongest predictor for persistent clinically relevant symptoms of anxiety and depression.

TABLE 1 Participants characteristics.

	n (%)
Overall	13,934 (100.0)
Age Groups*	
0–29	1,198 (8.6)
30–39	2,214 (15.9)
40–49	2,355 (16.9)
50–59	3,451 (24.8)
60–69	3,103 (22.3)
70+	1,612 (11.6)
Sex*	
Male	5,547 (39.8)
Female	8,374 (60.1)
Diverse	13 (0.1)
Born in Germany	
Yes	13,539 (97.2)
No	370 (2.7)
Missing	25 (0.2)
Education	
Low	489 (3.5)
Medium	4,075 (29.2)
High	8,786 (63.1)
Missing	584 (4.2)
Net household income (in Euro)	
<1750	1815 (13.0)
1750–3,000	3,915 (28.1)
3,000–4,000	2,895 (20.8)
4,000–5,000	2,153 (15.5)
>5,000	2,134 (15.3)
Missing	1,022 (7.3)
In partnership	
Yes	11,015 (79.1)
No	2,717 (19.5)
Missing	202 (1.4)
Child < 18 living in household	
Yes	3,326 (23.9)
No	10,529 (75.6)
Missing	69 (0.5)
State	
Saxony-Anhalt	9,693 (69.6)
Saxony-Anhalt	2049 (14.7)
Bavaria	1998 (14.3)
Others	168 (1.2)
Missing	26 (0.2)
City	
Yes	6,146 (44.1)
No	7,633 (54.8)
Missing	155 (1.1)

*obligatory answers.

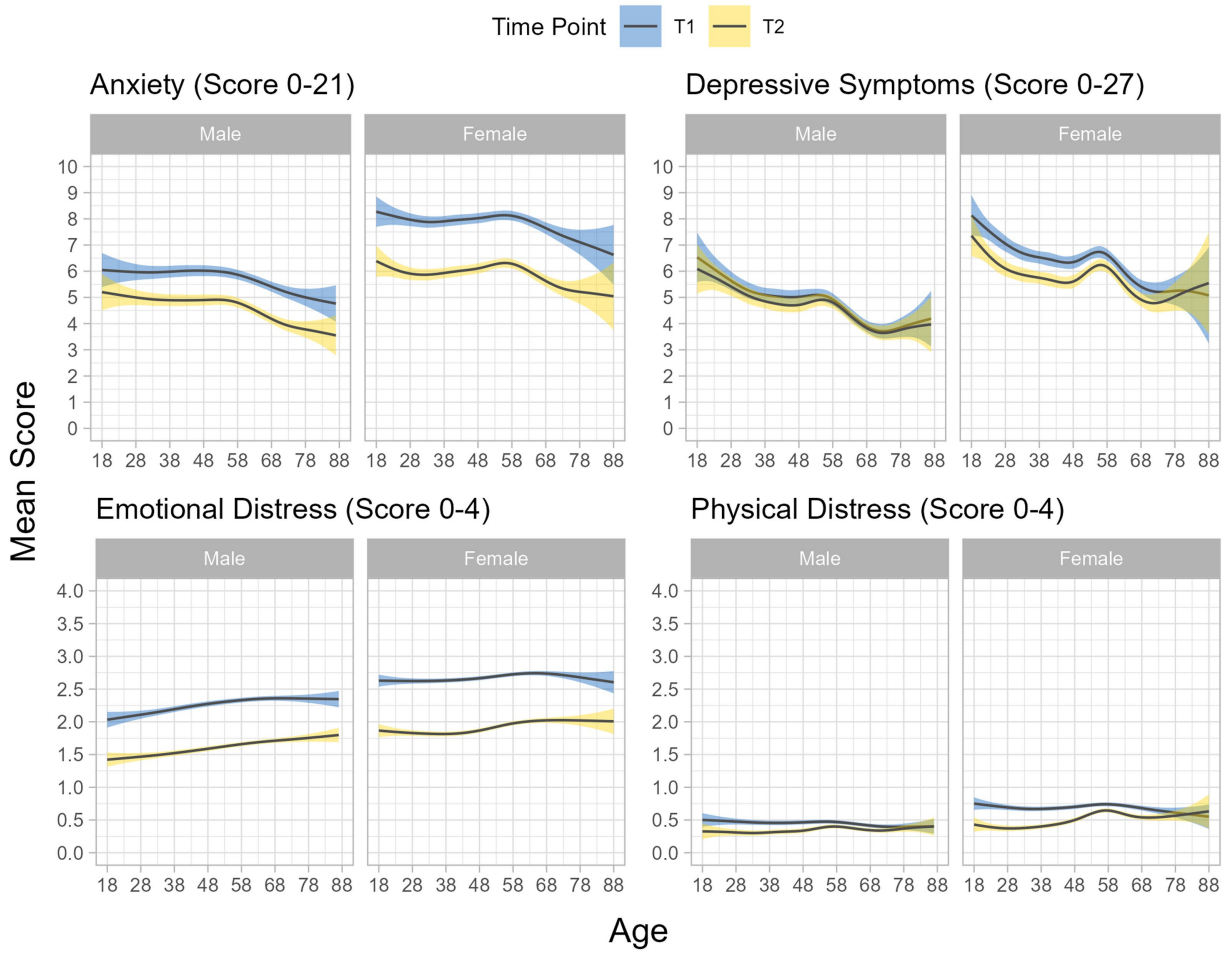

FIGURE 1
Average value of mental health indicators by age and sex* at the start of the war (T1) and 6 month later (T2). Figures are obtained by ggplot, applying the gam function with splines in mgcv library. *due to group size, analysis by age was only carried out for male and female sex.

With respect to fears, there were minor reductions for most investigated diseases or events (Figure 2). In contrast, there was a substantial reduction for fears of war consequences. Nevertheless, the fear of war consequences was much higher than any other fear also 6 months after the beginning of war, and around half of the participants reported very strong or strong fear.

At the T2, the dimensions of the fear of war consequences were asked in more detail (Figure 3). Fears of economic crisis, climate crisis and personal financial situation were all more pronounced than the fear of military expansion of the war. The most common fear was of economic crisis, with one third of the respondents reporting a very strong fear.

All fears related to war consequences were more pronounced in older people, except fears of worsening personal financial situations, which displayed no association with age (Table 3). Fears of conflict expansion were particularly pronounced among women. Consequences for personal financial situations displayed the strongest gradient across the income groups, with lesser effects in affluent households. Participants with children under 18 years were particularly affected by fears regarding personal financial situation in the context of war. Participants from Bavaria displayed substantially less fears in all assessed dimensions compared to Saxony-Anhalt and Saxony. Participants from rural regions were affected more strongly by all fears of consequences of war apart from those related to climate change. Education displayed no clear gradient for the fears.

4. Discussion

While the impairment of mental health was less pronounced after 6 months than immediately after the start of the war in Ukraine, elevated symptoms of anxiety and depression remained common. Most recent data on the proportion of people having clinically significant symptoms of anxiety and depression for the German population comes from the German National Cohort (NAKO), which has a sample with similar characteristics to our study sample (25). About 4.3 and 4.7% of NAKO participants displayed clinically relevant scores of anxiety before and at the beginning of the Covid-19 pandemic, respectively, and 6.4 and 8.8% of depression (26). The presented data show two to three times higher percentages of clinically relevant symptoms of anxiety and depression 6 months after the beginning of the war. Therefore, even if there is some indication of a less pronounced reaction than in the beginning of war, the impairment of mental health is still substantial.

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TABLE 2 Multi-and univariable logistic regression models for predictors of persistent anxiety and depression.

	Anxiety		Depression	
	OR [95% Confidence Interval]			
	Univariable	Multivariable	Univariable	Multivariable
Age (in years)*				
>50	1.009 [1.002; 1.016]	1.015 [1.006; 1.024]	0.999 [0.993; 1.005]	1.006 [0.999; 1.015]
<50	0.941 [0.925; 0.957]	0.922 [0.903; 0.941]	0.934 [0.913; 0.955]	0.912 [0.891; 0934]
Sex				
Male	Ref.			
Female	1.93 [1.71; 2.19]	1.37 [1.19; 1.58]	1.72 [1.52; 1.95]	1.27 [1.10; 1.46]
Diverse	11.92 [3.82; 36.07]	4.83 [1.03; 22.68]	11.52 [3.69; 34.86]	3.07 [0.68; 13.74]
Born in Germany				
Yes	Ref.			
No	1.19 [0.85; 1.63]	1.65 [1.15; 2.36]	1.25 [0.89; 1.71]	1.70 [1.18; 2.46]
Education				
High	Ref.			
Medium	1.35 [1.20; 1.52]	1.08 [0.94; 1.24]	1.72 [1.52; 1.94]	1.29 [1.12; 1.48]
Low	1.44 [1.08; 1.89]	1.16 [0.80; 1.67]	2.23 [1.71; 2.87]	1.20 [0.86; 1.68]
Net household income (in Euro)				
<1750	Ref.			
1750–3,000	0.65 [0.55; 0.77]	0.66 [0.55; 0.80]	0.53 [0.45; 0.62]	0.59 [0.50; 0.71]
3,000–4,000	0.59 [0.50; 0.71]	0.59 [0.47; 0.72]	0.45 [0.37; 0.53]	0.51 [0.41; 0.62]
4,000–5,000	0.49 [0.40; 0.60]	0.46 [0.36; 0.58]	0.36 [0.29; 0.44]	0.39 [0.31; 0.50]
>5,000	0.35 [0.28; 0.43]	0.34 [0.26; 0.44]	0.27 [0.21; 0.33]	0.30 [0.23; 0.39]
In partnership				
Yes	Ref.			
No	1.38 [1.21; 1.57]	1.21 [1.03; 1.43]	1.83 [1.62; 2.08]	1.38 [1.18; 1.62]
Child < 18 living in household				
No	Ref.			
Yes	1.12 [0.99; 1.27]	1.17 [0.99; 1.38]	0.94 [0.82; 1.07]	0.92 [0.78; 1.09]
State				
Saxony-Anhalt	Ref.			
Saxony	0.96 [0.82; 1.12]	0.97 [0.81; 1.16]	0.88 [0.74; 1.03]	0.87 [0.72; 1.05]
Bavaria	0.78 [0.66; 0.93]	0.89 [0.73; 1.09]	0.92 [0.78; 1.08]	1.03 [0.84; 1.25]
Others	0.43 [0.19; 0.82]	0.84 [0.24; 2.85]	0.70 [0.37; 1.22]	0.82 [0.24; 2.81]
City				
Yes	Ref.			
No	1.08 [0.97; 1.21]	1.05 [0.92; 1.20]	1.05 [0.94; 1.18]	1.11 [0.96; 1.27]
Fear of war consequences at T1 [0–4]	2.43 [2.25; 2.64]	2.36 [2.16; 2.58]	1.76 [1.63; 1.89]	1.77 [1.63; 1.93]

*Segmented analysis with break-point = 50.

Fear of war consequences was still the most prominent fear 6 months after the start of war in comparison to a range of other events or health related outcomes. In the beginning of the war, we did not distinguish between the various components, but 6 months later the economic fears were the leading component. Economic crises have been found to have a strong impact on population mental health, especially regarding depressive symptoms and anxiety, affecting groups less affluent more than others (10, 11). Therefore, the impact of war on mental health through triggering an economic crisis is plausible. Still, 6 months after the beginning of the war, a substantial fraction of the population feared the extension of the military conflict. This indicates the difficulty and complexity of the situation – some of the fears became more estimable as for example the increased living costs, while others remain potential and undefined.

10.3389/fpsyt.2023.1167615

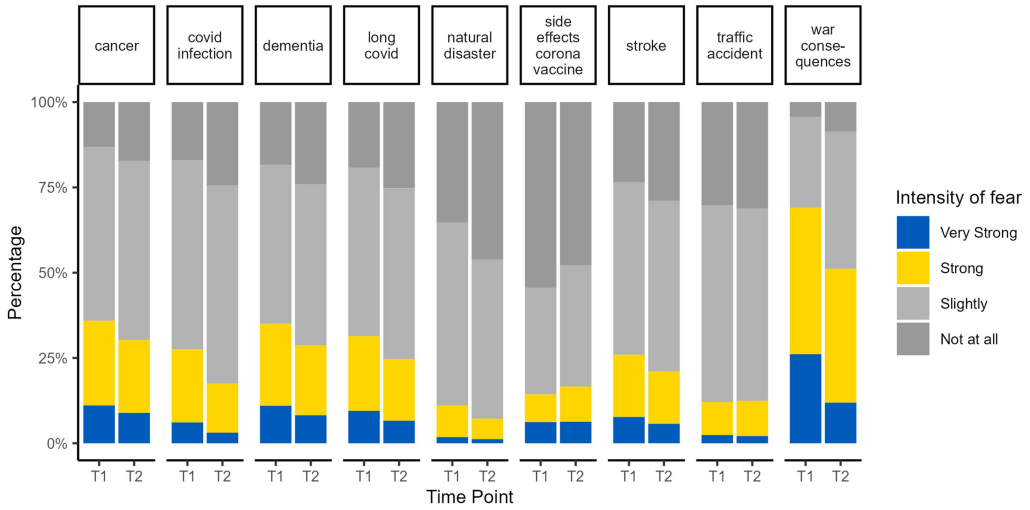

FIGURE 2
Fears of health related and other events at the start of the war (T1) and 6 month later (T2).

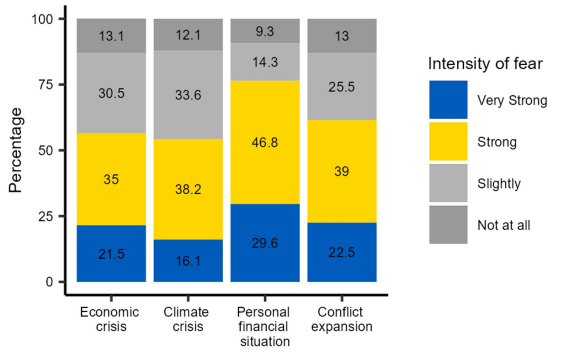

FIGURE 3
Specific fears related to war 6 month after the start of the war (T2).

We also found certain groups being more affected by continuing symptoms of anxiety, depression, distress, and by fear of the consequences of war. We already reported that general fear of war increased with age (12). The same pattern was observed for the specific fears of economic crisis, climate crisis, and conflict expansion. This is in contrast to the observations made during the Covid-19 pandemic, where higher age was a protective factor for mental health impairment (27). Women had higher risk of persistent depressive and anxiety symptoms and higher levels of fear of all war consequences. This is in line with the literature before and during the Covid-19 pandemic, where women always displayed higher symptom burden for anxiety, depression, and distress (28–30).

The fears of war consequences were higher in regions with Eastern bloc history, where even 30 years later past memories can be relevant. The higher fear of economic crisis in the Eastern States Saxony-Anhalt and Saxony, compared to Bavaria in West Germany, could further stem from the worse economic situation in Eastern Germany, with lower income (31) and higher unemployment (32).

Participants with lower household income had greater fear of worsening of their individual financial situation than those more affluent. In contrast, this correlation was not found for the fear of an economic crisis, even though this might especially affect low-income households (10). Apparently, general concerns related to an economic crisis might go beyond the situation involving the own precarious situation. Living in a low-income household was also identified as a risk factor for continuing clinically relevant symptoms of anxiety and depression. Hence, this group seems especially at risk of mental health impairment from the consequences of war.

Another vulnerable group were persons with migration background. We have a low proportion of persons with migration background in our sample, partly due to the recruitment regions and a high proportion of participants from rural regions. Thus, our sample is surely not representative of migrants living in Germany. Refugees from Ukraine and other countries are probably not represented in our study, however, this groups is expected to have an even higher burden of mental health impairment due to flight experiences and (33, 34) and at risk for re-traumatization by the continuing war (35).

4.1. Strength and limitations

The sample of DigiHero is population-based with respect to sampling, but in the composition not representative of the German population. Given the higher proportion of the better-educated being more likely to participate in health related studies, it is important that no education gradient was present for the studied questions. The sociodemographic characteristics of the DigiHero sample are similar to the participants of the NAKO cohort (25). In the NAKO study, participants received three postal invitations or were contacted by phone with a resulting response of *ca.* 20%. In an additional effort, potential respondents were even visited at home. In a previous analysis, we demonstrated that those recruited with the extensive efforts of home visits did not differ from those recruited before (36). In the DigiHero study, only a single invitation was sent, accepting a lower response at higher efficiency. With respect to online participation only,

10.3389/fpsyt.2023.1167615

TABLE 3 Multivariable ordinal regression for characteristics associated with specific aspects of fears.

	Economic crisis	Climate crisis	Financial situation	Conflict expansion
	OR [95%-CI]			
Age [per 10 years]	1.16 [1.13; 1.20]	1.15 [1.12; 1.18]	1.02 [1.00; 1.05]	1.25 [1.21; 1.28]
Sex				
Male	Ref.			
Female	1.66 [1.55; 1.78]	1.82 [1.70; 1.95]	1.54 [1.44; 1.64]	2.42 [2.26; 2.60]
Diverse	3.89 [1.06; 14.76]	2.50 [0.75; 8.37]	3.9 [1.11; 14.45]	6.85 [1.90; 28.84]
Born in Germany				
Yes	Ref.			
No	0.96 [0.78; 1.18]	1.07 [0.87; 1.32]	0.87 [0.71; 1.07]	0.99 [0.81; 1.23]
Education				
High	Ref.			
Medium	1.17 [1.08; 1.26]	0.90 [0.84; 0.97]	1.36 [1.26; 1.47]	1.04 [0.96; 1.12]
Low	0.87 [0.71; 1.07]	1.02 [0.83; 1.26]	0.81 [0.66; 1.00]	0.84 [0.68; 1.03]
Net household income				
<1750	Ref.			
1750–3,000	1.02 [0.91; 1.15]	0.93 [0.83; 1.04]	0.74 [0.66; 0.84]	0.98 [0.88; 1.10]
3,000–4,000	0.95 [0.84; 1.08]	0.86 [0.76; 0.97]	0.64 [0.57; 0.73]	0.88 [0.77; 0.99]
4,000–5,000	0.98 [0.86; 1.13]	0.85 [0.74; 0.97]	0.52 [0.46; 0.60]	0.89 [0.78; 1.01]
>5,000	0.84 [0.73; 0.96]	0.79 [0.69; 0.90]	0.35 [0.31; 0.40]	0.75 [0.65; 0.86]
In partnership				
Yes	Ref.			
No	0.83 [0.75; 0.91]	0.76 [0.70; 0.84]	0.73 [0.67; 0.80]	0.80 [0.73; 0.88]
Child < 18 living in household				
No	Ref.			
Yes	1.11 [1.01; 1.21]	0.92 [0.84; 1.00]	1.32 [1.21; 1.44]	0.97 [0.89; 1.05]
State				
Saxony-Anhalt	Ref.			
Saxony	0.84 [0.76; 0.92]	0.79 [0.72; 0.87]	0.88 [0.80; 0.97]	0.91 [0.82; 1.00]
Bavaria	0.63 [0.57; 0.69]	0.86 [0.78; 0.95]	0.56 [0.51; 0.62]	0.68 [0.62; 0.76]
Others	0.72 [0.38; 1.39]	1.09 [0.57; 2.08]	0.72 [0.38; 1.36]	0.60 [0.32; 1.12]
City				
Yes	Ref.			
No	1.35 [1.26; 1.45]	1.00 [0.93; 1.07]	1.45 [1.35; 1.55]	1.21 [1.13; 1.29]

we demonstrated in an earlier study that across a large sample of health related questions responses provided in the online only arm did not differ from responses provided in a sample, in which paper-based participation was possible (37). Our sample is likely representative of the fraction of the population participating in epidemiologic studies. Beyond this group, achieving representativeness is and will be increasingly difficult (38). Still, Participants of DigiHero were recruited independently of the here studied question and among them the response to the first questionnaire was high. Similarly, the fraction responding to the second questionnaire was also high and participation was not conditional on higher values of anxiety or depressive symptoms in the first questionnaire. Furthermore, the invitation to the first questionnaire spoke only of a "current topic" and did not mention the war. Overall, we cannot exactly estimate the level of concern for the entire German population, but our data inform about a substantial public health problem in this context.

The big sample, with coverage of rural and urban regions from three federal states in Germany are strengths of the study. The timely collection of comparison data at the beginning of the war was an advantage for the assessment of the effect of war after 6 months of exposure. This comparison was possible with a high response proportion for online surveys (39). Thus, we are confident of the relevance of our results and their contribution to mental health monitoring during prolonged mass traumatic events. The continuous assessment of mental health indicators is

important and should include other factors, such as the media exposure.

4.2. Conclusion

While an impairment of mental health related to the Russian invasion of Ukraine decreased, the negative effects persisted at a high level 6 months after the beginning of the war. Fear of the consequences of war still dominated across a range of potential fears. The concerns were likely more differentiated then in the beginning of war. Less affluent persons were more affected by fears regarding their personal financial situation related to the war than more affluent persons. The findings are relevant on a global level, as studies conducted immediately after the start of the war demonstrate a significant impact on mental health in countries beyond Ukraine and its neighboring countries (5, 15). Our study contributes to this body of knowledge by showing that the effects persist for up to 6 months after the initial shock of the war and may result in persistent mental health sequelae, particularly for already vulnerable groups.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethik-Kommission der Medizinischen Fakultät der Martin-Luther-Universität Halle-Wittenberg (ethics vote: 2020-076). The patients/participants provided their written informed consent to participate in this study.

Author contributions

JM, SD, BK, DC, CG, and RM developed the questionnaire, conducted the analyses, and drafted the manuscript. AB and OP were responsible for data curation. NO provided expert knowledge in the field of psychiatry. MB, DS, TF, MG, JH, IM, JR, MG, and RM developed the design of the DigiHero study. All authors provided comments on the manuscript and accepted the final version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1167615/full#supplementary-material

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COVID-19 or threat of a nuclear war in Europe? A cross-sectional study of anxiety levels in adults living in Portugal

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Background: Since 2019, Europe has experienced ongoing stressors with the emergence of the COVID-19 pandemic and the Russian–Ukrainian War, which have had social, financial, physical, and psychological impacts. Studies suggest that anxiety, fear, post-traumatic stress disorder, depression, and other psychological disorders are common in such situations, and there is a need for more research on the impact of the war on mental health in Portugal. The main goal of the present study was to assess the impact of the fear of COVID-19 and anxiety related to nuclear war on the general anxiety levels of adult individuals living in Portugal.

Methods: A cross-sectional study was conducted from May to July 2022 using an online questionnaire built on the Google Forms platform. Portuguese-speaking male and female individuals aged 18 years or older, who provided informed consent and agreed to participate, were included. The outcome variable was defined using the Portuguese version of the GAD-7 scale, while the main predictors were the FCV-19S and the NWA Scale in Portuguese. Linear and logistic regression models were used to test associations between predictors and outcome variable.

Results: The study included 1,182 participants, with a mean age of 46.5 (±11.7) years, mostly women (80.6%). The global mean GAD-7 score was 5.8 (±4.5) points, and 17.9% of the participants scored above the 10-point cutoff. Higher scores were found in both the FCV-19S and the NWA scale among participants with anxiety, as measured by both a 10-point cutoff ($p<0.001$), and GAD-7 scale mean scores ($p<0.001$). The study showed that fear of COVID-19 [OR of 1.133 (95%CI: 1.097–1.170)] and, at a lesser extent, nuclear war anxiety [OR of 1.020 (95%CI, 1.009–1.031)] contribute to anxiety in the general population. This is also true for those with a personal history of anxiety, revealed by multiple regression.

Discussion: This study contributes to the research on COVID-19's impact on anxiety and provides the first comprehensive assessment of nuclear war anxiety in Portugal. Results highlight the need for long-term care for anxiety, as prevalence is expected to increase due to the pandemic and war, even in non-conflict areas like Portugal.

KEYWORDS

COVID-19, pandemic, mental health, anxiety, nuclear war, Portugal

1. Introduction

Pandemics, as well as wars, are well-documented stressors with social, financial, physical, and particularly psychological impacts (1–4). Since 2019, the world, particularly Europe, has experienced continuous stress factors with the emerging of SARS-COV2 pandemic and, shortly after, the Russian–Ukrainian War.

The SARS-COV2 pandemic, first identified in Wuhan, China, in December 2019 and quickly expanded to a worldwide scale (5). It was declared a pandemic by the World Health Organization on 11th March 2020 (6), and the first case in Portugal was reported on 2nd March 2020 (5). Governments worldwide, especially in Europe, instituted measures to minimize the transmission and impact on health and the economy during the pandemic. The Portuguese Government's response was swift, including various restrictions such as sanitary fences, closure of commercial establishments and educational institutions, and mandatory confinement at home for various periods (5). At the end of December 2020, the first vaccine against COVID-19 was administered at Centro Hospitalar Universitário de São João, in Porto, Portugal, marking the beginning of the vaccination plan (5), and the gradual decrease in mortality (7). However, the situation in healthcare was described as unsustainable in January 2021 (5), with the main peak between October 2020 and March 2021 (8), followed by another peak in mortality between December 2021 and March 2022 (8). By the end of April 2022, it is estimated that there were more than 65 thousand daily infections and more than 22 thousand deaths due to COVID-19 in Portugal (9).

On the other hand, the Russian–Ukrainian War, beginning on 24 February 2022, rapidly emerged as the biggest humanitarian emergency in Europe since the Second World War (2). Although Ukrainians are the most affected, with millions of refugees, death of family or friends, and damage to patrimony (2), the economic and psychological impact of the war in Europe cannot be disregarded. Among other threats, the fall of financial markets around the world and the rise of prices for oil, natural gas, metals and food products (3, 10), and it introduced the possibility of a nuclear war (11).

Some studies suggest that anxiety, defined as fear or nervousness about what might happen, may be exacerbated in stressful or threatening situations such as wars and pandemics. Anxiety and fear, as well as post-traumatic disorder, depression and other psychological disorders are well documented in previous pandemics (12–15) and wars (1, 16), especially among soldiers and survivors (1).

The outbreak of COVID-19 has led to stressful situations worldwide, and there are several studies on the mental health concerns related to the virus (17–22). In Portugal, the literature also highlights the impact of the COVID-19 pandemic on psychological distress (23–26).

While Ukrainians have been the most impacted by the Russian–Ukrainian War, residents of other countries also experience anxiety and fear (2, 27, 28). A study revealed that Czech university students were highly concerned about the news of the war, with more than one-third of the participants exhibiting moderate and severe anxiety and over two-fifths exhibiting moderate, moderately severe and severe depression (2). Another study reported about 42.1% of the participants felt depressed due to the possibility of nuclear war (28).

A recent population survey of 621 adults in Portugal observed that 77% of the participants were afraid of a nuclear war in Europe following Russia's invasion of Ukraine, and less than 20% believed that there is no risk for European citizens' security (29). However, this topic has been less researched compared to the impact of COVID-19 pandemic on societies, and there are no published studies on the impact of the Russian–Ukrainian War on mental health in Portugal.

The main goal of the present study was to assess the impact of the fear of COVID-19 and anxiety related to nuclear war on the general anxiety levels of adult individuals living in Portugal. We hypothesize that demographic and psychological factors, as well as individual experiences and perceptions related to current events like the COVID-19 pandemic and the threat of nuclear war, are associated with anxiety symptoms.

2. Materials and methods

2.1. Study design, setting, and sample

A cross-sectional study was performed. From May to July 2022, an online questionnaire built into the Google Forms platform was conducted among adults living in Portugal.

In this study were included Portuguese speaking male or female individuals aged ≥18 years, able to read and write in Portuguese, with access to the Internet/email, after giving their informed consent and agreed to participate. Individuals were recruited by receiving the web link of the questionnaire through the research team's network of contacts, through community groups in social networks, and through other participants by snowball sampling.

Taking into account that in Portugal reside 10,343,066 individuals (30), the minimum required sample size of $n = 385$ was calculated for proportions, considering the most conservative scenario (a proportion of 50%), a level of confidence of 95% and an error margin of 5%.

The present study observed the Declaration of Helsinki ethical principles for medical research involving human subjects and was approved by the Ethics Committee of the University of Beira Interior – Portugal (CE-UBI-Pj-2022-038-ID1367). Electronic consent was obtained from all subjects involved in the study. Responses to the electronic questionnaire were anonymous.

The STROBE guidelines were used to ensure the reporting of this cross-sectional study (31).

2.2. Data collected by the questionnaire and study variables

The main predictors were defined as the Fear of COVID-19 Scale and Nuclear War Anxiety Scale in Portuguese.

Fear of COVID-19 Scale (FCV-19S): seven items rated on a five-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agreeing), such as "I am most afraid of coronavirus-19," "It makes me uncomfortable to think about coronavirus-19," "My hands become clammy when I think about coronavirus-19," "I am afraid of losing my life because of coronavirus-19"; developed by Ahorsu and colleagues in 2020 (32). A recently published systematic review of studies from 21 countries (16 languages, including Portuguese) synthesized the psychometric evidence for the Fear of COVID-19 Scale and found that it is a valid and robust instrument for assessing fear of COVID-19 (33). A total score is calculated by adding up the scores for the individual items, with a range of possible scores from 7 to 35. Higher

scores indicate a higher fear of COVID-19. In the present study, the version validated for the Portuguese population by Magano and colleagues in 2021 (34) was used and found to have good internal consistency (Cronbach's alpha of 0.89).

Nuclear War Anxiety (NWA) Scale: twenty-one questions rated on a seven-point Likert scale (from 1 = strongly disagree to 7 = strongly agree), such as "Eliminating the possibility of a nuclear war should be everyone's highest priority," "The threat of a nuclear war haunts my thoughts," "Eliminating the possibility of a nuclear war is worth any price," "Considering the prospect of nuclear war, I can find little hope for the future"; developed by Chandler in 1991 (35). A total score is calculated by adding up each item score (ranging from 21 to 147), and the higher the score, the greater the fear of nuclear war.

This scale measuring fear from nuclear war that has been published is the only one of its kind. Since there was no existing Portuguese version of the scale, our team used the translation methodology that we typically follow (36). This methodology, which is based on Brislin's four standard techniques (37), was used to ensure equivalence between the original and translated measure. The first step was to have a panel of six general practitioners who were native Portuguese speakers and fluent in English translate the English-language items. The translations were then reviewed by the authors who were not part of the initial translation process to ensure accuracy, semantics, and cultural appropriateness. Each item from the scale was evaluated one by one, and the translated item that best retained the original meaning and conveyed it in the simplest form was chosen. Accuracy, semantics, and cultural appropriateness were prioritized during the selection process, and items were adapted where needed. Based on all the inputs, an initial translated version was created for the scale. The final version of the Nuclear War Anxiety (NWA) Scale was back-translated by a native English speaker and matched with the original version. Suitable modifications were made to ensure that the same meaning was conveyed while also retaining cultural appropriateness. The final Portuguese version was then pilot-tested in 20 individuals from the general population who were not part of the survey to ensure language and cultural appropriateness. No alterations to the items were necessary in terms of ambiguity or misinterpretation. In the present study, Cronbach's alpha (internal consistency) for Nuclear War Anxiety (NWA) Scale was 0.84.

The following covariates were also collected: gender, age, marriage status, educational level, employment status, previous COVID-19 infection, previous anxiety disorder and previous exposure to war zones.

The Generalized Anxiety Disorder (GAD-7) scale in the Portuguese version (38) was used to define the outcome variable. The scale was used as a continuous variable according to crude values, which ranged from 0 up to 21. It was also used as a dichotomous variable (present/absent) using a 10-point cutoff, as sensitivity and specificity exceeded 0.80 (39). This approach allowed us to check the consistency of the detected predictors in both model building strategies.

The Generalized Anxiety Disorder (GAD-7) Scale is a seven item anxiety scale rated on a 4-point Likert scale (from 0 = not at all to 3 = nearly every day) (39), such as "Feeling nervous, anxious, or on edge," "Not being able to stop or control worrying," "Worrying too much about different things." It has already been adapted and validated for the Portuguese population (38). Adding the scores from the items of the scale allows the calculation of a total score. In the present study, Cronbach's alpha for the Generalized Anxiety Disorder (GAD-7) Scale was 0.90, indicating a high level of internal consistency.

2.3. Statistical analysis and model building

All data were analyzed using IBM SPSS Statistics© and STATA Statistical Package© software and the alpha level was set at 0.05. Recommendations from the TRIPOD statement were followed to report multivariable prediction model results (40).

To test associations between predictors and outcome variables, we used linear and logistic regression models. For model building, we first performed bivariate associations in order to identify significant variables to be included at a 0.25 alpha level (41). To check the applicability of parametric tests, normality of continuous variables was assessed using Kolmogorov–Smirnov test. Multivariable models were created using step-up and step-down approaches, and different models were validated using homoscedasticity tests and validation tools.

3. Results

1,204 participants were enrolled in the study, but 22 (1.8%) did not answer some questions. Due to this low rate of missing data, we decided to exclude them. Therefore, we included 1,182 participants with complete data, with a mean age of 46.5 (±11.7) years, mostly women (80.6%). Almost all participants were employed (91.7%) and most were married (63.1%). 60.5% had a previous COVID-19 infection, 43.2% had a previous history of anxiety, and only 5.6% had been exposed to a war zone.

Detailed baseline data on demographic and clinical features are reported in Table 1.

The global mean GAD-7 score was 5.8 (±4.5) points, and 17.9% of the participants showed scores above the 10-point cutoff. This was more pronounced in women versus men (19.3% vs. 11.8% prevalence, $p = 0.008$, chi-squared test = 7.114), single persons (43.3%, $p < 0.001$, chi-squared test = 27.146) and students (45.7%, $p < 0.001$, fisher exact test = 25.219). We also found a trend for lower anxiety prevalence with higher educational levels, from being higher in elementary school levels (40%) to lower in master or doctorate levels (14.6%) ($p = 0.007$, fisher exact test = 11.579). Participants with higher anxiety levels were also younger (mean: 42.7 years (±13.0) vs. 47.4 (±11.3), $p < 0.001$, independent samples t-test = −4.859). These trends were also consistent when analyzing GAD-7 mean scores among those subgroups (Table 1).

Higher scores were found, both in Fear of COVID-19 Scale and Nuclear War Anxiety scale, among participants with anxiety, either considering a 10-point cutoff ($p < 0.001$, independent samples t-test = 10.311 and 7.616, respectively), or in GAD-7 scale mean scores ($p < 0.001$, Pearson linear correlation = 0.414 and 0.318 respectively) (Table 1).

Table 2 reports the most relevant results regarding the best-fitted multivariate models with major identified predictors. Figure 1 presents the regression line of the multivariate analysis to GAD-7 score.

Logistic regression for having "Anxiety" identified as major significant predictors: age (OR: 0.956 for each age year), having a previous COVID-19 infection (OR: 0.597), having previous anxiety (OR: 4.243), Fear of COVID-19 Scale (OR: 1.133 per unit increase in

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TABLE 1 Data from demographic and clinical variables collected from all participants and comparisons according to the major outcome variables.

Predictor variable [Mean±SD or *N* (%)]	Total	Anxiety*			Generalized Anxiety Disorder (GAD-7) score*	
		No	Yes	*p* value	Mean	*p*-value
No. of total participants	1,182	971 (82.1%)	211 (17.9%)	–	5.8 (±4.5)	–
Age	46.5 (±11.7)	47.4 (±11.3)	42.7 (±13.0)	<0.001†	–	<0.001§
Men	229 (19.4%)	202 (88.2%)	27 (11.8%)	0.008‡	4.7 (±4.1)	<0.001†
Women	953 (80.6%)	769 (80.7%)	184 (19.3%)		6.0 (±4.5)	
Married	746 (63.1%)	638 (85.5%)	108 (14.5%)	<0.001‡	5.4 (±4.3)	<0.001‡
Divorced	145 (12.3%)	117 (80.7%)	28 (19.3%)		6.0 (±5.0)	
Widowed	18 (1.5%)	18 (100%)	0 (0%)		4.0 (±3.2)	
Single	273 (23.1%)	198 (56.7%)	75 (43.3%)		6.8 (±4.7)	
Educ. Elementary school	5 (0.4%)	3 (60%)	2 (40%)	0.007#	9.2 (±8.0)	0.003‡
Educ. High school	250 (21.2%)	190 (76%)	60 (24%)		6.5 (±5.0)	
Educ. Superior/College	254 (38.4%)	374 (85.3%)	80 (14.7%)		5.9 (±4.4)	
Educ. Master/Doctorate	273 (40%)	404 (85.4%)	69 (14.6%)		5.2 (±4.2)	
Employed	1,084 (91.7%)	902 (83.2%)	182 (16.8%)	<0.001#	5.6 (±4.4)	<0.001‡
Unemployed	22 (1.9%)	16 (72.7%)	6 (27.3%)		7.0 (±6.0)	
Student	46 (3.9%)	25 (54.3%)	21 (45.7%)		9.4 (±5.3)	
Retired	25 (2.1%)	24 (96%)	1 (4%)		4.8 (±3.0)	
Healthcare professional	5 (0.4%)	4 (80%)	1 (20%)		5.2 (±3.1)	
Previous Covid-19 infection	715 (60.5%)	602 (84.2%)	113 (15.8%)	0.024‡	5.7 (±4.4)	0.366†
No previous Covid-19	467 (39.5%)	369 (79%)	98 (21%)		5.9 (±4.6)	
Previous Anxiety	511 (43.2%)	353 (69.1%)	158 (30.9%)	<0.001‡	7.8 (±4.7)	<0.001†
No previous Anxiety	671 (56.8%)	618 (92.1%)	53 (7.9%)		4.3 (±3.6)	
Previous War zone exposure	66 (5.6%)	53 (80.3%)	13 (19.7%)	0.74‡	5.7 (±4.7)	0.888†
No previous War zone exp.	1,116 (94.4%)	918 (82.3%)	198 (17.7%)		5.8 (±4.5)	
Fear of COVID-19 Scale	14.4 (±5.6)	13.5 (±5.2)	18.2 (±6.1)	<0.001†	–	<0.001§
Nuclear War Anxiety scale	87.5 (±18.9)	85.6 (±18.3)	96.3 (±18.9)	<0.001†	–	<0.001§

*Outcome data presented as values considering only the count of participants within each of the predictor variables. †Independent samples *t*-test. ‡Chi-squared test. #Fisher exact test. §Pearson correlation test. ⁑Kruskal–Wallis test.

questionnaire score), and Nuclear War Anxiety scale (OR: 1.02 per unit increase in questionnaire score).

Linear regression for "GAD-7 score" identified as major significant predictors: age (decrease in 0.064 points for each age year), being employed or a healthcare professional (decrease in 0.971 points), having previous anxiety (increase in 2.591 points), Fear of COVID-19 Scale (increase in 0.246 points for each unit), and Nuclear War Anxiety scale (increase in 0.041 points for each unit).

4. Discussion

The present study showed that the prevalence of moderate generalized anxiety symptoms in our sample (17.9%) is similar to the prevalence found in other studies about the impact of COVID-19 pandemic (19–21), but higher than the prevalence of anxiety in Portugal before COVID-19 outbreak (4.9%). When compared to the burden of the Russian–Ukrainian War 2022 (2), our prevalence seems to be lower (17.9% vs. 22.3%). However, this study only analyzed young adults, so the comparison must be made with caution.

As known from the literature, there are sociodemographic characteristics of patients that impact the prevalence of anxiety.

According to gender, we found that anxiety symptoms appear to be more pronounced in women. However, this variable was not present in the logistic or linear regressions. Most of the literature shows a higher prevalence of anxiety in women compared to men (2, 19–22). Some hypotheses in the literature suggest that women's psychological distress during the COVID-19 pandemic may be due to the negative impact on the workforce, where women represent a large proportion, and due to women's neurobiological responses to stressors (20, 42, 43). However, a study conducted in China during COVID-19 outbreak showed no differences between genders (44). Studies on gender differences in risk perception have shown that women are more concerned about risks involving their home and family, while men are more concerned about risks involving their working life (e.g., unemployment and economic problems) (45–47). Since the COVID-19 pandemic and Russian–Ukrainian War affect

TABLE 2 Predictors identified on multivariate analysis according to the major outcome variables.

Outcome – Anxiety (logistic regression)				
Predictor variables in the model	OR	Value of *p*	95%CI	
Age	0.956	<0.001	0.942	0.970
Previous COVID-19 infection	0.597	0.004	0.422	0.844
Previous Anxiety	4.243	<0.001	2.950	6.103
Fear of COVID-19 Scale	1.133	<0.001	1.097	1.170
Nuclear War Anxiety scale	1.020	<0.001	1.009	1.031
(Constant)	0.023	<0.001		
AUC: 0.822 (95%CI: 0.792; 0.852); Nagelkerke Pseudo-R^2: 0.313; Hosmer&Lemeshow $p = 0.484$. This model presented a sensitivity of 27% and a specificity of 96%, a positive predicted value of 59.4% and a negative predicted value of 85.9%.				

Outcome – Generalized Anxiety Disorder (GAD-7) score (linear regression)			
Predictor variables in the model	Coef.	Value of *p*	Std. Error
Age	−0.064	<0.001	0.009
Employed/Healthcare professional	−0.971	0.017	0.405
Previous Anxiety	2.591	<0.001	0.223
Fear of COVID-19 Scale	0.246	<0.001	0.021
Nuclear War Anxiety scale	0.041	<0.001	0.006
(Constant)	1.433	0.045	
R^2: 0.325 (adjusted to 0.322); VIF variation: 1.024; 1.131. AUC, area under the curve; OR, odds ratio.			

both areas (home/family and working life), it is possible that gender was not present in the logistic and linear regressions because it impacts both genders, but in different ways. Another study also reported a statistical difference in adoption of recommended preventative health behaviours in response to the COVID-19 pandemic according to gender. However, when self-reported fear of the COVID-19 pandemic was included as a predictor, the gender difference stopped being statistically significant (48). Therefore, another hypothesis is that gender could be a confounding factor related to fear of the COVID-19 pandemic.

Patients' anxiety decreases with the age, which is in line with the literature (19, 20, 22). One previous study (2) did not report statistically significant differences between participants of different age groups, but this study only explored young adults. The impact of COVID-19 pandemic in school closures and social events may have been responsible for students' emotional distress (20, 49). This is consistent with both our findings and the literature (20, 22), which shows that student status is associated with higher levels of anxiety.

On the other hand, we found that being employed or being a health professional decreases the level of anxiety. We hypothesize that this is due to their lower concern of the impact of the pandemic and/or war on their financial situation. In the case of being a health professional, their greater knowledge of the COVID-19 pandemic may help them process pandemic news in a calmer way.

Additionally, we found that individuals with higher educational levels seem to have a lower prevalence of anxiety. Our findings are in line with the literature (20). The reasons for this are not clear, but we hypothesize that, similar to being a health professional, having more education can help a person better process news/information related to COVID-19 and war, making them less prone to anxiety.

Single people seemed to have a higher prevalence of anxiety. There is no consensus in the literature regarding marital status and the prevalence of anxiety, with some studies (20, 50) finding that being divorced or widowed were predictive factors for symptoms of anxiety, and one study indicating that married status was related with higher levels of anxiety when compared to unmarried individuals (20, 51). It seems that close family members can act as protective or stressful factors for anxiety, which can explain the mixed results in the literature.

Regarding previous COVID-19 infection, we found that having had COVID-19 infection is a protective factor for anxiety. However, this goes against the literature that showed that anxiety was higher in people affected by COVID-19 or who had close contact with COVID-19 infected people (20, 22). One explanation for our findings could be that the majority of people who had COVID-19 infection had mild symptoms or were asymptomatic, so the fear of infection could be reduced since what they experienced was not so bad as reported in the media.

Previous anxious people were more prone to be anxious regarding the fear of COVID-19 infection and nuclear war, which is in line with the literature (20) that mentions that individuals with past or present mental disorders or psychiatric illnesses are more sensitive to external stressors, such as social isolation and media use exposure (20, 52–54).

Anxiety increased as units on the Fear of COVID-19 and Nuclear War Anxiety scales increased. Our findings are in line with the literature, namely regarding the fear of COVID-19, which shows higher anxiety in people that worry about being infected or are more concerned about the war (2, 20).

We could not make inferences about the impact of being exposed to war in anxiety, since only 5.6% of the sample was exposed to it. The literature is unanimous about the impact of exposure to war on the prevalence of anxiety, both in civilians and deployed service members (55, 56).

Regarding the strengths and limitations of the present study, it is valuable to state that this is the first study in Portugal to evaluate the joint impact of two important stressors – the fear of COVID-19 and of a nuclear war – on the general anxiety of the adult population. It is also important to underline that the period when this study was conducted – 6th wave of COVID-19 pandemic and consolidation phase of Russia-Ukraine war – was ideally chosen to better study the role of these dependent variables on anxiety. As limitations, we would like to point out the cross-sectional nature of the study, it is not possible to determine the direction of causality or to make inferences about the effects of one variable on another. Instead, cross-sectional studies are useful for exploring associations between variables, generating hypotheses (57). Therefore, future longitudinal analysis will be needed to further study this phenomenon. Additionally, the low prevalence in the sample of individuals exposed to war conflicts impedes the study of the effect of being exposed to war on anxiety. The sample was recruited using a non-probability sampling method, which may not represent the entire population of interest. Conducting the survey online may

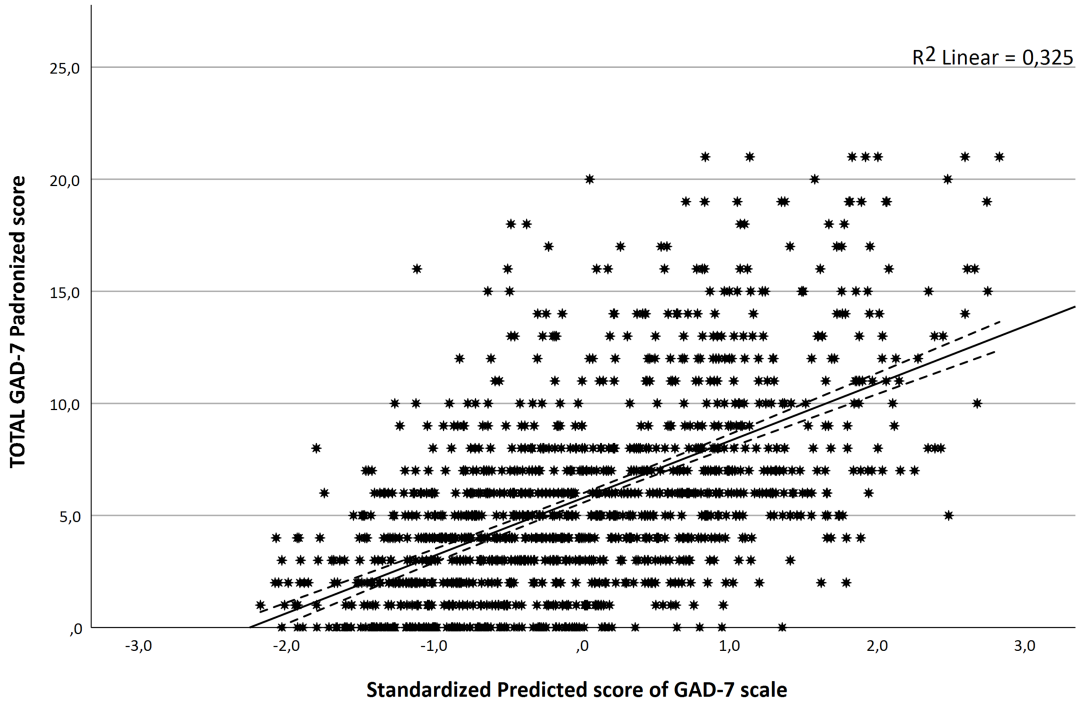

FIGURE 1
Regression line of the multivariate analysis to GAD-7 score.

have excluded individuals who do not have access to the internet or are not comfortable with completing surveys online. This may limit the generalizability of the study findings. Nonetheless, considering the very low rate of missing data (1.8% of all sample), the risk for non-response bias is low, which strengthens the confidence in the results. Even though a potential bias related to careless responding might exist due to the online nature of the survey (58), we believe this might be attenuated considering the large sample size. Additionally, the total variance extracted by either of the two main factors/predictors of interest does not exceeds 50%, indicating that the probability of a common method bias in our study is very low.

Based on the findings of the present study, several recommendations can be made for various stakeholders. Given that the prevalence of anxiety symptoms was found to be higher among young adults, it is crucial for healthcare professionals to prioritize mental health screening and treatment for this age group. They should also take into account the impact of employment status and previous anxiety history when devising interventions. Healthcare professionals should ensure that accurate information is shared with the public. People should be made aware of the pandemic and war's impact on their mental health and take steps to manage their anxiety levels, including seeking professional help if needed and avoiding misinformation and sensationalized news. Government and policymakers should ensure that the population has access to mental health resources, focus on providing financial support and resources for those most affected by the pandemic and war, including those who are unemployed. Additionally, the media should provide accurate and reliable information on the current status of the pandemic and the situation in Ukraine to help people better understand the situation and reduce anxiety levels.

5. Conclusion

In conclusion, the present study not only adds to the growing body of research about the impact of COVID-19 pandemic in increasing anxiety levels but also provides the first comprehensive assessment of nuclear war anxiety in Portugal, and its association with the general population's anxiety. This study has shown that both fear of COVID-19 and, at a lesser extent, nuclear war anxiety contribute to the general population's anxiety. This is also true for those with a personal history of anxiety, as revealed by the multiple regression analysis. These findings suggest that in the current setting of COVID-19 pandemic and Russia-Ukraine war, a key policy priority has to be the long-term care of people with anxiety and its expected increase in prevalence, even in populations living in areas distant to the conflict, such as Portugal.

Data availability statement

The datasets presented in this article are not readily available because Ethics Committee restrictions. Requests to access the datasets should be directed to FP, filipeprazeresmd@gmail.com.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the University of Beira Interior – Portugal (CE-UBI-Pj-2022-038-ID1367). The patients/participants provided their written informed consent to participate in this study.

Author contributions

FP contributed to the study's conception and design. FP, TM, IL, PS, and JS wrote the first draft of the manuscript and contributed to the interpretation of the results. TM was involved in data analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Publisher's note

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Investigating the effectiveness of protection motivation theory in predicting behaviors relating to natural disasters, in the households of southern Iran

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Background: Disasters can lead to large human casualties, destruction of property and economic and environmental resources. The purpose of the present study was to answer the question whether the Protection Motivation Theory (PMT) is effective in predicting behaviors related to the harmful effects of natural disasters in the households of southern Iran.

Materials and methods: This quantitative and cross-sectional study was conducted on 528 households in Jiroft city. Sampling was done by combined method (the combination of cluster, simple random, proportional and systematic random sampling). A total of 528 households were included. The tools for collecting data were demographic information and a researcher-made questionnaire related to PMT constructs and preventive behaviors from the harmful effects of natural disasters. Data was analyzed using SPSS v21 software, and the necessary analyzes (descriptive tests, chi-square, one-way ANOVA and Pearson's correlation test) were performed at a significance level of 0.05. Using Amos v 21 software, the predictors of safety behaviors were determined using path analysis.

Results: The results showed 51.7% lived in the city and 62.1% of residential buildings were of brick without markings. There is a significant difference between preventive behaviors and direct exposure to disasters ($p < 0.001$), education ($p = 0.004$), monthly income ($p = 0.004$) and source of information ($p = 0.040$). There was also a significant correlation between preventive behaviors and the number of vulnerable family members ($p = 0.001$, $r = 0.160$). The adjusted model of the path analysis test showed that protection motivation ($\beta = 0.547$), fear ($\beta = 0.147$) and perceived vulnerability ($\beta = 0.135$) had the greatest role among the constructs of the protection motivation theory.

Conclusion: According to the results of the study, it is suggested that health planners design and implement educational interventions based on the structures of the mentioned model to increase the preparedness of households against natural disasters.

KEYWORDS

natural disasters, protection, motivation, theory, household, predicting, behaviors

1. Introduction

A disaster is defined as the severe destruction of systems in society or the severe destruction of the functioning of a society. Disasters can lead to large numbers of human fatalities, loss of property and economic and environmental resources, so that society does not have the ability to provide the necessary medical and non-medical resources to deal with its risks (1). An important point is the amount of fatalities caused by disasters in underdeveloped countries, which is about 43 times that of developed countries (2). The data of the International Federation of Red Cross shows five global crises in the world during the years 2005–2014, which are, respectively, floods, storms, waves, heat and droughts. Of all these natural hazards, 48% happened in Asia. Building flexibility and minimizing losses caused by natural hazards are among the most important priorities of all governments in the world, which require the investment of governments and people (3).

Natural disasters cause loss and damage and may influence subjective expectations about the incidence and severity of future disasters. These expectations may in turn shape people's behaviors in the face of disasters, potentially spending their incomes on disaster risk prevention and mitigation (4). As a result, considering the global changes in climate, weather and environmental changes, it is necessary to think of measures to reduce the risk of natural disasters. During the past two decades, decision-making in natural disaster risk management has progressed significantly. This has led to a refocusing from the modern top-down, "command and control" approach to disaster management to encouraging "people-centered" methods and local participation (5).

Because effective preparation of individuals and families is needed before interventions can be implemented to deal with the effects of a disaster, it is important to understand why people do or do not act on disaster preparedness (6). Therefore, it is necessary to measure people's risk perception and behavior related to natural disasters in order to reduce the public health problems caused by these disasters (destruction of infrastructure, deaths, physical and mental illnesses, and disability) as much as possible (7). Even expanding the capabilities of disabled people is critical to deal with disaster. This can be considered by strengthening the meaningful participation of disabled people in decision-making processes on their well-being, not only during natural disasters, but also in everyday life (8).

Protection Motivation Theory (PMT) as a health promotion model states that a degree of risk-related information can create the necessary motivation to determine the severity of risk, vulnerability and ability to reduce risk in people (6). PMT has become a popular theory to explain residents' risk reduction behavior against natural hazards. This theory includes two stages of threat appraisal (perceived vulnerability, perceived severity, and reward) and coping appraisal (response efficacy, self-efficacy and response costs) and the construct of fear (9). According to this theory, a person is likely to perform preventive behaviors if they believe there is a possibility of a risk occurring (perceived vulnerability) and the consequences of the risk are serious (perceived severity) and in addition, the perceived internal and external rewards are less than existing behaviors that increase the probability of harm. Also, perceived self-efficacy and perceived response efficacy should overcome adaptive response costs. Protection motivation is synonymous with the behavioral intention that causes or continues the protective behavior (10).

In Wunnava's study, regression results showed self-efficacy and response costs were significant and consistent predictors of disaster recovery planning (11). The results of Tang's studies showed that self-efficacy, response efficacy, and perceived costs were significantly correlated with protection motivation and disaster preparedness behavior (6).

In addition to thanking you for your valuable comment, considering that in the investigated region, various natural disasters such as drought, floods, earthquakes and storms threaten the people of the region and there are common behavioral factors in them (for example, construction of safe housing and retrofitting of buildings). Can increase the safety of households against most natural disasters and individual natural disasters have been addressed in numerous researches, the innovation of our study is that it addressed the common behavioral factors of natural disasters with the protection motivation theory. Considering the importance of preventive measures related to reducing the harmful effects of natural disasters and the results of the studies mentioned above and significant occurrence of various natural disasters such as floods, earthquakes, droughts, storms, etc. in the Jiroft city, south of Iran, and the different cultural, economic-social and climatic conditions of southern Iran compared to other regions of the country and other countries, and so far that do not study to examine the preparedness of households in southern of Iran against natural disasters, it was decided to conduct this study titled "Investigating the Effectiveness of PMT in Predicting Behaviors Relating to Natural Disasters, in the Households of Southern Iran."

2. Methods

This was a cross-sectional study with a descriptive-analytical approach, which was conducted with the aim of determining the effectiveness of PMT in predicting the behaviors of coping with the harmful effects of natural disasters in the households in the south of Iran in 2022. The studied community included all the households in Jiroft city, south of Iran, who had their own residential house. Sampling was done by a combined method (cluster, simple random, proportional and systematic random sampling), so that each of the urban and rural healthcare centers of Jiroft city is considered as a cluster, 3 urban centers and 3 rural centers were selected by a simple random method, health centers, rural health houses and urban health posts were randomly selected (in total, 7 rural health house and 3 urban health post were included in the study). In each health house and health post, according to the total number of households, a number of households were included in the study according to the list of households and randomly based on the number of households in each health center.

A total of 570 people were included in the study, 42 questionnaires were incomplete, and therefore, the data of 528 people (273 urban households and 255 rural households) were analyzed. In each household, questions were asked from one person who met the entry criteria. The inclusion criteria included being native and resident of the region, owning a private home, and being able to understand and answer the questions in the questionnaire. Questions related to the literacy and comprehension skills of the head of the household, or his wife. Exclusion criteria included being non-native and non-resident of the area, having temporary housing

(living in a tent) and renting, not being able to speak clearly and answer questionnaire questions. Next, utilizing trained personnel, demographic information and a questionnaire created by the researcher a survey was completed by visiting the homes of the selected households where consent to participate in the study was given. Before completing the questionnaires, the objectives of the study were explained to the selected households by trained personnel and they were assured that their information would remain confidential, and if they had informed and freely verbal consent to participate in the study, the questionnaires were completed. In cases where we could not visit the households, questions were asked to the head of the family or his wife by phone after they gave free and informed consent to participate in the study. If a household did not meet the required conditions or was not willing to participate, a replacement was randomly selected from the unselected households.

The researcher-made questionnaire consisted of three parts. The first part of 15 demographic questions (including age, gender, residence status, education, occupation, life status with spouse, monthly income, type of building, number of years since the construction of the house, type of house ownership, number of family members, number of vulnerable people in family, height of the building from the ground, direct exposure to disasters, source of information for disaster management), the second part of the questionnaire related to the constructs of PMT, which generally consists of 46 questions, including 9 questions of perceived severity, There are 6 perceived vulnerability questions, 5 perceived costs questions, 4 perceived rewards questions, 9 self-efficacy questions, 7 response efficacy questions, 5 fear questions, and one protection motivation question. All questions of the protection motivation theory had a 5-point Likert response. The questionnaire of PMT was scored between 46 and 230. The third part included 27 questions about the behaviors related to reducing the harmful effects of natural disasters with yes and no options, the yes option was given a score of 2 and the no option was given a score of 1. The total score of the behaviors section was between 27 and 54. The validity of the questionnaire was confirmed according to the opinion of a panel of judges by measuring CVR and CVI indices and its reliability was confirmed through the completion of the questionnaire by 31 people from the target community using the test–retest method. Finally, after collecting the information, the data was entered into the SPSS v21 software, and the necessary analysis was performed using descriptive tests (number and percentage, mean and standard deviation), chi-square, one-way ANOVA and Pearson's correlation test at the mean level 0.05. Using Amos v 21 software, the predictors of safety behaviors were determined using path analysis.

3. Results

The results of this study showed 45.8% of the participants were less than 40 years old, 51.7% lived in the city, and 62.1% of the residential buildings were of ordinary brick type (Table 1).

In terms of the percentage of score obtained from the total score that can be obtained for the constructs of PMT and protective behaviors, the constructs of response costs and response efficiency scored the highest and preventive behaviors scored the lowest (Table 2).

Using chi-square test, there was a significant difference between preventive behaviors and direct exposure to disasters ($p < 0.001$). Using one-way analysis of variance, there was a significant difference between preventive behaviors and literacy level ($p = 0.004$), monthly income ($p = 0.004$) and source of information ($p = 0.040$). Using Pearson's correlation test, there was a significant correlation between preventive behaviors and the number of vulnerable people in the family ($p = 0.001$, $r = 0.160$).

In terms of the correlation between the protection motivation theory constructs and preventive behaviors from the harmful effects of natural disasters, there is an inverse and significant relationship ($p < 0.05$) between the constructs of perceived rewards and perceived costs and a direct and significant relationship between other PMT constructs and preventive behaviors ($p < 0.01$) was found (Table 3).

According to Table 4, the constructs of perceived vulnerability, fear and protection motivation had a significant direct effect among all the constructs of the theory of protection motivation to predict protection behaviors against the effects of natural disasters.

According to Table 5, the statistical indicators of the adjusted model show a reasonable adjustment.

Figure 1 shows that the PMT constructs predict 85.9% of the variance in safety behaviors. Among these constructs, protection motivation ($\beta = 0.547$), fear ($\beta = -0.147$), and perceived vulnerability ($\beta = 0.135$) had more significant roles than the others.

Therefore, the model presented in Figure 1 can be a suitable model for predicting protective behaviors against the harmful effects of natural disasters.

4. Discussion

The purpose of the present study was to answer the question whether the Protection Motivation Theory (PMT) is effective in predicting behaviors related to the harmful effects of natural disasters in the households of southern Iran. Based on the results of this study, preventive behaviors scored the lowest in the investigated households. In other studies conducted in various locations throughout the world, although there are differences in the level of preventive behaviors against risks in different societies, the results show that most households do not take preventive measures and do not have the necessary preparation against risks (12–14), for example, in the study of Han et al. (15) in China, only 44% of households stated that they had taken protective measures against earthquakes after the 2008 earthquake. Also, despite the implementation of educational programs by the responsible organizations in Iran, the results of most of the conducted studies indicate the inadequacy of preventive measures and preparedness of Iranian households against risks, and the households have shown relatively high vulnerability to potential risks (16). Studies have shown that various factors such as quality of life, trust in authorities and the government, psychological factors such as fear and stress, socio-economic factors, knowledge level, self-efficacy, health status and experience of disasters affect preventive behaviors and household preparedness against impact of hazards (17–22). Therefore, identifying obstacles and inhibiting factors and designing appropriate interventions can improve preventive behaviors in communities.

Based on the results of this study, in the studied households, the structure of response costs got the highest score, which means preventive behaviors have many costs (financially, equipment, time

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TABLE 1 Demographic and building characteristics of study participants (n = 528).

Variable		Number	Percent	Variable		Number	Percent
Age	Less than 40	242	45.8	Years pass to building	Less than 3 year	66	12.5
	40–60	153	29		3–10 year	130	24.6
	Above 60	133	25.2		10–20	173	32.8
Residual status	City	273	51.7		20–30	117	22.2
	Rural	255	48.3		Above 30 year	42	8
Sex	Male	126	23.9	Ownership status	Personal	358	67.8
	Female	402	76.1		Father's house	141	26.7
Literacy	Elementary	136	25.8		Children's house	29	5.5
	Guidance to diploma	296	56.1	Number of family persons	One person	16	3
	University	96	18.2		Two person	128	24.2
Job	Farmer/worker	124	23.5		3–5 person	285	54
	Employee	161	30.5		6 person and above	99	18.8
	Retirement	83	15.7	Number of vulnerable person in household	0	167	31.6
	Housewife	117	22.2		1 person	108	20.5
	Other	43	8.1		2 person	143	27.1
Living situation with spouse	Living with spouse	481	91.1		3 person and above	110	20.8
	Divorced or death spouse	47	8.9	The height of building from the ground	Good	270	51.1
Monthly income	Less than 400 dollars	351	66.5		Bad	258	48.9
	400–800 dollars	147	27.8	Direct exposure to disorders	Yes	119	22.5
	Above 800 dollars	30	5.7		No	409	77.5
Types of building	clay and mud	40	7.6	Source of information	TV/radio	163	30.9
	Brick without markings	328	62.1		Social networks	103	19.5
	A brick with markings	96	18.2		Health workers	138	26.1
	Steel-framed building	38	7.2		Internet	79	15
	Concrete structure building	26	4.9		Other	45	8.5

consuming, etc.) for households. Households perform preventive behaviors and prepare for risks if they are sure that they have the ability to overcome the costs of the recommended actions. According to the results of qualitative studies conducted by Rezabeigi Davarani et al. (17) in Kerman and Khosravi et al. (23) in Kermanshah, almost all the participants stated financial issues as a major obstacle for preventive measures and preparing households against earthquakes.

The results of the present study showed there is a significant difference between preventive behaviors and direct exposure to disasters. In a study conducted by Greer et al. (24) in the United States, earthquake experience was a significant predictor of risk reduction behaviors and in a study by Han et al. (15) in China, earthquake experience and concern for future damage had a significant effect on preventive behaviors and preparedness against earthquakes. In the study of Ansari et al. (25), flood experience had an effect on the protection motivation in flood-prone households.

Suffering from injuries and damages caused by destructive risks can make the victims take more protective and preventive measures than households that did not experience destructive risks. In Sun and Xue's (26) study in China, the relationship between the experience of a non-destructive earthquake and the intention to prepare against an earthquake was not statistically significant. Populations who have experienced non-destructive risks may consider the occurrence of frequent and non-destructive risks to be normal for them, and a false sense of security prevents them from taking preventive measures and preparing for risks. Also, studies have shown that the type of risk experienced can have an impact on the preventive measures of communities. For example, the results

10.3389/fpubh.2023.1201195

TABLE 2 The average score of PMT constructs and behaviors related to coping with disasters in the households participating in the study.

Variable	Mean	SD	Minimum	Maximum	Attainable score	Percent's of attained score
Perceived vulnerability	19.84	6.04	6	30	6–30	66.13
Perceived severity	31.45	6.49	15	45	9–45	69.88
Perceived rewards	13.8	4.34	4	20	4–20	69
Perceived costs	19.6	4.44	5	25	5–25	76.64
Self-efficacy	31.28	6.00	10	43	9–45	69.51
Response efficacy	26.34	5.58	8	35	7–35	75.25
Fear	17.96	5.55	5	25	5–25	71.84
Protection motivation	3.60	1.42	1	5	1–5	72
Safety behaviors	31.22	2.40	27	38	27.54	57.81

TABLE 3 Correlation between the constructs of PMT and natural disaster coping behaviors (Pearson correlation test).

Variables	Perceived vulnerability	Perceived severity	Perceived rewards	Perceived costs	Self-efficacy	Response efficacy	Fear	Protection motivation	Safety behaviors
Perceived vulnerability	1								
Perceived severity	0.254**	1							
Perceived rewards	0.015	−0.045	1						
Perceived costs	−081	−0.063	−0.121**	1					
Self-efficacy	0.071	0.000	−0.053	−0.004	1				
Response efficacy	0.158**	0.104*	−0.075	−0.125**	0.204**	1			
Fear	0.262**	0.414**	−0.036	−0.041	0.117**	0.103*	1		
Protection motivation	0.126**	0.283**	−0140**	−0.139**	0.247**	0.202**	0.424**	**1**	
Safety behaviors	0.166**	0.174**	−0.089*	−0.086*	0.166**	0.115**	0.121**	0.503**	**1**

*p-value < 0.05; **p-value < 0.01.

of Wei et al.'s (14) study in Taiwan showed that people with hurricane experience were significantly more prepared against hurricanes, while earthquake experience was not significantly related to the level of preparedness. Due to the unpredictability of the exact time and place of an earthquake, people may feel that they have less control over the risk of an earthquake and take less preventive measures.

In the present study, there was a significant difference between preventive behaviors and education. The results of other studies conducted in different parts of the world showed those with a higher level of education, took more preventive measures and had higher preparation against risks (12, 13, 20, 27–29). Considering that the educated class may have better economic conditions, they are more able to perform protective and preventive measures, especially strengthening and purchasing equipment. For example, the results of the study by Twerefou et al. (30) in Ghana showed that socio-economic factors have an overall positive effect on protective behavior against floods.

In this study, there was a significant difference between preventive behaviors and monthly income. In other studies conducted, including the study of Inal et al. (28) in Turkey, Kelly and Ronan (31) in New Zealand, Tang and Feng (6) in Taiwan, Wang et al. (27) in China, Armaş et al. (32) in Romania, and Zakour and Kim (33) in United States. The higher the household's job position and income, the more preventive behaviors and preparedness measures they reported against risks. One of the most important basic measures to reduce the vulnerability of households to hazards is the construction of standard and resistant houses. Buying land in low-risk areas and building a durable and standard house requires a lot of financial resources, and low-income households may not be able to pay the high costs of retrofitting their houses and buying equipment for emergency situations.

TABLE 4 Direct and indirect effects of variables on safety behaviors.

Variables	Standardized direct effects	Standardized indirect effects	Standardized total effects
Perceived vulnerability	0.135	0.006	0.141
Perceived severity	–	0.082	0.082
Response costs	–	−0.051	−0.051
Perceived rewards	–	−0.052	−0.052
Fear	−0.147	0.183	0.036
Self-efficacy	–	0.104	0.104
Response efficacy	–	0.054	0.054
Protection motivation	0.547	–	0.547

TABLE 5 Statistical indicators of adjusted model.

RMSEA[a]	NFI[b]	CFI[c]	GFI[d]	AGFI[e]	CMIN	DF[f]	CMIN/DF[g]	*p*-value	χ^2
0.000	0.992	1	0.998	0.990	4.705	9	0.523	0.859	4.705

[a]Root mean square error of approximation (RMSEA).
[b]The normed fit index (NFI).
[c]The comparative fit index (CFI).
[d]The goodness of fit index (GFI).
[e]Adjusted Goodness of Fit Index.
[f]Degrees of freedom (DF).
[g]Minimum discrepancy per degree of freedom (CMIN/DF).

The results of this study showed that there was a significant correlation between preventive behaviors and the number of vulnerable people in the family. In a study by Han et al. (34) in Taiwan, having a disabled member in the family was not a significant predictor of adopting emergency preventive measures, and households with a disabled member were less prepared for natural hazards. Perhaps in families where there is a vulnerable person, due to the need for continuous care, caregivers do not have enough time to participate in training classes and exercises. In a study by Adams et al. (18) that was conducted on disabled individuals over 18 years old, the results showed that participants who were in poor health and had activity limitations were less involved in preventive behaviors and disaster preparedness. Therefore, it is necessary to design and implement special interventions for vulnerable groups and other family members to promote preventive behaviors for households that have a vulnerable member at home.

In the present study, an inverse and significant relationship was observed between behaviors that prevent the harmful effects of natural disasters and the perceived rewards and costs constructs. In the study of Greer et al. (24) in the United States and Adhikari et al. (35) in Nepal, perceived costs were associated with household preventive actions. In the Cong study in the United States, perceived cost was a barrier to household disaster preparedness (36). In Botzen's study in New York, perceived cost did not play a role in flood damage reduction measures (37). In Sun and Xue's (26) study in China, residents had a lower intention to purchase earthquake insurance and stockpile equipment for emergencies than to participate in training and exercise activities. Households are likely to take actions such as participating in training and training courses that do not require a lot of financial resources, rather than expensive actions such as buying insurance and providing equipment.

In this study, a direct and significant relationship was found between the constructs of perceived vulnerability, perceived severity, self-efficacy, response efficiency, and fear and protection motivation with preventive behaviors. In the study of Greer et al. (24), the likelihood of an earthquake and the perceived consequences, self-efficacy and response efficacy were significantly related to the preventive actions of households. In a study conducted by Adams et al. (18) in the United States, self-efficacy and response efficacy were significantly positively related to preventive behaviors and disaster preparedness. The results of Adhikari et al.'s (35) study in Nepal showed perceived vulnerability, self-efficacy and response efficacy predicted the intention to prepare against risks and the relationship between these constructs with the intention to prepare behavior was significant. In Botzen's study in New York, high response efficacy and high self-efficacy played an important role in flood damage reduction measures (37).

The results of a systematic review study showed that people with higher self-efficacy took more preventive measures against disasters and had more preparedness intentions and behavior (38). In the Cong study in the United States, low self-efficacy and response efficiency were reported as barriers to household preparedness against disasters (36). People are likely to perform preventive and preparedness behaviors against disasters if they are confident the actions they take to prepare will reduce the consequences of the hazard and the probability of harm (response efficacy) and they are confident of their ability to perform preparedness and preventive behaviors (self-efficacy). The results of this study show the more motivated people are to take preventive measures against risks, the more preventive and protective behavior increases within them. In fact, the motivation to protect is synonymous with the behavioral intention that triggers or continues the protective behavior (10). In a study conducted by Zaremohzzabieh et al. (39) in Malaysia, the intention to perform behavior was directly related to preventive measures and preparedness of households against earthquakes.

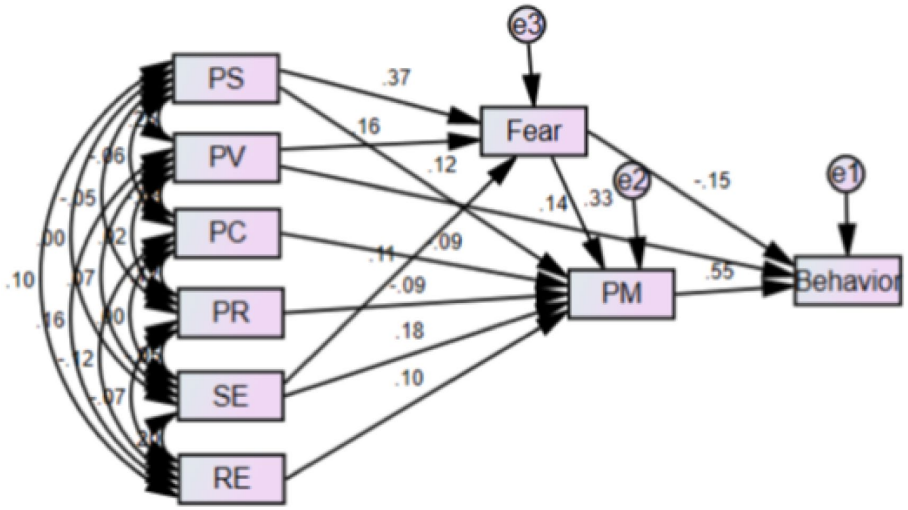

FIGURE 1
Modified model for safe behavior of households related to hazardous effects of the natural disasters (In this shape, PV = perceived vulnerability, SE = self-efficacy, RC = response costs, PR = perceived rewards, PS = perceived severity, PM = protection motivation).

In this study, fear was one of the predictors of preventive behaviors. Studies have shown that the feeling of fear and worry about the consequences of risks has an affect on preventive behaviors. For example, in Stewart's (40) study in the United States, fear of extreme consequences of climate hazards predicted the likelihood of residents evacuating. In the study by Ao et al. (12) in China, negative emotions (being nervous, afraid, and anxious) during an earthquake had a positive effect on preventive measures and preparedness of households against earthquakes. The study by Ansari et al. (25) showed fear of flooding has a positive correlation with risk reduction measures. In Greer et al.'s (41) study in the United States, feelings of fear or negative emotions related to earthquakes were significant predictors of intention to take risk reduction measures. In fact, the fear of the consequences of risks can make people adopt strategies to deal with the risk, therefore, it is necessary to design and implement the necessary training and sensitizing the society regarding the consequences of risks through different channels.

In this study, perceived vulnerability was one of the important predictors of preventive behaviors. The results of Ong et al.'s (42) study in the Philippines showed that the higher the perceived vulnerability of people, the greater the intention to prepare against earthquakes. Kurata et al. (43) showed that perceived vulnerability has a direct positive effect on evacuation intentions, beliefs and preparedness behaviors of Filipinos against the risk of volcanic eruption.

Finally, according to the results of the present study and the theoretical framework presented in this research, the more people see themselves exposed to risks and are aware of their vulnerability (high perceived vulnerability to the occurrence of natural disasters) and their fear of undesirable natural disasters, their motivation to protect themselves and others (protection motivation) is greater to take preventive and protective measures against the destructive effects of natural disasters. Therefore, carrying out appropriate health education and health promotion interventions can increase households' understanding of their vulnerability to natural disasters and, consequently, be effective in carrying out effective preventive measures against the effects of undesirable natural disasters.

5. Limitations

One of the limitations of this study is the prolongation of the data collection period due to the spread of COVID-19 in the region.

6. Conclusion

Based on the results of this study, PMT was a suitable scientific framework for predicting preventive behaviors against the potentially dangerous risks of disasters, the higher the perceived vulnerability, perceived severity, self-efficacy, response efficiency, fear and protection motivation, and the lower the rewards and cost of the perceived response, the more people take preventive measures. It seems that PMT can be used in developing educational programs and intervention techniques in order to increase preventive measures. In this study, preventive behaviors of households against risks were not favorable, one of the reasons for this is the high cost of protective and preventive measures and the insufficient income of most households. Therefore, the support of the authorities is necessary to reduce the vulnerability of the society. Considering the lower level of preventive behaviors in people with low education level, appropriate educational interventions should be prioritized in order to increase the knowledge level of all sections of the society, especially vulnerable groups. Considering the source of information for most of the participants was mass communication media and health workers, with correct and appropriate planning, the great potential of media and health workers can be used to transmit appropriate messages in order to increase awareness and improve preventive and protectively behaviors. It is suggested to conduct interventional studies to measure the amount of PMT-based interventions on preparedness behaviors to reduce the harmful effects of natural disasters.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by this study is approved by the ethical committee of Jiroft University of Medical Sciences with the number of IR.JMU.REC1400.034, all the methods were performed in accordance with the relevant guidelines and regulation. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

RF, SD, and FR were involved in all aspects of study conception and design, data collection, data analysis, interpretation, drafting of the manuscript, and critically revising the manuscript for intellectually important content. DM helped in the general design of the study, results from interpretation, co-authoring, and editing along with the whole manuscript. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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The mental condition of Polish adolescents during the COVID-19 pandemic and war in Ukraine

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Recently, the experience of the COVID-19 global pandemic has significantly affected the mental condition of entire societies by increasing anxiety and stress resulting from its sudden and completely unexpected nature. In Poland, apart from the pandemic, there is an ongoing threat of an armed conflict just across the border, which can constitute direct and indirect threats to physical and mental health. Each of these situations is unusual and difficult. It is also in sharp contrast to the developmental needs of children and adolescents. It especially violates the principal need of this developmental period, which is to grow up in a predictable as well as physically and emotionally safe environment. The purpose of the conducted research was to assess the psychological condition of Polish adolescents, whose social situation is difficult, in order to take appropriate preventive measures based on this assessment. The study was conducted using the "Who are You?" Scale of Transparency Anxiety and the Revised Child Anxiety and Depression Scale (RCADS), as well as a researcher-made survey containing questions about well-being in relation to the pandemic, distance learning and the ongoing war in a neighbouring country. Approval was obtained from the Bioethics Committee to conduct the projected research. The study included 945 adolescents aged 11 to 15 (M = 13.10; SD = 1.11) making a representative sample of adolescents from 14 regions in Poland. The results of the research and analyses show that the adolescents under study have a medium level of intensity of neuroticism, with the highest levels occurring in adolescents aged 14. Moreover, the adolescents manifest relatively lower symptoms of anxiety and depression as well as concern about the pandemic and the war in Ukraine than expected.

KEYWORDS

COVID-19 pandemic, war in Ukraine, mental condition, adolescents, Polish population

1. Introduction

The recent stressful experience of the COVID-19 global pandemic has significantly affected the psychological condition of entire societies by increasing anxiety and stress resulting from its sudden and completely unexpected nature (1, 2). In Poland, as in all Europe, social isolation and distance learning during the pandemic disrupted the lives of adolescents (3).

As stipulated in the guidelines of the Ministry of Health, the state of epidemic in Poland was in force between 15 March 2020 and 15 May 2022. Starting on 11 March 2020, the Polish government introduced distance learning for educational institutions (this did not, however, apply to special needs schools, educational and sociotherapy centres, centres for psychological guidance and educational counselling and schools at juvenile correctional centres and penal

institutions). Starting on 4 May 2020, nurseries and pre-schools returned to in-person education, while primary and secondary schools continued distance learning until the end of June 2020, i.e., until the end of the school year. In the meantime, a variety of restrictions was introduced in Poland, such as restrictions on the freedom of movement, the obligation to wear masks, a ban on gatherings of more than two people, and a regulation stipulating that persons under 18 could only be in public spaces with an adult guardian. Shopping centres, service outlets and points-of-sale, entertainment venues such as cinemas, bars and discos were closed. All educational institutions started the school year 2020/2021 in the in-person mode, yet as early as on 24 October 2020, Grades 4 to 8 and secondary schools started distance learning, and on 4 November were joined by Grades 1–3. On 18 January 2021, in-person education was reinstated in Grades 1–3 and special needs schools. All educational institutions returned to full-time in-person education on 19 April 2021. However, even after this time, many classes or entire schools operated periodically in the distance learning mode as the identification of COVID-19 patients among students or teachers resulted in the quarantine of all other persons who had contact with them, and thus the transition to distance learning (4). This situation lasted until the end of the 2021/2022 school year. At times, some restrictions were either eased or tightened (due to the increasing number of cases), and this frequently occurred overnight. In spring 2021, the Polish government decided to massively ease restrictions.

For the Poles the war in the neighbouring country, which broke out in February 2022, turned out to be an additional factor that potentially increased the sense of social anxiety (5). The research conducted in various war-torn regions of the world demonstrated that children or adolescents who witnessed the death of or injuries inflicted upon their close relatives, or their torture or detention, were under fire or experienced physical violence themselves, as a consequence of these events developed disorders in their general functioning and experienced negative changes in their mental health. Admittedly, most children indirectly affected by war do not have to experience drastic consequences of the war: separation from their families or loved ones, abandoning their homes and hometowns, or losing their friends. They do, however, experience social threat through participation at a collective level, if only by hearing news of ongoing hostilities (6), or also through contacts with refugees who are victims of war. The experience of war, even that behind a neighbouring border, can result in perceiving a sense of danger and vulnerability in the face of the event, which is the essence of experiencing trauma (7). This implies that the mental health risks to children and young people arising from war may be indirect.

Both situations therefore contributed to the development of psychological stress in the Polish society due to their objectively burdensome and unusual nature. For this reason, it seems reasonable to answer the question whether the situation-related higher sense of threat caused by both the pandemic and the war in Ukraine had adverse consequences for the mental health of Polish adolescents in the form of increased symptoms of anxiety and depressive disorders, and whether these symptoms are linked to neuroticism as a personality trait of Polish adolescents.

The COVID-19 pandemic disrupted daily life not only through the physical health concerns raised, but it also resulted in numerous restrictions. Extreme precautions, such as mandatory social distancing, strict hygiene measures including wearing face masks as well as restrictions on the freedom of movement, have been taken due to the public health emergency. Many people in different parts of the world were able to cope well with this crisis experience and to keep their mental balance (8, 9). Some researchers have even indicated the possibility of emerging from stressful events with increased resilience (2, 9). Many people have been experiencing mental health problems as a result of the pandemic and its effects. Stress, anxiety and depression were most frequently recorded among the general population. However, among different social groups, it is the adolescents who may be most vulnerable to the biopsychosocial stressors generated by the pandemic (10). The occurrence of anxiety and depressive symptoms is among the most frequently observed mental disorders resulting from the COVID-19 pandemic on every continents of the world (11).

In addition to the pandemic, there is an ongoing threat resulting from the armed conflict directly across the Polish border. The experience of mass immigration is a confrontation with the realities of war and makes us realise the existing threat. A sudden influx of refugees and their long-term presence may be the cause of significant and previously unexpected changes in everyday life. The entirety of this experience fulfils the criteria of a difficult or even crisis situation due to the awareness of the threat, difficulties in achieving everyday goals, and information overload related to the influx of negative news (12). It leads to exposure to direct and indirect risks to physical and mental health, which is particularly debilitating for children and adolescents, as it limits their developmental opportunities. These experiences are in sharp contrast to developmental needs, especially the central need for all children and adolescents to grow up in a predictable as well as physically and emotionally safe environment (6). The experience of war just across the border may result in the sense of danger and vulnerability, which is the essence of experiencing trauma (7, 13). In view of the previous experience of the COVID pandemic, which significantly strained the coping capabilities of children, adolescents and whole families, the ongoing war generates an additional potential sense of threat that young people and their caregivers across Europe have to cope with. Children and young people in Poland experience it particularly acutely, not only because of the geographical proximity of the war and military operations, but also because of direct contacts with war victims. In 2022 year 11.8 million Ukrainian refugees, mainly women and children, arrived in Poland, of whom more than 10 million returned to Ukraine at the time of writing this paper. However, this means that during the year an unusually large group of children with traumatic experiences stayed in Poland and was supported not only by adults: many of their Polish peers, whether in educational institutions or during informal contacts within the family or the local community, have experienced accompanying a colleague from Ukraine in a traumatic experience or have heard about such events from relatives or the media. This situation can be also traumatising as it involves participating in the experience of extreme danger felt by someone else (14). The field literature sees this type of experience as a risk of vicarious trauma (7) or secondary post-traumatic stress disorder (15), as traumatic events affect the mental health of those accompanying the suffering person, thus causing an increased risk of adaptation difficulties in the form of potential emotional disorders in various forms.

Uncertainty resulting from real threats to safety, health and life is a particularly difficult experience for children and adolescents because their ability to cope with stress is incomplete, which is due to the early

developmental stage (16–18). Children and adolescents are more vulnerable to environmental threats and situational stress because their cognitive performance and emotional maturity is lower than that of adults. This may result in difficulties in understanding stressful situations and in adopting a broader perspective alternative to the sense of threat, and may lead to using fewer coping strategies to deal with sudden changes arising from difficult events and situations (19).

Vulnerability to the development of anxiety and other internalising and externalising problems in adolescence can be explained by biochemical imbalances in the CNS during the period of intense developmental change as well as by higher levels of emotional reactivity and neuroticism (20–22). There are studies indicating a link between neuroticism and internalising psychopathology (i.e., distress, anhedonia, anxiety, fears of specific stimuli, social anxiety, and depression) (23). Neuroticism primarily reflects individual differences in the tendency to experience negative emotions and is a strong risk factor for the development of anxiety and depressive symptoms. Research by Williams et al. (23) suggests that neuroticism is a robust predictor of an adverse developmental trajectory for generalised stress leading to the development of psychiatric disorders. This was also confirmed by previous research conducted during the COVID-19 pandemic, which found that individuals who exhibit higher neuroticism experience more mental health problems (24). The findings of a study of Indian adolescents demonstrated that there is a strong positive correlation between neurotic personality trait, mental stress and perceived COVID-19-related stress. Thus adolescents with higher neuroticism are more vulnerable to mental stress during the COVID-19 pandemic. One may therefore conclude that neuroticism underlies vulnerability to stress in a proportion of the population (8), which accounted for a prediction of COVID-19-related stress of 73.4 per cent in the population of Indian adolescents with neurotic personality (25). In psychology, when looking for determinants of affective states, the sources of anxiety are often traced back to personality-related predispositions of the individual. Eysenck's (26, 27) three-factor model of personality distinguishes three personality dimensions: neuroticism, extraversion and psychoticism. Anxiety is one of the main symptoms of high levels of neuroticism. Neurotics have a greater tendency to excessively experience negative emotions and to dwell on stress, as well as to overly react with anxiety (26). This constant tendency to experience negative emotions such as fear or anxiety, which includes a strong component of negative thinking and a tendency to react with negative emotions, is defined in C.D. Spielberger's theory as identical with anxiety (a trait), as opposed to anxiety (a state) (28). Anxiety (a trait) is an established disposition to perceive various life situations as strongly threatening. It is shaped into a predisposition as a result of life experiences in the early years of development. It results in significant limitations in coping with challenges, which easily become stressful when perceived by a person with high anxiety levels. In this sense, a high level of neuroticism conditions a constant disposition to experience increasingly higher anxiety in difficult circumstances, and thus the situation of neurotic people who struggle with rough experiences can be particularly stressful, as the personal disposition to respond with anxiety will create a high risk in an anxiety-provoking situation. It is also worth remembering that not every anxiety reaction is a disorder, as some of them are relevant to the situation and subside with the disappearance of a threatening stimulus, which particularly concerns personalities with non-neurotic traits (28). The importance of protective factors that affect the intensity of subjectively experienced stress is also known. Due to individual dispositions, the same event may be burdensome and traumatising for one person, while for an individual with a different mental construct it will be merely a difficult challenge (29). Among the significant protective factors that affect the psychological condition of children and adolescents in a difficult situation one can identify coping strategies for dealing with stress. The array of the coping mechanisms changes with age to produce in adolescence a complex competence to regulate emotions as a result of an increase in metacognitive and self-regulatory abilities (17). Although the ability to use effective coping strategies varies during adolescence, yet due to cognitive competence it provides an important foundation for maintaining balance. Adolescents' coping efficacy is also conditioned by temperamental traits, the resultant resilience, impulse control, and adaptability which helps to find adaptive solutions and protects against the dominance of negative emotions (17, 30).

Previous research conducted in Poland shows that about 10% of young people had mental problems (31, 32). A survey conducted in Poland in June 2021 (i.e., at the end of the school year during the Covid-19 pandemic online learning experience) found that approximately 15 per cent of pupils in Poland need significant intervention related to their mental functioning due to poor well-being (33). At the same time, some reports have implied that adolescents have psychological well-being after all, as they prefer active strategies to cope with threatening situations and they spend most of their time online (30). Other reports suggest that young people used their time mainly for distance learning, communication with peers and entertainment. The pandemic-generated precedent of pursuing new habits such as distance learning and online education (34) also meant that, despite the resourcefulness of young people, the pandemic was associated with increased uncertainty as to a previously unfamiliar way of life, although in the adolescent population this phenomenon was not that much intensified (35).

Obviously, the impact of the pandemic on the mental health of children and adolescents does not always manifest itself so dramatically. In practice, it can occur in a wide variety of forms, starting from a persistent lower mood over a long period of time, through more or less serious problems in relationships with others or in learning, to the onset (or exacerbation) of symptoms of generalised anxiety.

In China, where the pandemic started, approximately 35% of the general population experienced mild to severe distress due to COVID-19 (10, 36). Analyses conducted by Chinese researchers using the CPDI (COVID-19 Peritraumatic Distress Index) showed that young people, under 18 years of age, had the lowest scores in this study [mild distress; mean (SD) = 14.83 (13.41)]. The low level of distress in adolescents was accounted for by the relatively low incidence rate in this age group and limited exposure to the pandemic due to home quarantine. In contrast, an analysis of papers with significant contributions to the health of adolescents and young adults in the United States (The Distinguished Dozen: 2022) demonstrated an essential impact of the pandemic on the mental health and well-being of young people. According to Hertz et al. (37), who conducted a cross-sectional survey of COVID-19-related experiences among adolescents aged 13–19 from October to November 2020, American students in Grades 7–12 reported poorer mental health. Moreover, Runkle et al. (38), who studied suicidal

behaviours in response to the COVID-19 pandemic among adolescents in the USA, identified four distinct crisis profiles: (a) depression/isolation/self-harm (10.4%), (b) interpersonal stress/depressed mood and anxiety (18.2%), (c) suicidal thoughts/depression (19.0%), and (d) adjustment/stress (52.4%). Following the study findings, they concluded that during the pandemic, in the subtypes of depression/isolation/self-harm and suicidal thoughts/depression there was an increase in suicidal thoughts and active rescue efforts (38).

Similar studies on the mental health of adolescents have been conducted in Europe. Data from a report by the OECD and the European Commission (39) show that the number of young people with depressive symptoms more than doubled in most EU countries. Young people were more likely than those in older age groups to view their mental condition as worse. Above all, there was an increase in the frequency of reported suicidal thoughts, although these were not associated with an increase in youth suicide rates. The incidence rate of anxiety in young people was also higher than before the pandemic. Gender-based disparities in the psychological condition of children and adolescents also increased. This means that young women were more likely to have symptoms of depression and anxiety than young men.

Taylor's (40) research suggests that the presence or absence of anxiety is an important component of behaviour during an epidemic or pandemic. Taylor et al. (40) concluded that during the COVID-19 pandemic, research participants most commonly exhibited five interrelated anxiety reactions, which were collectively termed as the COVID stress syndrome. These included: (1) fear of the danger of contracting SARSCoV2, (2) concern about the economic consequences of the COVID-19 pandemic, (3) xenophobic concerns about foreigners transmitting the Coronavirus, (4) traumatic stress symptoms related to direct or indirect experience of the disease (nightmares, intrusive thoughts or images related to COVID-19), and (5) compulsive checking and support-seeking related to the COVID-19 pandemic.

These reports have also been confirmed in other studies conducted among, e.g., young people in France and Spain (41, 42). According to research conducted in France, the number of adolescents suffering from anxiety increased significantly, and out of those who experienced anxiety during the pandemic, a significant proportion also had moderate or severe depression or experienced severe stress. In Spain, by contrast, 50.43% of adolescent respondents experienced the effects of the pandemic, of whom 21.34% experienced moderate to severe anxiety, 28.14% stress and as many as 34.19% depression.

The aim of this study was to determine whether Polish adolescents go through excessive experiencing of negative emotions and dwell on stressful events in a critical situation such as the COVID-19 pandemic and the war in Ukraine. The study set out to identify the relationship between neuroticism and the level of severity of anxiety and depressive symptoms, and to investigate whether changes associated with a persistent sense of threat might have adverse consequences in terms of the severity of symptoms of anxiety and depressive disorders in Polish adolescents. Moreover, a decision was taken to verify whether there are gender and age-related differences in the level of anxiety and depression severity, and whether there is an interplay between anxiety and depression severity. The research was conducted in order to propose evidence-based preventive interventions to young people.

2. Materials and methods

2.1. Research group

A total of 945 adolescents aged 11 to 15 (M = 13.10; SD = 1.11) participated in the study. The study was conducted on a representative sample of adolescents who came from 14 regions in Poland (out of 16 existing regions). The demographics of participants are presented in Table 1. The study was conducted in groups and took place in classrooms in May and June 2022. The questionnaires were prepared in electronic format. Young people taking part in the survey were given an individual identification code (ID) to access the online form. The questionnaire included instructions on how to proceed. The adolescents were accompanied during the study by persons prepared to give additional instructions (a school counsellor or psychologist). The student's parents or legal guardians gave their consent to the student's participation in the study. The adolescents gave their informed consent to participate in this study.

2.2. Research tools

The "Who are You"? Scale of Transparency Anxiety (WaY) by Elżbieta Skrzypek and Mieczysław Choynowski, adapted by Zwierzyńska and Matuszewski (28) was applied in the study. The scale is used to measure anxiety (a trait) as an indicator of neuroticism as two components: cognitive and emotional-physiological. This tool was standardised in a group of children from Grades 4–6 of primary school and Grades 1–3 of lower secondary school, which currently corresponds to the age group of children and adolescents from 11 to

TABLE 1 Characteristics of study participants.

	N (*N* = 945)	%
Gender		
Girls	520	55.03%
Boys	425	44.97%
Age		
11	70	7.37%
12	232	24.42%
13	291	31.16%
14	243	25.58%
15	109	11.47%
Place of school attendance		
Village	325	34.39%
Small town up to 20.000 residents	199	21.06%
Big city over 20.000 residents	228	24.13%
Major city over 100.000 residents	193	20.42%
Mother's education		
Primary	59	6.24%
Vocational	184	19.47%
Secondary	240	25.40%
Higher	462	48.89%

TABLE 2 Descriptive statistics of the study variables.

Variables	M	SD	Min	Max	Skewness	Kurtosis
RCADS						
SOC	3.50	2.05	0.00	9.00	0.38	−0.08
PD	1.65	1.57	0.00	9.00	1.41	3.00
MDD	6.40	3.47	0.00	15.00	0.29	−0.47
SAD	2.08	2.03	0.00	9.00	1.09	0.89
GAD	2.26	1.97	0.00	9.00	0.93	0.67
OCD	2.34	2.08	0.00	9.00	0.93	0.47
GLOBAL	39.89	26.42	0.00	141.00	0.94	1.07
WaY						
Lying	5.26	1.59	0.00	9.00	−0.59	0.93
Neuroticism	16.78	8.55	0.00	40.00	0.18	−0.55
Survey						
Q1	3.52	2.80	0.00	10.00	0.45	−0.74
Q2	2.50	2.70	0.00	10.00	1.07	0.30
Q3	4.75	3.06	0.00	10.00	0.03	−1.06

SOC, social phobia; PD, panic disorder; MDD, major depressive disorder; SAD, separation anxiety; GAD, generalised anxiety; OCD, obsessive-compulsive disorder; GLOBAL, the total anxiety and depression index; L, scale of lying; N, neuroticism scale; Q1, anxiety about the pandemic. Q2, distance learning. Q3, the war in Ukraine.

16 years of age. The WaY scale includes 50 statements, to which the subject is asked to respond by selecting YES or NO answers. The Neuroticism Scale (N) consists of 40 statements, with maximum score of 40 points. The confidence interval of +/− 3 points in relation to the raw score distribution is also identified for this scale. This scale also includes a control score, namely the Scale of Lying (L) consisting of 9 statements, which indicates socially expected behaviours and provides information about the intensity of the respondent's desire to seek social approval. The reliability of the test, measured by the Cronbach's α coefficient and set by the authors is 0.86, while in the study group the Cronbach's α is 0.89, indicating a high reliability of the tool.

The Revised Child Anxiety and Depression Scale RCADS by Chorpita et al., in its Polish adaptation by Ilona Skoczeń et al. (43) was applied in the study. Its objective is to assess the severity of symptoms of anxiety and depressive disorders in children. It allows to determine the anxiety and depression index (GLOBAL) as well as indices of Separation Anxiety Disorder (SAD), Generalised Anxiety Disorder (GAD), Panic Disorder (PD), Social Phobia (SOC), Obsessive-Compulsive Disorder (OCD) and Major Depression Disorder (MDD) based on the clinical criteria in the DSM-5 classification. The original English version of the tool is aimed at children and adolescents aged 3 to 17.5. The Polish version of the questionnaire was used on a sample of 501 children and adolescents aged 8 to 14 (43). The questionnaire contains 47 statements that need providing the information on the frequency of occurrence of a given symptom on the scale from "Never," "Sometimes," "Often" to "Always." Interpretation of the results should be done with caution, as research on this tool has been still ongoing (43, 44). The reliability of the questionnaire, assessed by the authors in compliance with the Bagozzi's formula, is 0.96. In this study, the reliability measured by Cronbach's α coefficient is 0.99.

The researcher-made survey consisted of three questions that addressed reactions to events related to the pandemic and the war in Ukraine. Respondents assessed on a scale of 0 (no concern) to 10 (very strong concern) their level of concern about the pandemic and the war in Ukraine, as well as the level of stress experienced during distance learning. Each question could be scored from 0 to 10.

The following questions were asked:

Q1. How much anxiety did you feel about the COVID-19 pandemic?

Q2. How would you assess the stress you usually feel during distance learning?

Q3. How much anxiety did you feel about the war in Ukraine?

2.3. Statistical analysis

Statistical analysis was performed using the STATISTICA software. The following methods were used: Kruskal-Wallis ANOVA rank test, Student's *t* test for significance of differences between groups, Pearson's *r* correlation coefficient and Chi-square correlation coefficient and linear regression analysis.

3. Results

3.1. Descriptive statistics

Table 2 presents the descriptive statistics of the examined variables, derived from, e.g., Revised Children's Anxiety and Depression Scale (RCADS) which allows to measure the anxiety and depression index (GLOBAL) and the indices of Separation Anxiety Disorder (SAD), Generalised Anxiety Disorder (GAD), Panic Disorder (PD), Social Phobia (SOC), Obsessive Compulsive Disorder (OCD) and Major Depression Disorder (MDD), the "Who are you?" Transparent Anxiety Scale (WaY), which measures neuroticism (N) and the desire to seek social approval (L) as well as answers to questions from the researcher-made survey.

TABLE 3 Differences between boys and girls in the desire to seek social approval (L) and neuroticism (N).

	Boys		Girls		*t*(943)	*p*-value	Cohen's *d*
	M	SD	M	SD			
WaY							
Lying	5.23	1.70	5.29	1.49	−0.579	0.563	-
Neuroticism	13.93	8.06	19.11	8.23	−9.706	<0.001	0.64

TABLE 4 Differences in levels of social approval (L) and neuroticism (N) by age.

	11		12		13		14		15		*H* (4, *N* = 945)	*p*-value
	M	SD	M	SD	M	SD	M	SD	M	SD		
WaY												
Lying	5.04	1.93	5.23	1.52	5.32	1.54	5.37	1.53	5.06	1.76	3.68	0.452
Neuroticism	15.19	9.88	16.87	8.09	16.71	8.52	17.58	8.48	16.00	8.76	5.84	0.211

TABLE 5 Severity of neuroticism vs. age of respondents.

	WaY N					
	11	12	13	14	15	N
Low	29 (42.03%)	59 (25.65%)	75 (25.42%)	60 (24.69%)	31 (28.70%)	254
Average	17 (24.64%)	78 (33.91%)	103 (34.92%)	77 (31.69%)	34 (31.48%)	309
High	23 (33.33%)	93 (40.44%)	117 (39.66%)	105 (43.62%)	43 (39.82%)	382
Total	69	230	295	243	108	945

$Chi^2 = 10.39$; df = 8; $p = 0.239$.

3.2. Level of neuroticism and social approval

Firstly, it was tested whether the levels of neuroticism and desire to seek social approval of the adolescents studied were gender-based (Table 3) and age-based (Table 4). The Student's *t* test for independent data was applied. As shown in Table 3 gender does not differentiate the level of desire to seek social approval in the adolescents under study, as expressed on the Scale of Lying, as presenting oneself in a better light (t = −0.579; df = 943; $p = 0.563$). Girls, however, manifest significantly higher levels of neuroticism than boys (t = −9.706; df = 943; $p < 0.001$), and this effect is moderate (d = 0.64). The anxiety level of the surveyed adolescents can be described as average (boys – sten score of 5–6, girls – sten score of 6). It was then tested whether age is a differentiating factor for anxiety and need for social approval. A non-parametric Kruskal-Wallis ANOVA rank test was used due to the large disparity in the volume of the subgroups (Table 4). The analyses showed that age did not affect the level of need for social approval [H(4, $N = 945$) = 3.68; $p = 0.452$] and the level of neuroticism [H(4, $N = 945$) = 5.84; $p = 0.211$] among the participants.

The age-related (Table 5) and gender-related (Table 6) distribution of the level of neuroticism of the adolescents represented by low (sten score of 1–4), medium (sten score of 5–6) and high (sten score of 7–10) scores was also investigated. The correlations obtained, as measured by the Chi-square coefficient, confirmed previous findings on the significance of gender and age for anxiety levels. Moreover, they allowed to illustrate the percentage distribution of results (low, medium or high scores). The abundance tables presented show that the highest number of subjects reached high values, i.e., above sten score of (40.42% of subjects). This means that a significant proportion of the adolescents surveyed demonstrate an excessive tendency to experience stress and to dwell on difficult situations. The highest percentage of high scores is observed among adolescents aged 14 (43.62%), and the lowest among 11-year-olds (33.33%). In addition, the youngest adolescents, i.e., 11-year-olds, most frequently (42.03%) revealed a low level of neuroticism. High scores were also more frequent among girls (44.04%) compared to boys (36.00%).

TABLE 6 Severity of neuroticism vs. gender of respondents.

	WaY N		
	Boys	Girls	Both
Low	142 (33.41%)	112 (21.54%)	254
Average	130 (30.59%)	179 (34.42%)	309
High	153 (36.00%)	229 (44.04%)	382
Total	425	520	945

$Chi^2 = 17.06$; df = 2; $p < 0.001$.

3.3. Level of anxiety and depression

The analyses aimed at whether there was a significant difference between boys and girls in terms of anxiety and depression as measured by the RCADS questionnaire. The Student's *t* test for independent samples was applied. The results are presented in Table 7. The girls under study demonstrate higher anxiety and depression in all areas investigated such as social phobia (t = −7.963;

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TABLE 7 Differences between boys and girls in the levels of anxiety and depression.

	Boys		Girls		$t(943)$	p-value	Cohen's d
	M	SD	M	SD			
RCADS							
SOC	2.93	2.00	3.97	1.98	−7.963	<0.001	0.52
PD	1.37	1.57	1.89	1.54	−5.100	<0.001	0.33
MDD	5.27	3.30	7.33	3.34	−9.463	<0.001	0.62
SAD	1.59	1.84	2.49	2.08	−6.905	<0.001	0.46
GAD	1.94	1.98	2.52	1.92	−4.568	<0.001	0.30
OCD	1.89	1.95	2.71	2.11	−6.178	<0.001	0.40
GLOBAL	32.25	24.87	46.14	26.02	−8.328	<0.001	0.55

TABLE 8 Severity of anxiety and depression vs. age of respondents.

	11		12		13		14		15		H (4, N = 945)	p-value
	M	SD	M	SD	M	SD	M	SD	M	SD		
RCADS												
SOC	2.91	2.01	3.37	1.96	3.49	2.04	3.70	2.09	3.73	2.18	8.30	0.081
PD	1.67	1.75	1.66	1.53	1.56	1.51	1.66	1.51	1.89	1.86	2.11	0.715
MDD	5.54	3.68	6.53	3.42	6.64	3.43	6.43	3.47	5.95	3.51	7.77	0.100
SAD	1.57	1.99	1.90	1.88	2.11	2.03	2.28	2.08	2.30	2.17	11.90	0.018
GAD	2.09	2.20	2.17	1.88	2.24	1.91	2.33	1.90	2.48	2.28	2.90	0.575
OCD	2.03	2.16	2.42	2.04	2.38	2.07	2.28	2.01	2.39	2.30	3.75	0.441
GLOBAL	33.30	27.23	39.89	25.09	39.93	25.92	41.28	26.54	40.91	29.44	6.69	0.153

df = 943; $p < 0.001$), panic disorder (t = −5.100; df = 943; $p < 0.001$), major depression disorder (t = −9.463; df = 943; $p < 0.001$), separation anxiety disorder (t = −6.905; df = 943; $p < 0.001$), generalised anxiety (t = −4.568; df = 943; $p < 0.001$), obsessive-compulsive disorder (t = −6.178; df = 943; $p < 0.001$), and in the total score (t = −8.328; df = 943; $p < 0.001$). These effects are weak to moderate.

It was also verified whether the age of the subjects affects the results obtained from the RCADS questionnaire (Table 8). The age of the adolescents had an impact only on the level of separation anxiety [H(4, N = 945) = 11.90; p = 0.018]. Post-hoc tests showed that 11-year-olds had significantly lower level of separation anxiety compared to 14- and 15-year-olds.

3.4. Concerns over the pandemic and war

The aim was to investigate whether there was a significant difference between boys and girls in terms of perceived anxiety related to the COVID-19 pandemic, distance learning and the war in Ukraine. Student's t test for independent samples was used. The results are presented in Table 9. Girls were significantly more concerned than boys about the situation related to the COVID-19 pandemic (t = −5.180; df = 896; $p < 0.001$) and the war in Ukraine (t = −7.939; df = 896; $p < 0.001$), and significantly more stressed about distance learning (t = −6.815; df = 896; $p < 0.001$). These effects were weak to moderate.

TABLE 9 Differences between boys and girls in terms of concern about the world's social situation.

	Boys		Girls		$t(943)$	p-value	Cohen's d
	M	SD	M	SD			
Survey							
Q1	2.99	2.87	3.95	2.67	−5.180	<0.001	0.35
Q2	1.73	2.44	3.12	2.74	−7.939	<0.001	0.54
Q3	3.99	3.15	5.36	2.84	−6.815	<0.001	0.46

The assumption whether the age of the subjects affected the level of anxiety was also investigated (Table 10). The age of the subjects did not influence the level of concern about the pandemic, distance learning and the war in Ukraine.

3.5. Dependencies between the variables under study

Finally, the level of neuroticism was measured to test whether it correlates with the symptom levels of anxiety and depression in the adolescents under study (Table 11), as well as the level of concern about the pandemic (Table 12), distance learning and the war in Ukraine.

Analyses were performed separately for boys and girls due to the previously noted gender-related differences in the levels of

TABLE 10 Level of concern about the world's social situation.

	11		12		13		14		15		H (4, $N = 898$)	p-value
	M	SD	M	SD	M	SD	M	SD	M	SD		
Survey												
Q1	3.39	2.69	3.51	2.74	3.76	2.82	3.32	2.80	3.35	2.98	3.97	0.410
Q2	2.39	2.82	2.46	2.44	2.40	2.60	2.75	2.94	2.35	2.82	2.34	0.674
Q3	4.44	3.22	4.63	2.98	5.01	3.00	4.67	3.11	4.61	3.16	3.01	0.556

TABLE 11 Correlation between neuroticism and adolescents' anxiety and depression levels by gender.

	WaY N	
	Boys	Girls
RCADS		
SOC	0.622***	0.552***
PD	0.488***	0.390***
MDD	0.603***	0.599***
SAD	0.531***	0.587***
GAD	0.524***	0.484***
OCD	0.604***	0.529***
GLOBAL	0.713***	0.691***

***$p < 0.001$.

TABLE 12 Subjects' gender-related correlations between neuroticism and concern about the world's social situation.

	WaY N	
	Boys	Girls
Survey		
Q1	0.324***	0.096*
Q2	0.399***	0.298***
Q3	0.304***	0.108*

*$p < 0.05$; ***$p < 0.001$.

these variables. Pearson's r correlation coefficient was applied. Neuroticism levels correlate positively with all dimensions of anxiety and depression in both boys and girls. These correlations range from moderate to very strong. The level of neuroticism correlates also positively with the level of concern about the pandemic, distance learning and the war in Ukraine. These correlations are moderate in boys and weak in girls.

Moreover, it was observed that in boys there is a weak positive correlation between age and social phobia ($r = 0.134$; $p < 0.01$), separation anxiety ($r = 0.155$; $p < 0.01$), generalised anxiety ($r = 0.101$; $p < 0.05$) and the total anxiety and depression index ($r = 0.101$; $p < 0.05$), i.e., the older the boys are, the more anxious they are and the more prone to depressive reactions. In girls, there is a weak positive correlation between age and social phobia ($r = 0.113$; $p < 0.05$) and separation anxiety ($r = 0.095$; $p < 0.05$), i.e., the older the girls are, the more likely they are to be fearful of negative social evaluation and slightly more anxious about separation from their caregiver (Table 13).

TABLE 13 Relationships between severity of anxiety and depression and age of adolescents surveyed.

	Age	
	Boys	Girls
RCADS		
SOC	0.134**	0.113*
PD	0.089	0.008
MDD	−0.006	0.054
SAD	0.155**	0.095*
GAD	0.101*	0.036
OCD	0.030	0.026
GLOBAL	0.101*	0.066
WaY		
Lying	0.048	−0.024
Neuroticism	0.067	0.037
Survey		
Q1	−0.018	0.002
Q2	0.041	0.046
Q3	0.015	0.036

*$p < 0.05$; **$p < 0.01$.

3.6. Neuroticism as a predictor of anxiety and depression

The linear regression analysis was applied to verify whether the level of neuroticism of the young people under study is a predictor of the general severity of anxiety and depression, which is reflected in the overall score in the RCADS questionnaire. The data are presented in Table 14. It turned out that neuroticism is a significant predictor of the general severity of anxiety and depression in the studied youth ($t = 31.67$; $df = 943$; $p < 0.001$) and accounts for 51.5% of variance of this outcome. It is also a predictor of the severity of all individual types of anxiety and depressive disorders, as measured by the RCADS scale (SOC - $\beta = 0.61$, $t = 23.84$, $df = 939$, $p < 0.001$, $R^2 = 0.21$; PD - $\beta = 0.46$, $t = 15.76$, $df = 939$, $p < 0.001$, $R^2 = 0.38$; MDD - $\beta = 0.64$, $t = 25.26$, $df = 939$, $p < 0.001$, $R^2 = 0.40$; SAD - $\beta = 0.59$, $t = 22.40$, $df = 939$, $p < 0.001$, $R^2 = 0.35$; GAD - $\beta = 0.52$, $t = 18.54$, $df = 939$, $p < 0.001$, $R^2 = 0.27$; OCD - $\beta = 0.58$, $t = 22.03$, $df = 939$, $p < 0.001$, $R^2 = 0.34$). The study results indicate the importance of the personality trait – neuroticism - for the occurrence of symptoms of emotional disorders in young people. Concurrently, this outcome suggests that a lower intensity of

TABLE 14 Regression analysis of the variable sum of anxiety and depression.

Predictor	*b**	*S.e. of b**	*b*	*S.e. of b*	t(943)	*p*
Constant			2.67	1.32	2.02	0.043
Neuroticism	0.72	0.02	2.22	0.07	31.67	<0.001***

$F(1, 943) = 1003.0$; $p < 0.001$; Std. error of estimation: 18.40; $R^2 = 0.515$. *$p < 0.05$; ***$p < 0.001$.

neuroticism may be, in a difficult situation, a protective factor for the emergence of anxiety and depression symptoms in the group of adolescents.

4. Discussion

This study examined the severity of anxiety symptoms, represented by the occurrence of various anxiety symptoms, symptoms of depressive disorders, severity of neuroticism, and attitudes towards social approval in adolescents aged 11 to 15. The study was carried out during a period of particular exposure of adolescents to traumatising social factors, i.e., in the spring of 2022 in Poland, just after the start of the war in Ukraine and 2 years after the onset of the COVID-19 pandemic. However, the level of severity of neuroticism as a trait was found to be moderate in the population of adolescents studied, and it was gender-related, i.e., it was higher in girls than in boys. However, the higher intensity of neuroticism in girls is a long-observed and repeatedly corroborated trend in research (34, 45, 46). Yet, it is interesting to note that in the study sample, the biggest proportion of respondents obtained high scores of neuroticism, i.e., above sten score of 7 (40.42% of the entire study sample), which shows that the significant part of the total number of the adolescents studied is vulnerable to stress and anxiety. The highest severity of neuroticism is observed among adolescents aged 14. Perhaps this group was most severely affected by both these difficult and unusual phenomena, i.e., the pandemic and the war, during their development due to personality susceptibility, which allows to predict the occurrence of anxiety and depressive disorders. It largely depends on to what extent those difficult situations - the pandemic and the war - disrupted the functioning of young people. An important condition for maintaining balance in a situational crisis overlapping with a difficult developmental stage is the very construct of a young person's personality. It also clarifies how individuals react differently to a common experience (45, 47).

Nonetheless, the results of the study showed relatively lower rates of symptoms of the observed disorders than expected. It turned out that the adolescents surveyed felt moderately concerned. Similar results were reported in a multicultural community study of adolescents in Singapore, where it was found that, despite the pandemic, about 50 per cent of the adolescents under study presented an average level of resilience, rather than a lower one, as it was assumed. Lower levels of resilience were specifically associated with poorer coping skills and lower socio-economic status, which in Singapore is the case of the minority of young people of Chinese origin (48).

In contrast, the group of the youngest adolescents surveyed (aged 11) demonstrated the highest percentage of low severity of neuroticism. At the same time, the profile of other age groups was similar in this respect. Through this inconsistency in the frequency distribution a developmental difference was probably identified and it demonstrated lower vulnerability to anxiety among young persons in preadolescence. This is consistent with the developmental dynamics, which is associated with an increase in the tendency towards anxiety and emotional instability in adolescents after the age of 12 in many cultural areas, regardless of the part of the world (44). The age-related difference in anxiety severity also relates to the prevalence of symptoms of selected anxiety disorders, which are fewer in adolescents at 11 years of age compared to their older peers. In the study group, a significant difference concerns separation anxiety, which is higher in older adolescents. In clinical terms, this is an indicator of a reduced sense of security, which is lower in adolescents aged 14 and 15. This is perhaps the result of emotional imbalance increasing with age, therefore there is a developmentally justified search for security in the relationship with parents (45, 48). However, it cannot be excluded, either, that adolescents express their concern with tragic events and with this infrequent developmental burden. It may have greater significance and stronger effects on the emotional state of older adolescents who perceive psychology-related changes more strongly and make more conscious judgements regarding the resources and risks present in the environment in comparison to the adolescents at an earlier stage of adolescence who are more focused on the biological changes (48). This effect is gender-related because boys, the older they get, are generally more anxious and prone to depressive reactions. In girls, on the other hand, it is expressed as an increase in the fear of negative social evaluation and separation from their caregiver: the older the girls are, the more likely they are to experience such fears. The differences identified confirm the knowledge of gender preferences, which in girls are significantly more related to sensitivity to social evaluation and approval-seeking, as partially indicated by the results obtained (49). The fact that boys are more prone to depressive reactions, however, is somewhat surprising in view of previous reports that girls in adolescence are also more susceptible to depression due to biochemical and emotional determinants (50). In an earlier study of Polish adolescents, the prevalence of depressive symptoms in girls was statistically significantly higher than in boys, at 33.6 per cent and 18.2 per cent for girls and boys, respectively (51). However, research on the assessment of the risk of depression among adolescents during the COVID-19 pandemic (52) does not indicate a gender advantage in terms of depressive reactions, which may suggest that the boys' population bears the consequences of the burdensome situations on a par with girls.

The research presented also showed that adolescent girls experienced significantly higher anxiety at the time of the survey than the adolescent boys. Thus, there are significant gender-related differences in the severity of anxiety symptoms among the subjects, as it is the girls who have significantly higher stress indicators than the boys in the study group. Previous extensive research on this developmental period shows that female gender is a risk factor for anxiety (53, 54), and adolescent girls report many times higher levels of stress than boys in this age group (55, 56). The results of the studies mentioned confirm this trend. The girls under study have more

depressive symptoms and a higher overall score for anxiety and depressive disorder symptoms, although the effect is not strong. Similar results were obtained in a study of Croatian adolescents published by a team of researchers from Rijeka (57), which showed that the average anxiety level of Croatian adolescents was not high. At the same time, girls also reported more anxiety symptoms, i.e., they felt anxious to a greater extent than boys in the Croatian study group.

The degree of concern about the pandemic and the war in Ukraine was also investigated by directly asking the youth surveyed about these issues. It turned out, as in the case of anxiety and depression symptoms, that girls were significantly more anxious than the boys about the COVID-19 pandemic and felt the stress related to distance learning more strongly. Moreover, their anxiety about the war in Ukraine was higher in the study group, although the effect of the observed differences was not strong. Perhaps the expectations of higher levels of anxiety and depression symptoms in adolescents are due to the search for analogies as to the way adults react to stress. However, this is age-determined (17), which is related to competence and predisposition in the cognitive assessment of a stressor. In earlier studies in adults, the propensity to anticipate catastrophic events and one's own coping ability in the secondary assessment of the stressor were predictors of anxiety, which was not confirmed in the adolescent group (58). At the same time, ruminations turned out to be a factor reinforcing adolescents' susceptibility to respond with anxiety, but this aspect of functioning was not investigated in the study group. The effect obtained in measuring the severity of anxiety of adolescents from Croatia is partly accounted for by the result showing that the adolescents under study are more likely to choose adaptive cognitive emotion regulation strategies than other strategies which potentially confirms the developmentally increasing ability to cope with crisis situations in this age group (18, 19).

However, the conducted research confirmed at least a moderate, and in some cases strong, association of neuroticism as a trait with the occurrence of psychopathological symptoms. In the group of adolescents studied, symptoms of anxiety were observed, including social phobia, panic anxiety, separation anxiety, generalised anxiety and obsessive-compulsive disorder, as well as symptoms of depression in connection with adolescents' neuroticism. It turned out, as expected, that the higher the neuroticism, the higher the prevalence of all the aforementioned manifestations of anxiety and depression, both in boys and girls. These results are compliant with initial reports on neuroticism and its anxiety-predisposing role, which was confirmed by Eysenck (26, 27). He states that the dominance of negative emotionality and the tendency of neurotics to overindulge in stress generates developmentally adverse consequences in the form of overreacting with anxiety. The result obtained is all the more worrying as about 40 per cent of the respondents are highly neurotic, which denotes a very high proportion of adolescents at a particular risk of constantly experiencing significant levels of anxiety in difficult situations. Alarming reports – provided by professionals observing the mental health crisis of young people – about the need to improve psychological counseling and psychiatric support after the pandemic seem justified (47). Not only treatment strategies, but perhaps mainly prevention of anxiety and depression are currently a challenge in Poland, also due to the ominous threat of war. It is also a challenge worldwide to prevent the effects of objective threats from being imprinted in the experiences and personalities of young people. Enhancing young people's coping competences may therefore be a challenge worth undertaking so as to effectively protect them from psychopathological effects even in such extreme experiences as the pandemic and the resultant social constraints, as well as the threat of an armed conflict caused by the war in the neighbouring country.

5. Conclusion

The findings of this study show that the average level of severity of neuroticism as a trait in the population of adolescents surveyed, aged 11–15, was moderate, although a significant proportion of the adolescents under study were highly vulnerable to stress and anxiety. The highest intensity of neuroticism was observed among adolescents aged 14, while the highest percentage of low level of neuroticism was found in the youngest adolescents surveyed (aged 11). The level of neuroticism varied by gender, i.e., it was higher in girls than in boys.

Moreover, the adolescents under study had relatively lower rates of anxiety and depression symptoms and concern about the pandemic and the war in Ukraine than expected. Cross-gender differences in experiencing symptoms of anxiety and depression were observed. The girls surveyed had higher levels of anxiety and depressive symptoms, and reported more anxiety about the pandemic and war in Ukraine. It turned out, as in the case of anxiety and depressive symptoms, that girls were significantly more anxious than boys about the COVID-19 pandemic and felt the stress of distance learning more strongly. Their anxiety about the war in Ukraine was higher in the study group, although the effect of the observed differences was not strong. Finally, it should be stressed that the age-related difference in the severity of separation anxiety was identified, which was higher in older adolescents (i.e., those aged 14 and 15), especially in boys. The older the adolescents are, the more anxious they are in general and more prone to depressive reactions. In girls, on the other hand, this is expressed by an increase in the fear of negative social evaluation and separation from the caregiver: the older the girls are, the more likely they are to experience such fears. The differences identified confirm the existence of gender-related preferences, which in girls are significantly more related to sensitivity to social evaluation and approval-seeking, and this is partly demonstrated in the results (49).

6. Limitations

Among the limitations of the study design presented, it is worth mentioning that the survey was conducted in groups via an online form, thus the young people provided self-reports on the basis of their own understanding of the survey questions. Although the procedure took place with the researcher present, it seems probable that some respondents may not have used the opportunity to ask for clarifications, in case the description of the statement was not well-understood. A questionnaire method was used, therefore the results only include information about the conscious experiences of the respondents, while the description of potential subconscious mental processes related to the suppression of unpleasant emotional states was not available in the study (59). Another limitation is the lack of information from parents that would enable to compare the results obtained from the adolescents, and this could be a significant contribution on the informative level as it is practiced in standard assessment procedures for children and adolescents. Due to the nature of the study, the research involved adolescents from a standard group participating in regular school education. This also means that on a day-to-day basis the respondents sufficiently adaptively cope with the demands of everyday life, i.e., they

have the resources to cope with stress (17). It seems reasonable to study the same variables in children and adolescents burdened with various anxiety disorders, i.e., to investigate whether high-risk groups experience an increase in symptoms in the event of higher situational stress. When examining the emotional impact of difficult situations in adolescents, it would be essential to monitor the use of coping strategies and to measure the level of resilience, as both variables in previous studies have been found to be important in shaping young people's individual responses to situational stress (57, 59). Conducting longitudinal and experimental studies in the future that could be useful for investigating prolonged exposure to stress factors (60) – which undoubtedly include the ongoing war in this part of Europe – is worth considering.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Faculty of Psychology at the Kazimierz Wielki University in Bydgoszcz, Poland (7/13.06.2023). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MW-S: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. IG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. MD: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Examining terror management theory in Ukraine: impact of air-raid alarms and explosions on mental health, somatic symptoms, and well-being

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Objective: This study sought to evaluate Terror Management Theory (TMT) assumptions about death awareness and its psychological impact in the context of a real-world war situation with high external validity. We examined if factors such as habituation to war circumstances and psychological resilience could buffer the effects on civilians' anxiety, physical and mental health, and affect.

Method: We implemented a pre-registered smartphone-based experience sampling method study over four weeks, with 307 participants (k = 7,824) living in war-affected areas in Ukraine whereby participants were regularly exposed to war situations, including air-raid alarms, explosions, and infrastructural problems.

Results: The data indicated that war situations significantly increased anxiety, negatively impacting mental health, and raising somatic symptom severity. While habituation showed a mild buffering effect on these impacts, resilience did not.

Conclusion: This real-world investigation supports TMT's fundamental assumptions about death awareness and its psychological implications. However, even amidst the presence of real, life-threatening situations, the buffering effects of habituation were surprisingly minimal. This suggests that further exploration of TMT's buffering factors in real-world scenarios is warranted.

KEYWORDS

terror management theory, mortality salience, mental health, somatic symptoms, experience sampling method, air-rail alarms, explosions, Ukraine

1. Introduction

This study examines the profound psychological implications of human mortality, as postulated by the Terror Management Theory (TMT). According to TMT, awareness of death incites anxiety and influences overall well-being, potentially moderated by factors such as self-worth (1–3). However, previous research, despite supporting TMT, has primarily relied on experimental mortality salience interventions, thereby raising questions regarding external validity (1, 4). Furthermore, the proposed buffering effect of psychological aspects like

self-worth and worldviews on death anxiety is inadequately explored (5, 6). Our research investigates these relationships within the authentic, distressing context of the war in Ukraine, utilising a longitudinal experience sampling design. This study focuses on the psychological impacts of war-specific situations, such as air-raid alarms and airstrikes (i.e., integral components of psychological warfare) on civilians. Historical accounts of psychological warfare have reported varying effects, from minimal psychological impacts to significant psychological and somatic symptoms. In light of this, we aim to assess the impact of these war-specific situations on anxiety, well-being, somatic symptom severity, and mental health, examining the potential buffering effects of habituation and resilience.

Our research is based on the understanding that mental health is an independent, unipolar dimension, not simply the absence of psychopathology but existing alongside mental disorders (7–9). Our research design, aiming for robust findings and enhanced ecological validity, includes a large sample size, daily assessments over four weeks, an examination of general physiological symptoms and mental health, daily anxiety level evaluations, the use of the affect grid for overall mood assessment, evaluation of war-specific experiences, investigation into habituation to war conditions, and consideration of resilience and general perceived stress as potential moderators.

1.1. Facing fear: terror management theory and its implications

It has long been assumed that confrontation with one's own transience triggers a deep anxiety (10). Learning to deal with the finite nature of our lives is an important and defining issue for many. Based on this assumption, psychologists developed Terror Management Theory [TMT; Greenberg et al. (2)], which posits that awareness of death causes anxiety (reflected in the term "terror" in TMT), and this, in turn, affects psychological well-being. One possible cause for this dynamic comes from evolutionary theory (i.e., a basic motive of our existence is to survive). Nevertheless, a further assumption of TMT is that the link between death awareness and well-being is buffered (i.e., moderated) by other factors such as self-worth. For example, among people who have high self-worth, death awareness may less likely decrease well-being, compared with people who have low self-worth.

There is research supporting TMT (3). Predominantly, studies use different experimental designs to induce mortality salience in participants, such as reading death related essays, using subliminal primes, or watching videos, films, or slide shows [for a meta-analytic review, see (1)] to assess the impact on death anxiety or other psychological concepts including self-esteem, body satisfaction, materialism attitudes, or self-transcendent values (1). In recent years, there has also been an interest in the impact of mortality salience on mental health disorders [e.g., (11)] by assuming that the fear of death also contributes to the development and maintenance of mental health problems [for a review, see (12)]. For example, using a mortality salience experiment, researchers found that reminding participants of death led to compulsive handwashing in people with an obsessive-compulsive disorder (13), social anxiety in socially phobic individuals (14), and anxious behaviours in people with a panic disorder (15).

Nevertheless, research has also raised several concerns about TMT. First, almost all past research lacks external validity [i.e., generalisability to our everyday life; Burke et al. (1); for a similar reasoning, see (12)]. Second, one assumption of TMT is that psychological buffers such as self-worth and worldviews influence the link between death awareness and anxiety. For example, higher self-worth and higher motivation to defend one's worldview are associated with a weaker association between mortality salience and anxiety. Interestingly, there is only very little empirical research which analysed this link in detail [for similar reasoning, see (6, 16)].

1.2. Air-raid alarms and airstrikes

Psychological warfare is an integral part of a war and is as old as humankind (17). In the last century, methods of psychological warfare have changed substantially, from airstrikes to newer forms of drone warfare (18). For example, airstrikes were used in World War (WW) I by Zeppelins, which dropped bombs on civilians [e.g., London; for a historical review, see (19)]. Airstrikes are associated with air-raid alarms, which warn the civil population of an impending airstrike. The main reason for these airstrikes was to put psychological pressure on the civil population due to the uncertainty of the time and place such airstrikes would take place. For example, airstrikes were used as an additional source of psychological warfare for a usually already distressed civilian population [e.g., due to deaths of family members; restrictions of everyday life; hunger; Linden (19) and Fegan (20)]. Whenever people are put under immense psychological stress for a certain time, people may develop somatic symptoms up to mental illnesses [e.g., anxiety disorders, panic attacks, post-traumatic stress disorders (PTSD), war syndromes; Jones and Wessely (21)].

1.3. Impact on mental disorders and health

Although there are reports of people developing severe psychological and somatic symptoms [e.g., (19); PTSD in soldiers: Johnson and Thompson (22)], other accounts describe the psychological impact of air-raid alarms and bombs on civilians as minor with extreme psychological reactions being rare [WWI: Anonymous (23); WWII: McLaughlin (24) and Vernon (25); Persian Gulf War: Sasson et al. (26); war in former Yugoslavia: Starcevic et al. (27)]. The reasons for this difference could be manifold. Propaganda and censorship in very early reports of WWI and WWII might have taken place by downplaying the psychological impact of the war situation on civilians. Furthermore, a conscious displacement of the psychiatric casualties after the war by re-labelling them becoming unrecognisable in hospital statistics have been described (19). Nevertheless, reports from more recent wars have found little evidence of a strong effect of air-raid alarms on mental health. For example, Sasson et al. (26) could not find any evidence that air-raid alarms raised the frequency of panic attacks in people with a panic disorder during the Persian Gulf War. Similar results have been found during the war in former Yugoslavia (27), such that no significant relationship between panic attacks and real danger was found. However, there was a direct impact of the war situation on feelings of anxiety, in line with one of the main assumptions of TMT. Therefore, panic attacks and fear induced by real danger might have different roots.

A further aspect of airstrikes is important to note. Some reports assume that air-raid *alarms* might have more impact on people's fear and anxiety than the actual bombing itself (20). In contrast, based on contemporary literature, people may become accustomed to air-raid

alarms such that alarms become a part of people's life during wartime [e.g., (28)]. So, habituation of people to the war situation could be a reason why some authors did not find any substantial effects of the war situation on people's psyche. This would be in line with one of the assumptions of TMT by postulating that psychological buffers can reduce the impact of a potential life threat on anxiety or well-being.

1.4. War situation and terror management theory: anxiety, physical, and mental health

From a theoretical point of view, air-raid alarms and explosions have the potential to activate mortality salience; that is: attention to one's own death is made accessible according to TMT [e.g., (2, 29, 30)]. This usually heightens anxiety levels and compromises well-being. However, psychological buffers such as high self-worth can mitigate this effect. Self-worth can be developed through an individual sense of life, overcoming the physical self, and changing worldviews. Interestingly, there is very little real-life empirical evidence [e.g., (6)] on that assumption which has also been criticised in past research [e.g., (31)]. Nevertheless, as already evidenced, the war in Ukraine had a significant negative impact on the Ukrainian population, especially in terms of mental health and well-being for combatants (32), as well as civilians (32–37).

In the past several decades, psychological research has often focused on negative aspects of people's psyche at a pre-clinical level, such as aggression, anxiety, racism, as well as mental disorders at a clinical level. However, this situation has changed since 1998 when Martin Seligman established work on Positive Psychology (38), which explicitly focuses on positive aspects of human life, such as mental health.

Mental health is not necessarily the absence of psychopathology. Several attempts have been made to operationalise mental health as a form of well-being and not the absence of mental disorder [for a review, see (39)]. A prominent approach, which is frequently used, is the concept from Keyes (9), who assumes that mental health (i.e., social, psychological, and emotional well-being) and mental disorder (e.g., panic disorder, major depressive episode, and generalised anxiety) constitute separate, although correlated, unipolar dimensions. Keyes found evidence that participants with a mental disorder can also have good mental health, termed "flourishing" [people with low mental health are "languishing"; see also Seligman (40)]. In a large U.S. adult population, Keyes found that only one fifth of participants were flourishing [i.e., had good mental health; Keyes (7, 9)]. In another study, it was found that adults with a mental disorder and moderate mental health (flourishing) functioned no worse than adults without a mental disorder but with low mental health [languishing; Keyes (8)]. Therefore, both concepts (mental health and mental disorder) are largely independent, but both are important when it comes to living a fulfilling life. This could also be a reason why some people develop a psychological disorder such as PTSD (low mental health), whereas others are rather resilient (high mental health) when faced with the same war-specific situations.

1.5. Research questions

This study aims to understand the psychological effects of war-specific situations on individuals and how factors such as resilience, habituation, and general stress may moderate these effects. Consequently, we present the following pre-registered research questions:

1. How do war-specific situations, such as air-raid alarms and explosions, and their resultant conditions (e.g., electricity outage, heating problems, water supply problems) impact anxiety, somatic symptom severity, mental health, and affect (both pleasure-displeasure and arousal-sleepiness scales)?
2. Is the association between war-specific situations and well-being (anxiety, somatic symptom severity, mental health, affect) moderated by generally perceived stress, resilience, habituation to air-raid alarms and explosions, and socio-demographic factors (age, sex)?

2. Materials and methods

2.1. Study design

In the present study, we want to test the assumptions of TMT by analysing the impact of war-specific situations (i.e., air-raid alarms, hearing airstrike explosions) on anxiety, well-being (affect), as well as somatic symptoms severity (as general indicators of mental illnesses), and mental health (flourishing) in a longitudinal design by using an Experience Sampling Method [ESM; Bolger (41) and Mehl and Conner (42)]. To analyse the assumptions of TMT in a real-word scenario with high ecological validity, we implemented the following design features: (1) a sufficiently large sample in order to have at least an 80% probability of replication if the hypothesis is true; (2) a longitudinal ESM study by assessing the concepts at hand during the everyday life of participants on a daily level for 4 weeks, which supports ecological validity by reducing biases (e.g., false memories, suppressed memories) and assessing the psychological concepts during the war-specific situations; (3) assessed severity of physiological/somatic symptoms in general (e.g., headaches, trouble sleeping, dizziness, chest pain) rather than specific clinical diagnosis; (4) assessed mental health (i.e., flourishing) in addition to somatic symptoms to also have a psychological view of well-being besides the physiological one; (5) assessed the general anxiety level each day as the most obvious emotion elicited by the war situation and a key concept in TMT (6); (6) assessed the general mood on that particular day, using the affect grid (43) as a quick measure assessing well-being along the dimensions of arousal-sleepiness and pleasure-displeasure; (7) assessed war-specific situations happened during each particular day (and previous night) because situations are frequent; (8) focused on the following core aspects based on the results of past research: Air-raid alarms and explosions (number, closeness) and their effects [i.e., electricity outage, heating problems, water supply problems; e.g., (26)]; (9) asked how participants are used to air-raid alarms and explosions at the beginning of the study and in the final questionnaire, to account for habituation [e.g., (28)]; and (10) assessed further moderating trait variables such as resilience (i.e., another psychological buffer against threat), general perceived stress, and socio-demographics (e.g., age and sex).

Based on this design, we were able to test several hypotheses. If the basic assumptions of TMT are true, then we should see heightened

anxiety and lower well-being (i.e., more negative feelings), stronger psychosomatic symptom expression, and lower mental health after a day where war-specific situations took place (air-raid alarms, explosions, heating problems, water supply problems, and power outages). Furthermore, if a positive self-worth buffers against these threats, then resilient people and people who are already used to the war situation (i.e., habituation) should be less affected by these events. To control for the general stress level during the 4-week assessment phase, which might have influenced our measures (e.g., higher somatic symptom severity, lower pleasantness), we controlled for the general perceived stress in all our analyses.

2.2. Participants, recruitment, and power consideration

The study was pre-registered (https://osf.io/bnkjm).

We expected a small effect size (Pearson $r = 0.1$) for all research questions. First, we calculated a rough estimation for the minimum sample size for the multilevel approach by using the recommendation of Twisk (44). Based on a classical power analysis for a cross-sectional design, we needed $N = 782$ participants (bivariate correlation, $\alpha = 5\%$, minimum power = 80%, two-sided). Based on this calculation, we derived a minimum sample size for the multilevel approach. The duration of the study was set to 4 weeks (28 days). Therefore, the final sample size had to be at least $N = 254$ participants (28 repeated measurements, assumed intraclass correlation ICC = 0.30).

Second, we used a more elaborated approach to simulate power in multilevel designs by using the R-package *simr* (45) using the following assumptions: $\alpha = 5\%$, ICC = 0.30, number of retests = 28, number of participants = 300. Furthermore, to be on the safe side, we assumed small effect sizes for the standardised effects at Levels 1 and 2 and cross-level interactions (i.e., 0.1), and a random slope for Level 1 effects of 0.01 [small effect; for recommendations, see (46)]. Using 1,000 simulations and testing several combinations between the number of participants and a number of retests (assuming a dropout during data collection phase), we reached a power of 100.00% (95% CI = 99.63, 100.00) for 300 participants and 14 retests (assuming a conservative 50% non-response rate in the longitudinal part), and a power of 95.10% (95% CI = 93.57, 96.35) for 200 participants and 14 retests (for all calculated combinations, see https://osf.io/s2ypw/). To account for non-response and dropout (~10%–15%), we aimed for at least 200 participants.

Participants were recruited via Taras Shevchenko National University of Kyiv subject pools and personal contacts of the third and fourth authors (e.g., Facebook and Telegram). Through an information webpage generated by the used ESM platform ESMira (47), participants were provided with information about the procedures, inclusion criteria, objectives, and could download the ESMira app to their personal smartphone (Android or iOS) to sign in into the study in order to participate.

In sum, 460 participants joined the study and completed the demographic questionnaire right after enrolling to the study. 445 participants completed at least one single end-of-day questionnaire, and 311 participants stayed until the end of the study by also filling-in the final questionnaire. From the 445 participants filling-in the end-of-day questionnaire, 27 had to be excluded because having not completed the demographic and final questionnaire, or just completed the end-of-day questionnaire once. Furthermore, 9 participants had to be excluded because the stated age was <17 years. The difference between the remaining 409 participants and the 311 participants staying until the end of the study by filling-in the final questionnaire ($n = 98$) can be considered a classical dropout.

A dropout analysis revealed that there were no significant differences between dropouts and complete participants regarding sex ($\chi^2 = 0.35$, $p = 0.84$, $\varphi = 0.03$), age ($t = -0.37$, $df = 379$, $p = 0.36$, Cohen $d = -0.04$), whether they are already used to air-raid alarms and explosions ($t = -1.41$, $df = 390$, $p = 0.08$, $d = -0.16$), relationship status ($\chi^2 = 0.82$, $p = 0.85$, $\varphi = 0.05$), and the area the participant lives within Ukraine ($\chi^2 = 3.50$, $p = 0.48$, $\varphi = 0.10$).

This resulted in a final sample size of $N_{final} = 307$ participants who completed the final questionnaire and at least two end-of-day questionnaires (83.4% females, 0.3% diverse, $M_{age} = 23.7$, $SD_{age} = 9.91$, range = 17–54 years, for educational level distribution, see Supplementary material).[1] All participants stated being of Ukrainian nationality except for one Russian citizen. On average, participants stated being already very used to air-raid alarms (demographic questionnaire: $M = 71.0$, $SD = 23.44$, range 0 to 100, Median = 73; final questionnaire: $M = 71.0$, $SD = 25.53$, range 0 to 100, Median = 76; $r = 0.67$; $t = -0.23$, $p = 0.818$). Moreover, 47.6% of the participants used Android smartphones, while 52.4% used Apple's iPhones.

Regarding relationship status, 45.0% were single and/or living alone, 32.6% were in a relationship, 19.9% were married or in a partnership, 0.8% were divorced, and none stated being widowed (1.7% missing). The majority lived in the centre of Ukraine, with Kyiv as the capital (47.9%, final questionnaire 49.5%), 4.6% in the East (final questionnaire 2.9%), 23.5% in the North (final questionnaire 23.5%), 4.6% in the South (final questionnaire 3.9%), 9.1% in the West (final questionnaire 9.1%), and 10.4% did not state any area (final questionnaire 11.1%). We used this regional classification to assess the differences based on the proximity to the war zone (35) and averaged probability of air-raid alarms occurrence, meaning that they are rarer in Western regions in comparison to others (33). The comparison between the stated area in the demographic questionnaire and 4 weeks later in the final questionnaire shows that some participants probably had to move due to the war situation.

The project was approved by the ethics committee of the senior authors' research institution (The Research Ethics Committee of the Faculty of Psychology of Taras Shevchenko National University of Kyiv, registration number 11-22/6).

2.3. Procedure

The data collection phase started in November 2022 and ended in January 2023 (recruitment on a rolling basis). For data collection and project administration of the ESM-part of the study, the open-source software *ESMira*[2] (47) was used. ESMira is designed for scientific studies by offering a wide repertoire of functions and possibilities for scientific data collection (e.g., presentation and

1 Two participants completed the demographic questionnaire and final questionnaire, but only once the daily questionnaire.

2 https://esmira.kl.ac.at/

consent of the informed consent form, data encryption, data security, anonymous chat function, graphical feedback, anonymity through randomly generated codes, and anonymous reward option). ESMira was available for both Android and iOS operating systems.

Time-points to complete the surveys were predefined by the authors, and participants received a "bing" (i.e., signal, in-app reminder through a smartphone notification) through ESMira on their individual smartphone asking to complete a particular questionnaire. After clicking on that bing, the questionnaire opened automatically.

First, every participant answered demographic questions after having enrolled in the study (bing sent out automatically 1 min after enrolment by ESMira). This was done for two reasons. First, to assess data quality by comparing demographic information with the same questions from the final questionnaire 4 weeks later. Second, to introduce the functionality of bings to participants. Study administrators, as well as participants, quickly received feedback if everything worked as intended.

On a daily basis, participants completed an end-of-day questionnaire asking about events which happened on that particular day (e.g., air-raid alarms, heating problems), their mental health as well as somatic symptom severity. The bing was sent out at 8 p.m., but participants had the possibility of manually adapting this time-point in case of conflicting daily routines (e.g., night shifts). Overall, 111 participants used this option and changed the time schedule a total of 248 times during the study.

At the end of the 4-week assessment phase, a final cross-sectional questionnaire was sent to participants, which consisted of all demographic questions from the first questionnaire for data quality assessment. Furthermore, the following concepts were assessed by referring to the last 4 weeks: general somatic symptom severity [SSS-8; Narrow et al. (48)], perceived stress [PSS-4; Cohen et al. (49)], resilience [BRS; Smith et al. (50)], and mental health [MHC-SF; Keyes (9)]. Finally, participants were asked about general feedback and were instructed on how to get their rewards.

Participants who completed the demographic questionnaire, the final questionnaire, and at least one daily questionnaire were eligible for a 5 € reward (= 180 Hrywnja ₴), obtained through an individual anonymous reward code sent to the senior author (AK) via email. ESMira stated which questionnaire was missing for participants who did not complete all information. In the server-based admin-tool of ESMira, the reward code could be checked for validity, to avoid misuse. Because the ESMira-specific user-id and email-address never had to be used together, this procedure guaranteed that the anonymity of the participant is not breached and that the codes are valid [for more details, see (47)].

During the study, participants could view general as well as personalised statistics in graphical format directly in their ESMira app. The general statistic showed a bar chart of the frequency of completed end-of-day questionnaires over time on a daily basis (for example, see Supplementary Figure S1 – left panel). Furthermore, participants also got feedback about their individual data, i.e., their average mood (from the affect grid) over time, and a scatterplot showing their individual association between the activity level and anxiety level (see Supplementary Figure S1 – right panel). All participants used this option at least once ($M = 18.3$ times, $SD = 17.43$, Median = 11, range 1 to 90).

Because the study was anonymous and there was a large geographical deviation of participants, it was important to give participants support whenever a problem occurs. First of all, we used Frequently Asked Questions (FAQs) within ESMira to give participants support to questions which frequently arise due to the study's design (e.g., "Where can I find my User-ID and is it anonymous?"; "I forgot to fill in the questionnaire yesterday. Should I make up for it today, a day later?"). Second, we used the built-in chat function of ESMira in order to give participants the possibility to send the study administrators a question anonymously. Furthermore, study administrators had the possibility to send participants (individual or groups of) a message, for example, if data were missing.

2.4. Measures

PSS-4, BRS, MHC-SF, and SSS-8 were translated to Ukrainian using a forward and backward translation procedure. Initially, AK and his colleague translated the items from English to Ukrainian (forward translation). Discrepancies between the two versions were resolved through the discussion between the two translators. Different translators, not aware of the original English version, translated items back into English (backward translation).

2.4.1. Demographic questionnaire (cross-sectional)

Following the installation of ESMira and registration during the study, participants were asked (via bings) for basic demographic details [sex (male, female, diverse), age, nationality (Ukraine; other, please state), current relationship status, living in which region of Ukraine (East, Centre, North, South, West)]. Furthermore, it was asked about the habituation to air-raid alarms and explosions ["From your personal point of view, how much are you already used to air-raid alarms and explosions?" (0 = *"not at all"*, 100 = *"already very much used to"*)].

2.4.2. End-of-day questionnaire (longitudinal)

Participants were asked to complete a daily questionnaire concerning their mental health by using the Mental Health Continuum Short Form measure [MHC-SF; Keyes (9), Keyes et al. (51), and Żemojtel-Piotrowska et al. (52)] adapted for the use in ESM designs [i.e., asking about the current day instead of the last 4 weeks; see also (53)]. The MHC-SF consists of 14 items asking about particular feelings which were present on that particular day [e.g., "Over the course of today, how often did you feel … happy?" (*"never", "once", "twice", "three times and more"*)] and assessed three dimensions of mental health: emotional, social, and psychological well-being.

Furthermore, we used the Somatic Symptoms Scale-8 [SSS-8; Narrow et al. (48)] to assess participants' somatic symptoms severity as preliminary indicators of a possible mental illness. The SSS-8 is a reliable and valid short scale of the PHQ-15, which was developed within DSM-5 field trials (48). The SSS-8 consist of 8 items and asks about the severity of physiological complaints (e.g., stomach or bowel problems: 1 = *"not at all"*, 5 = *"very strong"*) in the last night and present day ("During the course of last night and today, how much did you feel affected by the following complaints?").

We also used the affect grid [valence/pleasure, activation/arousal; Russell et al. (43)], which included: "How pleasant did you feel today

on average?" [VAS: 0 = '*very unpleasant*', 100 = '*very pleasant*'; "What was your average level of arousal today?" (VAS: 0 = '*drowsiness*', 100 = '*high arousal*')] followed by a question about the average anxiety level ["How was your average anxiety level today?" (VAS: 0 = '*no anxiety at all*', 100 = '*high level of anxiety*')], and several questions about the war situation on that particular day ["How many air raid alarms did you hear today?" (0, 1, >1); "How many explosions did you hear today?" (0, 1, 2, >2); "If there were explosions, from your subjective point of view, how far away was the closest explosion?" (VAS: 0 = '*very close*', 100 = '*very distant*'); "Were you faced with an electricity outage today?" ('*Yes*'/'*No*'); "Were you faced with problems of heating your flat/house today?" ('*Yes*'/'*No*'); "Were you faced with water supply problems today?" ('*Yes*'/'*No*')].

2.4.3. Final questionnaire (cross-sectional)

To demonstrate the construct validity of our adapted mental health scale, we used the original mental health scale developed by Keyes (9) to assess participants' stable, trait-like mental health (14 items, 6-point scale from 0 = *never* to 5 = *daily*). The same applied to the Somatic Symptom Scale (SSS-8), which we also used in its original form [8 items, 5-point scale from 0 = *not at all* to 4 = *very much*, (48)].

In addition, participants were asked to answer items regarding *perceived stress* (Perceived Stress Scale – PSS–4; Cohen et al. (49); 4 items, 5-point scale from 0 = *never* to 4 = *very often*) and *resilience* [Brief Resilience Scale – BRS; Smith et al. (50); 6 items, 5-point scale from 1 = *strongly disagree* to 5 = *strongly agree*]. With all measures, we asked participants to reflect on the last 4 weeks when answering the questions. All reliabilities were good to excellent (McDonald ω = 0.777 to 0.951, Supplementary Table S1 for details).

2.5. Statistical analyses

We used *R* (54) to conduct all statistical analyses using the *lme4* (55) and *sjstats* packages (56). Random-intercept, random-slope multilevel regression analyses were calculated in the first place because having a better fit than random-slope, fixed-intercept models. We encountered singular fit or non-convergence frequently; therefore, we successively excluded random-effects predictors one-by-one, starting with the least predictive, until there were no problems with model convergence or singular fit.

Then, we ran a baseline model without any predictors to calculate intraclass correlation coefficient (ICC) values (see Table 1). Next, we ran the multilevel model by simultaneously entering all Level 2 variables, i.e., demographics (age and sex), habituation, perceived stress level (PSS), and resilience (BRS). All Level 2 variables (except sex) were grand-mean centred (57, 58).

Because within-subject reliabilities were lower for the mental health subscales compared to the overall score (Supplementary Table S2), and correlations of the subscales with the overall score were substantial ($r = 0.89$ to 0.95; see Supplementary Table S3), as well as the intercorrelations of the subscales were also high ($r = 0.72$ to 0.84; see Supplementary Table S3) we only used the overall mental health score for our main research questions [see also (53)]. Furthermore, we did not have any specific hypotheses regarding the subscales. We additionally included the day of filling-out the questionnaire to all our MLM analyses because values were slightly but significantly declining over time for somatic symptom severity (−0.11) and mental health (−0.02; see also Supplementary Table S4).

The random-intercept random-slope model is displayed below (full model before excluding Level 2 variables due to non-convergence or singular fit):

Level 1 (within person): $(\text{anxiety, symptom severity, mental health, activation, arousal})_{ti} = \pi_{0i} + \pi_{1i}$ Air-raid alarms$[1]_{ti} + \pi_{2i}$ Air-raid alarms$[>1]_{ti} + \pi_{3i}$ Explosions$[1]_{ti} + \pi_{4i}$ Explosions$[2]_{ti} + \pi_{5i}$ Explosions$[>2]_{ti} + \pi_{6i}$ Electricity outage$_{ti} + \pi_{7i}$ Heating problems$_{ti} + \pi_{8i}$ Water supply problems$_{ti} + \pi_{9i}$ Day of study$_{ti} + e_{ti}$.

Level 2 (between persons): $\pi_{0i} = \beta_{00} + \beta_{01}$ Age.cgm $+ \beta_{02}$ Sex(female) $+ \beta_{03}$ PSS.cgm $+ \beta_{04}$ BRS.cgm $+ \beta_{05}$ Habituation.cgm $+ \beta_{06}$ Day of study $+ r_{0i}$.

Level 2 (between persons): $\pi_{1i} = \beta_{10} + r_{1i}$; $\pi_{2i} = \beta_{20} + r_{2i}$; $\pi_{3i} = \beta_{30} + r_{3i}$; $\pi_{4i} = \beta_{40} + r_{4i}$; $\pi_{5i} = \beta_{50} + r_{5i}$; $\pi_{6i} = \beta_{60} + r_{6i}$.

We used R^2_{GLMM} (59, 60) as a measure of explained variance, which can be interpreted like the traditional R^2 statistic in regression analyses. $R^2_{marginal}$ represents the proportion of variance explained by the fixed factors alone, and $R^2_{conditional}$ the proportion of variance explained by both fixed and random factors. Additionally, following Nakagawa and Schielzeth (60), we also included AIC and BIC as information criteria indices.

For research question 2, we calculated random-intercept, fixed-slope multilevel models because all full random models again failed to reach convergence. Because of the large number of interaction terms when including all Level 2 variables into a single model (eight Level 1 variables, five Level 2 variables), we decided to analyse interactions by only including one Level 2 variable at a time resulting in 5 multilevel models. Furthermore, because of the still large number of single results, we presented only the effect size of each predictor together with the level of significance (for the values, see Supplementary Table S5).

We applied Generalisability Theory Analysis [GTA; Brennan (61) and Shrout and Lane (62)] by using the *multilevel. Reliability* function in the *psych* package in *R* (54) to analyse the within-person as well as inter-individual reliability. Missing values were, in general, very rare (< 0.5%) or even not possible due to a forced-response design (e.g., MHC-SF in the longitudinal phase) and were replaced by using the nearest neighbour method (except demographic variables). Because the assessment of habituation to air-raid alarms and explosions from the demographic questionnaire and the final questionnaire were highly correlated with no mean difference ($r = 0.67$; $t = -0.23$, $p = 0.818$), we calculated a mean score and used this one in all further analyses. Finally, there was only one person who self-stated being diverse regarding their gender; we, therefore, excluded this person from further analysis.

All data, analysis scripts, and materials can be found online at https://osf.io/s2ypw/.

3. Results

3.1. Deviation from the pre-registration

First, although we stated in the pre-registration that we will include all longitudinal questionnaires from all participants, we decided to exclude participants who completed only a single questionnaire out of the possible 28 questionnaires ($n = 24$; 0.3% of

10.3389/fpsyt.2023.1244335

TABLE 1 Results of the multilevel analyses.

	Fixed						Random	
		B	SE	β	CI	*t*		*SD*
Somatic symptoms severity								
Intercept	β_{00}	15.12	0.69	−0.14	−0.36, 0.08	22.00***	r_{0i}	4.55
Within-person								
Air-raid alarms [1]	β_{10}	0.37	0.11	0.06	0.03, 0.10	3.36***		
Air-raid alarms [>1]	β_{20}	0.77	0.18	0.13	0.07, 0.19	4.41***		
Explosions [1]	β_{30}	−0.29	0.25	−0.05	−0.13, 0.03	−1.17		
Explosions [2]	β_{40}	−0.06	0.34	−0.01	−0.12, 0.10	−0.18		
Explosions [>2]	β_{50}	0.33	0.23	0.05	−0.02, 0.13	1.41		
Electricity outage [Yes]	β_{60}	0.01	0.16	> −0.01	−0.05, 0.05	0.07	r_{6i}	0.70
Heating problems [Yes]	β_{70}	0.76	0.14	0.13	0.08, 0.17	5.26***		
Water supply pr. [Yes]	β_{80}	0.33	0.16	0.05	0.00, 0.11	2.05*	r_{8i}	0.66
Day of study	β_{90}	−0.09	0.01	−0.12	−0.15, −0.09	−8.89***	r_{9i}	0.02
Between-person								
Age	β_{01}	−0.02	0.03	−0.04	−0.12, 0.05	−0.80		
Sex [female]	β_{02}	0.49	0.74	0.08	−0.16, 0.32	0.66		
PSS-4	β_{03}	1.89	0.39	0.24	0.14, 0.34	4.83***		
BRS	β_{04}	−1.22	0.45	−0.13	−0.23, −0.04	−2.68**		
Habituation	β_{05}	−0.01	0.01	−0.02	−0.11, 0.07	−0.49		
$R^2_{conditional} = 70\%$, $R^2_{marginal} = 13\%$, AIC = 35,282, BIC = 35,458, ICC = 65%								
Mental health								
Intercept	β_{00}	15.87	1.21	−0.13	−0.34, 0.08	13.02***	r_{0i}	7.96
Within-person								
Air-raid alarms [1]	β_{10}	−0.32	0.19	−0.03	−0.06, 0.00	−1.69		
Air-raid alarms [>1]	β_{20}	−0.27	0.31	−0.02	−0.08, 0.03	−0.87		
Explosions [1]	β_{30}	−0.31	0.44	−0.03	−0.10, 0.05	−0.70		
Explosions [2]	β_{40}	−0.60	0.60	−0.05	−0.16, 0.05	−0.99		
Explosions [>2]	β_{50}	−1.06	0.41	−0.09	−0.17, −0.02	−2.63**		
Electricity outage [Yes]	β_{60}	0.09	0.27	> −0.01	−0.04, 0.05	0.35		
Heating problems [Yes]	β_{70}	−0.89	0.28	−0.08	−0.13, −0.03	−3.16**	r_{7i}	1.61
Water supply pr. [Yes]	β_{80}	−0.45	0.29	−0.04	−0.09, 0.01	−1.56	r_{8i}	1.46
Day of study	β_{90}	−0.02	0.02	−0.01	−0.04, 0.01	−1.15	r_{9i}	0.25
Between-person								
Age	β_{01}	0.15	0.05	0.13	0.05, 0.22	3.21**		
Sex [female]	β_{02}	2.42	1.32	0.21	−0.01, 0.44	1.84		
PSS-4	β_{03}	−5.82	0.70	−0.39	−0.48, −0.30	−8.35***		
BRS	β_{04}	0.33	0.81	0.02	−0.07, 0.11	0.41		
Habituation	β_{05}	0.01	0.02	0.02	−0.07, 0.10	0.42		
$R^2_{conditional} = 73\%$, $R^2_{marginal} = 19\%$, AIC = 42,548, BIC = 42,724, ICC = 69%								
Anxiety								
Intercept	β_{00}	28.20	2.34	−0.33	−0.50, −0.16	12.04***	r_{0i}	15.26
Within-person								
Air-raid alarms [1]	β_{10}	4.67	0.66	0.18	0.13, 0.23	7.02***		
Air-raid alarms [>1]	β_{20}	5.45	1.06	0.21	0.13, 0.28	5.15***		

(Continued)

TABLE 1 (Continued)

		Fixed					Random	
		B	SE	β	CI	*t*		*SD*
Explosions [1]	β_{30}	7.80	1.53	0.29	0.18, 0.41	5.11***		
Explosions [2]	β_{40}	12.37	2.07	0.47	0.31, 0.62	5.97***		
Explosions [>2]	β_{50}	13.39	1.40	0.51	0.40, 0.61	9.58***		
Electricity outage [Yes]	β_{60}	0.70	0.89	0.03	−0.04, 0.09	0.79		
Heating problems [Yes]	β_{70}	3.13	0.94	0.12	0.05, 0.19	3.34***	r_{7i}	5.45
Water supply pr. [Yes]	β_{80}	1.39	0.91	0.05	−0.02, 0.12	1.52		
Day of study	β_{90}	−0.21	0.05	−0.07	−0.10, −0.04	−4.24***	r_{9i}	0.62
Between-person								
Age	β_{01}	0.11	0.09	0.04	−0.02, 0.10	1.25		
Sex [female]	β_{02}	5.14	2.42	0.19	0.01, 0.37	2.12*		
PSS-4	β_{03}	5.85	1.27	0.17	0.10, 0.24	4.61***		
BRS	β_{04}	−4.13	1.48	−0.10	−0.17, −0.03	−2.79**		
Habituation	β_{05}	−0.10	0.04	−0.09	−0.15, −0.02	−2.63**		
$R^2_{conditional} = 42\%$, $R^2_{marginal} = 12\%$, AIC = 56,754, BIC = 56,903, ICC = 33%								
Affect grid – valence (negative vs. positive)								
Intercept	β_{00}	54.43	1.84	0.11	−0.04, 0.26	29.64***	r_{0i}	11.67
Within-person								
Air-raid alarms [1]	β_{10}	−0.80	0.61	−0.03	−0.09, 0.02	−1.31		
Air-raid alarms [>1]	β_{20}	−1.84	0.97	−0.08	−0.16, 0.00	−1.90		
Explosions [1]	β_{30}	−2.95	1.40	−0.13	−0.25, −0.01	−2.10*		
Explosions [2]	β_{40}	−3.01	1.93	−0.13	−0.29, 0.03	−1.56		
Explosions [>2]	β_{50}	−4.87	1.29	−0.21	−0.32, −0.10	−3.77***		
Electricity outage [Yes]	β_{60}	0.27	0.81	0.01	−0.06, 0.08	0.33		
Heating problems [Yes]	β_{70}	−3.51	0.89	−0.15	−0.23, −0.08	−3.95***	r_{7i}	6.39
Water supply pr. [Yes]	β_{80}	−2.78	0.83	−0.12	−0.19, −0.05	−3.37***		
Day of study	β_{90}	0.09	0.04	0.03	0.00, 0.06	2.19*	r_{9i}	0.45
Between-person								
Age	β_{01}	0.07	0.07	0.03	−0.02, 0.09	1.10		
Sex [female]	β_{02}	−0.38	1.86	−0.02	−0.17, 0.14	−0.21		
PSS-4	β_{03}	−8.58	0.97	−0.28	−0.34, −0.22	−8.89***		
BRS	β_{04}	2.16	1.13	0.06	0.00, 0.12	1.90		
Habituation	β_{05}	0.01	0.03	<0.01	−0.05, 0.06	0.20		
$R^2_{conditional} = 34\%$, $R^2_{marginal} = 12\%$, AIC = 56,543, BIC = 56,691, ICC = 30%								
Affect grid – arousal (low vs. high activation)								
Intercept	β_{00}	57.20	1.83	−0.09	−0.24, 0.05	25.82***	r_{0i}	10.22
Within-person								
Air-raid alarms [1]	β_{10}	−0.79	0.65	−0.03	−0.09, 0.02	−1.21		
Air-raid alarms [>1]	β_{20}	−0.59	1.03	−0.02	−0.11, 0.06	−0.58		
Explosions [1]	β_{30}	1.46	1.50	0.06	−0.06, 0.19	0.98		
Explosions [2]	β_{40}	−4.08	2.08	−0.17	−0.34, 0.00	−1.96*		
Explosions [>2]	β_{50}	−1.47	1.39	−0.06	−0.18, 0.05	−1.06		
Electricity outage [Yes]	β_{60}	1.33	0.87	0.06	−0.02, 0.13	1.52	r_{6i}	3.14
Heating problems [Yes]	β_{70}	−2.20	0.90	−0.09	−0.17, −0.02	−2.44*	r_{7i}	4.60

(Continued)

TABLE 1 (Continued)

	Fixed						Random	
		B	SE	β	CI	*t*		*SD*
Water supply pr. [Yes]	β_{80}	−2.63	1.02	−0.11	−0.19, −0.03	−2.57*	r_{8i}	7.60
Day of study	β_{90}	0.03	0.03	0.01	−0.01, 0.03	1.00		
Between-person								
Age	β_{01}	0.25	0.07	0.11	0.05, 0.16	3.77***		
Sex [female]	β_{02}	3.83	1.86	0.16	0.01, 0.31	2.06*		
PSS-4	β_{03}	−5.62	0.97	−0.18	−0.24, −0.12	−5.77***		
BRS	β_{04}	2.60	1.14	0.07	0.01, 0.13	2.29*		
Habituation	β_{05}	−0.01	0.03	<0.01	−0.06, 0.05	−0.15		
$R^2_{conditional} = 26\%$, $R^2_{marginal} = 7\%$, AIC = 57,611, BIC = 57,787, ICC = 26%								

Reference category for air-raid alarms and explosions was 0 (i.e., no air-raid alarms, no explosions) and for sex it was male. CI = 95% confidence interval; β = standardised B; PSS-4 = general perceived stress scale – 4; BRS = brief resilience scale; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (two-sided). ICC of the null model. When applying Bonferroni correction, all effects significant on $p < 0.05$ are not significant anymore.

cases) because of non-compliance. All 24 did not complete the final questionnaire and, as such, were considered dropouts. Second, we did not include area where participants lived in Ukraine in the analyses because many (12.7%) moved during the 4-week assessment phase (i.e., area after 4 weeks was different from the one stated in the demographic questionnaire) or misclassified the area where they live. Third, participants stated that there were no explosions in 87% of cases; therefore, we excluded the question of closeness of the explosion from further analysis ($n = 670$; 8.6% of cases; $M = 46.7$, $SD = 27.7$, Median = 45, range 0 to 100). Finally, although we stated in the pre-registration we were going to use VAS from 1 to 100, due to technical reasons, we had to use a VAS from 0 to 100 (i.e., faulty hard coded definition in ESMira).

3.2. Validity check and reliabilities

Participants stated their demographics at two points during the study, at the beginning and in the final questionnaire. All demographics were highly consistent. Responses for participants' sex showed only one deviation, and for age, only one deviation larger than 1 year. Relationship status was also highly consistent (Kappa $\kappa = 0.90$), showing some inconspicuous changes ($n = 19$ participants changed their current relationship status during the 4-week assessment phase).

Our measure of mental health in the daily questionnaire was substantially correlated with mental health ($r = 0.70$, $p < 0.001$) and moderately correlated with somatic symptoms stated in the final questionnaire in line with past research [4-week time frame, $r = -0.23$, $p < 0.001$, (63), $r = -0.27$, (53), $r = -0.40$]. Furthermore, daily mental health was correlated with resilience ($r = 0.20$) and perceived stress ($r = -0.46$) in the final questionnaire (across all data points; all $ps < 0.001$). Similarly, somatic symptom severity assessed in the daily questionnaire was substantially correlated with the somatic symptoms ($r = 0.69$, $p < 0.001$) and moderately correlated with mental health ($r = -0.24$, $p < 0.001$) in the final questionnaire. Furthermore, somatic symptom severity on a daily basis was correlated with resilience ($r = -0.26$) and perceived stress ($r = 0.33$) in the final questionnaire (across all data points; all $ps < 0.001$). All results speak for the criterion and construct validity of the daily mental health and somatic symptoms measure used in the current study. For all intercorrelations between Level 2 measures and separately for males and females, see Supplementary Table S3.

Internal consistencies of all trait-level instruments used were good to excellent (Cronbach $\alpha = 0.783$ to 0.952; McDonald $\omega = 0.781$ to 0.952, see Supplementary Table S1 for details). For the longitudinal Level 1 measurements, we calculated within- and between-subject reliabilities. Due to the large sample size (which substantially slows down the calculation procedure in *R*) as well as to analyse the reliability equivalence between the Operating Systems (OS) Android and iOS smartphones (i.e., graphical display of questionnaires slightly differs because of the different basic designs of the OS), we calculated the reliabilities for both OS separately. Within-person ($R_C = 0.60$ to 0.87) and between-person ($R_{kR} = 0.94$ to 0.98) reliabilities were good to excellent for mental health as well as somatic symptom severity (see Supplementary Table S2 for details), and differences between OS were negligible (maximum difference = 0.02). This suggests reliable assessment of both within-person changes and inter-individual differences as well as across different OS (64).

3.3. Descriptive statistics/preliminary analyses

A substantial percentage of participants overall were affected at least once by our war-specific indicators during the 4-week assessment phase (air-raid alarms: 83.1% of participants; explosions: 57.5%; electric outages: 85.8%; heating problems: 71.1%; water supply problems: 69.7%; see Figure 1 for the frequency over time). This is also in line with independent statistics collected during the assessment phase (November 2022 to January 2023), 2,144 air-raid alarms have been triggered throughout the Ukraine, and 790 explosions.[3]

During the 4-week assessment phase, participants had, on average, an anxiety level of 34.2 (Median = 30, range 0 to 100) with a large standard deviation ($SD = 26.4$), indicating that anxiety strongly varied

3 https://air-alarms.in.ua/

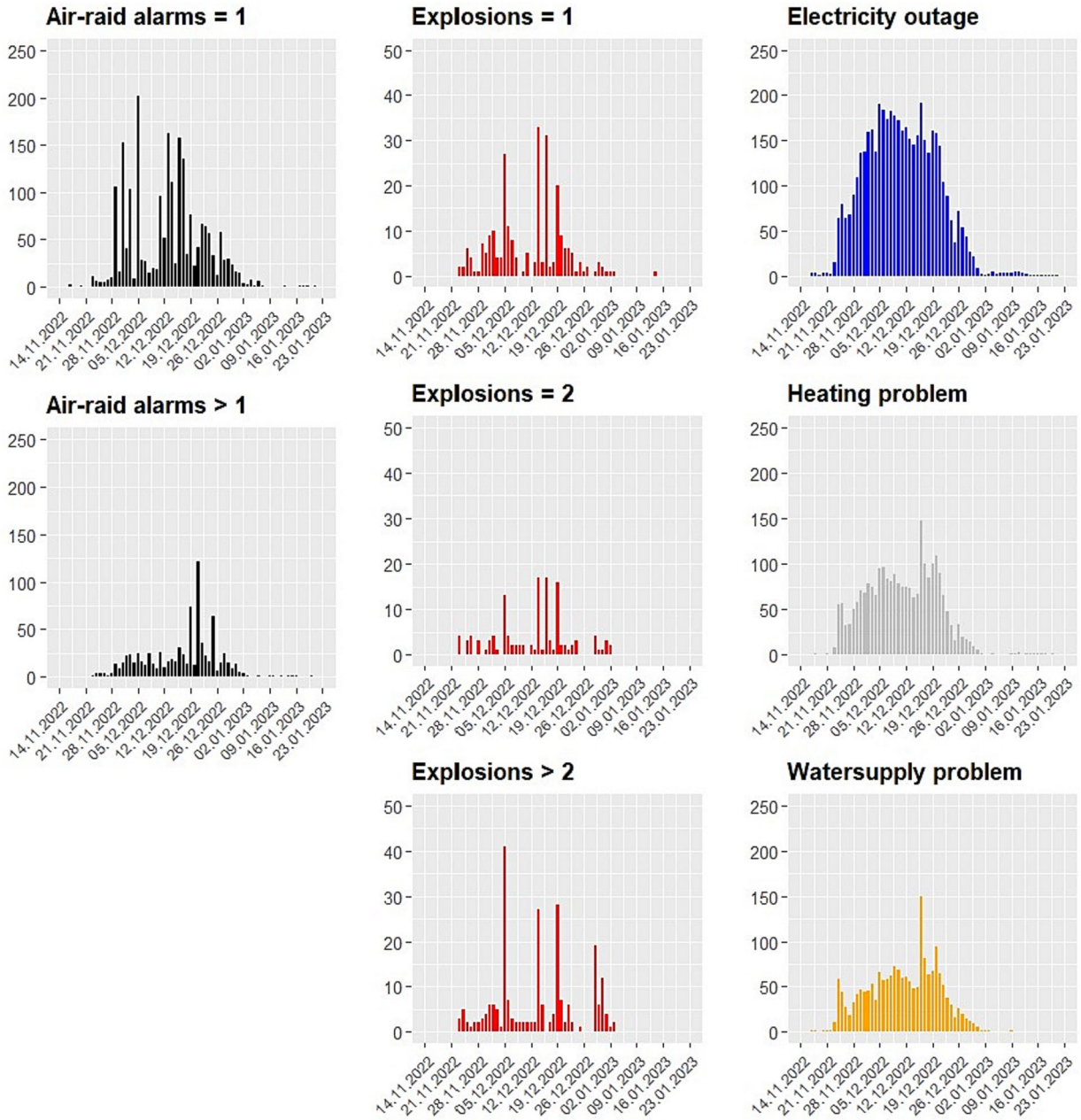

FIGURE 1
Frequency of reported war-specific situations experienced by participants during the assessment phase.

over time. In 27.2% of daily questionnaires (2,117 out of 7,665), participants stated that there was an air-raid alarm on that particular day (more than one air-raid alarm: 10.4%; 1.7% missing). In 3.2% of days, they reported hearing a single explosion on that day (two explosions: 1.6%, more than two explosions: 4.1%; 3.5% missing). In 58.8% of cases, they reported an electricity outage (1.5% missing), in 31.1% a heating problem (1.6% missing), and 24.3% a water supply problem (1.8% missing). Although some of the percentages of war-specific situations appear low (e.g., explosions), these figures are around 0% in countries *without* a war situation.

Because participants frequently used the graphical feedback function in ESMira (see Supplementary Figure S1 for an example), the question arose as to whether or not this could constitute an intervention effect itself on our dependent measures [i.e., reactivity; e.g., (65)]. For example, an individuals' mood levels may decline over time as a result of that individual seeing graphical feedback that their own self-reported mood is declining over time. We calculated simple fixed-effects multilevel models with the number of graphics viewed and the day of the study, and the interaction between both onto the dependent variable (somatic symptoms, mental health, anxiety, pleasure, and arousal). To avoid problems of multicollinearity, the *number of graphics* was grand-mean centred and *day of study* person-mean centred. If there is an intervention effect, we would expect that a possible influence on our dependent measures changes over time, i.e., there should be an interaction effect between *total number of graphics* viewed and the *day of study*. Indeed, we found three

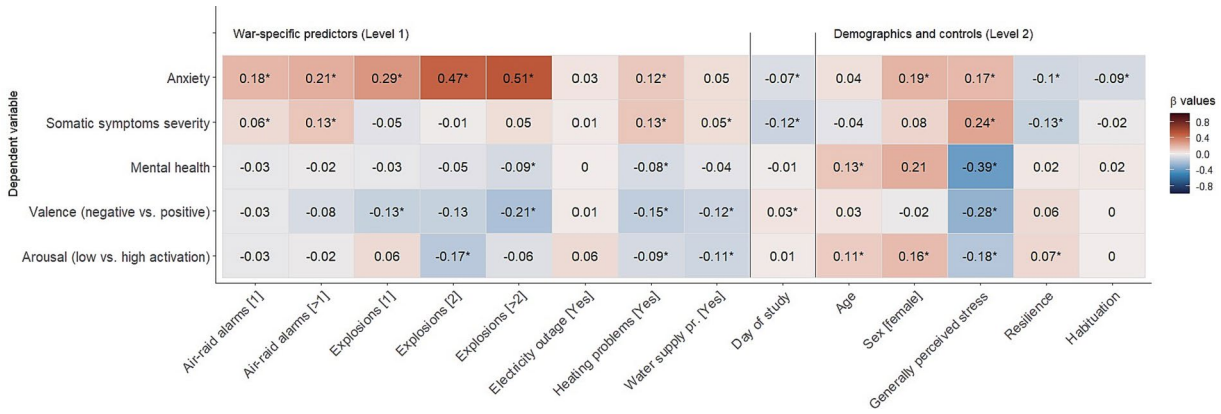

FIGURE 2
Results of the multilevel model (Standardised β values; * = significant).

significant intervention effects [for mental health (β = 0.02), anxiety (β = −0.03), and pleasantness (β = 0.02)], although all had a small effect size (see Supplementary Table S4 for details).

3.4. Research question 1: what impact do air-raid alarms and explosions and resulting situations thereof have on anxiety, mental health, severity of somatic symptoms, and well-being (i.e., pleasantness and activation)?

As can be seen in Table 1 and Figure 2, results are manifold. Strongest effects of the war situation were found with anxiety levels in line with TMT. Explosions and air-raid alarms had a substantial effect, followed by heating problems (assessment phase was during winter months of January and February). Electricity outages and water supply problems had no significant effect (see Table 1). Women and participants with a high general perceived stress had higher anxiety values, while resilient participants had lower anxiety scores, as expected. Habituation only mildly buffered against feelings of anxiousness.

When it comes to somatic symptoms, air-raid alarms significantly raised the severity of symptoms, but explosions and electricity outages had no substantial effect. Heating and water supply problems again raised symptom severity. No sex-specific effects and effects of habituation were found. As expected, general perceived stress was positively associated with symptom severity and negatively associated with resilience. Despite being statistically significant, the effect sizes of the war-specific situations [Mean |β| = 0.06, i.e., very small effect; Funder and Ozer (66)] were substantially smaller than for anxiety (Mean |β| = 0.23, i.e., medium effect).

A similar picture compared to somatic symptoms emerged for mental health where again small effect sizes have been found for the war-specific situations (Mean |β| = 0.04, i.e., very small effects). Having experienced heating problems and more than two explosions on a particular day lowered mental health significantly, but air-raid alarms, electricity outages, and water supply problems had no significant impact. Older participants were slightly more mentally healthy, and participants with generally large perceived stress had lower mental health scores which was even the strongest effect (β = −0.39; see Table 1).

Similar results were found for the other indicator of well-being; that is: the judgement of the valence (negative vs. positive) of one's well-being on a particular day. Explosions, heating problems, and water supply problems were significantly associated with lower positivity. Regarding trait variables, only the perceived general stress showed any significant association and a large effect size. In general, again, effect sizes were small across demographics and trait variables (Mean |β| = 0.11, i.e., small effect).

Finally, war-specific situations were associated with reduced activation among participants (Mean |β| = 0.08, i.e., small effect). In general, older participants, and females, were slightly more activated than younger participants, and men, respectively. More generally, stressed participants had lower activation, and resilient people were slightly more activated than low-resilient people. Again, effects sizes were rather small-to-medium.

In sum, the following general results were observed (Figure 2): war-specific situations had the strongest effects on experienced anxiety (|β|s = 0.03 to 0.51), followed by mental health (|β|s = 0.01 to 0.09) and somatic symptom severity (|β|s = 0.01 to 0.13), although anxiety showed more variability over time within participants (ICC = 33%) than mental health (ICC = 69%) and somatic symptoms (ICC = 65%) (Table 1) suggesting these concepts were more stable longitudinally. These results underline one of the main assumptions of TMT that mortality salience heightens anxiety and can also impact other psychological concepts associated with well-being (physical and mental health, affect).

3.5. Research question 2: are there any moderators?

As can be seen from Figure 3, having low general perceived stress, higher resilience, and habituation to the war situation (all Level 2) did not appear to have an impact on the association between war-specific situations and our dependent measures: somatic symptom severity, mental health, and well-being (valence, arousal). This also applies to demographic differences regarding participants' sex and age. The only significant interactions were found for anxiety, where older

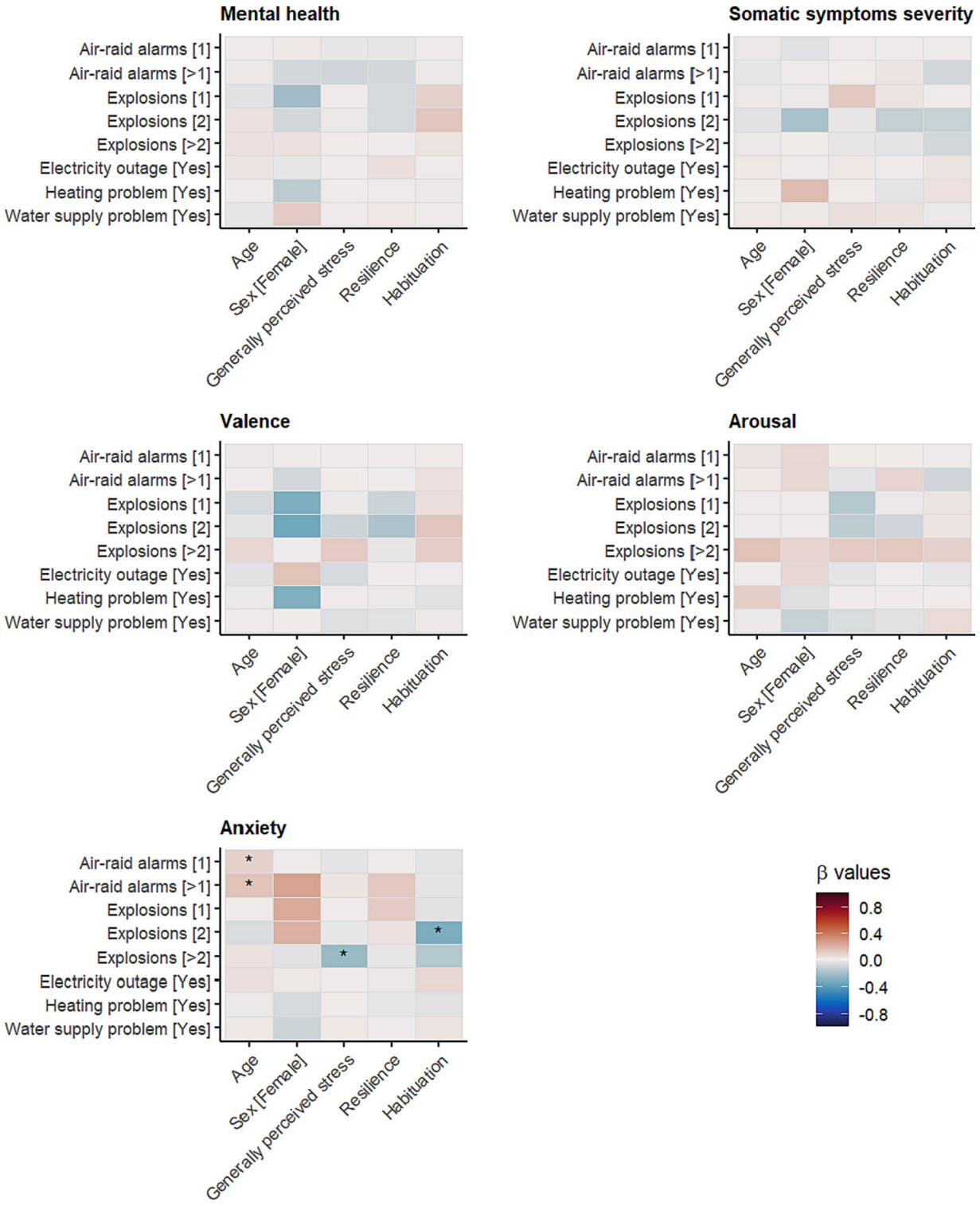

FIGURE 3
Standardised cross-level interaction effects (Bonferroni corrected significance level: *$p < 0.00125$).

participants stated higher anxiety due to air-raid alarms than younger participants (β = 0.09 and 0.14, respectively, Supplementary Table S5), although effect sizes were small. Significant effects were also found for the impact of explosions, yet this is counterintuitive because reporting more than two explosions and higher general perceived stress was associated with lower anxiety scores when compared to the group without any explosions on that particular day (β = −0.24; Figure 3). This might be due to the rather low frequency of participants having experienced more than two explosions on a particular day where no association was found (frequency: 4.1%; Supplementary Figure S2). In line with TMT, a significant interaction between habituation and anxiety was found when faced with explosions, such that habituation

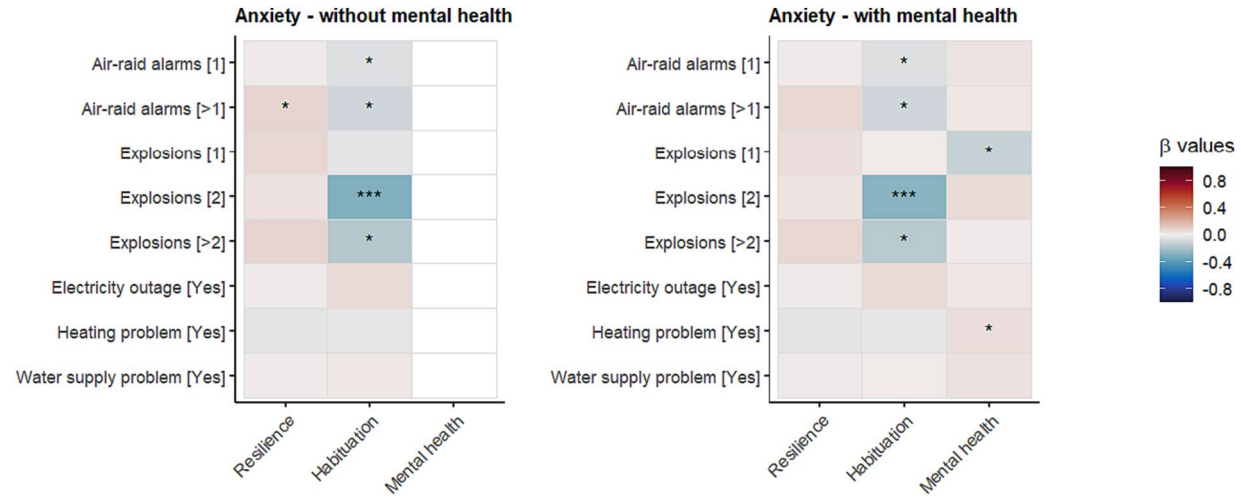

FIGURE 4
Impact of psychological buffers (resilience, habituation, and mental health) on the association between war-specific situations and anxiety. *$p < 0.05$; ***$p < 0.001$; When applying Bonferroni correction, only the effect on habituation and having experienced two explosions is significant (see also Figure 3).

and anxiety were negatively associated among people who experienced two explosions compared to people who experienced no explosions (i.e., low association between habituation and anxiety; effect size of the difference in associations: $\beta = -0.31$). Interestingly, this effect was weaker and not significant among participants who experienced *more than two* explosions ($\beta = -0.17$; ns) although this might be due to the low frequency of cases (frequency: 1.6%, Supplementary Figure S3).

3.6. Explorative analyses: is mental health a further psychological buffer?

Mental health could act as a psychological buffer against the impact of war-specific situations on anxiety. If positive mental health acts as a resilience factor based on the assumptions of TMT, then we would expect that positive mental health buffers against the threat of war-specific situations (i.e., mental health is a moderating factor). Because we did not pre-register this particular research question, we present the results as explorative. As can be seen from Figure 4 (for details, see Supplementary Table S6), although mental health showed some moderating effects between explosions/heating problems and anxiety, when applying Bonferroni correction, these effects are not significant anymore.

4. Discussion

In the present study, the following main results were found. As expected, based on the assumptions of TMT, the war situation (air-raid alarms, explosions) had an immediate effect on perceived anxiety (27, 67). Also, as expected, situations resulting from the direct threat of war which are less immediately life-threatening (e.g., heating problems) had a lesser impact on perceived anxiety. In contrast to anxiety, somatic symptom severity was less affected by the war situations (only air-raid alarms) as well as mental health; specifically, having heard more than two explosions significantly reduced mental health, although effect sizes were substantially smaller than for anxiety. Explosions had a similar effect on affect, such that they reduced mood and slightly reduced arousal, but again effect sizes were smaller than those for anxiety. In general, situations stemming from war situations had only a small impact. Electricity outages had no significant effect at all, and heating and water supply problems only had little influence on anxiety. Overall, the findings lend support to our first research question and one of the basic assumptions of TMT. Furthermore, all these effects appeared to be independent of participants' age and sex as well as general perceived stress-level, resilience, and habituation to the war situation, except for some minor effects found for anxiety. This, in part, supports our second research question that habituation and/or resilience buffers against life-threatening war situations.

As expected, and also in line with the assumptions of TMT, war-specific situations elicited anxiety and negative valence. Interestingly, war-specific situations *lowered* the activation level of participants, which might be counterintuitive. Fear and threat elicit action to deal with threats – often referred to as the "fight, flight, or freeze" reaction (68) – may explain this result. In the present study, the threat of war may lead to 'freeze' reactions which can manifest themselves as withdrawal, freezing in place, or avoiding certain situations (e.g., staying at home, do not waste personal resources, endure the situation). This is understandable since the war situation cannot easily be resolved by the civil population (e.g., avoiding water-supply problems due to bombings).

Also of interest is that electricity outage was not a significant predictor of any outcome; that is: electricity outage did not appear to impact participants' lives to a degree through which they experienced negative psychological or physical health. Furthermore, habituation was also of low predictive power and only reached statistical significance for anxiety; participants appeared to be used to air-raid alarms and explosions, which may buffer them against the impact of war-specific situations (28). This is in line with one of the basic assumptions of TMT, although effects were weak in our study. However, past research operationalised "psychological buffer" as having self-worth and stable world views, rather than habituation and

resilience as defined in the present study, which may explain the differences between the present study and prior work.

Mental health seems to be largely different from mental illness when defined as somatic symptom severity, since we observed only a small-to-medium negative association [$r = -0.27$; see Supplementary Table S3; Keyes (7, 9)]. The pattern of effects was very similar for air-raid alarms and explosions, although effect sizes were small. Furthermore, although more resilient participants were less anxious, had less somatic symptom severity, had higher mental health, and felt more positive than less resilient participants, they appeared to be equally affected by war situations. This suggests that being more resilient may not buffer against war-specific situations, although again, effect sizes were small. This is also in line with the exploratory analysis. Only habituation to the war situation had some buffering effects by reducing the association between explosions and anxiety, such that the higher the habituation, the less likely explosions elicited anxiety (see also Supplementary Figure S3).

These results largely underline the assumptions of the TMT; specifically that a potential threat to one's life leads to heightened anxiety and lower well-being (higher somatic symptom severity, lower well-being, lower positivity; Research question 1). Nevertheless, the mortality salience intervention was in the present study a real life-threat in contrast to the often-used mortality salience instruction of experimental studies (e.g., reading texts about death); we would therefore have expected stronger effects based on the real situation. A result less in line with TMT was that being resilient, or habituated to the war situation, did not substantially mitigate the impact of mortality salience on our dependent measures.

It has been argued that air-raid alarms might have a larger impact than the actual bombing (20) or hearing explosions thereof. Our results found that this appeared to be true for symptom severity, but that explosions (rather than air-raid alarms) had a larger impact on all other outcomes (anxiety, affect grid, mental health), contrary to this theory.

In sum, our study is consistent with past research in two primary ways. First, it is consistent with findings from WWI (23), WWII (24, 25), Persian Gulf War (26), and former Yugoslavia (27), suggesting that the civil population is overall rather resilient to indirect war-specific situations (i.e., no direct contact with combat operations on the front lines) when it comes to their mental health and physiological symptom severity. Second, our study largely supports the assumptions of TMT, whereby effects on anxiety were largest, followed by impact on well-being as well as symptom severity. However, the assumption of psychological buffering effects (habituation and resilience) could only be confirmed for habituation, but not resilience or mental health, and effects were weaker compared to the direct link between mortality salience and anxiety.

4.1. Limitations

Although our design had several advantages compared to previous studies, our study also has several limitations. First of all, we assessed only a time-frame of 4 weeks between December 2022 and January 2023, which might not be representative of the general war situation in Ukraine (i.e., habituation since the start of the war might have already taken place). This is also of relevance when it comes to the long-term effects of war situations, which are often relevant for severe psychological problems such as PTSD. Although we found rather weak effects of war-specific situations on well-being on a daily basis, these weak effects might accumulate over time, leading to severe symptoms later on. Second, although sufficiently powered, our sample was majority female (83.4%), so findings may not generalise to males; however, at the time of the data collection, compulsory military service was in force for males. Furthermore, participants were on average younger ($M_{age} = 23.7$ years) compared to a community-based sample and so findings may not generalise to older adults. Third, we asked participants about anxiety in general, whereas, in TMT research, participants are often asked specifically about *death* anxiety. Nevertheless, effects on anxiety in our study were substantial and similar to those observed in past research using a general anxiety scale (69). Fourth, although our design has high ecological validity, concepts were assessed at the end of the day by retrospectively remembering what happened on that particular day and how one felt. Asking questions about anxiety or well-being directly after events such as air-raid alarms and explosions, such as by using an event-based sampling schema, might have improved ecological validity but would have been ethically problematic. Furthermore, TMT also assumes that a link between mortality salience and anxiety is distal, such that it does not establish itself immediately but only after a couple of minutes; therefore, in experiments, often filler-tasks are used [see Juhl and Routledge (6) for a discussion about proximal and distal measurement of anxiety after mortality salience in TMT research]. Moreover, immediate assessment after the event might even be detrimental.

4.2. Future directions

In the present study, we analysed the negative effects of a war situation on the civil population in Ukraine. Future research might analyse possible positive effects when the war is over. The Post Traumatic Growth (PTG) theory assumes a positive effect due to potentially life-threatening situations which have ended. The effect is defined as "positive psychological change experienced as a result of the struggle with highly challenging life circumstances" (70). It is assumed that PTG is more than just a return to the psychological state prior to the war situation; instead, PTG involves positive changes in self-perception, enhanced levels of functioning, and developing closer relationships with others (71).

5. Conclusion

In the present study, we used a sufficiently large sample to allow us to detect small effect sizes. This allowed us not only to judge if an effect is significant, but also *how important* the effect is for the assumptions of TMT. We applied a sophisticated design (4-week ESM) by focusing on physiological (symptom severity) and psychological variables (mental health, anxiety, and affect) to analyse the impact of war-specific situations (air-raid alarms and explosions) and situations that arise from this (electricity outage, heating problems, and water supply problems). Therefore, the study had high ecological validity to test the assumptions of TMT.

The present study seems to be one of the few studies analysing TMT in real-life situations (6) by generally supporting the key assumptions of TMT; specifically, that mortality salience leads to heightened anxiety levels and compromised well-being, psychological

buffers can mitigate this effect, and that the term *terror* (reflecting the impact on anxiety) is justified. Nevertheless, TMT also assumes an impact on other indicators of well-being (physiological and mental health, affect), which we found, but to a much lesser extent, and also assumes that there are protective psychological factors (e.g., self-worth, resilience) that buffer against aversive effects. We found some evidence of habituation to the war situation and some buffering effects, although not for resilience or mental health.

In sum, the present study, in general, supports the assumptions of TMT but additionally ranks the assumptions as follows: (1) impact on anxiety (strongest); (2) mental health and somatic symptom severity; and (3) protective factors (weakest).

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://osf.io/s2ypw/.

Ethics statement

The studies involving humans were approved by the Research Ethics Committee of the Faculty of Psychology of Taras Shevchenko National University of Kyiv, registration number 11-22/6. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SS, DL, and AK contributed to the conception and design of the study. AK and SP recruited participants. DL supervised the technical realisation of the study using ESMira and provided technical support with translations. SS performed the statistical analysis. SS wrote the first draft of the manuscript. AK wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1244335/full#supplementary-material

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What are effective strategies to respond to the psychological impacts of working on the frontlines of a public health emergency?

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Background: The COVID-19 pandemic has disrupted the healthcare and public health sectors. The impact of working on the frontlines as a healthcare or public health professional has been well documented. Healthcare organizations must support the psychological and mental health of those responding to future public health emergencies.

Objective: This systematic review aims to identify effective interventions to support healthcare workers' mental health and wellbeing during and following a public health emergency.

Methods: Eight scientific databases were searched from inception to 1 November 2022. Studies that described strategies to address the psychological impacts experienced by those responding to a public health emergency (i.e., a pandemic, epidemic, natural disaster, or mass casualty event) were eligible for inclusion. No limitations were placed based on study design, language, publication status, or publication date. Two reviewers independently screened studies, extracted data, and assessed methodological quality using the Joanna Briggs Institute critical appraisal tools. Discrepancies were resolved through discussion and a third reviewer when needed. Results were synthesized narratively due to the heterogeneity of populations and interventions. Outcomes were displayed graphically using harvest plots.

Results: A total of 20,018 records were screened, with 36 unique studies included in the review, 15 randomized controlled trials, and 21 quasi-experimental studies. Results indicate that psychotherapy, psychoeducation, and mind–body interventions may reduce symptoms of anxiety, burnout, depression, and Post Traumatic Stress Disorder, with the lowest risk of bias found among psychotherapy interventions. Psychoeducation appears most promising to increase resilience, with mind–body interventions having the most substantial evidence for increases in quality of life. Few organizational interventions were identified, with highly heterogeneous components.

Conclusion: Promoting healthcare workers' mental health is essential at an individual and health system level. This review identifies several promising

practices that could be used to support healthcare workers at risk of adverse mental health outcomes as they respond to future public health emergencies.

Systematic review registration: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=203810, identifier #CRD42020203810 (PROSPERO).

KEYWORDS

mental health, healthcare workers, COVID-19, public health emergency, education/awareness and skill development/training, prevention

1 Introduction

The COVID-19 pandemic has been a significant disruption to health systems worldwide. Throughout the lifting and reinstatement of public health restrictions and waves of heightened pandemic activity, there was a growing recognition of a "shadow pandemic" of adverse mental health effects due to the pandemic (1). Healthcare workers (HCWs) in various settings are particularly at risk for significant and prolonged impacts given their frontline role in pandemic response. Previous research has demonstrated long-standing psychological consequences experienced by HCWs after SARS (2, 3), and it is expected that there will be large-scale and long-term psychological impacts due to responding to COVID-19 among several occupational groups (4–8). Several systematic reviews of studies exploring the effects of the COVID-19 pandemic on the mental health of HCWs have reported a high prevalence of anxiety, depressive symptoms, insomnia, burnout, emotional exhaustion, and somatic symptoms (9, 10). Notably, factors such as the incidence of infection in the local setting, peer infections or deaths, and a shortage of personal protective equipment all increased the likelihood of experiencing adverse mental health outcomes (9, 10). At the same time, the availability of psychological support resources had a protective effect (9). With this knowledge, an action plan, support, and resources for individuals and organizations are needed to adequately support those experiencing or at risk for psychological distress or adverse mental health outcomes.

There is currently limited guidance on how best to support HCWs in response to and following public health emergencies, such as pandemics. Recent syntheses have gathered very low- to moderate-certainty evidence about interventions that may positively affect healthcare workers' mental health during a disease outbreak. However, these reviews have focused only on narrow categories of intervention, for example, online mindfulness programs (11), or limited populations, for example, those experiencing burnout (12). There is a need for a high-quality systematic review that captures a broad range of mental health-promoting interventions delivered during various public health emergencies to further inform strategies to improve mental health in HCWs. This review aims to answer the question: What are effective strategies to address the psychological impacts [i.e., anxiety, depression, and Post Traumatic Stress Disorder (PTSD)] experienced by HCWs responding to a public health emergency?

2 Methods

The protocol for this systematic review was registered (PROSPERO #CRD42020203810) and published *a priori*. There were no deviations from this protocol. The Cochrane Handbook for Systematic Reviews of Interventions guided our review protocol (13).

2.1 Search strategy

In collaboration with a health sciences librarian, a comprehensive search strategy was developed and executed in MEDLINE, PsycINFO, Embase, EMCARE, CINAHL, Sociological Abstracts, Business Source Premier, and the Cochrane Central Register of Controlled Trials from inception to 1 November 2022. Search terms related to (1) healthcare personnel; (2) pandemic, epidemic, COVID-19, natural disaster, or public health emergency; (3) psychological supports, interventions, and programs; and (4) mental health outcomes were used (see Supplementary Files, Figure 1 for complete MEDLINE search strategy). Reference lists of included studies and relevant systematic reviews were hand-searched, and relevant experts were contacted to identify any studies that were not captured via our search. Gray literature sources were searched until 22 January 2022, following the Canadian Agency for Drugs and Technologies in Health Grey Matters tool for searching health-related gray literature to identify unpublished studies (14).

2.2 Inclusion and exclusion criteria

Eligible studies described interventions to prevent, minimize, or treat adverse psychological or mental health or wellbeing at an individual, organizational, or systemic level resulting from a public health emergency, defined as emergent situations as those in which the scale, timing, and unpredictability of health consequences threaten to overwhelm routine capabilities (15); for our purposes, we defined these as an epidemic, pandemic, natural disaster, or mass casualty event. The population was limited to frontline HCWs who were involved in the response to the public health emergency. Ongoing public health crises without distinct starting points are excluded from this contextual requirement (e.g., the opioid epidemic, poverty, homelessness as epidemics, or the prolonged HIV/AIDS epidemic). HCWs included medically trained healthcare professionals typically considered at the frontlines (e.g., nurses and physicians in acute care, outpatient, public health, and long-term care) and allied health professions (e.g., personal support workers, infection control professionals, and social workers). Emergency and law enforcement workers whose work is not primarily associated with health (e.g., police and firefighters; non-health-related essential workers such as grocery store employees and cleaning staff; and civilian volunteer emergency responders) were excluded. Any comparison group, such

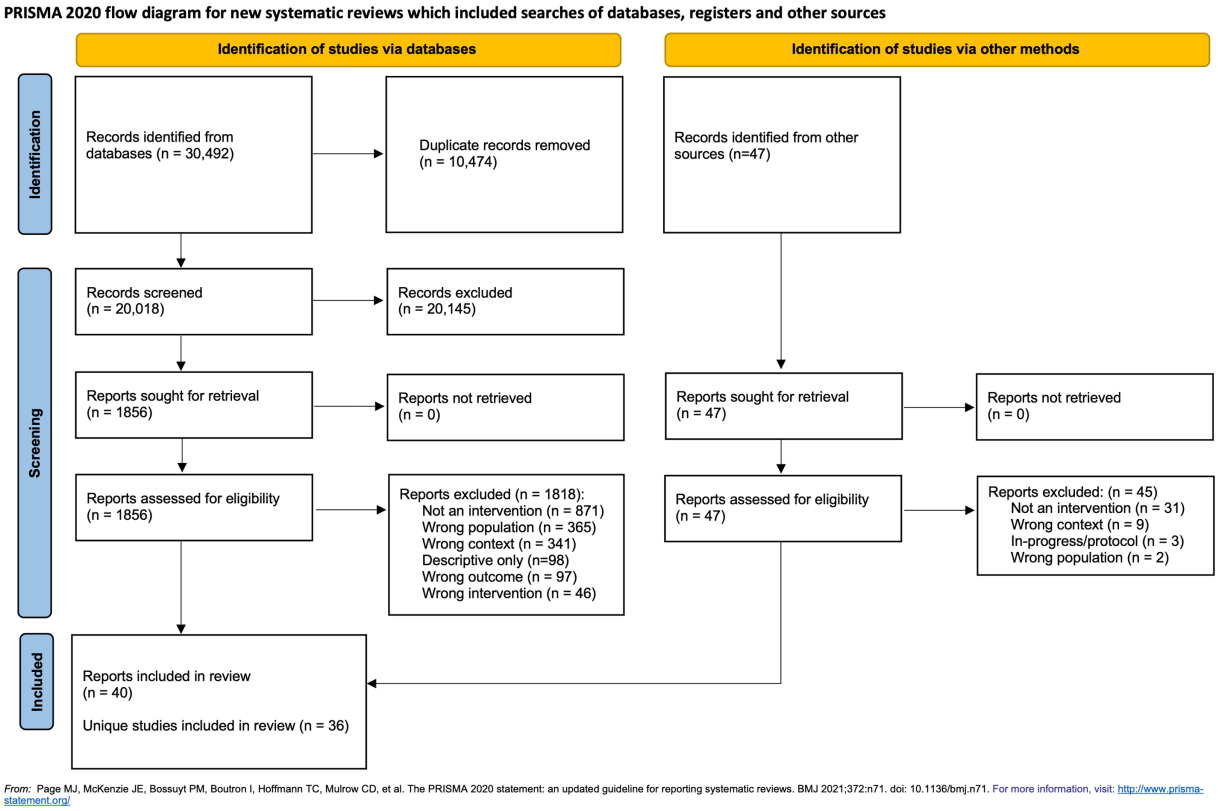

FIGURE 1
PRISMA diagram.

as placebo control, standard care, or pre-intervention data, was included. Studies that reported occupational, psychological, or mental health outcomes were all included. For this review, mental health is defined per the World Health Organization's definition as "a state of mental wellbeing that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community" (16). These outcomes were defined *a priori* by the research team as anxiety, depression, burnout, exhaustion, resilience, altered mood, or clinical diagnoses of mental disorders such as depression or PTSD. Descriptive-only or in-progress studies that described interventions without reporting on mental health or wellbeing outcomes were excluded. No restrictions were placed on study design, language, publication status, publication date, or study location.

2.3 Study selection and data extraction

Once databases were searched and duplicates were removed, the title and abstract of each reference were screened independently by two trained reviewers. Full texts of all potentially relevant articles were retrieved and screened independently by two experienced reviewers. Disagreements were resolved through discussion or a third team member when needed.

Two trained team members independently completed data extraction and critical appraisal, with discrepancies resolved through discussion or a third team member when needed. A data extraction form was created and trialed with three studies and contained 42 items related to study characteristics (study aim, study design, and country); study sample (participant age, gender, professional role, organization, and sample size); intervention and comparator groups; and outcomes (primary and secondary outcomes, measurement methods including anxiety; depression; PTSD; burnout; quality of life; resilience and coping; and mood-related outcomes). Mean differences between groups were extracted to compare outcomes across studies with expected results. Where within-group baseline and end-of-study data were reported, they were transformed into the mean difference and standard deviation of the difference using guidance from the Cochrane Handbook for Systematic Reviews (17). The intervention-related information was extracted using the template for intervention description and replication (TIDieR) checklist (18). Critical appraisal was completed using the appropriate Joanna Briggs Institute critical appraisal tool for the study design extracted (19). Studies rated as unclear or high risk of bias on more than half of domains were defined as having an increased risk of bias; those rated as unclear or high for three or more domains were defined as having some concerns.

2.4 Data synthesis

A visual examination of the data extraction table organized by contextual information (i.e., disaster type, setting, and intervention) revealed significant heterogeneity in the data; thus, a meta-analysis was deemed inappropriate. Interventions were categorized post-hoc as falling within four broad categories to support the narrative synthesis: psychotherapy, psychoeducation, mind–body, and organizational interventions; studies that did not fit within one of these categories were classified as "other." Harvest plots were created

for each intervention type and mode of delivery to display study outcomes graphically. Each row of the plot showed effect sizes for each category of results extracted (e.g., anxiety, depression, PTSD, burnout, quality of life, resilience or coping, and mood), with the size of the bar indicating the effect size. Effect size estimates were extracted from the published articles when reported as Cohen's d or Hedge's g or were calculated using the Carlson–Schmidt method for paired pre-treatment and post-treatment data (20, 21) or the Campbell Collaboration's effect size calculator created by Wilson (22, 23). Bars were color-coded by study design (RCT vs. quasi-experimental) and risk of bias (low, some concerns, and high), and studies with a statistically significant change were labeled.

3 Results

3.1 Characteristics of included studies

Across databases, 30,492 records were identified, along with 47 from reference lists and gray literature (Figure 1). Following de-duplication, the remaining 20,018 records were screened by title and abstract. Of the 1,856 articles assessed at the full-text level, 39 publications describing 36 unique interventions met eligibility criteria (Figure 1) (24–62).

Studies were published between 1994 and 2022 (Table 1). Nine studies were conducted in the United States (26, 29, 38, 39, 41, 42, 44, 50, 56), three in the United Kingdom (25, 36, 59), China (27, 34, 52), Italy (40, 60, 61), and Taiwan (28, 37, 58), Turkey (46, 54, 57), and two in Sierra Leone (24, 53). The remaining 10 studies were conducted in Armenia (37), Chile (30), Indonesia (48), Iran (62), Israel (45), Japan (49) and the Philippines (55), Singapore (51), South Africa (31), and Spain (35). Interventions were delivered in response to an infectious disease pandemic or epidemic ($n = 24$, 67%), namely COVID-19 ($n = 20$, 56%) (25, 27, 31, 34–36, 40, 44, 46–48, 50–52, 54, 57, 59–62), Ebola ($n = 3$, 8%) (24, 29, 53), and SARS ($n = 1$, 2%); natural disasters ($n = 10$, 38%), namely earthquakes ($n = 4$, 11%) (28, 30, 37, 49), hurricanes ($n = 5$, 14%) (38, 39, 41, 42, 56), and typhoons ($n = 1$, 3%) (55); or mass casualty events ($n = 2$, 6%) (26, 45).

Fifteen studies (42%) were randomized controlled trials (25, 26, 34–36, 39, 45–47, 50–52, 54, 57, 62), 17 (47%) were single-group pre–post quantitative studies (24, 27–29, 31, 37, 40–42, 44, 49, 55, 56, 58–61), and four (11%) were non-randomized interventions with a comparator group (30, 38, 48, 53). Interventions were categorized into four intervention types: psychotherapy interventions ($n = 9$, 25%) defined as comprehensive psychological support including cognitive behavioral therapy (CBT) or training in psychological first aid (PFA), usually delivered or supported by a mental health professional (24–34); psychoeducation interventions ($n = 11$, 31%) which consisted of primarily didactic or interactive educational strategies to promote the use of self-management techniques and build resilience and coping ability (35–45); mind–body interventions ($n = 12$, 33%), such as meditation, yoga, and exercise (46–57); and workplace-based interventions ($n = 3$, 8%) such as in-service-training and workplace hubs (58–60). Two identified interventions using music therapy (61), and aromatherapy (62) did not fit well within other intervention categories and are thus presented separately as 'other'. Most studies ($n = 22$, 61%) were delivered to a diverse group of HCWs (24, 26, 28, 30, 31, 35, 36, 39–42, 44, 49–53, 56, 59, 61, 62). In contrast, others specifically targeted nurses ($n = 9$, 25%) (27, 34, 45, 47, 48, 54, 57, 58, 60), social workers ($n = 6$) (38, 46), counselors ($n = 1$, 3%) (37), mental health professionals ($n = 1$, 3%) (55), and public health workers ($n = 1$, 3%) (29). Complete details on each intervention following the TIDieR framework can be found in the Supplementary Files, Table 1.

3.2 Risk of bias

The risk of bias was moderate to high in most studies; within the RCTs, one study (7%) was defined as having a low risk of bias (35), nine (60%) as having some risk of bias concerns (25, 26, 36, 45, 47, 50, 51, 57, 62), and five (33%) as having a high risk of bias (34, 39, 46, 52, 54) (Figure 2). Of quasi-experimental studies, seven (33%) were rated as having a lower risk of bias (24, 27, 31, 40, 44, 58, 60), seven (33%) were rated as having some concerns (30, 38, 41, 48, 53, 59, 61), and seven (33%) as having a high risk of bias (28, 29, 37, 42, 49, 55, 56) (Figure 3). The most problematic domains within the RCTs were lack of blinding (participant, interventionist, and assessor), allocation not concealed, appropriateness of the statistical analysis, and incomplete follow-up. The most problematic domains within quasi-experimental studies were lack of a comparator group, incomplete follow-up, and the use of multiple assessment outcome measures. Full critical appraisal results can be found in Supplementary Files, Table 2.

3.3 Mental health-related outcomes by intervention type

3.3.1 Psychotherapy

Nine studies were included that used psychotherapy to support healthcare workers' mental health: three RCTs (25, 26, 34) and six quasi-experimental studies (24, 27–31). The components of the psychotherapy varied widely: five included CBT (24–26, 30, 34), two used psychological first aid (28, 29), one focused on mindfulness-based stress reduction (31), and one on acceptance and commitment therapy (27). Interventions were delivered in groups ($n = 5$, 56%) (24, 27, 29–31), one-on-one ($n = 2$, 22%) (26, 28), and electronically ($n = 2$, 22%) (25, 34). Interventions varied from a single session (28) to 12 weeks in duration.

Overall positive effects were reported across mental health outcomes (Figure 4, Table 2). However, most studies had some concerns or a high risk of bias. Many were not statistically significant: group CBT during Ebola and e-CBT during COVID-19 both significantly decreased anxiety scores with small–moderate effect sizes (24, 34), but a CBT- and positive-psychology-focused app during COVID-19 and group-based Acceptance and Commitment Therapy (ACT) did not (25, 27). Group-based CBT during Ebola also significantly reduced depression with small to moderate effect sizes, as did group-based ACT (24, 27); however, this was not seen in interventions of a CBT and positive psychology-based app or e-CBT during COVID-19 or in-person CBT in response to the September 11th attacks (25, 26, 34). Symptoms of PTSD generally improved across four studies with moderate to large effect sizes (24, 26, 28, 30); however, in one study that compared the effect of in-person group CBT following a natural disaster, those with and without diagnosed PTSD only improved in the group with a clinical diagnosis of PTSD (30). Only a single study each found statistically significant

TABLE 1 Description of interventions.

Author, Year	Disaster, Year	Setting	Study Design	N	Participants	Age (Mean, (SD))	Sex (% F)	Intervention	Comparator	Duration	Follow-Up
Psychotherapy interventions ($n = 9$)											
Cole (24, 32, 33)	Ebola, 2013–2015	Ebola treatment centers, Sierra Leone	Single-group pre–post	253	Former Ebola treatment center staff	30 (7.0)	23 (6% NR)	Group CBT plus home booklet, single 3 h session/week	Pre-intervention	6 weeks	2 weeks
De Kock (25)	COVID-19	NHS Highland, UK	RCT	107	Health or social care workers in NHS	18–25: 2.4%; 26–30: 5.9%; 31–40: (18.3); >40: 73.4	88	My Personal Self app, evidence-based app using CBT and positive psychology, adapted for COVID-19 context (narrative of delivery, text message prompts, 24-h support line)	CG1: WL; CG2: original My Personal Self app	4 weeks	Immediate
Difede (26)	11 September Attacks, 2001	New York City, USA	RCT	21	Disaster relief workers	45.8 (7.7)	3	In-person CBT by a licensed psychologist (75 min session/week) plus daily homework	Usual care	12 weeks	Immediate and 3 months later
Jing (27)	COVID-19	Tertiary general hospitals, Xuzhou City, China	Single-group pre–post	226	Nurses	≤30: 61.9%; 31–40: 29.6%; 41–50: 7.1%; 51–60: 1.3%	95	Group-based ACT program; two modules focused on work and life; participants encouraged to participate in mindfulness daily	Pre-intervention	10 weeks	Immediate
Ke (28)	Taiwan Earthquake, 2016	Chi-Mei Medical Center, Tainan City, Taiwan	Single-group pre–post	67	HCW, physicians, and nurses	32.7 (5.2)	53	Single session, in-person PFA, debriefing, and minilectures. Physical therapists provided muscle and mental relaxation programs.	Pre-intervention	1 session	1 month later
Klomp (29)	Ebola, 2014–2016	CDC deployment, USA	Single-group pre–post	~100	Public health staff	NR	NR	Deployment Safety and Resilience Team training based on PFA	Pre-intervention	Variable	Immediate
Leiva-Bianchi (30)	Chile Earthquake and Tsunami, 2010	Hospital, public department, and school, Constituçion and Talca, Chile	Non-randomized intervention	29	HCW, public department workers, and teachers with 3+ severe symptoms of PTSD	IG: 46 (NR) CG1: 48 (NR) CG2: 51 (NR)	IG: 100 CG1: 88 CG2: 75	In-person 60–90 min weekly group CBT session led by trained therapists and included psychoeducation, breathing retraining, behavioral activation, and cognitive restructuring	CG1: Individuals without PTSD CG2: Abbreviated intervention	10–12 weeks	Immediate

(Continued)

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TABLE 1 (Continued)

Author, Year	Disaster, Year	Setting	Study Design	N	Participants	Age (Mean, (SD))	Sex (% F)	Intervention	Comparator	Duration	Follow-Up
Osman (31)	COVID-19	South Africa	Single-group pre–post	47	HCW	Median: 34, IQR: 18	NR	Mindfulness-based stress reduction program delivered by a clinical psychologist	Pre-intervention	4 weeks	Immediate
Zhou (34)	COVID-19	Tianjin Medical University Hospital Airport Site, China	RCT	118	Nurses with insomnia	29.6 (4.5)	98	e-CBT for insomnia	No intervention	6 weeks	Immediate
Psychoeducation interventions ($n = 11$)											
Berger (45)	Lebanon War, 2006	Primary Care Clinic, Israel	RCT	80	Well baby clinic nurses	IG: 49.3 (7.4) CG: 47.7 (7.1)	100	6-h weekly group-based psychoeducational sessions to improve knowledge and self-management including tools such as breathing, meditation, relaxation, exercise, self-affirmation, and guided imagery.	Wait-list control	12 weeks	3 months
Fiol-DeRoque (35, 43)	COVID-19	Spain	RCT	482	HCW	41.4 (10.4)	83	PsyCovidApp, self-management, psychoeducational based on CBT and mindfulness including content on emotional skills, healthy lifestyle, work stress and burnout, and social support. Daily self-monitoring prompts with tailored self-management	Sham control	2 weeks	Immediate
Gnanapragasam (36)	COVID-19	NHS Trusts, England	RCT	894	NHS affiliated staff	18–29: 13.4%; 30–39: 21.1%; 40–49: 29.1%; 50–59: 26.5%; ≥60: 9.8%	84	Foundations App, to promote behavior change, positive habits, promote mental wellbeing, manage stress and improve sleep; users choose one of the six focus areas (relaxation, sleep, anxiety, feeling down, stress, self-esteem)	Usual care	8 weeks	Immediate

(Continued)

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TABLE 1 (Continued)

Author, Year	Disaster, Year	Setting	Study Design	N	Participants	Age (Mean, (SD))	Sex (% F)	Intervention	Comparator	Duration	Follow-Up
Karakashian (37)	Armenian Earthquake, 1988	City of Giumri, Armenia	Single-group pre–post	25	School counselors that provided psychological intervention	30–53	100	Single-session didactic-experiential group therapy to discuss experiences, coping strategies, issues, and treating trauma.	Pre-intervention	2-h seminar	Immediate
Leitch (38)	Hurricanes Katrina and Rita, 2005	New Orleans and Baton Rouge, USA	Non-randomized intervention	142	Social workers	22–39: 32.4% 40–54: 38.8% 55+: 28.8%	86	Group psychoeducation 'Somatic ExperiencingÔ/ Trauma Resiliency ModelÔ' plus 1–2 individual sessions with trained clinicians.	Staff who declined participation	1–2 weeks	3–4 months
Mahaffey (39)	Hurricane Sandy, 2012	Community Organization, USA	RCT	167	Disaster responders with active responder status	IG: 51.8 (15.3) CG: 51.2 (15.5)	IG: 47 CG: 59	In-person group disaster work resilience training program focused on psychoeducation to build resilience reduce stress and enhance coping strategies.	Waitlist control group	4-h session	3 months
Pallavicini (40)	COVID-19	Hospitals, Milan, Italy	Single-group pre–post	20	HCW	43 (10)	60	Virtual reality-based psychoeducational experience to reduce stress and anxiety, MIND-VR.	Pre-intervention	Single session	Immediate
Powell (41)	Hurricane Sandy, 2012	Federally qualified health centers, USA	Single-group pre–post + qualitative	69	HCW, disaster response, and social service providers	NR	80	In-person group 'Resilience and Coping for the Healthcare Community' workshop using a solution-focused approach	Pre-intervention	3-h workshop	Immediate and 3 weeks
Powell (42)	Hurricane Sandy, 2012	Social service organizations, New York and New Jersey, USA	Single-group pre–post	839	Social service providers, including social workers and counselors	NR	84	In-person group psychoeducational workshop, "Caregivers Journey of Hope"	Pre-intervention	Half-day workshop	Immediate
Yi-Frazier (44)	COVID-19	Children's hospital and medical center, Seattle, USA	Single-group pre–post	153	HCW and staff,	40.6 (10.1)	92	Promoting Resilience in Stress Management (PRISM); manualized, skills-based coaching program to promote resilience and stress management	Pre–post	6 weeks	Immediate

(Continued)

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TABLE 1 (Continued)

Author, Year	Disaster, Year	Setting	Study Design	N	Participants	Age (Mean, (SD))	Sex (% F)	Intervention	Comparator	Duration	Follow-Up
Mind–body interventions ($n = 12$)											
Hosseinzadeh (46)	COVID-19	Ankara, Turkey	RCT	49	Social workers	33.0 (6.0)	55	Mindfulness training sessions plus daily meditation homework	Waitlist	4 weeks	1 month
Hsieh, 2022 (47)	COVID-19	Hospitals, Taiwan	RCT	79	Nurses	IG: 42.3 (8.5); CG: 32.5 (8.2)	NR	Gong meditation; Guided meditation through a series of real-time adjusted gong strikes	Smartwatch to measure stress	2 days	Immediate
Ibrahim (48)	COVID-19	Hospitals, West Java, Indonesia	Non-randomized intervention	50	Nurses	21–30: 44%; 31–40: 38%; 41–50: 18%	48	Mindfulness breathing meditation delivered via WhatsApp; included protocol of mindfulness breathing with video practice guidelines and tutorials and reflective exercises	"Control" not described	4 weeks	Immediate
Iwakuma (49)	Great East Japan Earthquake, 2011	Tohoku Region, Japan	Single-group pre–post	17	HCW	50 (NR)	94	In-person group breathing-based meditation seminar	Pre-intervention	45 min	Immediate
Joshi (50)	COVID-19	Duke Medical Centre, Durham, USA	RCT	80	HCW	40 (11)	83	Transcendental Meditation, a practice in which individuals silently recite a single mantra without concentration or contemplation. Eight instructional sessions plus 20 min, 2x/day of self-practice	Access to wellness resources	3 months	Immediate
Keng (51)	COVID-19	Duke-NUS medical school, Singapore	RCT	80	HCW	30.2 (6.2)	90	Headspace meditation app	Lumosity app	3 weeks	Immediate
Li (52)	COVID-19	Had returned from Wuhan, China	RCT	134	HCW	21–30: 34.3%; 31–40: 42.6%; 41–50: 17.1%; 51–60: N6%	70	Brief mindfulness meditation	"Control" not described	16 days	Immediate

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TABLE 1 (Continued)

Author, Year	Disaster, Year	Setting	Study Design	N	Participants	Age (Mean, (SD))	Sex (% F)	Intervention	Comparator	Duration	Follow-Up
Liu (53)	Ebola, 2013	Ebola clinic, Sierra Leone	Non-randomized intervention	41	International HCWs from China	35 (range: 24–46)	49	In-person Ba Duan Jin, a medium-to-low intensity aerobic exercise.	No intervention control	30 min daily	6 weeks
Si (54)	COVID-19	Hospital, Turkey	RCT	101	Nurses	IG: 28.9 (6.8); CG: 28.9 (5.6)	81	Laughter yoga: Stretch-relaxation, laughter, deep breathing exercises. Techniques to break down barriers to laughter and develop feelings of childish play	"Control" (not described)	4 weeks	Immediate
Waelde (56)	Hurricane Katrina, 2005	Mental Health Agency, New Orleans, USA	Single-group pre–post	20	Mental HCW and staff	49 (11)	85	In-person 4-h 'Inner Resources for Stress' meditation retreat and home study program 30 min/day, 6 days/week	Pre-intervention	8 weeks	3 and 8 weeks
Waelde (55)	Typhoon Haiyan, 2013	Quezon City, Philippines	Single-group pre–post	68	Mental health professionals, faculty, and students	37.3 (11.6)	75	In-person 4-h 'Inner Resources for Stress' meditation workshop and home study program 30 min/day, 6 days/week	Pre-intervention	8 weeks	8 weeks
Yildirim (57)	COVID-19	COVID-19 unit, University hospital, Istanbul, Turkey	RCT	104	Nurses	IG: 27.6 (5.2); CG: 29.1 (6.6)	80	Mindfulness-based breathing and music therapy, 30-min per day led by a certified therapist	Relaxed in a quiet and calm setting for 30 min	Single session	Immediate
Workplace-based interventions ($n = 3$)											
Chen (58)	SARS, 2003	SARS treatment hospital, Taiwan	Single-group pre–post	116	Nurses	31 (10.8)	98	In-service training on infection control, manpower allocation, PPE, mental health support team.	Pre-intervention	3 months	1 month
Saqib (59)	COVID-19, 2020	NHS, UK	Single-group pre–post	21	NHS staff	NR	NR	Hospital-based workplace hub for staff to destress and recuperate with board games, mindfulness activities, books, self-guided meditation, and volunteer-led yoga and mindfulness sessions.	Pre-intervention	1 month	Immediate

(Continued)

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TABLE 1 (Continued)

Author, Year	Disaster, Year	Setting	Study Design	N	Participants	Age (Mean, (SD))	Sex (% F)	Intervention	Comparator	Duration	Follow-Up
Zaghini (60)	COVID-19	University Hospital, Italy	Single-group, post-test	322	Nurses	43.4 (8.3)	76	Proactive management, reorganized care settings, increased staffing levels, online education to increase competence and knowledge related to COVID-19; participatory approach to intervention, unit-level focus, enhanced surveillance for COVID-19 exposed	None	NR	5 months
Other interventions ($n = 2$)											
Giordano (61)	COVID-19, 2020	University Hospital of Bari, Italy	Single-group pre–post	29	HCW ≥ 18 years old working on COVID-19 unit	31.8 (8.3)	65	Trained music therapists developed 15–20-min playlists and listening guides targeting relaxation and reducing anxiety and stress; recover energy and support concentration; and/or release tension and instill calm.	Pre-intervention	5 weeks	Immediate after listening
Mahdood (62)	COVID-19	University hospitals, Hamadan, Iran	RCT	80	HCW 18–50y, with anxiety and insomnia	IG: 31.5 (7.8); CG: 33.1 (7.6)	73	Damask Rose aromatherapy before work shift and during sleep	Paraffin oil	30 days	Immediate

CBT, cognitive behavioral therapy; CDC, Centers for Disease Control and Prevention; CG, control group; COVID-19: Coronavirus Disease 2019; EAP, employee assistance program; HCW, healthcare worker; IG, intervention group; ICU, intensive care unit; NHS, National Health Service; NR, not reported; PFA, psychological first aid; PTSD, post-traumatic stress disorder; RCT, randomized controlled trial; SARS, Severe Acute Respiratory Syndrome; UK, United Kingdom; USA, United States of America.

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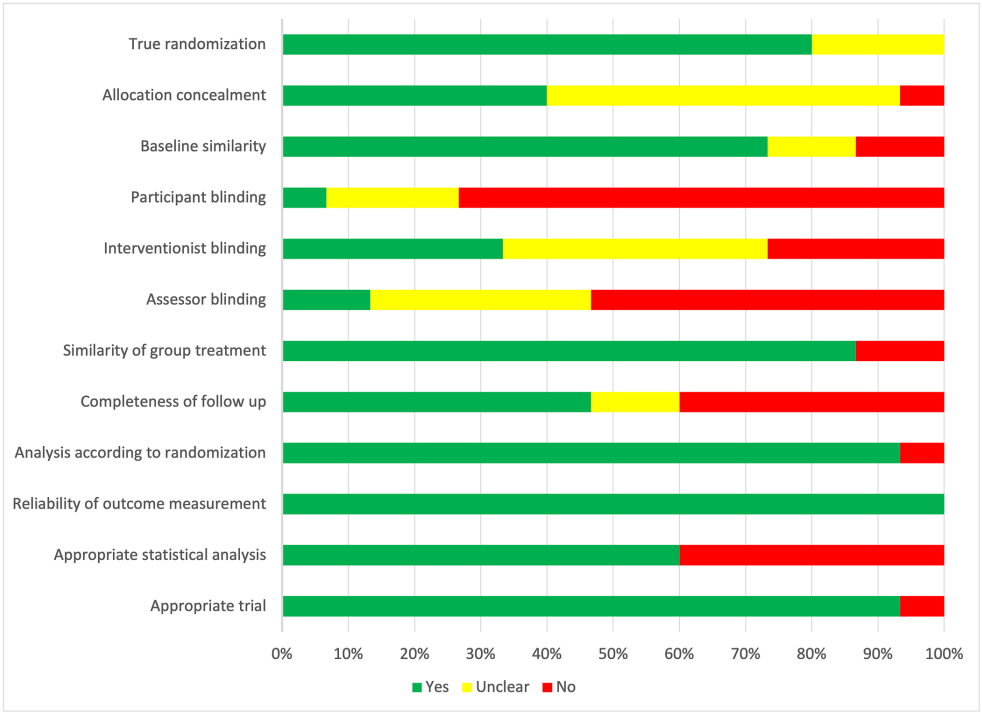

FIGURE 2
Risk of bias in randomized controlled trials.

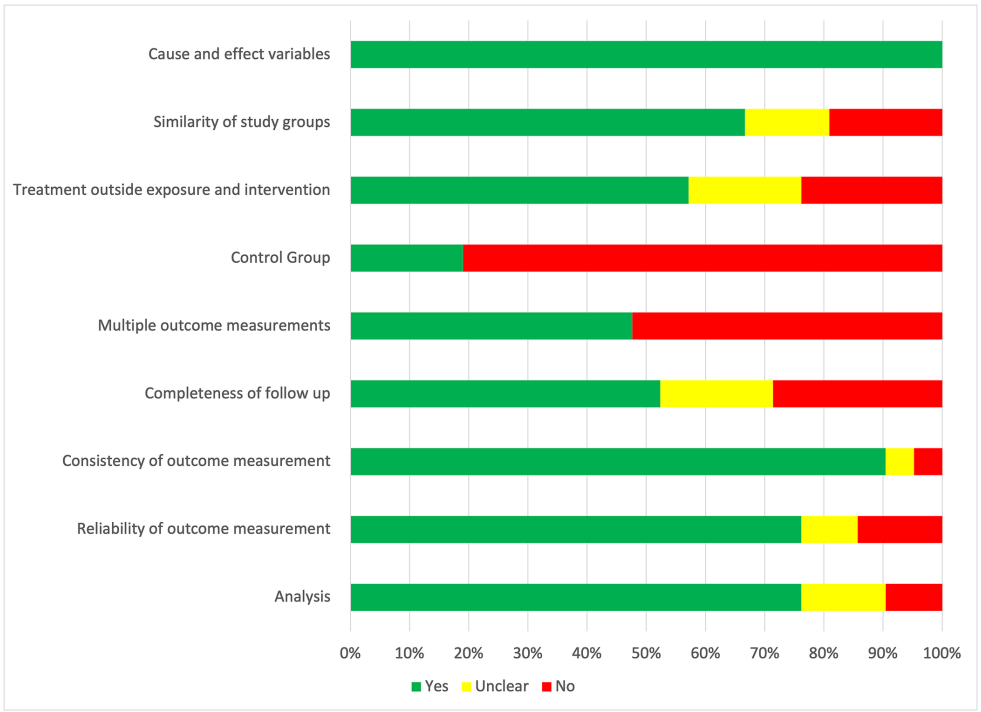

FIGURE 3
Risk of bias in quasi-experimental studies.

improvements in burnout (31), mood (24), and coping self-efficacy (29) with small effect sizes following mindfulness-based stress reduction, group-based CBT, and psychological first aid training, respectively; a single study also explored quality of life (25), with no statistically significant effects found using a CBT and positive psychology-based app.

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TABLE 2 Results.

Study	Risk of bias	Tool	Results (mean difference ± SD or 95% CI, unless otherwise reported)
Anxiety			
Psychotherapy			
Cole (24, 32, 33)	Low	GAD-7 (*Phase 2*)	**−4.46 ± 4.08, p < 0.001**
		GAD-7 (*Phase 3*)	**−3.12 ± 4.06, p < 0.05**
De Kock (25)	Some concerns	GAD-7 (vs. *original app*)	Cohen's d: +0.01 (−0.26, 0.28)
		GAD-7 (vs. *waitlist*)	Cohen's d: −0.06 (−0.31, 0.19)
Jing (27)	Low	SCL-90 – Anxiety	**−0.20 (−0.31, −0.10)**
Zhou (34)	High	GAD-7	**INT: – 3.0 ± 3.0; CON: −0.5 ± 3.4, p < 0.05**
Psychoeducation interventions			
Fiol-DeRoque (35)	Low	DASS-21 – Anxiety	SMD: −0.04 (−0.12, 0.04)
Gnanapragasam (36)	Some concerns	GAD-7	OR: 0.70 (0.36, 1.35)
Pallavicini (40)	Low	STAI	**−4.0 ± 5.2, p = 0.016**
Yi-Frazier (44)	Low	GAD-7	**−2.04 (−2.74, −1.34)**
Mind–body interventions			
Hosseinzadeh (46)	High	DASS-21 – Anxiety subscale (*End of study*)	INT: −1.9 ± 2.7; CON: −0.9 ± 2.9, *p* = 0.17
		DASS-21 – Anxiety subscale (*Follow-up*)	INT: −1.1 ± 2.6; CON: −0.2 ± 2.9, *p* = 0.10
Joshi (50)	Some concerns	GAD-7	**−2.2 (−3.8, −0.5)**
Keng (51)	Some concerns	DASS-21 (*T2*)	−0.126 (SD: NR), *p* = 0.148
		DASS-21 (*T3*)	−0.046 (SD: NR), *p* = 0.638
Li (52)	High	GAD-7	INT: −0.52 ± 2.19; CON: – 0.85 ± 2.20, *p* > 0.05
Liu (53)	Some concerns	% self-reporting anxiety symptoms (tool NR)	−13% (SD: NR), *p* > 0.05
Waelde (56)	High	STAI	**−8.65 ± 9.0, p < 0.05**
Waelde (55)	High	Anxiety severity (single item, 1, not at all, to 5, extremely anxious)	−0.85 ± 0.46, p = NR
Yildirim (57)	Some concerns	STAI	**INT: −8.96 ± 9.58; CON: −0.92, 8.87, p = 0.01**
Workplace-based interventions			
Chen (58)	Low	Zung's Self-rating Anxiety Scale	**−0.42 (−0.54, −0.29)**
Other interventions			
Mahdood (62)	Some concerns	STAI (*T2*)	**INT: −4.33 (0.39); CON: 0.60 (0.39), p < 0.001**
		STAI (*T3*)	**INT: −6.71 (0.55); CON: −1.28 (0.55), p < 0.001**
Depression			
Psychotherapy			
Cole (24, 32, 33)	Low	PHQ-9 (*Phase 2*)	**−4.51 ± 6.37, p = 0.033**
		PHQ-9 (*Phase 3*)	**−2.72 ± 5.06, p < 0.05**
De Kock (25)	Some concerns	PHQ-9 (vs. *original app*)	Cohen's d: 0.19 (−0.12, 0.50)
		PHQ-9 (vs. *waitlist*)	Cohen's d: −0.18 (−0.46, 0.11)
Difede (26)	Some concerns	BDI	INT: −2.27 ± 5.26; CON – 0.08 ± 5.29, *p* > 0.05
Jing (27)	Low	SCL-90 – Depression	**−0.30 (−0.42, −0.18)**
Zhou (34)	High	PHQ-9	INT: −3.5 ± 3.1, CON: −0.9 ± 3.1, p > 0.05
Psychoeducation interventions			
Fiol-DeRoque (35)	Low	DASS-21 Depression	SMD: 0.00 (−0.07, 0.08)
Gnanapragasam (36)	Some concerns	PHQ-9	OR: 0.70 (0.39, 1.28)

(Continued)

TABLE 2 (Continued)

Study	Risk of bias	Tool	Results (mean difference ± SD or 95% CI, unless otherwise reported)
Karakashian (37)	High	Hamilton Rating Scale for Depression	**Significant difference, data NR**
Mahaffey (39)	High	PHQ-9	−1.2 (−2.4, 0.0)
Mind–body interventions			
Hosseinzadeh (46)	High	DASS-21 – Depression (*End of study*)	**INT: −3.1 ± 5.0; CON: −0.29 ± 5.5, p = 0.008**
		DASS-21 – Depression (*Follow-up*)	**INT: −1.4 ± 5.0; CON: +1.3 ± 5.2, p = 0.002**
Joshi (50)	Some concerns	PHQ-9	−1.9 (−3.7, 0.1)
Keng (51)	Some concerns	DASS-21 (*T2*)	−0.166 (SD: NR), $p = 0.057$
		DASS-21 (*T3*)	**−0.222 (SD: NR), p = 0.021**
Li (52)	High	PHQ-9	INT: −1.24 ± 2.88; CON: −1.46 ± 3.04, $p > 0.05$
Waelde (56)	High	CES-D	−1.68 ± 5.1, $p > 0.05$
Waelde (55)	High	CES-D	+0.10 ± 0.44, p = NR
Workplace-based interventions			
Chen, 2006 (58)	Low	Zung's Self-rating Depression Scale	**−0.48 (−0.63, −0.33)**
PTSD			
Psychotherapy			
Cole (24, 32, 33)	Low	PCL-C (*Phase 3*)	**−12.98 ± 11.93, p < 0.01**
Difede (26)	Some concerns	CAPS	INT: − 11.6 ± 15.7; CON: −2.1 ± 13.4, $p > 0.05$
		PCL-C	INT: −7.7 ± 9.4; CON: +10 ± 8.0, $p > 0.05$
Ke (28)	High	Symptoms of PTSD (HCP-administered questionnaire)	**−16.4% (SD: NR), p < 0.05**
Leiva-Bianchi (30)	Some concerns	SPRINT-E (*with PTSD*)	**−6.0 ± 1.4, p < 0.01**
		SPRINT-E *(no PTSD)*	0.5 ± 1.1, $p > 0.05$
		SPRINT-E (*Abbreviated intervention with PTSD*)	−1.3 ± 2.1, $p > 0.05$
Psychoeducation interventions			
Fiol-DeRoque (35)	Low	DTS	SMD: 0.00 (−0.06, 0.07)
Karakashian (37)	High	DSM-III-Revised criteria for PTSD	**Significant difference, data NR**
Leitch (38)	Some concerns	PCL-C	**−6.6 (−10.5, −2.7)**
Mahaffey (39)	High	CAPS for DSM-5	−1.4 (−3.4, 0.6)
Mind–body interventions			
Keng (51)	Some concerns	PCL-C (*T2*)	−0.092 (SD: NR), $p = 0.336$
		PCL-C (*T3*)	−0.153 (SD: NR), $p = 0.079$
Waelde (56)	High	PCL-S	**−6.03 ± 6.24, p < 0.01**
Burnout			
Psychotherapy			
Osman (31)	Low	MBI (*emotional exhaustion*)	**−1.38 ± 4.6, p = 0.04**
		MBI (*professional accomplishment*)	**Median difference: 1, IQR 0, 3, p = 0.002**
		MBI (*depersonalization*)	Median difference: 0, IQR −2, 0, $p = 0.15$
Psychoeducation interventions			
Berger (45)	Some concerns	ProQOL – burnout	**−10.1 (−13.2, −6.9)**
Fiol-DeRoque (35)	Low	MBI (*emotional exhaustion*)	SMD: +0.01 (−0.06, 0.08)
		MBI (*professional accomplishment*)	SMD: −0.05 (−0.12, 0.03)
		MBI (*depersonalization*)	SMD: +0.01 (−0.06, 0.09)
Powell (41)	Some concerns	ProQOL – Burnout	−0.22 ± 2.12, $p > 0.05$

(Continued)

TABLE 2 (Continued)

Study	Risk of bias	Tool	Results (mean difference ± SD or 95% CI, unless otherwise reported)
Yi-Frazier (44)	Low	MBI (*emotional exhaustion*)	**−0.37 (−0.56, −0.18)**
		MBI (*cynicism*)	**−0.22 (−0.41, −0.03)**
		MBI (*professional efficacy*)	−0.09 (−0.04, 0.23)
Mind–body interventions			
Hsieh (47)	Some concerns	Occupational Burnout Inventory (*Personal burnout*)	**−6.53 (SE = 1.26), p < 0.001**
		Occupational Burnout Inventory (*Work-related burnout*)	**−5.85 (SE = 1.37), p < 0.001**
		Occupational Burnout Inventory (*Client-related burnout*)	**−3.98 (SE = 1.69), p = 0.019**
		Occupational Burnout Inventory (*Overcommitment to work*)	**−3.69 (SE = 1.49), p = 0.013**
Joshi (50)	Some concerns	MBI (*emotional exhaustion*)	**−5.4 (−9.2, −1.6)**
		MBI (*professional accomplishment*)	+1.9 (−0.4, 4.1)
		MBI (*depersonalization*)	−1.7 (−3.6, 0.2)
Keng (51)	Some concerns	ProQOL – burnout (*T2*)	−0.077 (SD: NR), $p = 0.308$
		ProQOL – burnout (*T3*)	−0.127 (SD: NR), $p = 0.098$
Si (54)	High	MBI	**INT: −11.0 ± 8.0; CON: −0.4 ± 6.4, p < 0.001**
Quality of life			
Psychotherapy			
De Kock (25)	Some concerns	Warwick-Edinburgh Mental Wellbeing Scale (vs. *original app*)	Cohen's d: −0.20 (−0.48, 0.08)
		Warwick-Edinburgh Mental Wellbeing Scale (vs. *waitlist*)	Cohen's d: 0.15 (−0.10, 0.41)
Psychoeducation			
Berger (45)	Some concerns	ProQOL – compassion satisfaction	**+11.4 (8.4, 14.4)**
		ProQOL – compassion fatigue	**−7.6 (−10.7, −4.6)**
Gnanapragasam (36)	Some concerns	GHQ-12	**+1.34 (0.53, 2.15)**
Powell (41)	Some concerns	ProQOL – compassion satisfaction	+0.67 ± 3.58, $p > 0.05$
		ProQOL – secondary traumatic stress	+0.10 ± 3.51, $p > 0.05$
Mind–body interventions			
Ibrahim (48)	Some concerns	Warwick-Edinburgh Mental Wellbeing Scale	INT: +2.4 ± 3.5; CON: +1.3 ± 6.9; p = NR
Keng (51)	Some concerns	ProQOL – compassion satisfaction (*T2*)	+0.053 (SD: NR), $p = 0.483$
		ProQOL – compassion satisfaction (*T3*)	**+0.183 (SD: NR), p = 0.007**
Liu (53)	Some concerns	WHOQoL-BREF – Physical health	**+10.1 (8.2, 12.0)**
		WHOQoL-BREF – Psychological	**+10.5 (8.1, 12.9)**
		WHOQoL-BREF – Social relationships	**+8.3 (6.7, 9.9)**
		WHOQoL-BREF – Environment	+0.9 (−1.1, 2.9)
Si (54)	High	Life Satisfaction Scale	**INT: +8.9 ± 2.7; CON: +0.1 ± 2.4; p < 0.001**
Yildirim (57)	Some concerns	Previously developed psychological wellbeing scale	**+5.15 (1.27, 9.03)**
Workplace-based interventions			
Zaghini (60)	Low	Nurses QoL	**+0.08 ± 0.3, p = 0.003**
Resilience and coping			
Psychological support techniques			
Jing (27)	Low	CD-RISC	+ 1.15 (−4.53, 2.23)
Klomp (29)	High	Self-efficacy to handle challenging situations	**+ 0.30 (0.24, 0.35)**

(Continued)

TABLE 2 (Continued)

Study	Risk of bias	Tool	Results (mean difference ± SD or 95% CI, unless otherwise reported)
Psychoeducation			
Gnanapragasam (36)	Some concerns	BRS	+ 0.06 (−0.05, 0.16)
Leitch (38)	Some concerns	Coping (4-item, study-specific scale)	−0.12 (−0.47, 0.23)
		Resiliency (7-item, study-specific scale)	**+1.0 (0.6, 1.3)**
Powell (41)	Some concerns	Coping Self-Efficacy Scale	+4.7 ± 27.4 p > NR
Powell (42)	High	Coping strategies (single item, Likert scale from 1, not at all to 5, a lot)	**+0.70 ± 0.55, p < 0.01**
Yi-Frazier (44)	Low	CD-RISC	**+1.74 (1.00, 2.48)**
Mind–body interventions			
Joshi (50)	Some concerns	CD-RISC	+1.5 (−0.6, 3.7)
Mood-related outcomes			
Psychological support techniques			
Cole (24, 32, 33)	Low	5-item Dimensions of Anger Reaction (*T2*)	No significant difference
		5-item Dimensions of Anger Reaction (*T3*)	**−3.17 ± 3.80, p < 0.01**
Mind–body interventions			
Iwakuma (49)	High	Temporary Mood Scale – Anger	**Baseline, median: 15 (IQR: 12–15), End of study, median: 15 (IQR: 15–15), p = 0.018**
		Temporary Mood Scale – Confusion	**Baseline, median: 14 (IQR: 11–15), End of study, median: 15 (IQR: 15–15), p = 0.001**
		Temporary Mood Scale – Depression	**Baseline, median: 12 (IQR: 11–15), end of study, median: 15 (IQR: 15–15), p = 0.005**
		Temporary Mood Scale – Fatigue	**Baseline, median: 10 (IQR: 8–13), end of study, median: 15 (IQR: 13–15), p = 0.001**
		Temporary Mood Scale – Strain	**Baseline, median: 10 (IQR: 6–13), end of study, median: 14 (IQR: 13–15), p = 0.003**
		Temporary Mood Scale – Vigour	**Baseline, median: 5 (IQR: 4–9), end of study, median: 9 (IQR: 6–10), p = 0.01**
Organizational			
Saqib (59)	Some concerns	Self-reported mood (single item) before and after session	Sad: −37.62% Neutral: −53.12% Happy: +90.75% (p = NR)
Other interventions			
Giordano (61)	Some concerns	Self-reported mood (study-specific tool)	**Breathing, energy, and customized energy playlists decreased tiredness, sadness, fear, and worry (all p < 0.05, data NR)** **Customized breathing, customized energy playlists decreased sadness, fear, and worry (all p < 0.05, data NR);** no difference in tiredness

Brief Resilience Scale; CAPS, Clinician-Administered PTSD Scale for DSM-5; CD-RISC, Connor-Davidson Resilience Scale; CES-D, Center for Epidemiologic Studies Depression Scale; CI, Confidence interval; CON, Control group; DASS-21, Depression, Anxiety, Stress Scale; DSM, Diagnostic and Statistical Manual of Mental Disorders; GAD-7, Generalised anxiety disorder 7 scale; GHQ-12, General Health Questionnaire; HCP, Healthcare provider; INT, Intervention group; IQR, Interquartile range; MBI, Maslach Burnout Inventory; NR, Not reported; OR, Odds ratio; PCL-C, PTSD Checklist-Civilian version; PCL-S, PTSD Checklist-Specific Version; PHQ-9, Patient Health questionnaire 9; ProQOL, Professional Quality of Life; QoL, Quality of life; SLC-90, Symptom Checklist 90 scale; SMD, Standardized mean difference; STAI, State Trait Anxiety Inventory; PTSD, Post-traumatic stress disorder; SE, Standard error; SPRINT-E, Short Post-Traumatic Stress Disorder Rating Interview; WHOQoL-BREF, World Health Organization Quality of Life Brief Version.
Bold indicates a statistically significant difference.

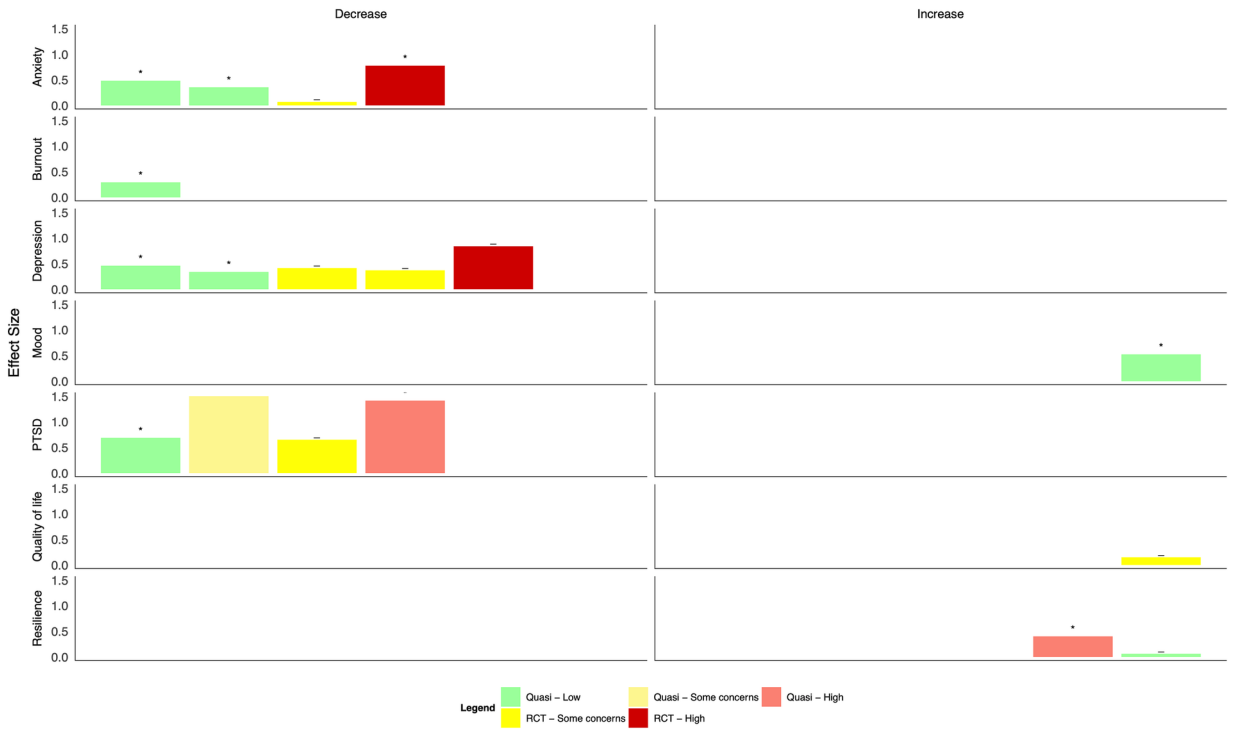

FIGURE 4
Harvest plot of the effects of psychotherapy on mental health outcomes.

3.3.2 Psychoeducation

Ten studies were identified that used psychoeducation to promote healthcare workers' mental health: four RCTs (35, 36, 39, 45) and six quasi-experimental studies (37, 38, 40–42, 44). All interventions included workshops or educational materials; 60% ($n = 6$) focused on physical stress management (35, 36, 38–40, 45). Few incorporated direct support from a mental health professional ($n = 4$, 40%) (35, 37, 38, 44), peer support ($n = 2$, 20%) (37, 42), or a basis in CBT ($n = 2$, 20%) (35, 36). Half of the interventions consisted of only one session (37, 39–42), with the longest lasting 12 weeks (45). While two interventions (20%) were self-paced apps (35, 36), most were delivered face-to-face ($n = 6$, 60%) (37–39, 41, 42, 45) and in a group setting ($n = 7$, 70%) (37–39, 41, 42, 44, 45).

Generally, psychoeducational interventions promoted positive effects on mental health outcomes, although many changes were not statistically significant (Figure 5, Table 2). Both a virtual reality-based stress management intervention and resilience coaching program studies with low risk of bias found moderate to large statistically significant reductions in anxiety (40, 44); two app-based psychoeducation interventions found small, non-significant decreases (35, 36). Four studies explored burnout. Two group-based psychoeducation interventions resulted in small, statistically significant decreases (44, 45). In contrast, a single, group-based session did not result in a statistically significant change. HCWs who used a CBT-based app reported slightly higher burnout scores at the end of the intervention (35). Moderate-to-large reductions in depression and PTSD symptoms were observed after using a psychoeducation app and group-based workshops (36, 37, 39). However, differences were generally not statistically significant; a fourth study of an app-based intervention found no change in either outcome (35). Concerning positive mental health outcomes, group-based resilience workshops and a mental wellbeing app resulted in moderate improvements in quality of life, although with some concerns of risk of bias (36, 45). A similar improvement was found following a resilience-focused group-based workshop, although the findings were not statistically significant (41). Resilience measures improved following group-based resilience training (38, 44) and group-based stress reduction (42) with moderate to large effect sizes. A single resilience training workshop and app-based intervention did not result in statistically significant improvements in resilience among HCWs (36, 41).

3.3.3 Mind–body interventions

Twelve mind–body interventions were identified: seven RCTs (46, 47, 50–52, 54, 57) and five quasi-experimental studies (48, 49, 53, 55, 56). Nearly all interventions included a focus on physical stress management ($n = 10$, 91%) (46, 48–57), and over half of the interventions had an educational workshop ($n = 6$, 55%) (46, 49, 50, 53, 55, 56) or educational materials ($n = 6$, 55%) (46, 48, 51, 54–56). Only two (18%) involved interaction with a mental health professional (46, 50), and none incorporated peer support. The length of interventions ranged from a single session (49, 57) to 8 weeks (55, 56). Interventions were predominantly delivered in groups ($n = 8$, 73%) (48–50, 52–57), with one (9%) (51) provided asynchronously via a mobile application and two (18%) (46, 47) not reporting whether interventions were delivered in group or individual format. Five interventions (45%) used virtual delivery (46, 48, 51, 52, 54), and five (45%) were delivered in person (47, 49, 53, 55, 56); one did not report the mode of delivery (50).

FIGURE 5
Harvest plot of the effects of psychoeducation on mental health outcomes.

Findings from mind–body interventions suggest moderate to large reductions in anxiety, burnout, and depression, and small to moderate decreases in PTSD as well as large increases in quality of life; however, many did not reach statistical significance, and all studies had some concerns or a high risk of bias (Figure 6, Table 2). Of eight studies that measured anxiety, statistically significant improvements were found following a transcendental meditation intervention, a meditation retreat followed by a home study program following Hurricane Katrina, and a mindfulness-based breathing and music therapy intervention (50, 56, 57). These improvements did not reach statistical significance in interventions consisting of mindfulness training for social workers (46), a mindfulness app (51), a Ba Duan Jin intervention (53), or a meditation retreat and home practice following Typhoon Haiyan (55). In an RCT of brief mindfulness meditation, decreases in anxiety following the intervention period were large in the control group (52). Significant reductions in burnout were reported following Gong meditation (47), transcendental meditation (50), and laughter yoga (54), but not following a meditation app (51).

Statistically significant decreases in depression were only found following mindfulness training plus daily meditation (46); moderate effect sizes were found following transcendental meditation (50), a meditation app (51), and meditation retreats following Hurricane Katrina (56). In one RCT of brief mindfulness meditation and a quasi-experimental study of a meditation retreat, depression scores were higher in the intervention vs. comparator group (52, 55). Concerning PTSD symptoms, a meditation retreat following home practices resulted in statistically significant reductions (56); however, reductions were not significant following the use of a mindfulness app (51). Ba Duan Jin exercises (53), laughter yoga (54), and mindfulness breathing and music therapy (57) resulted in large and statistically significant improvements in quality of life; these improvements were not significant following a mindfulness breathing intervention delivered via WhatsApp (48) or the use of a meditation app (51). Only one study explored the impact of transcendental meditation on resilience, which did not find a statistically significant difference between groups (50).

3.3.4 Organizational interventions

Three different interventions were delivered at the organizational level during the 2003 SARS pandemic in Taiwan (58) and the COVID-19 pandemic in the UK (59) and Italy (60), all with low or some concerns concerning the risk of bias (Figure 7, Table 2). These interventions included enhanced training and surveillance infection prevention and control measures (58, 60), reorganization of care and staffing levels (58, 60), and supports such as yoga, mindfulness, and general mental health support (58, 59). The effect of these changes was evaluated after 1 month (59) and up to 5 months (60). An intervention focused on staffing, infection prevention and control measures, and mental health supports resulted in statistically significant reductions in anxiety and depression; effect sizes were moderate, and the risk of bias was low (58). An intervention delivering a mental health support hub within the hospital resulted in a large improvement in mood but was not statistically significant, and there were some concerns about the risk of bias (59). Finally, an intervention including proactive management, reorganized care settings, an increase in staffing, and online education resulted in small but statistically significant improvements in quality of life among nurses (60).

3.3.5 Other intervention types

Finally, two interventions were identified that did not fall into one of the categories above. Giordano et al. used trained music

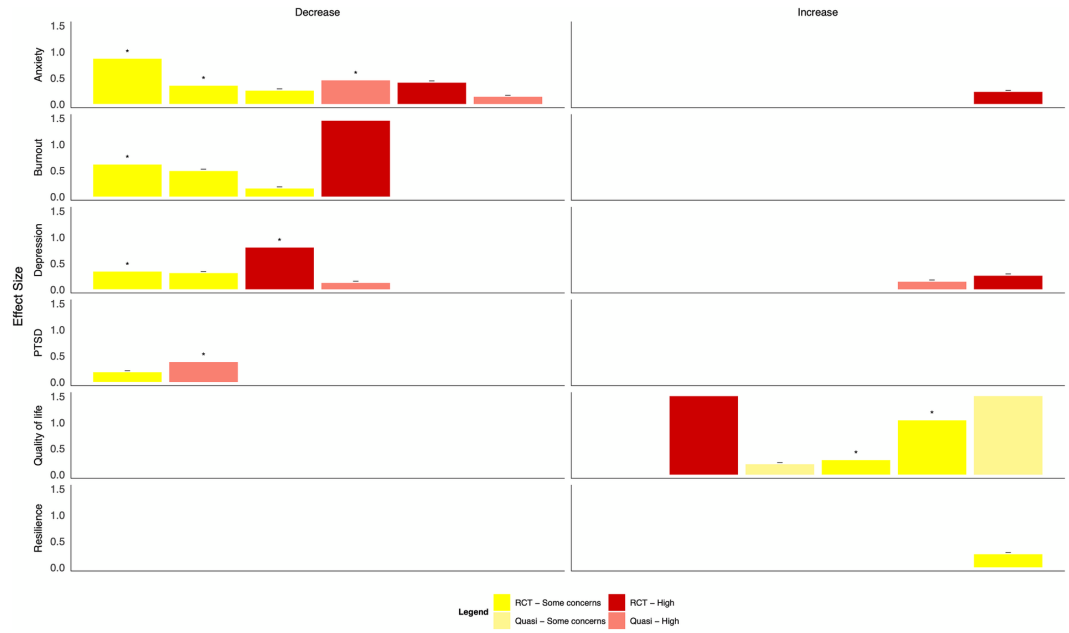

FIGURE 6
Harvest plot of the effects of mind–body interventions on mental health outcomes.

FIGURE 7
Harvest plot of the effects of organizational interventions on mental health outcomes.

therapists to develop relaxation playlists and listening guides to reduce stress and anxiety and improve energy and concentration among HCWs in Italy during the COVID-19 pandemic, with some concerns about the risk of bias (61). After 5 weeks, playlists decreased tiredness, sadness, fear, and worry compared to pre-intervention. Mahdood et al. tested aromatherapy before a work shift and during sleep on HCW with anxiety and insomnia during the COVID-19 pandemic in Iran; some concerns were identified with the risk of bias (62). Those in the intervention group displayed statistically significant reductions in anxiety compared to the control group after 30 days.

3.4 Mental health outcomes by delivery mode

When intervention categories were combined, few clear patterns emerged for differences in effect size by mode of delivery (in-person,

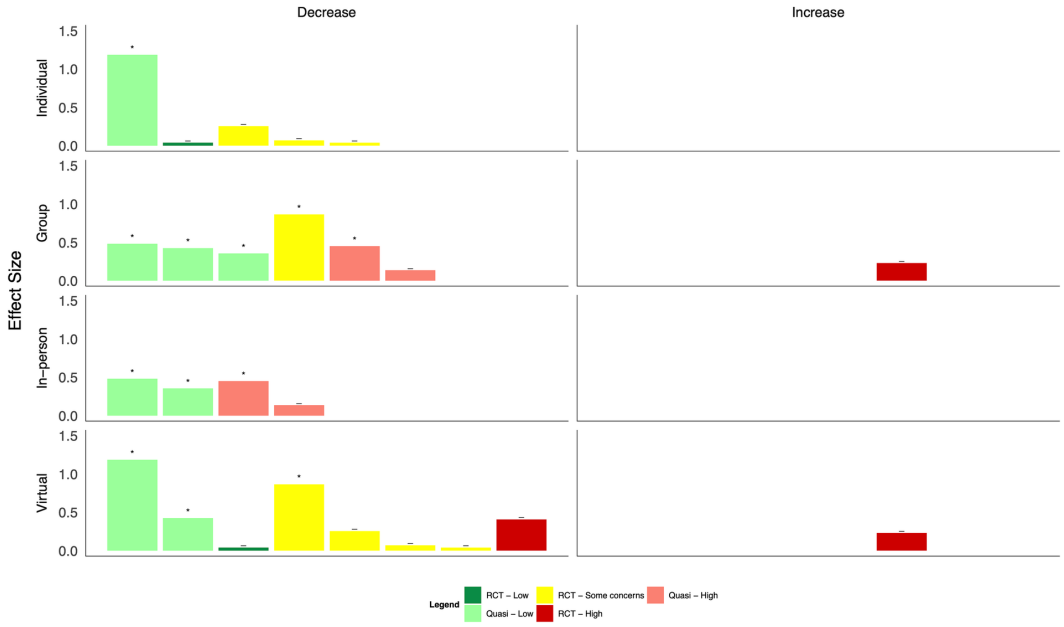

FIGURE 8
Harvest plot of changes in anxiety by mode of delivery.

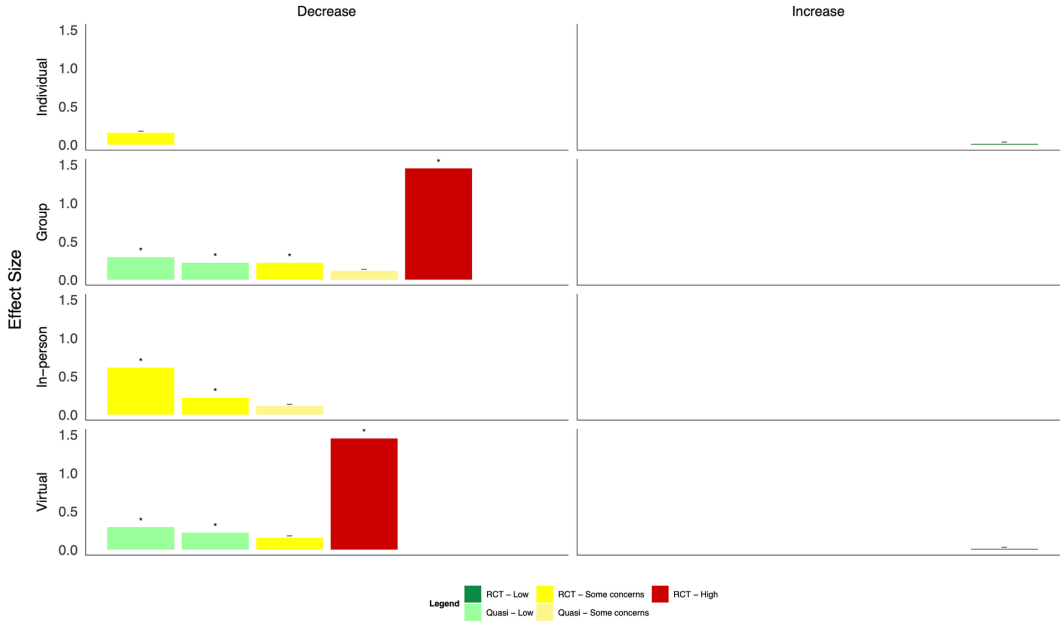

FIGURE 9
Harvest plot of changes in burnout by mode of delivery.

virtual, individual, and group-based, Figures 8–13). With respect to anxiety, interventions that were delivered in a group-based format were more consistently statistically significant than interventions delivered individually, with effect sizes generally moderate, and in-person compared to virtually delivered interventions had more consistently positive findings for reductions in depression. In the remaining comparisons, there were either similar findings by mode of delivery or too few studies in one or more categories to make meaningful comparisons.

4 Discussion

This review examined the use and effectiveness of strategies implemented at the individual and organizational levels to mitigate the psychological impacts experienced by those responding to a public health emergency. Recent systematic reviews focused on the COVID-19 pandemic have reported on the growing prevalence of adverse mental health outcomes in HCWs, which adds to the body of literature from

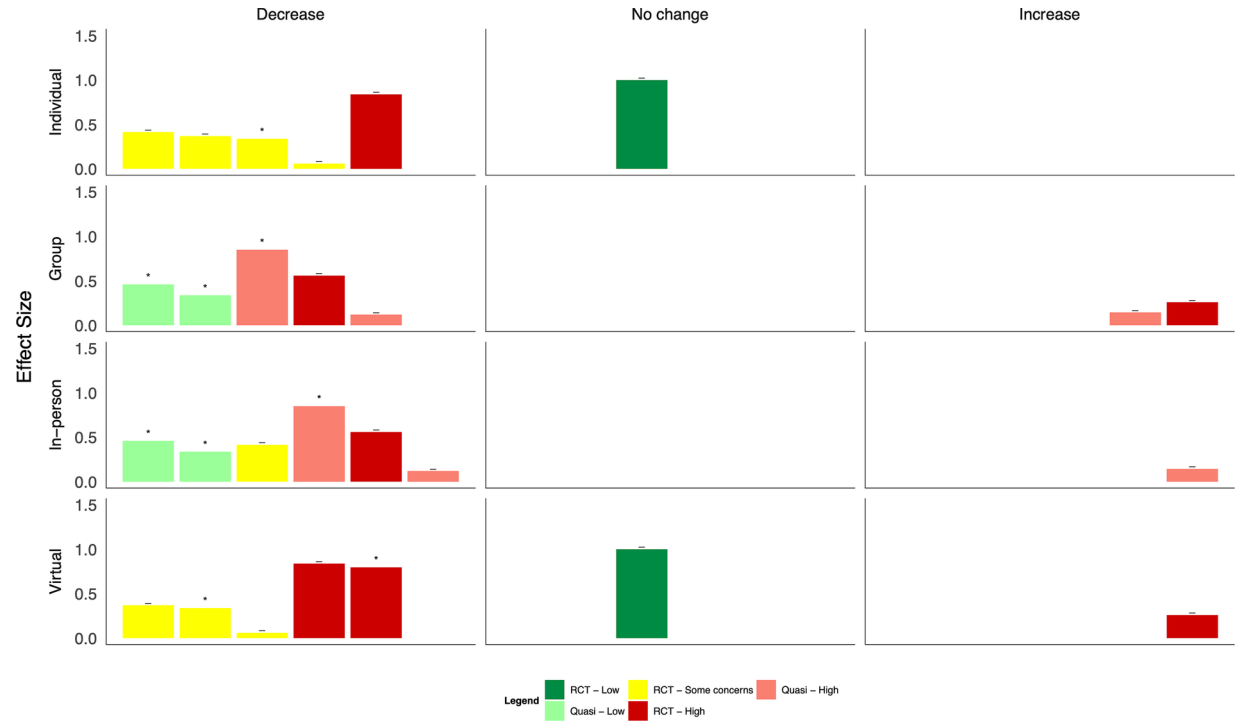

FIGURE 10
Harvest plot of changes in depression by mode of delivery.

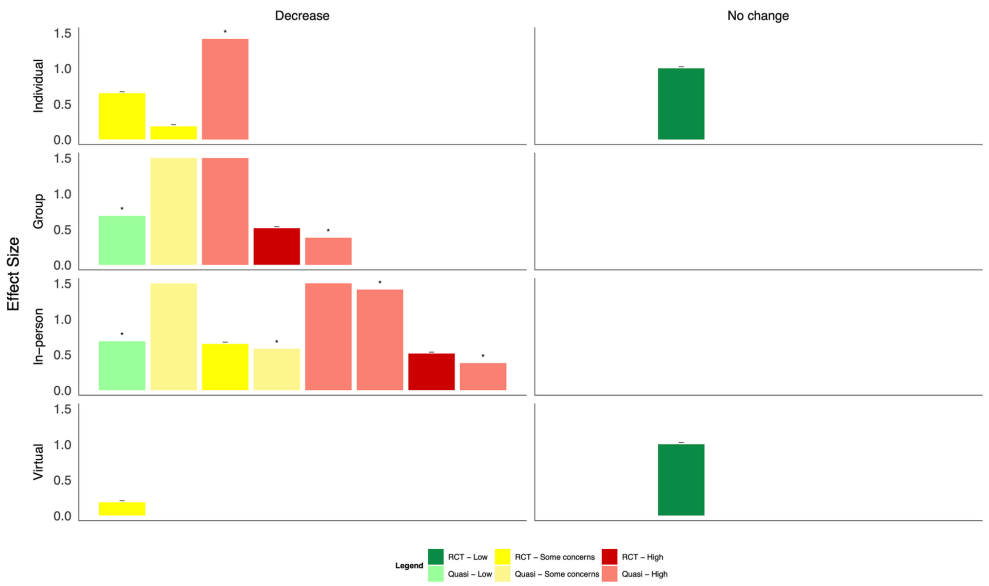

FIGURE 11
Harvest plot of changes in Post traumatic stress disorder by mode of delivery.

previous public health emergencies (63–68). In addition to documenting the burden, there is also a need to identify effective interventions that can be used in recovery from the early, acute phases of the pandemic and a knowledge of the types of interventions that could be efficiently implemented in future public health emergencies.

This review found that psychotherapy had the strongest effect on decreasing several negative mental health outcomes and that psychoeducation may also be effective. Mind–body interventions seem particularly promising for improving quality of life, but more high-quality research is needed. These findings are consistent with the findings of a rapid synthesis of strategies to support the mental health and resilience of the public health workforce (including studies that were not focused on public health emergencies) (69). This review found that effective interventions were multi-sessional, built on

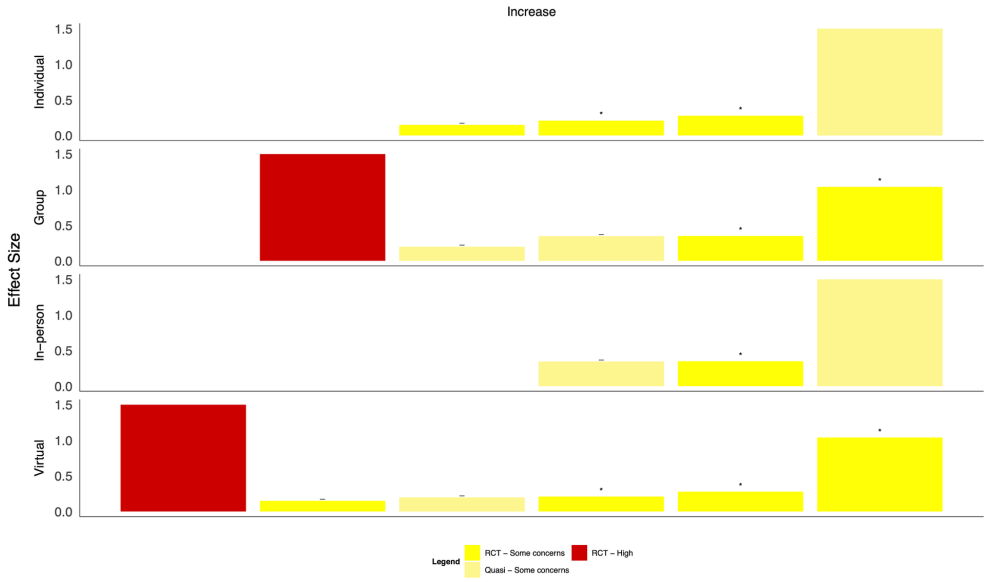

FIGURE 12
Harvest plot of changes in quality of life by mode of delivery.

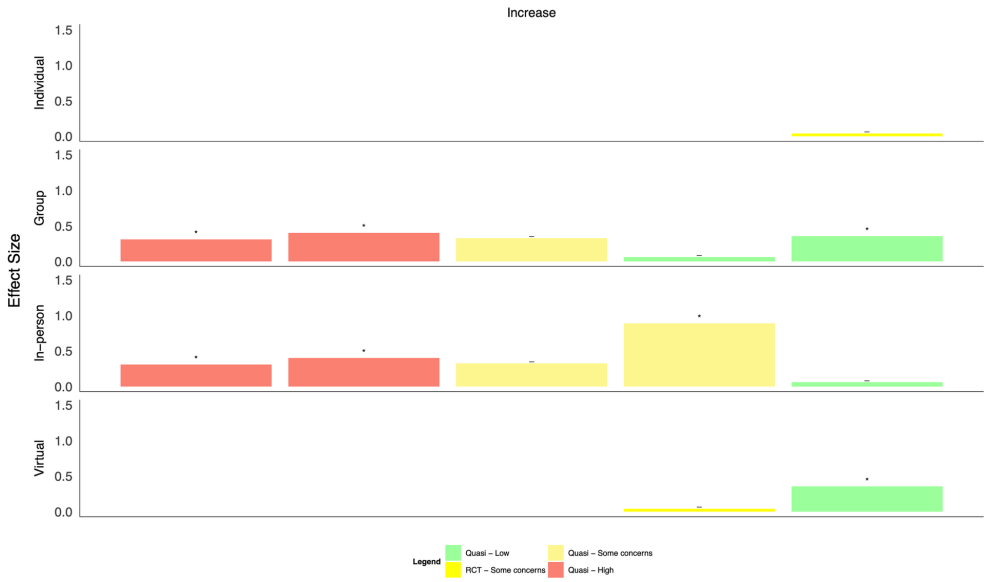

FIGURE 13
Harvest plot of changes in resilience by mode of delivery.

existing evidence-based practices such as CBT, aimed to increase knowledge and skills in safety, problem-solving, resilience, and coping, and incorporated aspects of physical stress management. Another review focused on only eHealth interventions to reduce stress and promote the mental health of healthcare professionals and also found preliminary effectiveness for 'third wave' psychotherapies, such as mindfulness, compassion, and acceptance therapies. Like in this review, high heterogeneity was found across studies (70). Finally, a 2020 Cochrane review found very low certainty evidence that resilience training, which included mindfulness and cognitive behavioral therapy, may result in higher resilience and lower depression and stress in healthcare professionals. Importantly, this review only included studies published up to June 2019, thus did not include important lessons learned during the COVID-19 pandemic.

A future focus on widespread organizational-level interventions is also important to inform future emergency response. While individual-level interventions do appear to have positive impacts, there may be important equity and access implications. Many of the interventions tested during the COVID-19 pandemic were offered virtually, given widespread public health protocols in place to reduce the spread of infection; this mode of delivery may have also enhanced the participation of HCWs who may be unable or unwilling to take

part in in-person programming. An important factor that is not considered in research-tested interventions is the cost of delivery. Out-of-pocket expenses for mental health treatment by a qualified professional may be prohibitive for many HCWs. Similarly, there is a need for more cultural competency in psychological interventions (i.e., CBT and PFA). Differing cultural perspectives may lead to conflicting views on how some think about and understand mental health and wellness, and research literature has highlighted the importance of considering cultural components in the spread and scale of evidence-based mental health interventions (71). Recognizing diversity within the workforce is a critical step in providing adequate mental health support.

Based on the visual inspection of the harvest plots, the data suggest that group-based interventions may be more effective than individually delivered interventions, including one-on-one intervention delivery or delivery via the internet or mobile applications, suggesting that a sense of group cohesion is relevant to effective interventions. This is in line with data from qualitative reviews, which have identified feelings of camaraderie and team building as important components that may mediate the efficacy of the intervention on individuals' mental health (72, 73). A recently published scoping review synthesized evidence on the key concerns of healthcare providers with respect to COVID-19 (74). Based on the findings, the authors recommended timely and personalized mental health support, particularly through interdisciplinary teams, to minimize burnout; this recommendation is supported by the findings presented here.

To answer our research question, we employed a comprehensive search strategy of multiple databases and gray literature and followed best practices for evidence synthesis, following the Cochrane Handbook for Systematic Review of Interventions to reduce bias in our study. The certainty of the findings of this review is limited by the quality of the included single studies. Most studies were quasi-experimental, using a pre-test and post-test design rather than RCTs. This is not surprising given that many were evaluations of real-world programs that were implemented in response to an unexpected public health emergency and were not pre-designed for the purpose of determining intervention efficacy. Thus, positive findings from studies without an appropriate control group may be confounded by other factors. At the same time, these real-world evaluations may be more generalizable than studies that are conducted in tightly controlled trial conditions. Within the included studies, effect sizes do appear to be larger in studies with a higher risk of bias. A large loss to follow-up was observed across both RCTs and quasi-experimental studies, which may overinflate the effect estimates if those who withdraw from a study are those who are not experiencing a benefit of the intervention. Heterogeneity within categories was high, precluding the use of statistical techniques such as meta-analyses to estimate effect sizes more precisely. These factors should be considered when using the evidence presented here in decision-making.

In addition, studies measuring anxiety, burnout, depression, and PTSD included in this review rarely provided a diagnostic criterion for inclusion. It is possible that the types of interventions needed to effectively treat a clinical diagnosis of a mental health disorder such as generalized anxiety disorder or major depressive disorder may be different than the type of intervention needed to reduce the risk of developing such disorders. Further studies should clearly describe recruitment strategies and eligibility criteria and perform subgroup analyses by baseline scores to better understand whether tailoring of interventions may be needed based on one's baseline mental health status. This is particularly important for including diverse populations who are less likely to acknowledge psychological symptoms and report being concerned about the stigma associated with mental illness (75). Finally, most of the interventions included were of relatively short duration; the medium- or long-term impact of these interventions is unknown.

5 Conclusion

This review adds to a growing body of evidence on strategies to mitigate the adverse psychological effects of frontline HCWs responding to a variety of public health emergencies, including pandemics and natural disasters. This review highlights the need for ongoing, rigorous research and evaluation of mental health programming implemented at the individual and organizational levels to mitigate the mental health risks in future pandemics or public health emergencies. Strategies to improve the mental health and wellbeing of HCWs following the COVID-19 pandemic will not be a "one size fits all" approach; however, the data to date elucidate promising areas to invest in to support the mental health of HCWs.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

SN-S: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. EB: Conceptualization, Data curation, Methodology, Supervision, Writing – review & editing. SH: Conceptualization, Formal analysis, Project administration, Writing – original draft, Writing – review & editing. DS: Methodology, Writing – review & editing. LA: Methodology, Writing – review & editing. EA: Methodology, Writing – review & editing. LK: Methodology, Writing – review & editing. JT: Methodology, Writing – review & editing. OB: Methodology, Writing – review & editing. SK: Methodology, Writing – review & editing. SM: Methodology, Writing – review & editing. MD: Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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Chain mediations of perceived social support and emotional regulation efficacy between role stress and compassion fatigue: insights from the COVID-19 pandemic

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Background: Nurses at the frontline faced high risks of the COVID-19 infection, undertook heavy workloads of patient care, and experienced tremendous stress that often led to compassion fatigue.

Aim: This study was to explore the role of positive psychosocial resources (i.e., perceived social support and emotional regulation efficacy) in the relationship between role stress and compassion fatigue.

Methods: A cross-sectional design was conducted in Hubei Province, China between May and September 2021. The Role Stress Questionnaire, the Perceived Social Support Scale, the Emotional Regulation Efficacy Scale, and the Professional Quality of Life Scale were used to measure key variables of interest. Nurse socio-demographic data were also collected. Structural equation modeling was used to explore the relationships, including potential mediating effect, among role stress, perceived social support, emotional regulation efficacy, and compassion fatigue.

Results: A total of 542 nurses participated in this investigation, and 500 were eventually enrolled in the analysis. The incidence of compassion fatigue among nurses was 94.2%, including 65.8% of nurses reporting at least moderate compassion fatigue. Univariate analysis showed that educational level, marital status, hospital rank, sleep time were the factors affecting compassion fatigue of the nurses. The structural equation modeling revealed that: Role stress had a direct positive effect on compassion fatigue; Perceived social support and emotional regulation efficacy partially mediated the link between role stress and compassion fatigue respectively; And there was a chain mediating role of perceived social support and emotional regulation efficacy between role stress and compassion fatigue.

Conclusion: The incidence of compassion fatigue was high during the COVID-19 pandemic among bedside nurses in China. Improving social support and enhancing the efficacy of emotion regulation may help alleviate compassion fatigue directly and/or via buffering the impact of role stress.

KEYWORDS

COVID-19, compassion fatigue, emotional regulation efficacy, nurses, perceived social support, role stress

1. Introduction

The sudden outbreak of the COVID-19 pandemic was an unexpected public health crisis and posed dramatic challenges to healthcare system around the world (1). Nurses were called to fight against the COVID-19 pandemic at the frontline. In this silent yet brutal battle, nurses experienced fears of infections, unexpected changes in the type of work, exhaustion due to heavy workloads, feelings of inadequate support, and uncertainty about disease control (2–4). Furthermore, they also experienced unprecedented psychological impact from the deaths of patients they cared for (5). Both the physical and mental challenges during the COVID-19 pandemic expose bedside nurses to an extremely high risk of suffering from compassion fatigue.

"Compassion fatigue" was first introduced in 1992 to describe nurses' burnout and it has received attention from the healthcare industry since then (6). According to Figley (7), compassion fatigue is defined as the secondary trauma experienced by helpers when providing assistance to recipients with empathy as a premise, which leads to a decreased interest and ability in empathizing with oneself, as well as a sense of fatigue from the work of helping. This sense of fatigue can not only alter the original work values of helpers, but also is accompanied by a range of psychological discomfort symptoms. Compassion fatigue can result in poor health outcomes of nurses, such as insomnia, reduced immunity, headaches, sleep disorders, etc. It can also impact nurses' performance at work, such as reduced quality of care, missed care, and medical errors (8–10). During the COVID-19 pandemic, research has focused primarily on investigating the current state of compassion fatigue (i.e., prevalence, associated factors) and the need to improve compassion fatigue in healthcare workers (i.e., neutralizing emotional trauma, utilizing relaxation strategies, improving capacity to respond to disasters and teaching coping strategies for dealing with psychological problems) (11, 12). However, few studies have explored the mechanisms by which compassion fatigue occurs during the COVID-19 pandemic. In addition, as an important healthcare workforce, nurses bear a heavy burden in clinical care and public prevention (13). Therefore, it is necessary to explore the mechanism of compassion fatigue among nurses to promote their physical and mental health.

To date, compassion fatigue has been linked to work-related stress as a main risk factor for developing compassion fatigue. One common source of work-related stress is the roles that arise from perceived multiple expectations within a social structure (14). When the expectations are conflicting, ambiguous, or overloaded, individuals experience role stress (14). Due to long working hours, heavy workload, fear of infecting their relatives and concerns about seeing patients die, nurses working during the pandemic experienced high role stress (3, 4, 15, 16). Indeed, studies have demonstrated that role stress has a strong connection with compassion fatigue (8, 17). In a study of Spanish medical staff, Ruiz-Fernández (18) and his team found that higher role stress was likely accompanied with more compassion fatigue. However, the strength of such relationship is unclear among nurses during the COVID-19 pandemic.

Recently, a series of studies have been conducted to identify potentially protective factors of compassion fatigue. Among many explored factors, psychosocial resources have drawn attention to the research community regarding their roles in compassion fatigue development. Psychosocial resources represent individual and relational factors with intrinsic values to promote physical and mental health (19). Positive psychosocial resources can help individuals recover quickly after experiencing negative events, especially major trauma, difficulties, setbacks, difficulties, stress, and even life-threatening situations (13). Psychosocial resources can effectively alleviate the effect of physical and psychological distress on compassion fatigue (13, 20, 21).

Perceived social support is one type of psychosocial resources. It is an essential component of a person's social support system and can be defined as an emotional experience of individuals who believe they are respected, supported, and understood in society and receive support from others (22). Perceived social support is widely referred as a protective factor for psychosocial adjustment. It is believed that the establishment of social support platforms may effectively buffer the impact of the COVID-19 pandemic on the mental health of healthcare workers (3, 22). For instance, Polish nurses who had higher levels of perceived social support tended to have lower levels of compassion fatigue (23). Social support also helps individuals better manage consequent emotional damage in stressful situations (23–25).

Another psychosocial resource is emotional regulation efficacy, which can be defined as an individual's confidence in his or her competence to regulate emotions. It can reduce emotional tension, relieve anxiety and depression, and promote mental health (26). The ability to effectively regulate emotions may alleviate the potential adverse effects when people encounter difficulties in public health emergencies (27). Appropriate emotional regulation abilities were found to reduce compassion fatigue in Iranian nurses in the COVID-19 outbreak (28). Adaptive emotion regulation strategies can buffer negative feelings caused by stress and enhance personal well-being (29). Similarly, individuals who were more able to manage their emotions perceived lower levels of stress which is a critical risk factor of compassion fatigue (30). Thus, the two psychosocial resources, perceived social support and emotional regulation efficacy, appeared to mediate the relationship between nurse role stress and compassion fatigue. However, it is unclear to what extent such complex relationships hold among Chinese nurses in public health emergencies particularly like the COVID-19 pandemic.

This study was aimed to examine the relationships between role stress, two psychosocial resources factors (perceived social support and emotional regulation efficacy), and compassion fatigue during the COVID-19 pandemic. We hypothesized that role stress was positively and directly associated with compassion fatigue (H1); perceived social

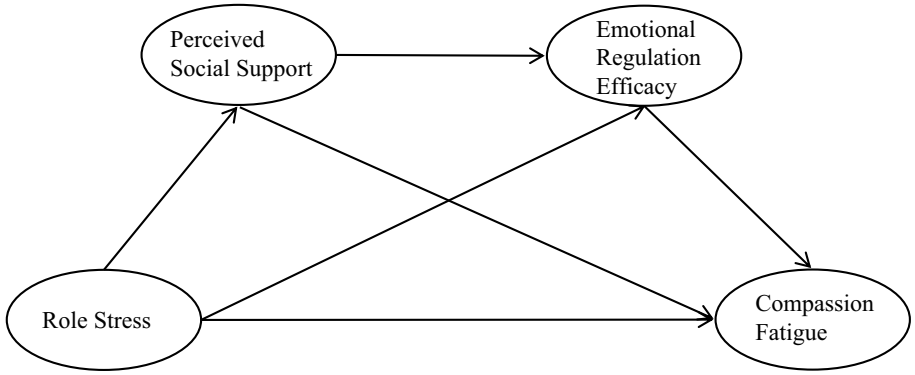

FIGURE 1
Hypothesized mediation model.

support mediated the relationship between role stress and compassion fatigue (H2); The relationship between role stress and compassion fatigue was mediated by emotional regulation efficacy (H3); and perceived social support and emotional regulation efficacy exert chain-mediating roles in the influence of role stress on compassion fatigue (H4). These hypotheses are depicted in Figure 1.

2. Materials and methods

This study was carried out with adherence to the STROBE guidelines after it had been approved by the institutional review board (Approval: HBZY2020-C14-01) and in accordance with the Declaration of Helsinki (31).

2.1. Study design

This study used a cross-sectional design.

2.2. Study population

The study population was registered nurses recruited from seven hospitals in three cities (Wuhan, Jingzhou, and Hanchuan) in Hubei Province. The participants were selected for the study if they had provided direct patient care during the pandemic and from May to September, 2021. Advanced practice nurses and intern nurses were excluded from this study.

2.3. Data collection

Data for this study were collected online anonymously. To ensure the completeness of survey responses, the participants had to answer each question before they could submit the survey. Upon receiving the completed questionnaires, two researchers checked the quality of the data. The questionnaires were excluded if they included identical responses to the majority of the questions or response times were unreasonably short.

2.4. Sample size

A power analysis was conducted to estimate the minimum sample size required in this study using the following sampling formula: $n = \frac{\left(Z_{\frac{\alpha}{2}}\right)^2 p(1-p)}{d^2}$ (32), where $\alpha = 0.05$, Z = confidence level ($\frac{\alpha}{2}$), p = prevalence, and d = marginal error. The incidence of compassion fatigue was estimated at 50% according to a cross-sectional study by Kabunga et al. (33). With a 95% confidence level, a margin of error of 0.05, and considering a 20% sample attrition rate, it was estimated that at least 461 questionnaires should be distributed to participants.

2.5. Measures and survey instruments

2.5.1. Role stress questionnaire

The Role Stress Questionnaire, which was developed by Peterson et al. (34) and then translated and revised it into Chinese by Li et al. (35), was used to measure the level of role stress nurse participants experienced. This questionnaire consists of 13 items (e.g., "I often face situations where my goals conflict with each other"). It contains three sections: role conflict (3 items), role ambiguity (5 items), and role overload (5 items). Each item is scored on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), with the five items of role ambiguity being scored reversely. To determine the level of role stress, a total score was calculated, with a higher score indicating a higher level of role stress. The Cronbach alpha of this scale 0.838 suggested a high reliability in this study.

2.5.2. Perceived social support scale

Nurses' perceived social support was measured using the Chinese version of the Perceived Social Support Scale. Zimet et al. (36) developed the original version of the Perceived Social Support Scale, which has been translated into Chinese by Jiang (37). The scale includes 12 items (e.g., "I can rely on my friends in times of difficulty") in three dimensions: family support (4 items), friend support (4 items), and other support (4 items). Participants rated how much support they had received from family, friends, and others on a

7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). A total score of the scale reflects the overall level of support. As the score increased, the perception of social support improved. The Cronbach alpha (0.972) indicated a high reliability in this study.

2.5.3. Emotional regulation efficacy scale

The Emotional Regulation Efficacy Scale by Caprara et al. (38) was developed to assess nurses reported emotion regulation efficacy. Chinese researchers adapted this scale to the needs of the Chinese population for measuring individuals' efficacy of emotion regulation (39). The scale consists of 17 items (e.g., "I express my pleasure when something pleasant happens") in total and includes two subscales, the efficacy to express positive emotions (POS) and the efficacy to manage negative emotions (NEG). POS is composed of 6 questions for two sub-dimensions: efficacy to convey happy/excited emotions and efficacy to express proud emotions. The NEG consists of 11 questions, including managing anger/rage, frustration/pain, and guilt/shame. The scale is scored on a 5-point Likert scale ranging from 1 (very unlikely) to 5 (very likely). The scores were calculated for each subscale (i.e., POS and NEG) as the sum of individual items in each of them. Higher scores reflected greater efficacy of emotion regulation. The Cronbach alpha of the two subscales (0.934 & 0.951) indicated high reliability of emotion regulation efficacy.

2.5.4. Chinese version of professional life quality scale (ProQOL)

Compassion fatigue among participating nurses was measured using the Chinese Version of the Professional Life Quality Scale (ProQOL). The original ProQOL was developed by Figley (7) and was later adapted to Chinese by Chen et al. (40). The Chinese version has been used to measure compassion fatigue status among doctors, nurses, chaplains, police officers, and rescue workers. This 30-item scale (e.g., "I am Satisfied with my job") contains three subscales: compassion satisfaction (10 items), burnout (10 items), and secondary trauma (10 items). Items 1, 4, 15, 17, and 29 are scored in reverse order and the rest in positive order on a 5-point Likert scale. To indicate a concern in the three subscales, the cutoff score of the compassion satisfaction subscale was <37; the cutoff score of the burnout subscale was >27, and the cutoff score of the secondary traumatic subscale was >17. If the score of any one subscale exceeded the cutoff score, it was considered mild compassion fatigue. If the score of any two subscales exceeded the cutoff score, it was categorized as moderate compassion fatigue. If the scores off all three subscales surpassed the cutoff score, it was considered severe compassion fatigue. A total score of this ProQOL was also calculated to indicate the overall level of compassion fatigue. Cronbach's alpha coefficient for this study was 0.761, which indicated good reliability.

2.5.5. Socio-demographic characteristics

Additional to the aforementioned measures of key variables of interest, socio-demographic data was collected too. A self-developed general information questionnaire was included in the survey to collect nurse socio-demographics, including gender, age, education, marital status, monthly income, job title, years as a clinical nurse, employment type, hospital rank, number of night shifts per week, and daily sleep time.

2.6. Statistical analysis

Descriptive statistical analysis was performed to describe the distribution of each variable of interest. Specifically, frequencies and percentages were performed to describe categorical variables, while means and standard deviations were used to describe continuous variables. Pearson correlation coefficients were used to measure the correlation between compassion fatigue, role stress, perceived social support, and emotional regulation efficacy. An analysis of nurses' compassion fatigue was performed using the independent sample *t*-test or one-way analysis of variance (ANOVA). Parameters outside the limit of ±2 for skewness and ± 7 for kurtosis were considered as an index of non-normality (29). The skewness and kurtosis of the variables in this study were within the above range, which indicated a normal distribution in general. These analyses were carried out with SPSS 25.0.

Finally, we verified and analyzed research hypotheses by constructing structural equation models using AMOS (v23). Fitness of each model was also evaluated using the following indicators: (a) χ^2/df; (b) Normed fit index (NFI); (c) goodness of fit index (GFI); (d) adjusted goodness of fit index (AGFI); (e) Tucker-Lewis fit index (TLI); (f) comparative fit index (CFI); and (g) root mean square error of approximation (RMSEA). An RMSEA $\leq$0.08, χ^2/df < 5, and the rest of the indices, such as NFI $\geq$ 0.90, GFI $\geq$ 0.90, AGFI $\geq$ 0.90, TLI $\geq$ 0.90 and CFI $\geq$ 0.90, indicated a satisfactory model fit (41, 42). A *p*-value of <0.05 were considered statistical significance in this study.

3. Results

3.1. Characteristics of the participants

Forty-two questionnaires were excluded from the 542 submitted questionnaires (a valid rate of 92.25%) mainly due to concerns of data quality and validity. Characteristics of the participants are presented in Table 1. Of the 500 participants, 477 (or 95.4%) were female. Nearly two-thirds (61.6%) were between 26 and 35 years old. The majority of the nurses were with a bachelor's degree (79.4%), married and with children (59.8%), holding a job title of Level 1 (64.6%), employed under contract (73.2%), and working in tertiary hospitals (64.0%). Nearly half of the nurses (49.4%) had a monthly salary between 3001 and 6000 RMB and worked 1 ~ 3 nightshifts per week (48.6%). Another 18.2% had three or more nightshifts per week. Nearly three-fifths had 5–20 years of working experience (59.0%). Approximately 3 in 5 nurses (61.6%) nurses reported having 4–6 h of sleep per day.

3.2. Status of nurses' compassion fatigue, role stress, and psychosocial resources

As shown in Table 2, the average total scores of compassion fatigue, role stress, perceived social support, and emotional regulation efficacy were 81.87 ± 10.80, 36.71 ± 7.44, 62.04 ± 12.77, and 62.79 ± 10.05, respectively. Compassion fatigue was positively correlated with role stress ($r = 0.62$, $p < 0.01$) but negatively related to perceived social support ($r = -0.33$, $p < 0.01$) and emotional regulation efficacy ($r = -0.40$, $p < 0.01$). Role stress was negatively correlated with perceived social support ($r = -0.30$, $p < 0.01$) and emotional regulation efficacy ($r = -0.39$, $p < 0.01$). Perceived social support was positively associated with emotional regulation efficacy ($r = 0.66$, $p < 0.01$).

Mild compassion fatigue was found in 142 nurses (28.4%), moderate compassion fatigue in 139 nurses (27.8%), severe

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TABLE 1 Sociodemographic information and distribution of compassion fatigue (n = 500).

Factors	N (%)	Compassion fatigue M (SD)	t/F	p
Gender				
Male	23 (4.6)	81.65 (11.55)	−0.10	0.92
Female	477 (95.4)	81.88 (10.78)		
Age				
≤25	87 (17.4)	84.01 (11.14)	1.99	0.12
26 ~ 35	308 (61.6)	81.18 (10.99)		
36 ~ 45	78 (15.6)	81.47 (9.97)		
≥46	27 (5.4)	84.07 (8.92)		
Educational level				
Technical secondary school	7 (1.4)	86.29 (5.56)	3.00	0.03
Junior college	83 (16.6)	80.40 (9.57)		
Undergraduate college	397 (79.4)	81.86 (10.99)		
Postgraduate or above	13 (2.6)	89.31 (11.54)		
Marital status				
Unmarried/single	94 (18.8)	81.90 (10.36)	2.70	0.03
Unmarried with a partner	50 (10.0)	85.82 (12.30)		
Married w/kids	299 (59.8)	81.26 (10.54)		
Married w/o kids	45 (9.0)	80.31 (11.50)		
Divorced/Widowed	12 (2.4)	86.33 (7.66)		
Hospital rank				
Grade A tertiary hospital	303 (60.6)	81.00 (10.91)	3.16	0.01
Grade B tertiary hospital	17 (3.4)	88.06 (13.35)		
Grade A secondary hospital	146 (29.2)	83.27 (9.70)		
Grade B secondary hospital	16 (3.2)	83.25 (12.47)		
Community hospital	18 (3.6)	78.11 (10.85)		
Job title				
Level 1	323 (64.6)	81.51 (11.06)	2.40	0.07
Level 2	153 (30.6)	81.84 (9.84)		
Level 3	20 (4.0)	88.15 (12.56)		
Level 4	4 (0.8)	81.25 (9.88)		
Employment methods				
Contract system	366 (73.2)	81.66 (10.90)	1.89	0.15
Personnel agency	69 (13.8)	80.83 (10.26)		
Formal staffing	65 (13.0)	84.18 (10.63)		
Monthly income (RMB)				
<3000	40 (8.0)	81.28 (12.09)	0.69	0.56
3001 ~ 6000	247 (49.4)	82.61 (10.41)		
6001 ~ 9000	152 (30.4)	80.93 (11.06)		
9001 ~ 12000	42 (8.4)	81.12 (10.05)		
>12000	19 (3.8)	82.74 (12.67)		
Years of working				
<1	23 (4.6)	85.65 (10.17)	2.39	0.07
1 ~ 5	138 (27.6)	82.75 (11.36)		
5 ~ 20	295 (59.0)	80.92 (10.63)		
≥20	44 (8.8)	83.57 (9.87)		

(Continued)

TABLE 1 (Continued)

Factors	N (%)	Compassion fatigue M (SD)	*t/F*	*p*
Weekly night shift				
0	166 (33.2)	81.26 (10.63)	0.61	0.65
1 ~ 3	243 (48.6)	81.85 (10.67)		
≥3	91 (18.2)	83.05 (11.45)		
Sleep time (hour)				
<4	69 (13.8)	85.90 (11.86)	4.30	<0.01
4 ~ 6	308 (61.6)	81.41 (10.21)		
6 ~ 8	109 (21.8)	81.17 (11.43)		
≥8	14 (2.8)	77.79 (8.94)		

TABLE 2 Correlation analysis between compassion fatigue, role stress, perceived social support and emotional regulation efficacy of nurses.

Variables	1	2	3	4	Mean (SD)
1. CF	1				81.87 (10.80)
2. RS	0.62**	1			36.71 (7.44)
3. PSS	−0.33**	−0.30**	1		62.04 (12.77)
4. ERE	−0.40**	−0.39**	0.66**	1	62.79 (10.05)

**$p < 0.01$; CF, compassion fatigue; RS, role stress; PSS, perceived social support; ERE, emotional regulation efficacy.

compassion fatigue in 190 nurses (38.0%), and no compassion fatigue in only 29 nurses (5.8%).

3.3. The relationship between psychosocial resources, role stress, and compassion fatigue

Estimates from the structural equation models are summarized in Table 3. The model fit the data well, as shown in Figure 2. The significance of the potential mediating effects was tested using the bias-corrected Bootstrap method (5000 randomly repeated samples). The significance of the effect was based on the 95% confidence intervals that did not contain zero. The effect was also controlled for socio-demographics of the participants. Before constructing structural equations, the effect of socio-demographics on compassion fatigue was assessed by regression analysis. This result showed that only sleep time ($B = -2.06$, $p < 0.05$) significantly affected compassion fatigue and was included as a control variable in the estimated model ($\beta = -0.13$, $p < 0.001$).

The result of the model suggested that role stress had a direct effect on compassion fatigue ($\beta = 0.51$, $p < 0.001$). The indirect influence of role stress on compassion fatigue via its effect on perceived social support and emotional regulation efficacy respectively, was significant ($\beta = 0.06$, $p < 0.001$; $\beta = 0.06$, $p = 0.001$). Importantly, the model also indicated a significant chain mediation effect of perceived social support and emotional regulation efficacy ($\beta = 0.05$, $p < 0.001$).

4. Discussion

Using data from a cross-sectional survey, this study examined influencing factors of compassion fatigue among nurses in China during a public health emergency (i.e., the COVID-19 pandemic) and tested the possible mediating roles of perceived social support and emotional regulation efficacy between role stress and compassion fatigue. Our findings provided new insights into the complex relationship between role stress, psychosocial resources (i.e., perceived social support and emotional regulation efficacy), and compassion fatigue. These findings are informative for developing a healthy and competency nursing workforce in China beyond the COVID-19 Pandemic.

Nurses in China experienced unprecedently high compassion fatigue during the COVID-19 pandemic. In our study, more than 9 in 10 nurses reported compassion fatigue, including 65.8% with moderate or severe compassion fatigue. Previously, Hunsaker et al. (43) found that 65.9% of nurses experienced compassion fatigue in a study of 1000 emergency department nurses in the United States. Wang et al. (44) investigated 1123 clinical nurses and found that 88.38% of nurses suffered from compassion fatigue in 2020. Our findings and these results suggest that the occurrence of compassion fatigue is extremely common among nurses. Furthermore, compared to the studies before the COVID-19 pandemic, the rate of compassion fatigue is higher in our study, which suggest that nurses' compassion fatigue has been exacerbated by the high-intensity, high-risk, high-stress work associated with the COVID-19 pandemic (1). Such a high compassion fatigue is alarming for a healthy and stable nursing workforce as other researchers have indicated that nurses are more likely to leave nursing when they experience compassion fatigue (45). Hospital executives as well as health policymakers should make a commitment to help nurses manage compassion fatigue. Research is also warranted to examine potential long-term consequence of COVID-19 pandemic on the health of frontline nurses, including compassion fatigue and other health issues.

Our study further confirms the positive relationship between role stress and compassion fatigue and provides empirical evidence

quantifying this relationship in frontline nurses in China during the public health emergency. Previously, Yates (46) has concluded that job stress results in burnout, one dimension of compassion fatigue. Similarly, Alharbi et al. (17) noted that the COVID-19 outbreak increased nurses' work stress, which raised the risk of compassion fatigue. The above observations were in line with the results we obtained. Additional to their heavy patient care duties, frontline nurses often have may other roles in life, such as caregivers, parents, husbands or wives, etc., which can add extra stress when they already face tremendous stress working at the frontline battling the pandemic as a direct care provider. Consequently, they are more likely to experience burnout, depression, and anxiety, which are closely tied to compassion fatigue.

TABLE 3 Direct, indirect, and total effects of role stress on compassion fatigue.

Pathway	Estimate	95%CI		*p*
		Lower	Upper	
Direct effects				
RS → PSS	−0.24	−0.34	−0.14	***
PSS → ERE	0.56	0.48	0.64	***
ERE → CF	−0.28	−0.37	−0.18	***
RS → ERE	−0.15	−0.25	−0.05	0.002
PSS → CF	−0.20	−0.28	−0.11	***
RS → CF	0.51	0.41	0.60	***
Sleep time→CF	−0.13	−0.20	−0.07	***
Indirect effects				
RS → PSS → CF	0.06	0.03	0.11	***
RS → ERE → CF	0.06	0.02	0.11	0.001
RS → PSS → ERE → CF	0.05	0.03	0.09	***
Total effects				
RS → CF	0.86	0.65	1.09	***

***$p < 0.001$; RS, role stress; CF, compassion fatigue; PSS, perceived social support; ERE, emotional regulation efficacy.

The research findings indicate that in addition to the direct impact, role stress also indirectly influences compassion fatigue through perceived social support. According to the stress-buffering theory, high levels of social support can protect individuals from the potential negative effects of stressors (47). This suggests that an increased level of perceived social support is beneficial in alleviating the impact of stress on compassion fatigue. Wu et al. (48) conducted a cross-sectional survey involving 1464 Chinese bank employees and found that perceived social support could mediate the relationship between job stress and burnout. Additionally, through an investigation of 444 Chinese nurses, Liu and Aungsuroch (49) demonstrated that perceived social support acted as a mediator between work stress and burnout. The above results were consistent with the present study. Therefore, in highly stressful clinical environments, hospital managers could implement training activities aimed at enhancing nurses' perception of social support to reduce their compassion fatigue.

In addition to the mediating role of perceived social support, emotional regulation efficacy also partially mediates the relationship between role stress and compassion fatigue. This finding is in agreement with previous studies. For instance, in a

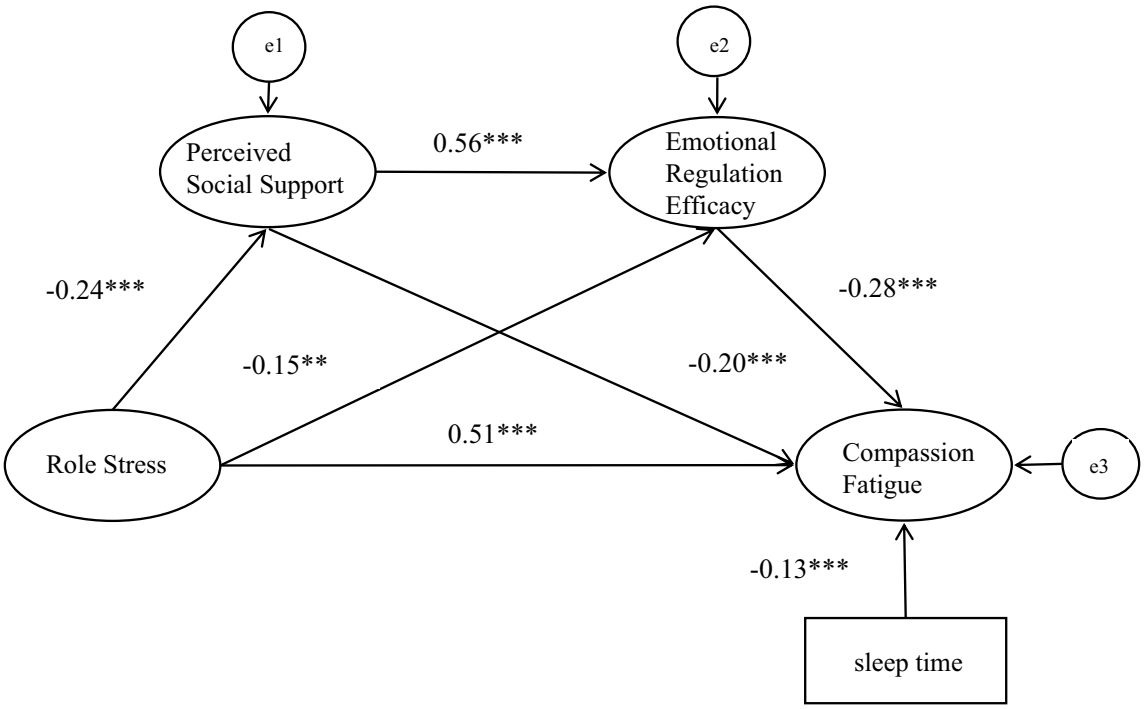

FIGURE 2
The model of compassion fatigue, emotional regulation efficacy, perceived social support, role stress and demographic factors. ***$p < 0.001$, **$p < 0.01$. CMIN/DF = 3.013, NFI = 0.959, GFI = 0.946, AGFI = 0.911, TLI = 0.959, CFI = 0.972, RMSEA = 0.064.

cross-sectional survey of 264 Italian professionals working with refugees, Tessitore et al. (50) found that emotion regulation exerted a mediating effect on the association between secondary traumatic stress and burnout. Similarly, Kshtriya et al. (51) revealed an indirect mechanistic pathway suggesting that the mediator, an emotion regulation strategy that expressed inhibition, increased the negative impact of occupational stress on the psychological well-being of emergency personnel when it was enhanced. The current research provides support for the mediating role of emotional regulation efficacy, which may be explained using a person-by-situation approach to the emotion regulation model. According to this model, individual reconstruction of emotions can lead to better mental health outcomes when exposed to high-stress environments that are relatively uncontrollable (52). This suggests that hospital administrators need to provide education and training for nurses to enhance the regulation of emotional abilities and alleviate potential adverse psychological health outcomes.

This research offered new understanding that the chain mediating effect of perceived social support and emotional regulation efficacy on the relationship between role stress and compassion fatigue. In this study, nurses were exposed to high-pressure clinical environments due to their heavy workloads, caring for critically ill patients, and performing duties in multiple roles. However, perceived social support and emotional regulation efficacy are positive psychosocial qualities acting as internal protective factors for individuals (22, 29). Researchers believed that individuals with a higher perception of social support can typically regulate their emotions better (53), which may reduce the effects of stress on compassion fatigue. When individuals face stress in their personal or professional lives, positive psychosocial resources may enhance their psychosocial resilience (53, 54). This resilience empowers individuals with courage and perseverance to confront negative thoughts generated by these stressors (13, 55). Therefore, strengthening positive psychosocial resources is crucial for maintaining psychological well-being. This pathway, which we have found, precisely explains the effectiveness of these psychological interventions during the COVID-19 pandemic. This also points to the need to deeply investigate the mechanisms and scientifically set up interventions. In the future, we need to dig deeper into positive psychosocial resources to broaden our understanding of the mechanism of compassion fatigue.

Additional to the aforementioned factors, our study also found sleep time was an important factor significantly associated with compassion fatigue. Similar to Stewart et al. (56), compassion fatigue could occur when nurses did not get enough sleep. Studies have shown that sleep deficit may cause a range of physiological stress responses that alter the composition of the gut microbiota. The altered microbiota may affect the function of the nervous and immune systems, thereby reducing an individual's ability to cope with psychological and physical stress and making him or her more susceptible to stressful life events (57). It suggests that managers should arrange shifts scientifically and mobilize human resources reasonably, which is beneficial for nurses' physical and mental health.

Findings from this study have several implications for nursing management, research, and policies. According to our results, perceived social support and emotional regulation efficacy have a positive protective effect against compassion fatigue. Therefore, nursing managers need to strengthen nurses' construction of social support comprehension and enhance their emotional regulation abilities to alleviate compassion fatigue. On one hand, nursing managers could enhance nurses' perception of harmonious interpersonal environments through some methods such as mindfulness interventions (58) and peer support programs (59). The enhancement of this comprehension of social support in interpersonal interactions helps shift nurses' negative perceptions of stress to a positive focus on stress, thereby improving nurses' well-being. On the other hand, nursing managers could enhance nurses' emotional regulation abilities through activities like Yoga (60) and Balint group exercises (61), which include expressing positive feelings and managing negative emotions. Simultaneously, nurses can seek social support from family, friends, and organizations to maintain stable emotions and expand positive psychosocial resources.

5. Strengths and limitations

This study enriched positive psychology and deeply explored the mechanism of compassion fatigue from the perspective of positive psychosocial resources. It turns out that perceived social support and emotional regulation efficacy play an essential role in buffering compassion fatigue, which provides a meaningful reference for psychological intervention for nurses in the future.

Despite the aforementioned strengths, this study has several limitations that should be noted. First, this study is a cross-sectional survey study, therefore our findings are limited to correlation relationship rather than causal relationships. It thus is necessary to conduct longitudinal studies in the future to explore the causal relationship between role stress, psychosocial resources, and compassion fatigue. Second, we only surveyed nurses in hospitals in Hubei Province. Given the geographic diversity in China, our findings may not be generalizable to nurses in other parts of China. Large-scale at national level should be considered in the future.

6. Conclusion

Nurses experience high level of compassion fatigue, a condition that is widespread and requires more attention. This study used structural equation modeling and found that when nurses are in high role stress circumstances, perceived social support and emotional regulation efficacy may buffer the negative effects of role stress on compassion fatigue. Moreover, it indicates that by building a excellent support system and managing emotions effectively, people can enhance their psychological well-being and activate positive forces within themselves. This will help nurses deal with role stress associated with the outbreak and improve compassion fatigue. It also helps to provide thoughts on promoting the mental health of nurses when uncertain public health event occurs in the future.

Data availability statement

The datasets presented in this article are not readily available. However, the data that support the findings of this study are available from the corresponding author upon reasonable request. Requests to access the datasets should be directed to HH, hhjiabei@hbtcm.edu.cn.

Ethics statement

The studies involving humans were approved by Hubei University of Chinese Medicine (Approval: HBZY2020-C14-01).

Author contributions

YZ: Formal analysis, Writing – original draft, Writing – review & editing. HH: Conceptualization, Methodology, Writing – review & editing. CY: Writing – review & editing. XW: Investigation, Writing – review & editing, Data curation. JL: Formal analysis, Validation, Writing – original draft. JX: Data curation, Investigation, Writing – review & editing. BF: Data curation, Investigation, Writing – review & editing. YC: Data curation, Formal analysis, Writing – original draft. CM: Conceptualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Integrative attitudes of Ukrainian war refugees in two neighboring European countries (Poland and Hungary) in connection with posttraumatic stress symptoms and social support

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Since February 24th, 2022, millions of Ukrainians have sought refuge in other, mainly European countries. Hungary, after Poland, is the second largest host of Ukrainian refugees. Only a portion of them are asylum seekers (~11.0% in Poland and ~1.1% in Hungary). The aim of the study is to compare the integrative acculturation attitudes between the war refugees residing in the two European countries. The comparison takes into account both the suffering of posttraumatic stress symptoms and social support. It is the first comparative study of this kind pertaining to the Ukrainian refugees in European countries. The data were obtained by a survey method using the modified CAPI (Computer Assisted Personal Interview) technique. The data analyzed were collected between November 21st and December 20th, 2022 from 728 adult Ukrainian individuals who crossed the borders of Poland and Hungary after February 24th, 2022. The research results show that refugees in Poland perceive significantly more social support and show stronger integrative attitudes than refugees in Hungary. The two samples do not differ regarding the presence of posttraumatic stress. The integrative attitudes proved not to be linked to gender and age, but linked to the host country. Besides social support and the host country, posttraumatic stress also proved to be a significant predictor of integrative attitudes.

KEYWORDS

war refugees, Ukraine, mental health, PTSD, economic growth, social support, acculturation attitudes

1. Introduction

According to Maughan and Burgess, there are two main aspects of social sustainability relating to mental health. The first is the ability to rebuild the social capital lost due to the mental illness (like employment, education, or housing) and the second is the required societal support (including the support provided by health care professionals, organizations, and wider public) (1).

Humanitarian crises, such as those caused by natural disasters or wars, are associated with an increased prevalence of mental disorders (like depression and PTSD) as violence is a major threat to mental health (2).

Millions of Ukrainians have sought refuge in other, mainly European countries since February, 24th, 2022. According to the UNHCR statistics, by September 6th, 2023 there were 6.201.600 Ukrainian war refugees recorded worldwide (3) resulting in the worst migration crisis in Europe since World War II (4). The migration was involuntary. Refugees had been forced to move in order to maintain personal safety. They did not migrate for better economic or educational opportunities (5).

Exposure to armed conflict has been associated with negative mental health consequences. Hoppen and Morina estimated in their meta-analysis that 354 million adult war survivors suffer from posttraumatic stress disorder (PTSD) and major depression (because of wars which occurred between 1989 and 2015) (6). Individuals with PTSD suffer from the persistent recollections of the traumatic events and experience the avoidance of stimuli. They are associated with the trauma accompanied by general unresponsiveness and increased arousal, irritability, sleep disorders, and impaired attention (7).

The Russo-Ukrainian war began at a time when the Ukraine population was already in a poor state of physical and mental health because of the Covid-19 pandemic. An armed conflict occurring immediately after a pandemic creates an atmosphere of uncertainty and instability that negatively influences mental health, especially for those who are directly affected by the war (8). Additionally, the healthcare system of Ukraine was compromised even during pre-pandemic times. It was challenged badly during the pandemic. Now, it is suffering severely mainly by the damaged infrastructure due to the war (9).

Studies examining the connection between the war and the mental health of Ukrainians report that people experience worsening mental health after the Russia's attack in February 24th, 2022 (10–13). Most notable are increases in the incidence of anxiety, depression and loneliness (11). High rates of PTSD have also been documented in war-affected populations (12). In their study, Kuparov and colleagues found that Ukrainians that stayed in Ukraine reported less symptoms of anxiety, depression and stress than those who moved abroad (13).

One of the earliest published articles dealing with the mental health of the Ukrainian war refugees was a study based on a sample of 304 individuals surveyed in Germany. It showed that severe psychological distress, severe depressive symptoms and anxiety are prevalent for a significant portion of refugees (40.5 and 20.4%, respectively) (14). In line with this observation, another study also reported that Ukrainian refugees staying in Poland showed severe depressive and anxiety symptoms at a comparable level (~30% of the 623 individuals) (15).

The question arises whether posttraumatic stress urges individuals to adapt to the new culture, or, on the contrary, makes the successful adaptation more difficult. On one hand, we can expect that traumatic memories make returning to the home country impossible (an urge to adapt to the current environment). On the other hand, severe symptoms may make taking initiatives more difficult.

The literature is inconclusive regarding the relationship between posttraumatic stress and acculturation. Stasielowicz (16) studied the adaptive performance of refugees who experienced trauma living in Germany. Adaptive performance refers to "altering behavior to meet the demands of a new situation, event, or set of circumstances" (17, p. 615). It can be needed at a workplace, at any new institution, or system in the host country. The author found that posttraumatic stress was negatively related to task-oriented adaptive performance.

Nonetheless, there are studies which found a positive, or no relationship between posttraumatic stress and acculturation. One of them sought to examine whether PTSD or major depression inhibits psychosocial adaptation in refugees. In the research participation in and dropouts from a short integration-supporting program held in Australia for refugees from the former Yugoslavian countries was monitored. The study found that neither PTSD nor depression were related to dropouts (18). Jurcik et al. (19) also reported that acculturation and PTSD are not related when examining the relationship in a sample of refugees residing in Canada.

However, a study examining the relationship between trauma, acculturation, and mental health symptoms in Somali refugees in the United States (20) resulted in quite an unexpected finding. Various acculturation dimensions (American cultural identity, English language competency, and American cultural competency) occurred despite traumatic experiences and mental health symptoms.

Thus, sometimes posttraumatic stress may be an inhibiting factor, sometimes a neutral one, and sometimes a facilitating factor in regards to cultural adaptation. We propose that social support can be related to this relationship. If an individual receives the necessary help, then posttraumatic stress can facilitate participating in the life of the host country.

According to the UNHCR data, only a portion of the refugees in Poland and Hungary are asylum seekers. In Poland, by September 2023, out of 14.881.470 Ukrainian refugees that crossed the Polish border, 1.639.725 were asylum seekers (~11.0%). Meanwhile in Hungary, only 37.565 individuals were asylum seekers out of the 3406.310 that entered Hungary (~1.1%) (21). These two ratios are obviously very different. Hungary, after Poland, is the second largest recipient of Ukrainian refugees. Nonetheless, it is not the country of destination. Ukrainians usually stay only a few days and move onward to Western European countries (4, 22).

On one hand, governmental policies, resources, services of the host country, community attitudes toward immigrants are crucial to the settlement of refugees. On the other hand, empowerment and participation of the asylum seekers in local communities (23) are also key to success. Applying for asylum in a certain country is a sign of an acculturative purpose with respect to that country. Immigrants find their way in a host society in various ways. We can distinguish between assimilation, integration, separation, and marginalization in the framework of the well-known cultural adaptation strategies theory of Berry (24). Assimilation means adapting to the culture of a host country and putting aside the migrant's home culture. Separation involves keeping the original culture and rejecting the host country one. Integration is the maintaining of the original culture while including compatible aspects of the culture of the new country of stay. Lastly, marginalization is not adapting to the new culture and losing the original one (5, 25). The framework incorporates two dimensions: contact with members of the origin culture and contact with members of the host culture. Integration (contact with members of both the origin and the host culture) is desirable from the perspective of the host culture. It can also be beneficial for refugees' mental health.

Integration supporting initiatives, like, e.g., simplified path to employment, were implemented in both countries. Nonetheless, two

aspects of key importance in influencing the mental state and acculturation of immigrants are very different in the countries. First, Poland has been one of the favorite destinations of Ukrainian immigrants well before the war started. The contemporary migrations from Ukraine to Poland started in the 1990s. Ukrainians became the largest migrant group in Poland (26) and Poland was the main European Union country which Ukrainians choose for work (27). Consequently, war-refugees could find substantial social support in Poland from other individuals from the Ukrainian culture. Social support can mitigate refugees' isolation and loneliness by enhancing the sense of belonging, and facilitate integration into a new society (28–30). Additionally, language competencies crucially influence the success of cultural adaptation (31).

Social support refers to the support available through interpersonal connections (32). Weinert and Brandt (33) conceptualized social support mainly in the nursing context. Their concept was based on the five underlying factors identified by Weiss (34): the sense of being valued, being an integral part of a group, perceived chances for intimacy, perceived opportunities for nurturance, perceived availability of information, emotional and material help. The measuring tool from this approach, the PRQ-2000 (35), has been successfully implemented in studies dealing with cultural adaptation with respect either to migrant people (36) or international students (37). The tool has showed consistently that acculturation stress is lower when social support is stronger.

Social support appears to be a very important element linked to cultural adaptation irrespective of the specific method used for data collection. An interview-study involving service providers and policymakers in health and immigrant settlement in Canada showed that social support is perceived to play an important role in immigrant settlement and to have a positive impact on immigrant health (29). Social support is a substantial factor not only from the perspective of service providers and policymakers, but immigrants themselves emphasize its role. Liamputton and Kurban studied young Middle-Eastern refugees living in Melbourne with a qualitative approach addressing how they perceive their wellbeing and the barriers they face in their new homeland. The researchers identified the presence or absence of social support (from family, teachers, church, etc.) as a key factor influencing the refugees' ability to adapt to their new environment (28). Questionnaire based studies, other than those using the PRQ-2000, also showed that social support perceived by refugees is linked with positive mental state characteristics. In a study of minority Syrian refugees living in Iraq, Yildirim and colleagues (38) found social support (measured by the Multidimensional Scale of Perceived Social Support) (39) to be related with flourishing. The flourishing embraced several forms of personal resources (engagement with daily activities, being respected by others, having a purposeful life, and being optimistic about the future) (40).

The aim of this study is to compare the integrative acculturation attitudes of war refugees residing in Poland and Hungary. Posttraumatic stress symptoms are taken into account in addition to social support. The mental state of refugees can also be connected to acculturation in addition to the structural-environmental factors (like language difficulties, the presence of others from the home culture who can provide social support, national legislation, etc.). This study is both interdisciplinary and international. It is the first comparative study of this kind taking into account the Ukrainian war refugees in European countries.

Our findings may also have practical implications. The results may provide guidance for policymakers planning actions toward Ukrainian refugees in European countries. This may prevent some of the refugees who are able and willing to work from falling into long-term unemployment, especially the not in employment, education or training ("NEET") status. Reducing long-term unemployment and the number of people in the "NEET" status has been the highest priority in the European Union youth employment policy (41).

We expected refugees surveyed in Poland to show a stronger integrative attitude than those surveyed in Hungary (H1). Simply put, this expectation was based on the statistics regarding the number of asylum-seekers in each country.

We also expected refugees from Poland to report a stronger integrative attitude even after controlling for social support (H2).

Finally, we investigated, without formulating explicit expectations, the potential link between social support and the relationship between posttraumatic stress and integrative cultural adaptation.

2. Materials and methods

2.1. Method

The data were collected in face-to-face interviews through a survey method using the modified CAPI (Computer Assisted Personal Interview) technique. The study used a standardized measurement tool - a questionnaire also containing psychological scales enabling the characterization of the respondents in terms of their emotional state. This was important due to the traumatic circumstances of the migration. The sample was selected according to a scheme known as "random-route." In this selection method, the pollster receives a selected address called the "starting point." Next, the pollster starts the research conducting successive interviews in every nth apartment, starting from the starting point.

The survey was carried out among Ukrainians aged 18 and over who crossed the Polish-Ukrainian and Hungarian-Ukrainian borders after the date of Russia's armed invasion (February 24, 2022). The structure of the defined population was not known. The pollsters selected the respondents in accordance with the sample instructions and gave the respondents a mobile device on which the survey tool was uploaded. The respondents completed the questionnaire by themselves. The data was automatically recorded in the system and ready for analysis, so there was no need for manual recording. Automation accelerated the processing of the results.

2.2. Sample

The size of the population of Ukrainian refugees residing in Poland and Hungary was estimated in September, 2022 based on the latest UNHCR data available: 1.017.655 individuals in Poland (the number of active registrations in the PESEL database, from around the 1.5 million refugees who applied for a temporary protection; those who left the country for over 30 days were excluded) and 28.662 individuals in Hungary (the number of applications for temporary protection). The total estimated population size was approximately 1.05 million Ukrainians. According to the outlines in the table by Krejcie and Morgan (42),

a sample size of 384 is suggested as appropriate for a population of one million. The data collection was conducted during one month period (from November 21st until December 20th, 2022) in Poland and Hungary. In total, 807 valid surveys were obtained. Due to the dynamic size and structure of the population, it was assumed that in order to achieve an appropriate selection of the sample the population should be divided into strata from which individuals were then drawn for the sample. Our research reached respondents from all the Ukrainian oblasts, including the occupied Autonomous Republic of Crimea, Luhansk, and Donetsk oblasts. The selection criteria were as follows: (1) War refugee – the respondent first entered the territory of Hungary or Poland after the date of Russia's invasion of Ukraine (February 24th, 2022); (2) Ukrainian resident - the respondent was a resident of Ukraine before first entering the territory of Poland or Hungary; (3) Adult – the respondent was at least 18 years old; (4) Not a Hungarian minority – the minority was excluded from the data.

For the purpose of this study, we used data obtained from 728 Ukrainians (see Table 1).

The respondents arrived from all 24 Ukrainian oblasts, as well as one autonomous republic and two cities with a special status (Autonomous Republic of Crimea, Donetsk Oblast, and Kherson Oblast, respectively) (see Supplementary Table S1).

The distribution of oblasts that Ukrainian refugees arrived from likewise differed between Poland and Hungary, $p < \alpha$ ($p = 0.0000$). Residents whose oblast capitals are very large and large cities of Ukraine (Kyiv, Lviv, Donetsk, Odessa, Kherson) relocated to Poland more often. Refugees in Hungary were mainly residents of Transcarpathia, Kyiv Oblast, and oblasts close to the border with Hungary (Ivano-Frankivsk).

2.3. Measurements

Personal Resource Questionnaire (PRQ 2000) (35). The 15-question PRQ 2000 is designed to measure the perceived level of social support. It is graded on a 7-point Likert scale that corresponds to the level of agreement (from 1 = "strongly disagree" to 7 = "strongly agree"). The score range is from 15 to 105, where a higher score denotes a higher level of perceived social support. Sample items are: „There is someone I feel close to who makes me feel secure" or „I belong to a group in which I feel important." The scale had a good consistency in our study ($\alpha = 0.942$).

The Posttraumatic Stress Disorder Checklist-5 (PCL-5) (43). This is a 20-item self-report instrument, which assesses symptoms of PTSD as defined by the DSM-5. The 20 items of the PCL-5 reflect the frequency with which respondents have experienced the item in question rated on a 5-point Likert-scale ranging from "not at all" to "extremely." A total score (0–80) can be obtained by summing up the scores for each of the 20 items. A clinical diagnosis cannot be achieved based purely on the score obtained from the PCL-5. However, scores at or above the cut-off score of 33 are indicative of provisional PTSD. Sample items include: "Feeling very upset when something reminded me of the stressful experience." or "Avoiding memories, thoughts, or feelings related to the stressful experience." The Ukrainian version of the PCL-5 questionnaire used on a large sample ($N = 2,203$) in 2016 showed a high reliability of the scale ($\alpha = 0.960$) (44), just like in our study ($\alpha = 0.944$). Even the subscales of PCL-5, except the two-items Avoidance ($\alpha = 0.564$), showed sufficient consistency (Re-experiencing: $\alpha = 0.821$; Negative alterations in cognitions and mood: $\alpha = 0.857$; Alterations in arousal and reactivity: $\alpha = 0.856$).

Integrative cultural adaptation attitudes (45). These attitudes were measured using some of the items measuring integrative attitudes of the Acculturation Attitudes Scale (AAS). The AAS is a 56-item instrument that assesses 14 areas of individual and family life. Out of the fourteen areas we used society („While living in Poland / Hungary, I would like to retain the Ukrainian cultural heritage and lifestyle and participate fully in various aspects of life of the Polish / Hungarian society"), values ("I would encourage children to educate and to participate fully in various aspects of life of Polish / Hungarian society, while teaching them Ukrainian values and customs"), success ("To be successful, we must participate fully in various aspects of life of the Polish / Hungarian society, but also maintain our Ukrainian culture and heritage"), and interests ("Ukrainians should join together and form organizations to represent Ukrainian interests in Poland / Hungary, and also actively participate in Polish / Hungarian organizations"). The consistency of the answers for the four items translated into Ukrainian for the purpose of this study was sufficient ($\alpha = 0.762$). We used the average score of the agreement with the statements on the 5-points scale as an index for the integrative attitude.

2.4. Research model

Linear regression analysis was used for hypothesis testing. Three models were built: The first one incorporates age, gender and host

TABLE 1 Demo-social characteristics of the studied sample.

Variables		Poland, Valid $N = 400$	Hungary, Valid $N = 328$	Differences
Age	Mean (SD) Min-Max	M = 36.8 (SD = 12.2) 18–65	M = 37.8 (SD = 10.9) 18–63	$p = 0.180$
Gender % (*N*)	Female	90% (359)	71% (233)	$p = 0.0000$
	Male	10% (41)	29% (95)	
Place of residence in Ukraine % (*N*)	Village	14% (57)	17% (56)	$p = 0.0000$
	Small town (up to 20 thousand inhabitants)	16% (62)	20% (67)	
	Medium city (from 20 to 99 thousand inhabitants)	23% (92)	32% (106)	
	Large city (from 100 to 500 thousand inhabitants)	26% (104)	16% (51)	
	Very large city (over 500 thousand inhabitants)	21% (85)	15% (48)	

TABLE 2 Social support, posttraumatic stress and integrative attitudes (M/SD) in the two samples (PL, HU).

Variables	Hungary	Poland	Differences
Social support	67.707 (18.901)	77.122 (14.411)	$Z = -7.129$ $p = 0.0000$
Posttraumatic stress	28.863 (15.368)	26.355 (16.942)	$Z = -1.736$ $p = 0.083$
Integrative attitude	4.380 (1.206)	4.994 (0.993)	$Z = -7.067$ $p = 0.001$

TABLE 3 Integrative attitude in connection with demographic variables, social support and posttraumatic stress (standardized β coefficients are listed).

Model No.	Variables	1	2	3
1.	*Age*	0.021 $p = 0.556$	0.050 $p = 0.094$	0.045 $p = 0.135$
	Gender (1 = female, 2 = male)	−0.029 $p = 0.426$	0.011 $p = 0.724$	0.010 $p = 0.738$
	Country (1 = Poland, 0 = Hungary)	0.263 $p = 0.0000$	0.131 $p = 0.0000$	0.132 $p = 0.0000$
2.	*Social support*		0.572 $p = 0.0000$	0.589 $p = 0.0000$
	Posttraumatic stress		0.161 $p = 0.0000$	0.142 $p = 0.0000$
3.	*Social support × posttraumatic stress*			0.067 $p = 0.042$
	R^2 Significance in R^2 change	0.074 $p = 0.0000$	0.372 $p = 0.0000$	0.375 $p = 0.042$

country as the main demographic variables and examines how these variables are related to integrative attitudes. The second model adds the psychological variables of social support and posttraumatic stress, as independent variables. Adding psychological variables to demographic ones makes it possible to detect the potential change in the relationship between demographic variables and integrative attitudes. Particularly, we expected the connection between the country and the integrative attitude to decrease, since we anticipated social support to be the primary explanation for the relationship between country and integration. Lastly, the third model included the interactive component of social support × posttraumatic stress.

3. Results

Table 2 shows the scores of the distinguished variables in the samples from the two host countries. The consistency of measurements proved to be high with respect to all three variables ($\alpha s > 0.75$).

We can see that refugees in Poland perceive significantly more social support and show stronger integrative attitudes than refugees in Hungary. The two samples do not differ regarding the presence of posttraumatic stress symptoms. In Hungary, 45.9% of females and 44.2% of males fall into the group experiencing provisional PTSD (scored more than 32 points) (45.4% of the whole sample), while in Poland it was 45.7% of females and 36.6% of males (44.8% of the whole sample).

The integrative attitudes proved not be linked to gender and age. Nonetheless, they were linked to the host country ($\beta = 0.263$) (see Table 3). The coefficient of the host country decreases after incorporating social support into the model ($\beta = 0.131$) since the host country and social support are correlated, see the first row of Table 2, but, it remains significant. Thus, Poland remains attractive beyond the greater amount of perceived social support. The effect size of social support proved to be large ($\beta = 0.572$). Besides social support and the host country, posttraumatic stress is also a significant factor with a positive coefficient in the second model, with a small effect size ($\beta = 0.161$). The coefficient remains positive and significant ($\beta = 0.142$) even after incorporating the interactive component (social support × posttraumatic stress) in the third model. This interactive component also proved to be a significant predictor of integrative attitudes, with a very small effect size ($\beta = 0.067$) (see Table 3).

4. Discussion

Presented study investigated the integrative cultural adaptation strategy of Ukrainian war refugees in relation to social support and posttraumatic stress in two countries, Poland and Hungary. The refugees' appearance and cultural practices are mostly similar to those dominant in Poland and Hungary. Both countries are neighboring countries. Both are very receptive and helpful towards Ukrainian refugees, and both have supportive legislation encouraging employment. Yet, a much larger portion of refugees are asylum-seekers in Poland than in Hungary. The difference between the two countries can be explained to some extent by social support considering the large number of Ukrainians present in Poland even before the war. Moreover, Poland may be also more attractive to Ukrainians even besides social support due to the other factors, such as the similarity between the spoken languages.

Data from Ukrainian war-refugees were collected at the end of 2022 in Poland and in Hungary about integrative attitudes (45), social support (35), and posttraumatic stress (43).

The distribution of age and gender of the respondents differed between Poland and Hungary. The average age of the respondents in Hungary was slightly higher than of respondents in Poland However, this is not a statistically significant result, $p > \alpha$ ($p = 0.180$). There were also differences in gender between the host countries, $p < \alpha$ ($p = 0.0000$). The surveyed population was very female biased. A greater degree of female bias was visible among refugees in Poland, where women accounted for 90% of the sample. In the Hungarian sample women comprised 71%.

There were also differences in the characteristics of the place of residence of the Ukrainian refugees. Most of the respondents from Hungary lived in medium-sized and small towns before first arriving in the host country. The largest number of respondents from Poland lived in very large and large cities in Ukraine.

A substantial part of the refugees (approx. 44% in both countries) were found to have a severe level of posttraumatic stress (PCL-5 scores >32).

We hypothesized and found that the integrative attitude is more positive in Poland (H1). It remained more positive even after controlling for social support (H2). Perceived social support proved to be the strongest correlate of integrative attitudes. This is in agreement with what others found with different methods in different studies (28, 29, 38). We expected perceived social support to be related to the relationship between posttraumatic stress and the integrative adaptation purposes. What we found, a weak but significant relation, is in line with the common sense of social support being most needed in severe life situations in order to overcome the crisis. The positive relationship between posttraumatic stress and integrative attitudes remained even after controlling for this interaction.

The high level of provisional PTSD prevalence is above the level that meta-analyses report with respect to war refugees (approx. 30%) (46, 47). This high ratio of provisional PTSD emphasizes the urgency for help to be provided by professional services, even if perhaps the majority of refugees would recover without professional intervention. Similarly to Rousseau and colleagues (48) findings with respect to war-refugees residing in Canada.

We believe that the separate effect of the host country (stronger integrative purpose in Poland) came, at least in some part, from the closeness of the spoken languages, Polish and Ukrainian. The differences between the meanings of some words can be small when distinguishing between two languages with the same origin (49). It unquestionably helps immigrants to find jobs, cope with everyday challenges, and communicate with members of the host country (50–52). Gaining language proficiency has a significant impact on the well-being of immigrants (53). Hungarian is a language "island" in Europe surrounded by Neo-Latin, Germanic, and Slavic languages (54). Polish is a West Slavonic Language, while Ukrainian and Russian languages (spoken by 97% of Ukrainians), are East Slavonic Languages. Both originated from Common Slavic, also called the Proto-Slavic language (55). Polish, Russian, and Ukrainian spoken languages overlap substantially. In Hungary, even English cannot function as a mediating language, since millions of Hungarians do not speak English at all (56). In short, language competence is a key factor in acculturation and mental health (31, 50–52). Nonetheless, in the presented study we did not measured the host country language proficiency among the respondents. Thus, this is an area to be explored in some future research.

We can corroborate the consensual knowledge in literature that social relationships are needed for social integration (e.g., (28, 29, 38)). On a very general level, the concept of the need to belong (57) explains why an individual may lose adjustment to society without possessing satisfactory social relationships. The survey addressed not the support received from the host society in general, but mainly support from close relationships. Perceived social support proved to be the strongest correlate of integrative attitudes. It would be useful to distinguish whom the help comes from to get a clearer picture of the role that close relationships play in forming integrative attitudes. We found that the relationship between the host country and integration decreased when perceived social support was added to the model. This can be explained on the basis of many Ukrainians residing in Poland even before the war. Among the limitations of our study, there is a lack of detailed information on the relationships of the refugees with culturally experienced Ukrainians that have been living in the host country since the time before the war.

After reviewing the literature, where controversial results can be found (16, 18–20), we introduced perceived social support into the system of relationships to investigate the integrative component of posttraumatic stress and social support and its relation with cultural adaptation. Although the interaction mattered and a positive relationship of posttraumatic stress with integrative attitudes was stronger when individual perceives being socially supported, the separate positive link of posttraumatic stress with integration did not disappeared from the model. This is in line with the findings of Jorgenson and Nilsson (20) with respect to Somali refugees in the United States. They found better English language and American cultural competencies among refugees with more traumatic experiences and more mental health symptoms.

The concept of posttraumatic growth has the potential to make a bridge between controversial findings. Posttraumatic growth, as Tedeschi and Calhoun write "is the experience of positive change that occurs as a result of the struggle with highly challenging life crises. It is manifested in a variety of ways, including an increased appreciation for life in general, more meaningful interpersonal relationships, an increased sense of personal strength, changed priorities, and a richer existential and spiritual life" (58). Posttraumatic stress disorders and posttraumatic growth can coexist. PTSD can positively influence posttraumatic growth among refugees as Von Arcosy and colleagues (59) found. Having data not only about posttraumatic stress, but also about posttraumatic growth could offer a clearer picture about the connection between trauma and cultural adaptation in a new country.

Several limitations should be acknowledged in this study, including the ones concerning the sample features such as incomplete data about the population of Ukrainian war refugees in both countries. The challenge was in preparing an exhaustive sampling frame of refugees. For example, in Poland refugees registered in the PESEL database, which enabled them to obtain social benefits. Nonetheless, the database lacked some records, like a record of the place of residence. Another limitation about the sample features was related to the population dynamics. The fluctuation of refugees is understandable given the situation from which they are fleeing and the opportunities they will seek in other countries. For researchers, this is a challenge in terms of difficulties in estimating and interpreting the results. Moreover, there were no data obtained about the time the sample population had spent in Poland and in Hungary. We mentioned that Hungary remains a transient country for most of the Ukrainian refugees who stay there for a few days. This was stated based only on reference to external data. Such a comparison requires further investigation which is beyond the scope of our study. Another limitation is that we do not have direct information from our respondents on their language competence in the language of the host country. We also do not have specific information with respect to the origin of the received social support. We should add that we do not have individual information on war experiences or how the respondents were affected by the war, whereas literature data clearly shows that mental health consequences of war are strongly connected to how one is affected by the war (12). Moreover, the distribution of the home oblasts was different in the two samples. This implicates potentially different reasons for moving west; however, we have not addressed the motivation for migrating in our questionnaire. Instead, we supposed homogenous motives of searching for a safer life.

Obviously, in a large-sample questionnaire study the very complex phenomenon of being a war refugee cannot be fully studied.

A practical conclusion of the study results is that early actions consisting of providing mental health support, social support, and communicative language competences undertaken by policymakers in European countries accepting war refugees from Ukraine can change the integrative attitudes of the refugees. Moreover, they can reduce the risks of long-term unemployment and its resource consequences for health care systems (60) and rebuild the two main aspects of social sustainability relating to mental health - the social capital lost due to the mental illness and to the societal support. Adult women comprised 90% of the Polish and 71% of the Hungarian sample (at the end of 2022). Therefore, European policymakers should consider various scenarios while supporting the integration process of the refugees. Employment may not be the best solution for women of all ages. Moreover, integration with the labor market should consist of various tools and procedures to support the Work-Life-Balance of working adults, especially that many of the refugees have dependents or are older people (61–63).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Institutional Ethics Committee of University of Krakow Rector's Research Ethics Board (protocol code DNa.0046.1.5.2022, 28.09.2022) and Egyesített Pszichológiai Kutatásetikai Bizottság (protocol code 2022-108, 08.10.2022). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JK: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. CC: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. KK: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. DL: Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing. PW: Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1256102/full#supplementary-material

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Incidence of mental disorders in soldiers deployed to Afghanistan who have or have not experienced a life-threatening military incident—a quasi-experimental cohort study

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Introduction: There is very good international research on deployment-related mental disorders in military personnel. The incidence rates show a very wide range. A new strategy is therefore proposed in order to achieve better standardization and thus better comparability of the studies. In addition to a non-deployed comparison group, we propose to compare deployed soldiers with and without critical military incidents during the deployment. This additional distinction makes it possible to differentiate between the influencing variables of actual threat and general deployment stress.

Methods: $N = 358$ male combat soldiers deployed to Afghanistan were included in the study. Clinical interviews were conducted several days before deployment and after deployment. Of them, $n = 80$ soldiers suffered a life-threatening military incident during deployment, whereas 278 soldiers did not. Odds ratios (OR) were calculated for the groups with and without critical military incidents and the new onset for PTSD, anxiety disorders and depressive disorders.

Results: When comparing both groups, we found significantly higher 1-year incidence rates in the group with critical military incidents: 6.4% vs. 1.1% (OR 6.2) for post-traumatic stress disorder (PTSD); 7.0% vs. 1.1% (OR 6.5) for depression; and 15.9% vs. 2.8% (OR 6.6) for anxiety disorders. The 1-year incidence rate of mental multimorbidity (PTSD with anxiety or depression) was 4.8% vs. 0.4% (OR 12.0).

Discussion: These results indicate that life-threatening military incidents during military deployment are important to mental health. As the different threat levels of the various missions are taken into account, additional predictors could be determined more precisely in further research.

KEYWORDS

military personnel, PTSD, depression, anxiety, mental health, military deployment

Introduction

There is an abundance of literature on the prevalence and incidence rates of post-traumatic stress disorder (PTSD) among emergency responders (1–3) and civilians (4, 5) after major disasters. As PTSD is only one mental health outcome among others, common mental disorders such as depression or anxiety are often not recorded. A methodological problem with many studies lies in the naturalistic design. As major disasters are difficult to predict, it is not possible to carry out baseline measurements. The pure prevalence rate of mental disorders can therefore only be attributed to the events to a limited extent. In addition, the informative value is often impaired by the fact that no comparison group is included or available. For example, after the WTC terrorist attacks of 9/11, it is virtually impossible to identify emergency services personnel who were not deployed there in any way after the attack. To address this issue, meta-analyses can help reconcile such differences. However, the problem that often remains is that the clinical and methodological heterogeneity of the studies is very high. This is also significantly limiting the substance of the meta-analyses (6).

For military personnel deployed in war zones, it is somewhat easier, as the missions are more predictable and therefore allow for baseline measurements. Thus, there is a good database on mental disorders after deployments abroad (7–9), while the results of incidence rates are inconsistent in terms of timing and data collection (10, 11). Comparability is also limited by a variety of missions with different military conflict potential as well as different types of data collection, such as the use of questionnaires, clinical interviews or register studies (12, 13). As a result, the incidence rates of deployment-related mental disorders among this population vary widely, e.g., the range for PTSD is between 0.1% (14) and 27.8% (15).

Most studies include undeployed soldiers who refer to comparable units as a control group (16). Differences in the development of mental disorders can therefore be attributed to the deployment. Nevertheless, since the circumstances of deployments abroad differ from those in the home country, this comparison is somewhat problematic. Personal restrictions such as absence from home, climate changes, constant readiness, carrying out operations under different threat conditions, etc. are part of everyday life here. This means that different situations are compared over time, which is the intent of the studies, but each situation is part of the military's self-image. Although there is no doubt that a deployment abroad increases the burden and stress level, it is only likely to contribute to the development of mental disorders in a few cases. Rather, military threats such as active combat operations, defined as violence by armed forces against people, animals or objects or violence against armed forces through attacks, mines, firefights, etc., are likely to be responsible (17–19).

Following on from these considerations, an extended approach would be to compare soldiers who are on the same deployment during the same period of time. The discrimination could then be made between a risk group of soldiers with critical military incidents, defined as events with a real risk of injury or death, and a comparison group of soldiers without such an event during deployment. The delta of new occurrences of mental disorders could thus be attributed more directly to these war-related events. This would make it easier to compare the different studies and probably lead to more consistent results. As the different threat levels of the various deployments are thus taken into account, other important predictors such as age, gender, rank, duration of deployments, equipment (20), etc. could be determined more precisely. On the other hand, different types of stressors could also be investigated in these missions. Nordstrand and colleagues found that Norwegian soldiers deployed to Afghanistan showed higher posttraumatic deprecation following the non-threat-based stressors "moral challenge or witnessing" than soldiers who experienced "personal threat" (21).

PTSD is one of the most common deployment-related mental disorder in the German Armed Forces (22). A study examining the 1-year incidence rate among German soldiers deployed to Afghanistan found that 2.1% had a new onset of PTSD (unweighted), compared to 0.2% of never-deployed soldiers (23).

To examine the extent to which critical military incidents are responsible for the incidence, we compared military personnel with and without these events. We hypothesized that soldiers exposed to a critical military incident during deployment are more likely to develop PTSD, anxiety and depressive disorders as well as "multimorbidity" defined as PTSD with a depressive or an anxiety disorder.

Methods

Eligible participants were military personnel of an entire combat troop contingent deployed in Afghanistan from November 2013 to July 2014. These troops were part of the International Security Assistance Force (ISAF) which was a multinational military mission in Afghanistan from 2001 to 2014. The baseline assessment was embedded in the deployment training in November 2013 and took place a few days before the deployment. The second survey was conducted one year after the baseline assessment and had the same framework conditions. From a total of 511, $n = 496$ servicewomen and men (97%) were recorded at the first measurement point. There were $n = 135$ (27%) drop-outs between the two assessments. The main reasons for the dropouts were changes in the military resource planning and medical conditions. We excluded $n = 3$ female soldiers due to lack of representativeness of such a small subgroup, thus $N = 358$ male combat soldiers remained.

Data collection consisted of the clinical interview Mini Diagnostic Interview for Mental Disorders (24) according to ICD-10. Therefore, troop psychologists were trained in this interview. After the training, the agreement of diagnoses between the troop psychologists was 95% (inter-rater reliability). That is acceptable. This interview covers the most common mental disorders, including PTSD, anxiety disorders and depressive disorders.

By comparing the two assessments, it is possible to calculate the new onset of mental disorders after deployment. In the present data analysis, we examined the 1-year incidence rate of mental disorders in $N = 358$ physically uninjured male combat soldiers. The focus was on PTSD, anxiety disorders and depressive disorders. For this purpose, all anxiety disorders, consisting of specific phobias, obsessive-compulsive disorders, agoraphobia (with and without panic attacks), panic attacks, social phobias and generalized anxiety disorders, as well as all depressive disorders, consisting of major depression, dysthymia and hypomania, were summarized.

With respect to the methodological considerations, we compared the incidence rates of 80 combat soldiers who suffered a critical military incident, and 278 who did not. All soldiers of the same rank had the same risk of encountering critical military incidents during

deployment resulting in a quasi-experimental design of the study. Sociodemographic characteristics were compared between both groups using *t*-tests for independent samples.

Odds ratios (OR) were calculated for the groups with and without critical military incidents sand each mental health outcome for PTSD, anxiety disorders and depressive disorders. Soldiers with the specific pre-deployment diagnosis were each excluded because they were "not at risk" of developing the same diagnosis again (see Figure 1). To test for confounding variables, analysis of covariance (ANCOVA) was performed including the new onset of the specific mental disorders as dependent variable, critical incidents (yes/no) as independent variable and sociodemographic data as covariates.

This cohort study was commissioned by the Federal Ministry of Defence (PIII5-Az-66-55-05). The original research question of the Federal Ministry of Defense related to "Psychological Fitness" and participation was mandatory. Obtaining a written informed consent was not applicable for this project. However, the participants were informed about the meaning and purpose of the study. To comply with the ethics regulations, we therefore obtained approval from the ethics committee of the Bundeswehr University Munich (No: EK UniBw M 23-01) for this research project. In addition, the approval of the Federal Ministry of Defense was obtained for this publication. Further methodological details and legal aspects are published elsewhere (25).

Results

Age ranged from 18 to 49 years (mean 26.6 years, standard deviation 4.9; median 25 years, interquartile range 23–28 years). Participants were enlisted soldiers ($n = 211$, 58.9%), non-commissioned officers ($n = 111$, 31.0%), or officers $n = 32$ (8.9%). There was a small amount of missing data ($n = 4$; 1.1%).

Comparing both groups, with and without critical military incidents, there were no differences in sociodemographic data as shown in Table 1. The 1-year incidence rates were found for PTSD with 6.4% vs. 1.1%, depression 7.0% vs. 1.1%, and anxiety disorders 15.9% vs. 2.8% with OR ranging from 6.2 to 6.6. The 1-year incidence rate of mental multimorbidity (PTSD with anxiety or depression) was 4.8% vs. 0.4% (OR 12.0). All comparisons revealed statistically significant differences. Table 2 shows the 1-year incidence rates for the subgroups and total group.

Although participants represent a relatively homogeneous group, ANCOVAs were conducted to test whether other factors influence the higher incidence of these mental disorders among soldiers with critical military incidents. There was no significant effect of covariates on the incidence of depressive disorders, anxiety disorders, or multimorbidity, but critical incidents remained statistically significant. As shown in Table 3, the sociodemographic data had no significant influence on the incidence of PTSD.

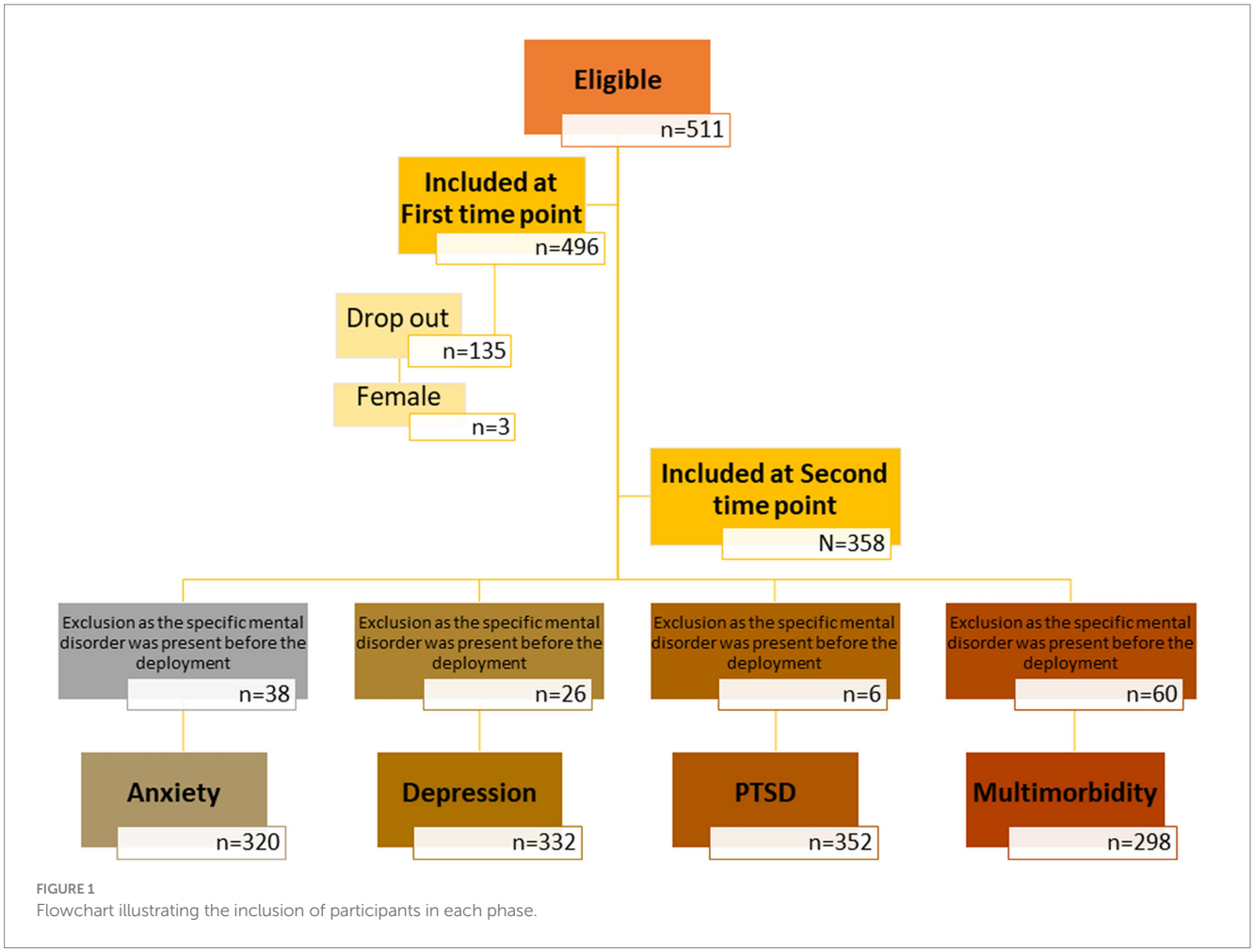

FIGURE 1
Flowchart illustrating the inclusion of participants in each phase.

TABLE 1 *t*-test for group differences between soldiers with and without critical incidents during deployment in relation to demographic characteristics.

	Deployment	*N*	Mean	SD	*T*-value	df	*p*-value
Age	With critical incident	79	26.5	4.85			
	Without	277	26.6	4.95	−0.09	354	0.933
Rank	With critical incident	78	1.6	0.71			
	Without	276	1.5	0.64	1.30	352	0.209
N_Depl.	With critical incident	80	0.8	1.03			
	Without	278	0.8	1.22	−0.40	356	0.691

SD, standard deviation; *p*-value, significance 2-tailed; N_Depl., number of deployments; YoS, years of service.
Differences in df are due to missing data. df with decimals were corrected due to variance heterogeneity using Welch's test.

TABLE 2 1-year incidence rates for male German military personnel deployed to Afghanistan with and without critical military incidents.

	Total group *n/N* (%) 95% CI	Without CrI *n/N* (%) 95% CI	With CrI *n/N* (%) 95% CI	OR (w/o CrI) (95% CI)	X^2 (w/o CrI)	*p*
PTSD	8/352 (2.3%) 0.7–3.8	3/274 (1.1%) 0–2.9	5/78 (6.4%) 3.1–9.7	6.19 (1.45–26.50)	7.7	0.005
Depression	8/332 (2.4%) 0.8–4.1	3/261 (1.1%) 0–3.0	5/71 (7.0%) 3.5–10.6	6.52 (1.52–27.96)	8.2	0.004
Anxiety	18/320 (5.1%) 3.1–8.2	7/251 (2.8%) 0–5.6	11/69 (15.9%) 10.6–21.3	6.61 (2.46–17.79)	17.6	<0.001
Multi-morbidity	4/298 (1.3%) 0.0–2.6	1/236 (0.4%) 0–1.9	3/62 (4.8%) 2.0–7.7	11.95 (1.22–116.95)	7.2	0.007

Data are reported as *n* incidence/*n* soldiers at risk (%) 95% CI significance.
CrI, critical incident; OR, odds ratio; w/o, with vs without; *p*, level of significance; PTSD, post-traumatic stress disorder; multimorbidity, PTSD with depression or anxiety.

TABLE 3 ANCOVA to test the influence of critical incidents during deployment on the incidence of PTSD including number of previous deployments, age, and rank as covariates.

Predictors	*df*	*F*	Sig.	R^2	η^2
Number of previous deployments	1	2.10	0.148		0.006
Age	1	0.19	0.667		0.001
Rank	1	0.15	0.695		<0.001
Critical incident	1	8.49	0.004		0.024
Total	4 (348)	3.90	0.004	0.043	0.043

Df, degrees of freedom; *F*, *F*-value; Sig., significance; R^2, coefficient of determination; η^2, partial eta square.

Discussion

As expected, the group that faced critical military incidents during deployment had significantly higher 1-year incidence rates for all investigated mental disorders. This was particularly pronounced in the comorbidity of PTSD with anxiety or depression. These results indicate that it is more meaningful to compare the outcomes of soldiers who experienced life-threatening military incidents to soldiers on the same deployment who did not experience such an incident, since the living conditions for both groups are comparable. The 1-year incidence for PTSD in our total group with 2.3% corresponds to the unweighted 2.1% 1-year incidence found by Wittchen and colleagues in German soldiers deployed to Afghanistan (23) and to 2.9% each for PTSD and depression found in a representative sample of U.S. Reserve and National Guard (26). The added value is the differentiation of groups with and without critical military incidents during deployment, resulting in an increased 1-year incidence of PTSD with 6.4% for the at-risk group with these incidents. The higher 1-year incidence of PTSD in our sample with no critical military incidents, compared to the never-deployed soldiers (23) of 1.1% vs. 0.2%, could be due to possible differences in exposure to critical events outside the military. In addition, the stressful environment abroad and the reintegration in the home country confer a higher vulnerability to these episodes, supporting our research strategy.

In a recently published study, Dyball and colleagues (27) examined the mental health point prevalence several years after deployment of physically injured and uninjured male military personnel. Soldiers exposed to critical military events during their deployment in Afghanistan up to 2014 were included. Compared to the uninjured group (22), our 1-year incidence rates in the total group (uninjured group with and without critical incidents) are noticeably lower in all categories. Comparing the soldiers with critical military incidents in our study to the uninjured group in the study by Dyball and colleagues

(27), the rates are comparable and only remain lower for depression (7.0% vs. 16.8%) in our sample.

In addition to possible differences in the exposure to critical military incidents, the lower depression rate in our sample could be due to several factors. Firstly, results from questionnaires often overestimate mental disorders due to the specificity of the tests. Secondly, we calculated incidence rates and therefore soldiers with previous but ongoing mental disorders are not included. Finally, a large interval between deployment and testing confers a high probability of exposure to additional military and non-military life-critical incidents. We believe that the data from Dyball and colleagues (27) and ours would be more comparable if these factors were considered. This could be achieved in a collaborative project as suggested by Himmerich and colleagues (28).

While our results are not surprising, they can nonetheless be used by policy and stakeholders to address risk factors more specifically, report critical military incidents more clearly, and appreciate these incidents as occupational hazards. Since the conditions for both groups are comparable, the increased OR can most likely be attributed to the critical military incidents. This association has long been recognized for PTSD. However, our data also show such an effect for anxiety disorders and depressive disorders. In the future, this could make it even easier for those affected to have their symptoms recognized as an operational injury and thus as an occupational disease. Screening this risk group for psychological symptoms over a longer period of time seems sensible, as already suggested by Stene et al. (29) and Pirard et al. (30). Our results might also be used for psychoeducational and destigmatization programs for military personnel, as well as previously proposed virtual (31) or other pre- (32) and post-deployment training programs (33–37).

A limitation of our study results is the lack of differentiation between the various critical military incidents during the deployment and the lack of comparison between military ranks. This is due to the relatively small number of soldiers exposed to these incidents, making such sub-samples too small. In addition, the obligatory nature of data collection may have introduced biases in the responses received. It is also known that the perceived threat (38) and the witnessing of acts of violence (39) have a major influence on the psychological consequences. This was not recorded in this study, but should be taken into account in similar studies. This can make it easier to differentiate between the groups of those directly affected, those observed and those not involved. In addition, it would have been helpful to include traumatic experiences prior to deployment in the ANCOVA.

The risk of developing a mental disorder during deployment is significantly higher for members of the armed forces who experience life-threatening military incidents than for those who do not. However, the stress factors of foreign deployments alone, such as the general threat situation, appear to increase the risk. We do not have another control group of non-deployed military personnel from the same time period. However, a comparison with another study (23) shows a higher incidence of PTSD in our deployment group without life-threatening military incidents at 1.1% compared to 0.2%. This leads to the conclusion that other critical events such as sexual assaults, fear of attacks, mines, etc. also play an important role. It is therefore quite possible that both groups also exhibited more severe symptoms, but these were not sufficient for a diagnosis of PTSD, as has already been reported in other studies (40).

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: given the sensitivity of the mandatory study design, the data were not made publicly available. Data requests can be directed to the corresponding author. They are then checked on a case-by-case basis and require the approval of the Federal Ministry of Defence. Requests to access these datasets should be directed to uw@ptzbw.org.

Ethics statement

The studies involving humans were approved by Bundeswehr University Munich (No: EK UniBw M 23-01). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because the original research question of the Federal Ministry of Defense related to "Psychological Fitness" and participation was mandatory.

Author contributions

UW: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft. K-HR: Methodology, Supervision, Validation, Writing – review & editing. KR: Formal analysis, Supervision, Validation, Writing – review & editing. KK: Formal analysis, Supervision, Validation, Writing – review & editing. NH: Formal analysis, Validation, Writing – review & editing. HH: Conceptualization, Formal analysis, Methodology, Supervision, Validation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Prevalence and factors associated with fear of COVID-19 in military personnel during the second epidemic wave in Peru

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Introduction: During the COVID-19 pandemic, the mounting workload and heightened stress may contribute to exacerbated mental health challenges, including an increased fear of COVID-19, among military personnel. Despite the potential influence of these factors, there remains a scarcity of studies addressing mental health issues, particularly the fear of COVID-19, within this specific population. We aimed to determine the prevalence and factors associated with fear of COVID-19 among military members.

Methods: A cross-sectional study was conducted between November 2 and 9, 2021, during the second wave of the COVID-19 pandemic in the Lambayeque region, Peru. The outcome variable was fear of COVID-19, assessed using the Fear of COVID-19 Scale. The association with resilience (Connor-Davidson Resilience Scale, abbreviated as CD-RISC), food insecurity (Household Food Insecurity Access Scale, abbreviated as HFIAS), physical activity (International Physical Activity Questionnaire-Short Form, abbreviated as IPAQ-S), eating disorder (Eating Attitudes Test-26, abbreviated as EAT-26), and other socio-demographic variables was assessed.

Results: Among the 525 participants, the median age was 22, 95.8% were male, and 19.2% experienced fear of COVID-19. A higher prevalence of fear of COVID-19 was associated with age (PR=1.03; 95% CI: 1.01-1.06), religion (PR=2.05; 95% CI: 1.04-4.05), eating disorder (PR=2.95; 95% CI: 1.99-4.36), and having a relative with mental disorder (PR=2.13; 95% CI: 1.09-4.17). Overweight (PR=0.58; 95% CI:

0.37-0.90) and a high level of resilience (PR=0.63; 95% CI: 0.43-0.93) were associated with a lower prevalence of fear of COVID-19.

Discussion: Two out of ten military personnel were afraid of COVID-19. Our results highlight the need for targeted interventions addressing the factors contributing to fear of COVID-19 among military personnel, emphasizing the significance of mental health support and preventive measures within this specific population.

KEYWORDS

COVID-19, fear, mental health, military, Peru

Introduction

Since the onset of the COVID-19 pandemic, it has posed a threat to both physical (1–4) and psychological health (5–14). This impact, coupled with its effects on social and economic aspects, has had far-reaching consequences on the safety and overall well-being of the population (15, 16). The severity (2, 17) and high transmission rate of COVID-19 (18, 19) have instilled fear in people (15, 20). This fear is exacerbated by misinformation, leading to the psychological impact of concerns about infection and the potential to infect loved ones (20, 21).

The estimated prevalence of fear of COVID-19 varies between 30.5% and 41.8% in different populations (22, 23). Notably, a study conducted among Peruvian policemen reported an even higher rate, with 42.5% expressing fear of COVID-19 (24). In Latin America, an average fear percentage of 15.54 has been described on the COVID-19 fear scale (25), which is comparatively lower than other continents, ranging from 21.7% to 23.8% (23).

While fear of COVID-19 has been extensively studied in healthcare personnel (26), there is a notable gap in research concerning military personnel, despite their crucial role in the fight against COVID-19 (5, 27). This population bears the responsibility of providing protection and security to citizens, often involving tasks such as setting up temporary hospitals, ensuring compliance with preventive measures, and assisting in the transfer of patients or handling of deceased individuals (28). Consequently, military personnel could be exposed to traumatic experiences, risking both their psychological and physical well-being, similar to healthcare personnel (29). A study conducted in the Spanish Armed Forces revealed that 52.6% of participants felt the need for psychological help in anticipation of a new wave of the pandemic, and 49.2% reported experiencing fear of death (28).

Studies in the general population have found factors associated with fear of COVID-19 such as being aged between 50 and 64 years (30), being a female (31), low resilience, having chronic diseases (31, 32), anxiety (33), alcoholism (31), smoking (31), perception of getting infected with COVID-19, and fear of risk for loved ones (33). However, the instrument used to measure fear of COVID-19 was not validated (30), nor did the authors investigate other variables of interest such as religious aspects, eating disorders or family history of mental health, which we have evaluated in a military population.

In the landscape of the COVID-19 pandemic, the psychological well-being of military personnel emerges as an essential yet often overlooked component. Men and women in active service, occupying crucial roles in the pandemic response, face a unique amalgamation of challenges and tensions. The constant exposure to risks during operations, the emotional burden of protecting the population, and the uncertainty associated with the nature of the pandemic shape a uniquely stressful environment (34).

The justification for conducting this study is grounded in the urgent need to comprehensively understand how the fear of COVID-19 permeates the mental health of military personnel (5, 35). This group, essential in pandemic management, faces particular pressures and fears. By exploring underlying factors, this study aims to expand existing knowledge and provide fundamental insights that have so far remained in the shadows of research.

The uniqueness of the military context, characterized by constant duty and exposure to extraordinary situations, highlights the need for a precise and comprehensive approach in researching the fear of COVID-19. The results derived from this study will not only contribute to the scientific foundation related to mental health in crisis situations but will also inform specific strategies and policies that effectively address psychological concerns in this specialized group.

This study seeks to address this gap by delving into the prevalence and factors associated with fear of COVID-19 among Peruvian military personnel during the second wave of the pandemic. Military personnel, integral to enforcing preventive measures, ensuring public safety, and contributing to patient care, face unique challenges that expose them to potential trauma and psychological stress (28, 29). Existing studies within the military context, such as those in the Spanish Armed Forces, underscore the need to explore the psychological well-being of military personnel during the ongoing pandemic (28).

Our research not only contributes to the broader understanding of fear of COVID-19 but also expands the scientific evidence by

examining factors such as age, religiosity, body weight, family history of mental health, and eating disorders in this specific population. Religious aspects are considered, acknowledging their potential influence on coping mechanisms and mental well-being, especially in the high-stress military environment where individuals may turn to their beliefs for support and resilience (36–38). The study delves into eating disorders, recognizing the complex relationship between mental health, stress, and unique eating patterns that may emerge in response to the specific stressors faced by military personnel (22, 39). Additionally, exploring the family history of mental health aims to provide insights into individual susceptibility or resilience to stressors, including those associated with the COVID-19 pandemic, within the military context (40, 41).

Furthermore, our study highlights the significance of resilience as a distinctive protective factor in understanding the fear of the virus among military personnel (discussed in the discussion section). By uncovering these nuanced associations, we aim to provide essential insights that inform tailored strategies, policies, and interventions to address the psychological impact on military personnel—insights that are crucial in navigating the complexities of mental health during crises. Through a comprehensive exploration of fear of COVID-19 in military personnel, this study endeavors to pave the way for evidence-based psychological interventions that cater specifically to the unique challenges faced by this essential group in the context of the post-pandemic world and future health emergencies or disasters.

Given the importance of understanding the psychological impact of the COVID-19 pandemic on military personnel, this study seeks to contribute valuable insights into the prevalence and factors associated with fear of COVID-19 in this specific population. It is essential to clarify that while this research shares a common participant pool and data collection duration with a larger study (42), the focus and objectives of this investigation are distinct and represent an independent analysis. This ensures transparency and acknowledges the connection with previous research, avoiding any ambiguity regarding the nature of this study. While the present study shares participants and data collection duration with a larger primary investigation (42), it is crucial to emphasize that this work represents a distinct secondary analysis. The primary study aimed at determining the prevalence and factors associated with depression and anxiety (42). In this secondary analysis, we specifically focus on unraveling the prevalence and factors associated with fear of COVID-19 among military personnel. This approach ensures transparency and elucidates the relationship between the two studies, underscoring the unique contribution of this research in addressing the psychological implications of the pandemic on military personnel.

Our research aims to expand the scientific evidence on fear of COVID-19 in military personnel to know the psychological impact that the pandemic has caused in this population and to allow the future implementation of psychological interventions to cope with this fear. Therefore, this study aims to address the following questions: What is the prevalence of fear of COVID-19 among Peruvian military personnel during the second pandemic wave, and what factors are associated with this fear in this specific population?

Materials and methods

Study design and population

This study is analytical and cross-sectional. We used a secondary data analysis to identify the prevalence and the factors associated with fear of COVID-19 in military personnel in Lambayeque, Peru. The primary study aimed to assess the prevalence and factors associated with depressive and anxious symptoms in military personnel (42).

The population of the study is comprised of 820 military personnel in charge of the first line of defense of the health emergency due to COVID-19 in the city of Lambayeque, Peru.

By the primary study, we aimed for a sample size of 582 military personnel, considering a precision of 2.5%, a confidence level of 99%, an expected prevalence of 12.8%, and accounting for a 20% allowance for potential missing data or refusals. During the study, we successfully achieved the participation of 86.6% (n = 710) of the population, exceeding our initial expectations (42).

In the primary study, the military personnel that were included were those who were working for one month, at least, at the moment of the administration of the survey. Exclusions included individuals who declined to provide consent for study participation (n=10), those working remotely due to a high risk of COVID-19 (n=6), individuals in quarantine due to confirmed coronavirus infection (n=5), and those who had been working for less than one month (n=8). Additionally, 81 individuals could not be invited as they were not present during the data collection period. Furthermore, we excluded 95 military personnel who did not correctly complete the instruments related to depression and anxiety. Therefore, the final sample used for the primary study analysis comprised 615 individuals (42). The sample selection for this study involved several considerations. The initial access to the internet was facilitated through the smartphones owned by each military participant. In cases where individuals did not have internet access, data-sharing arrangements were made for their participation. All participants were proficient in reading and writing in Spanish, as the study involved Peruvian military personnel.

For this research, we excluded 90 records of military personnel who did not complete the Fear COVID-19 Scale. This scale measured the outcome variable of this research. Therefore, the sample selected for this secondary data analysis consisted of 525 military personnel. The response rate for the study was 64.02% (525/820). Regarding the 525 military personnel selected for this analysis, we found that the median age was 22, 95.8% were male, 17.1% consumed alcohol frequently, and 8.2% reported having sought mental health support due the COVID-19 pandemic.

Additionally, since the study focused on a specific population with unique characteristics and faced restrictions due to the pandemic and social distancing measures, snowball sampling was employed to reach military personnel more effectively. This method was chosen to ensure the inclusion of participants who might be harder to reach through conventional sampling approaches.

For this secondary analysis, the statistical power of the eating disorder and resilience factors was estimated. In the case of the eating disorder, a statistical power value of 99.27% was estimated.

This calculation was based on the fear of COVID-19 proportion in the group without an eating disorder (p1 = 0.163) and the corresponding proportion in the group with an eating disorder (p2 = 0.444). Additionally, the respective sample sizes were considered, with n1 = 471 for the group without an eating disorder and n2 = 54 for the group with an eating disorder. Regarding resilience, a statistical power value of 77.15% was estimated. This calculation was based on the fear of COVID-19 proportion in the low resilience group (p1 = 0.233) and the corresponding proportion in the high resilience group (p2 = 0.140). Additionally, the respective sample sizes were considered, with n1 = 296 for the low resilience group and n2 = 229 for the high resilience group.

The study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) cross-sectional reporting guidelines to ensure comprehensive and transparent reporting of the research methods and findings.

Procedure

Authorization was requested from the infantry brigade of Lambayeque to conduct the research with military personnel. Data collection forms were created using the REDCap system to ensure optimal data quality control, and an online questionnaire link was generated. However, it is important to clarify that all data, including responses to the questionnaire, was collected through self-administration by participants via the online questionnaire link, which was distributed to their smartphones while they were gathered in the military facility's meeting room. Military personnel were gathered in groups, and the online questionnaire link was shared with them to access via their smartphones and respond to the research questions. The execution took place in person, adhering to strict biosecurity measures, including the mandatory use of masks, continuous hand sanitization, and utilization of open spaces for ventilation. Data collection occurred from November 2 to 9, 2021, organized in two shifts (morning and afternoon), and supervised by a military member of the 7th Infantry Brigade, located in the Lambayeque region, Peru. The questionnaire link was distributed to the study population through text messages, WhatsApp virtual messages, and internal coordination groups. Before initiating the questionnaire, participants were electronically asked for their informed consent to participate in the study.

To address potential issues like duplications or fraud in the online survey, we employed various strategies. Initially, participants were required to provide informed consent electronically before accessing the questionnaire, ensuring that only authorized individuals took part. The survey link was distributed through military channels, and participants were continuously supported and overseen by their superiors or military officers during execution. This ensured that all respondents were indeed military personnel.

Additionally, we utilized the REDCap system, an advanced data entry tool. Within REDCap, we implemented several measures to ensure the correct arrangement, provision, and completion of questionnaires. These measures included unique and anonymized identifiers on each form, consistent questionnaire ordering (beginning with consent and informed assent, followed by general data and variables of interest instruments), conditional logic for skip questions, mandatory fields to prevent missing information, and minimum and maximum ranges in numerical variables. Moreover, we incorporated the REDCapcha feature to detect and deter traffic from automated programs or bots.

Variable and measures

Dependent variable

Fear of COVID

The outcome variable, fear of COVID-19, was operationally defined as a score higher than 16.5, calculated by summing the responses to the 7 items of the Fear of COVID-19 Scale (43). This cutoff point has been validated in similar studies conducted on frontline COVID healthcare professionals (44) and the general population (43).

Independent variables

Food insecurity

it was assessed using the Household Food Insecurity Access Scale (HFIAS) based on the FANTA-III criteria for evaluation. Mild food insecurity (FI) is assigned with a score of 2 to 3 points in the first item, 1 to 3 in the second item, or 1 in the third or fourth item. The scoring for moderate FI includes 2 to 3 points in the third or fourth item, or 1 to 2 in the fifth or sixth item. Severe FI is characterized by a score of 3 points in the fifth or sixth item, or 1 out of 3 in the seventh, eighth, or ninth item. Finally, the variable was dichotomized into the absence of food insecurity and the presence of food insecurity, including mild, moderate, and severe levels.

Physical activity

This was assessed using the International Physical Activity Questionnaire IPAQ-S (short version). Low physical activity was operationally defined as engaging in less than 150 minutes per week of moderate physical activity. Moderate physical activity was defined as any activity lasting at least 10 minutes and requiring moderate physical effort. Vigorous physical activity was defined as any activity performed for at least 10 minutes and requiring intense physical effort.

Eating disorder

It was obtained with the EAT-26, Eating Attitudes Test, after categorizing the score obtained about the absence or presence of such disorder, using a cut-off point of 20 points.

Resilience

It is operationally defined as a score above 30 points obtained from the answers of the Connor-Davidson questionnaire in the abbreviated version (45).

Socio-demographic variables

Among them, we can mention age in years, gender (female, male), marital status (single, married, cohabiting, divorced), religion

(none, Catholic, non-Catholic), having children (no, yes), frequent consumption of alcohol (no, yes) and tobacco (no, yes), body mass index (underweight, normal, overweight, obese), previous history of mental health (no, yes), previous family history of mental health (no, yes), report of having sought mental health support (no, yes), confidence in the government to handle the pandemic (no, yes), and how long the sample was working during the COVID-19 health emergency (one to six months, seven to twelve months, thirteen to eighteen months, nineteen months, or more).

Figure 1 shows a Directed Acyclic Graph (DAG) illustrating the influence of confounding variables Figure 1.

Measures

Fear of COVID scale

This scale consists of seven items and is reliable and valid for assessing fear of COVID-19 among the general population, with a Cronbach's alpha of 0.82 (46). An investigation of the psychometric properties of the Spanish version of the Fear of COVID-19 Scale in a sample of the Peruvian population showed that this brief scale of fear of COVID-19 has adequate measurement properties both in terms of reliability and validity (47).

Household food insecurity access scale

It is composed of nine questions that assesses food access of the last four weeks. It has adequate internal consistency (Cronbach's alpha of 0.74) (48). Also, this scale has the following categories: food security, mild, moderate and severe food insecurity (49).

International physical activity questionnaire - short form

This instrument is composed of seven questions that evaluate physical activity in the last week. It is divided into low, moderate and high physical activity, after a weighted estimate of total physical activity reported in the last week (50). It shows adequate psychometric properties in Latin American population (50–52). In its abbreviated version, adequate correlations (0.26-0.69) in Spanish-speaking population have been estimated (53).

Eating attitudes test-26 item

This instrument is made up of 26 items measured with a Likert scale (never, rarely, sometimes, often, very often and always). It has been validated in male population from Colombia (Cronbach's alpha 0.98, sensitivity: 100%, specificity: 97.8%) (54) It has been validated in the female population of Latin America (55, 56), demonstrating adequate reliability (Cronbach's alpha: 0.92; sensitivity of 100% and specificity of 86.6%) in women from Colombia (56).

Connor Davidson abbreviated questionnaire

This questionnaire is composed of ten questions and has excellent psychometric properties (Cronbach's alpha of 0.89) in the general population (57).

Statistical analysis

The statistical analysis was conducted using Stata 17

In the descriptive analysis, we calculated frequencies and percentages for categorical variables. For the numerical variable, age, which exhibited a non-normal distribution, we reported the median and interquartile range.

For hypothesis testing, we employed the Chi-squared test to assess the association between categorical independent variables and the outcome variable (fear of COVID). Regarding age, a numerical variable, we applied the Mann-Whitney U test after confirming the non-normal distribution assumption.

To delve into the factors associated with fear of COVID, we constructed both simple and multiple regression models. Prevalence

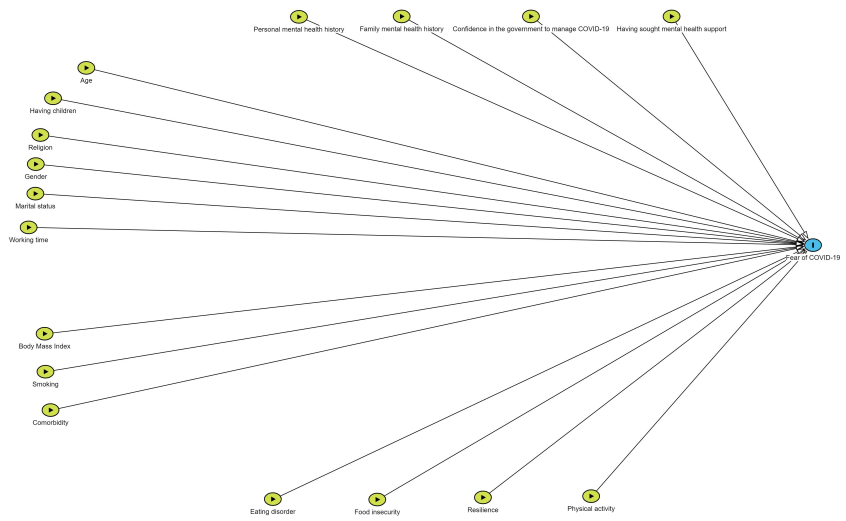

FIGURE 1
Directed Acyclic Graph (DAG) of the factors associated with fear of COVID-19.

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ratios (PR) with corresponding 95% confidence intervals (95% CI) were estimated using generalized linear models with a Poisson distribution family and a log-link function, incorporating robust variance.

Ethical aspects

The primary study was ethically approved by the Ethics Committee of Universidad San Martín de Porres (USMP) with the code 269-2022-CIEI-FMH-USMP. Participants were fully informed about the voluntary nature of their participation, and their privacy was strictly respected. Informed consent was obtained electronically from all participants, who were military personnel. No incentives were offered for participation, ensuring that involvement in the study was solely based on voluntary contributions. The collected data were treated with utmost confidentiality, and measures were in place to ensure anonymity.

Results

Almost half of them had food insecurity (49.5%) and 43.6% had a high level of resilience. Also, 19.2% felt fear of COVID-19 Table 1.

A total of 10.7% and 10.1% mentioned having felt fear of losing their lives due to coronavirus and having felt uncomfortable thinking about coronavirus, respectively. In addition, 9.1% reported having felt much fear of COVID-19 Figure 2.

We found that the participants with a low level of resilience had a higher level of prevalence of fear of COVID, in comparison with those who had a high level of resilience (23% vs. 14%; p=.007). Moreover, military personnel with eating disorders showed a higher prevalence of fear of COVID, in comparison with those who did not have that disorder (44.4% vs. 16.4%; p<.001). Furthermore, age in years, religion, frequent consumption of alcohol and tobacco, having a relative with mental illnesses, and how long they have been working were associated with fear of COVID-19 Table 2.

In the multiple regression model, we found that the factors associated with a high level of prevalence of fear of COVID-19 were age (in years) (PR=1.03; 95% CI: 1.01-1.06), having a religion (PR=2.05; 95% CI: 1.04-4.05), having a relative with a mental disorder (PR=2.13; 95% CI: 1.09-4.17) and having an eating disorder (PR=2.95; 95% CI: 1.99-4.36). In contrast, being overweight and having a high level of resilience reduces the prevalence of fear of COVID-19 in military personnel by 42% (PR=0.58; 95% CI: 0.37-0.90) and 37% (PR=0.63; 95% CI: 0.43-0.93) (Table 3, Figure 3).

Discussion

Main findings

It was found that two out of every ten participants were afraid of COVID-19.

TABLE 1 Characteristics of military personnel from Lambayeque, Peru (n=525).

Characteristics	N (%)
Age*	22 (19–31)
Gender	
Female	22(4.2)
Male	503(95.8)
Marital status	
Single	390(74.3)
Married	117(22.3)
Domestic partner	12(2.3)
Divorced	6(1.1)
Religion	
None	80(15.2)
Catholic	359(68.4)
Non-Catholic	86(16.4)
Having children	139(26.5)
Alcoholism	90(17.1)
Smoking	35(6.7)
Comorbidity	
Hypertension*	50(9.5)
Diabetes	10(1.9)
BMI (categorized)**	
underweight/normal	312(60.4)
Overweight	172(33.3)
Obesity	33(6.4)
Personal mental health history	
No	518(98.7)
Yes	7(1.3)
Family mental health history	
No	502(95.6)
Yes	23(4.4)
Having sought mental health support	
No	482(91.8)
Yes	43(8.2)
Confidence in the government to manage COVID-19	
Yes	288(54.9)
No	237(45.1)
How long have you been working?**	
1 to 6 months	134(26.2)
7 to 12 months	82(16.0)

(Continued)

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TABLE 1 Continued

Characteristics	N (%)
13 to 18 months	110(21.5)
19 months or more	186(36.3)
Food insecurity	
No	265(50.5)
Yes	260(49.5)
Physical activity	
Low	64(12.2)
moderate	37(7.1)
High	424(80.8)
Eating disorder	
No	471(89.7)
Yes	54(10.3)
Resilience	
low	296(56.4)
high	229(43.6)
Fear of COVID-19	
No	424(80.8)
Yes	101(19.2)

* Median (25th percentile - 75th percentile).
**Missing values.

Higher prevalence of fear was associated with older age, religious affiliation, a family history of mental illness, and the presence of an eating disorder. Conversely, lower prevalence of fear was linked to being overweight and exhibiting a high level of resilience.

Prevalence of fear of COVID-19

The prevalence of fear of COVID-19 in our study was found to be 19.2%, which contrasts with the higher incidence reported in a study by Caycho et al. in our country (42.5%) (24) and in Spain by Lázaro-Pérez et al. (80%) (28). The difference in prevalence could be attributed to the timing of the investigations. Caycho et al. conducted their study in 2020, during the peak of COVID-19 cases and deaths in our country (24), where the armed and police forces played a crucial role in enforcing security measures. Similarly, Lázaro-Pérez et al. conducted their research at the beginning of the second wave (August-September 2020), a period marked by the discovery of new virus variants and the announcement of a new confinement, leading to heightened anxiety in the Spanish population (28).

Despite the potential overall decrease in fear compared to earlier stages, military personnel faced unique challenges and stressors associated with their crucial roles in the pandemic response. Our study aims to provide valuable insights into the psychological impact on military personnel during this specific phase, contributing to a nuanced understanding of fear even when it might be relatively lower in the general population. Furthermore, we acknowledge that the incidence of fear of COVID-19 in our study might have been influenced by the timing of our investigations. However, the continuation of significant indicators of lethality and SARS-CoV-2 positivity during the second wave in Peru (58, 59), particularly in the Lambayeque region, necessitated the maintenance of strict measures, including social distancing, mandatory social isolation, and targeted quarantines. Frontline personnel, including the military, played a crucial role in ensuring compliance with these measures.

Resilience and fear of COVID-19

Participants with a high level of resilience had a 47% lower prevalence of fear of COVID-19. This finding coincides with what was reported by Satici et. al, who found that during the first months of the pandemic people with resilience felt less fear of COVID-19 because of a mechanism involving subjective hope and happiness in the face of adversity (60). It aligns with findings reported in Turkey, where resilience was identified as a mediator in the relationship between fear of COVID and mental health outcomes (anxious and depressive symptoms) in university students (61). In Brazil, resilience had a mediating effect (B=0.14; 95% CI: 0.027-0.254) and explained 35% of

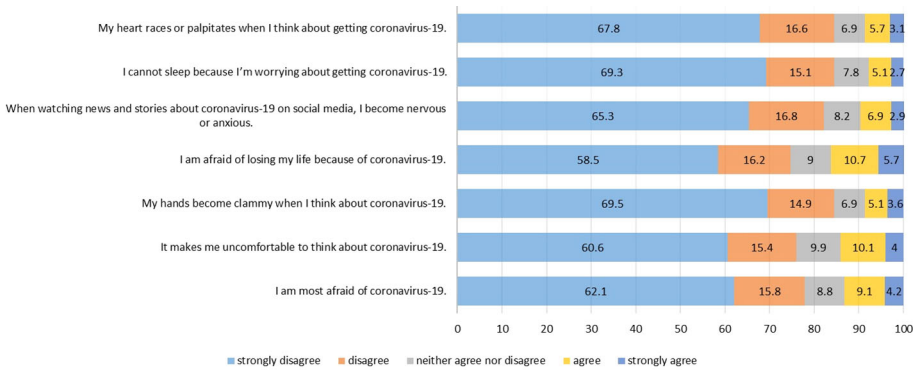

FIGURE 2
Fear of COVID-19 Scale.

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TABLE 2 Factors associated with fear of COVID-19 in military personnel, bivariate analysis.

Variables	*Fear of COVID*		*p**
	No (n=424) n(%)	Yes (n=101) n(%)	
Age (years)***	21(19-31)	25(20-36)	**0.004****
Gender			0.329
Female	16(72.7)	6(27.3)	
Male	408(81.1)	95(18.9)	
Marital status			0.312
Single	321(82.3)	69(17.7)	
Married	91(77.8)	26(22.2)	
Domestic partner	8(66.7)	4(33.3)	
Divorced	4(66.7)	2(33.3)	
Religion			**0.035**
None	72(90.0)	8(10.0)	
Catholic	288(80.2)	71(19.8)	
Non-Catholic	64(74.4)	22(25.6)	
Having children	106(76.3)	33(23.7)	0.116
Alcoholism	62(68.9)	28(31.1)	**0.002**
Smoking	20(57.1)	15(42.9)	**<0.001**
Comorbidity			
Hypertension*	38(76.0)	12(24.0)	0.369
Diabetes	7(70.0)	3(30.0)	0.383
BMI (categorized)			0.993
underweight/normal	253(81.1)	59(18.9)	
Overweight	140(81.4)	32(18.6)	
Obesity	27(81.8)	6(18.2)	
Personal mental health history			0.110
No	420(81.1)	98(18.9)	
Yes	4(57.1)	3(42.9)	
Family mental health history			**0.013**
No	410(81.7)	92(18.3)	
Yes	14(60.9)	9(39.1)	
Having sought mental health support			0.271
No	392(81.3)	90(18.7)	
Yes	32(74.4)	11(25.6)	
Confidence in the government to manage COVID-19			0.154
Yes	239(83.0)	49(17.0)	
No	185(78.1)	52(21.9)	
How long have you been working?			**0.015**
1 to 6 months	113(84.3)	21(15.7)	
7 to 12 months	64(78.1)	18(22.0)	
13 to 18 months	78(70.9)	32(29.1)	
19 months or more	158(85.0)	28(15.1)	
Food insecurity			0.828
No	215(81.1)	50(18.9)	
Yes	209(80.4)	51(19.6)	
Physical activity			0.121
Low	46(71.9)	18(28.1)	
moderate	32(86.5)	5(13.5)	
High	346(81.6)	78(18.4)	
Eating disorder			**<0.001**
No	394(83.7)	77(16.4)	
Yes	30(55.6)	24(44.4)	
Resilience			**0.007**
low	227(76.7)	69(23.3)	
high	197(86.0)	32(14.0)	

*P-value of categorical variables calculated with the Chi-squared test.
**P-value of categorical-numerical variables calculated with the U test (Mann-Whitney).
***Median - interquartile range.
Bold values highlight statistically significant p-values associated with the variables.

the relationship between fear of COVID and anxiety (62). Similar results were reported by Javier-Aliega et al. in young individuals from Lima, where resilience was negatively correlated with fear of COVID-19 (B=-0.372, Beta= −0.251, TOL=0.594, VIF=1.675) (63).

Although we did not find a similar study that associated these variables in the military population studied in the context of the COVID-19 pandemic, there is literature that supports resilience as a protective factor against mental health problems, in addition to being associated with better military performance (64, 65). In addition, there is evidence suggesting that individuals with more resilience tend to externalize less fear and anxiety, which may be explained by the military training that rewards resistance, self-sufficiency and privacy, stigmatizing both physical and emotional weakness (66).

Factors associated with fear of COVID-19

In our research, we found that the older the age, the higher the prevalence of fear of COVID-19. This is similar to what was reported in the United States by Niño et. al, who conducted a study in 10,368 American citizens. These authors identified that the

10.3389/fpsyt.2024.1309957

TABLE 3 Factors associated with fear of COVID-19 in military personnel, simple and multiple regression analysis.

Characteristics	*Fear of COVID-19*					
	Simple regression			Multiple regression		
	PR	95% CI	p*	PR	95% CI	p*
Age (years)***	1.02	1.01-1.04	**0.003**	1.03	1.01-1.06	**0.041**
Gender						
Female	Ref.			Ref.		
Male	0.69	0.34-1.40	0.308	1.30	0.53-3.19	0.569
Marital status						
Single	Ref.			Ref.		
Married	1.26	0.84-1.88	0.266	0.99	0.55-1.78	0.962
Domestic partner	1.88	0.82-4.32	0.134	1.60	0.45-5.71	0.472
Divorced	1.88	0.59-5.97	0.281	1.27	0.29-5.67	0.751
Religion						
None	Ref.			Ref.		
Catholic/Non-Catholic	2.09	1.06-4.14	**0.034**	2.05	1.04-4.05	**0.039**
Having children	1.35	0.93-1.95	0.112	0.83	0.46-1.50	0.536
Alcoholism	1.85	1.28-2.69	**0.001**	1.52	0.96-2.42	0.075
Smoking	2.44	1.41-4.23	**0.001**	1.41	0.82-2.42	0.209
Comorbidity						
Hypertension*	1.28	0.86-2.17	0.358	1.14	0.68-1.92	0.125
Diabetes	1.58	0.60-4.14	0.355	0.28	0.04-1.94	0.787
BMI (categorized)						
underweight/normal	Ref.			Ref.		
Overweight	0.98	0.67-1.45	0.934	0.58	0.37-0.90	**0.016**
Obesity	0.96	0.45-2.06	0.919	0.61	0.28-1.33	0.216
Personal mental health history						
No	Ref.			Ref.		
Yes	2.27	0.95-5.43	0.067	0.87	0.45-1.68	0.671
Family mental health history						
No	Ref.			Ref.		
Yes	2.14	1.24-3.67	**0.006**	2.13	1.09-4.17	**0.028**
Having sought mental health support						
No	Ref.			Ref.		
Yes	1.37	0.80-2.36	0.256	1.26	0.66-2.42	0.480
Confidence in the government to manage COVID-19						
Yes	Ref.			Ref.		
No	1.29	0.91-1.83	0.155	1.05	0.72-1.53	0.781
How long have you been working?						
1 to 6 months	Ref.			Ref.		

(Continued)

TABLE 3 Continued

Characteristics	*Fear of COVID-19*					
	Simple regression			Multiple regression		
	PR	95% CI	p*	PR	95% CI	p*
7 to 12 months	1.40	0.79-2.47	0.244	1.21	0.70-2.10	0.497
13 to 18 months	1.86	1.14-3.03	**0.013**	1.54	0.92-2.59	0.100
19 months or more	0.96	0.57-1.62	0.880	0.86	0.48-1.55	0.620
Food insecurity						
No	Ref.			Ref.		
Yes	1.04	0.73-1.48	0.828	1.04	0.74-1.46	0.815
Physical activity						
Low	Ref.			Ref.		
moderate	0.48	0.19-1.19	0.113	0.49	0.20-1.22	0.125
High	0.65	0.42-1.02	0.059	0.94	0.59-1.49	0.787
Eating disorder						
No	Ref.			Ref.		
Yes	2.72	1.89-3.90	**<0.001**	2.95	1.99-4.36	**<0.001**
Resilience						
low	Ref.			Ref.		
high	0.60	0.41-0.88	**0.009**	0.63	0.43-0.93	**0.019**

*P-values obtained with Generalized Linear Models (GLM), Poisson family, log-link function, robust variance.
Bold values highlight statistically significant p-values associated with the variables.

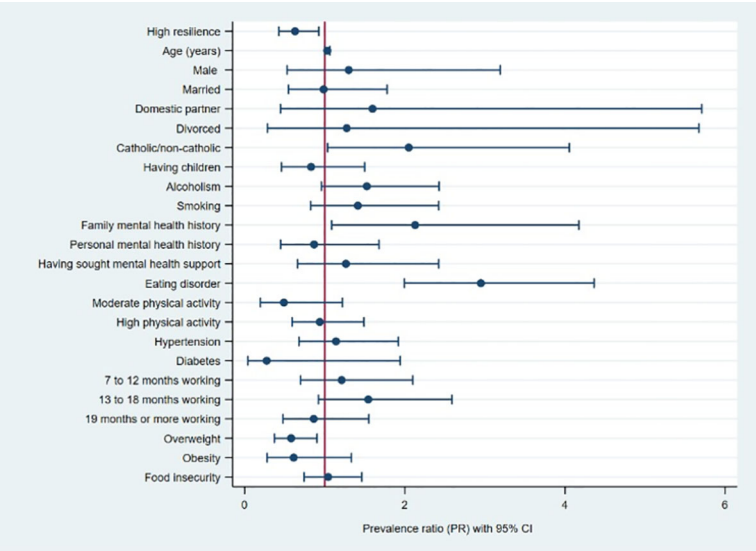

FIGURE 3
Forest plot of the factors associated with fear of COVID-19 in military personnel.

older the age, the greater the perception of threat and, hence, the greater the fear of COVID-19 (30). This finding could be explained by the fact that these individuals are part of the population at risk of experiencing a more serious and complicated disease, with higher mortality rates (67–69). However, our findings align with those of Soraci et al. in the Italian population and Mistry SK et al. in Bangladesh, as we observed a significant association between age and fear of COVID-19 in our study (11, 12). On the contrary,

Andrade et al, in Brazil, reported that the older the age, the lower the fear of COVID-19. The authors stated that the older population tends to worry less about death, has less knowledge of the disease and is generally more reluctant to accept safety measures (70).

Participants who identified as religious exhibited a 105% higher prevalence of fear of COVID-19. This finding contrasts with Prazeres et al.'s study in Portugal, which found no association between religiosity and fear of COVID-19 (36). In contrast, Ghoncheh K. et al. in Iran reported that individuals with greater religiosity and spirituality experienced less fear of COVID-19 due to their coping mechanisms rooted in their belief systems, helping them manage various difficulties and reduce psychological distress (37). The discrepancy in our study's findings could be attributed to the workload of military and police forces, coupled with social distancing measures that restricted religious community gatherings, depriving individuals of the support typically derived from religious activities such as masses and spiritual retreats. This interpretation aligns with the observations made in the United States by Gomez et al., who analyzed the emotional impact of COVID-19 quarantine on individuals' religiosity (38).

Overweight participants exhibited a 42% reduction in the prevalence of fear of COVID-19. While no similar studies were found, this finding contrasts with Chen et al.'s report in China, where overweight individuals showed higher levels of fear of COVID-19 compared to those with a normal BMI (71). The discrepancy might be attributed to sociodemographic and cultural factors (72–74). In our country and Latin America, being overweight might not be perceived as a health concern, as it is sometimes associated with strength and protection against adverse situations (75, 76), including the COVID-19 pandemic, despite the numerous studies linking overweight and obesity to higher morbidity and mortality from the disease.

The prevalence of fear of COVID-19 increases by 113% for participants who have a family member with a history of mental health issues. While no similar studies have been identified, this finding might be elucidated by existing evidence indicating that caregivers of individuals with mental illnesses experience significant physical and emotional stress. Consequently, family members of those with mental health issues may have a lower quality of life and a predisposition to conditions such as anxiety, depression, and post-traumatic stress disorder. These mental health challenges could potentially justify their heightened fear in the context of the COVID-19 pandemic (40, 41, 77).

The prevalence of fear of COVID-19 increases by 195% for participants with an eating disorder. This aligns with findings reported by Bemanian et al. in Norway and Dos Santos et al. in Brazil, both identifying a robust association between psychological stress related to COVID-19 and various eating disorders, including emotional eating and binge eating disorder (39, 78). Research supports the notion that eating disorders may serve as mechanisms for managing negative emotions through the release of serotonin and dopamine resulting from inadequate carbohydrate and lipid intake (79, 80). Additionally, restrictive eating patterns may be influenced by fear of COVID-19, including concerns about food quality and the potential for transmission (81). However, it's worth noting that these findings contrast with studies by Ilktac et al. and Pak et al., who observed minimal associations between these variables. In their multiple models, the effect of eating disorders was diluted when considered alongside other confounding variables (82, 83).

Implication of findings in mental health

Considering the great impact of the COVID-19 pandemic on mental health in the general population, the findings reported in this study support the need for the implementation of strategies focused on populations facing unique challenges, such as military personnel. Measures to address this situation could be taken through the strengthening of the Community Mental Health Centers, which should engage and establish an ongoing assessment of this population to avoid adverse consequences on their mental health.

The study's findings underscore the significant impact of the COVID-19 pandemic on mental health, particularly among military personnel. To address the unique challenges faced by this population, future research and interventions should consider several key recommendations. Firstly, there is a need for the development and implementation of tailored mental health strategies specifically designed for military personnel. These strategies should take into account the distinct stressors and challenges associated with their roles during pandemic responses. Additionally, strengthening Community Mental Health Centers is crucial. These centers should actively engage with military personnel, conducting ongoing assessments to identify mental health concerns promptly. This proactive approach can help in avoiding adverse consequences on the mental health of military personnel. Exploring and implementing preventive measures is also important. Proactive approaches may include early intervention programs, resilience-building initiatives, and mental health education tailored to the unique needs of military personnel. Collaboration between mental health professionals, military authorities, and researchers is encouraged. Interdisciplinary approaches can provide comprehensive insights and facilitate the development of effective mental health interventions. Furthermore, conducting longitudinal studies to track the long-term mental health effects on military personnel is essential. Considering the evolving nature of the pandemic and its aftermath, these studies can provide valuable insights into the persistence and trajectories of mental health challenges. Extending research to include global comparisons is another recommendation. Examining how different countries and military structures cope with mental health challenges during and after pandemics through comparative studies can offer a broader perspective on effective strategies.

Unique contributions to knowledge from a psychiatric perspective

In our primary investigation, we conducted a comprehensive cross-sectional study aiming to determine the prevalence and factors associated with depression and anxiety in Peruvian military personnel during the second wave of the COVID-19

pandemic (42). Our findings revealed a 29.9% prevalence of depression and a 22.0% prevalence of anxiety symptoms (42). On the other hand, distinctively contributing to our understanding of mental health in military contexts during the COVID-19 pandemic, our secondary analysis focuses on the fear of COVID-19 among military personnel. This exploration is vital, considering the unique challenges these individuals face, such as constant exposure to stressful situations and the pressure associated with being at the forefront of a health emergency response. The study not only unravels the prevalence of fear but also identifies specific factors influencing the mental well-being of military personnel. While the primary study provided a comprehensive exploration of depression and anxiety, the secondary analysis specifically hones in on the fear of COVID-19 within the military population. Together, these studies offer a nuanced understanding of mental health challenges, providing a more holistic view of the multifaceted psychological impact experienced by military personnel during the ongoing pandemic.

Limitations and strengths

This study has several limitations. Firstly, the cross-sectional design hinders the attribution of causality among the variables under investigation. Secondly, there is a potential selection bias, as the primary study only encompassed one department, overlooking a significant portion of military personnel across other departments in the country. Nonetheless, a notable strength lies in the extensive probability sample obtained, and the instruments employed have been validated within our country. Furthermore, the study introduces novel variables, such as religion, eating disorders, and family history of mental problems, which were not previously considered in similar investigations.

Thirdly, we considered the potential for non-response bias. However, the study's design, which involved gathering military personnel in groups and distributing the questionnaire within these controlled environments, minimized the likelihood of extensive non-response bias. The survey wasn't widely promoted on social media platforms among the military; instead, participants were grouped and provided with the questionnaire link, ensuring a consistent response. Additionally, the key characteristics and sociodemographic features captured in our study align with known profiles of military personnel. This alignment is reflected in the 64.02% response rate, with only 10 military personnel declining to participate, indicating a generally representative sample. Fourth, there's a potential for late bias as data collection occurred during the second wave of the COVID-19 pandemic, particularly in a phase of decreasing infection rates. However, during this period, Peru maintained significant measures such as mandatory social distancing, low vaccination coverage, and targeted quarantines in districts with high positivity rates. The reported 14.6% positivity and 14% lethality during epidemiological week 39 (the week when data was collected) in the Lambayeque region further highlights the ongoing impact of the pandemic during our study period, particularly on mental health and fear of COVID-19 among frontline populations such as military personnel (84). Fifth, there's the potential for common method bias. However, we mitigated this risk by employing a diversified data collection approach, incorporating both in-person administration and electronic surveys. The instruments and questionnaires used in the study were meticulously designed and validated to ensure a comprehensive understanding of the constructs of interest (85, 86). Furthermore, we implemented various strategies, including unique identifiers, randomized question orders, and skip patterns in the electronic surveys, to enhance the reliability and validity of the data.

Conclusions

In our conclusion, our findings highlight that a significant proportion, specifically two out of every ten military personnel, experienced fear of COVID-19. It is imperative to underscore the importance of directing focused attention towards the factors linked to the development of this fear within military personnel. Notably, age, religion, being overweight, having a family member with a history of mental illness, and having an eating disorder emerge as key determinants.

Acknowledging the inherent limitations of our study, we believe these results hold valuable insights for informed decision-making. They could significantly contribute to the formulation of effective mental health policies and targeted interventions across all levels of care. It is crucial to emphasize the need for considering military personnel as a priority group in the broader context of the post-pandemic scenario and future health emergencies or disasters. These considerations underscore the nuanced complexities of the mental health landscape, warranting tailored strategies for this particular population.

Data availability statement

The dataset generated and analyzed during the current study is not publicly available because the ethics committee has not provided permission/authorization to publicly share the data, but it is available from the corresponding author upon reasonable request.

Ethics statement

The studies involving humans were approved by Ethics Committee of Universidad San Martín de Porres (USMP) with the code 269-2022-CIEI-FMH-USMP. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

DV-G: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. HD-T: Conceptualization,

Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CP-R: Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CV-M: Data curation, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. VV-P: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. VF-R: Conceptualization, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CP-V: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. DF: Data curation, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MV-G: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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From active duty to activism: how moral injury and combat trauma drive political activism and societal reintegration among Israeli veterans

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Trigger warning: This article deals with combat experiences and their consequences and could be potentially disturbing.

Introduction: Moral injury (MI) is a severe form of combat trauma that shatters soldiers' moral bearings as the result of killing in war. Among the myriad ways that moral injury affects veterans' reintegration into civilian life, its impact on political and societal reintegration remains largely unstudied but crucial for personal, community, and national health.

Methods: 13 in-depth interviews examine combat soldiers' exposure to potentially morally injurious events (PMIEs) that include killing enemy combatants, harming civilians, and betrayal by commanders, the military system, and society. Interviewees also described their political activities (e.g., voting, fundraising, advocacy, protest) and social activism (e.g., volunteering, teaching, charitable work). Interviewees also completed the Moral Injury Symptom Scale.

Results: Two distinct narratives process PMIEs. In a *humanitarian* narrative, soldiers hold themselves or their in-group morally responsible for perpetrating, witnessing, or failing to prevent a morally transgressive act such as killing or injuring civilians or placing others at unnecessary risk. In contrast, a *national security* perspective blames an out-group for leaving soldiers with no choice but to act in ways that trigger moral distress. Associated with shame and guilt, the humanitarian perspective triggered amends-making and *social* activism after discharge. In contrast, a national security perspective associated with anger and frustration fostered protest and intense *political* activism.

Discussion: Despite its harmful health effects, moral trauma and injury can drive intense political and social activism, depending upon the narrative veterans adopt to interpret PMIEs. Aside from moral injury's personal, familial, and social effects, moral injury drives veterans' return to the political arena of civil society. As such, veterans play a central role in politics and dramatically affect post-war policy in democratic nations following conflict.

KEYWORDS

moral injury, morally injurious events, social activism, political participation, combat trauma, veteran integration

Introduction

Moral injury is a potent and debilitating mental health crisis that combat soldiers face (1, 2). Moral injury, or more specifically, *military* moral injury, denotes the intense psychological distress following potentially morally injurious events (PMIEs) that comprise injuring or killing others in war. The distress is moral because killing, however convincingly sanctioned by the principle of self-defense, remains deeply disturbing. While moral injury may follow unlawful acts of rape and murder, it is far more pervasive in the wake of *permissible* killing in war, including killing enemy combatants or collaterally killing civilians. Shame, guilt, anger, and frustration accompany moral injury and distress, where the most severely morally injured may suffer debilitating anomie, self-condemnation, social withdrawal, and low self-esteem. Others, like the subjects of this study, undertake political activism and become essential participants in the public discourse about war.

Investigating social activism and political participation among Israeli combat veterans, this study describes how exposure to PMIEs affects subsequent reintegration into political life. Beginning with a literature review, we examine three distinct domains that rarely intersect: moral injury, political participation, and veteran activism. Turning to the results, the data demonstrate how reactions to PMIEs are far more variable than previously suggested. Some combatants adopt a humanitarian narrative and attribute their moral distress and subsequent activism to their shame and guilt from killing innocents in war, however legally defensible this may have been. But another group takes a different tack and utilizes a "national security" narrative to interpret morally injurious events. These combatants exhibit anger and frustration more than shame and guilt. Indignant at being forced to harm civilians by an enemy who uses human shields and fights without uniforms, these soldiers return to civilian politics to defend and justify their actions. Each group then, engages in a unique form of political activism, drawing from and relieving their moral distress. We take up the theoretical and practical implications of the data in our discussion.

Literature review: moral injury, political participation and veteran activism

The literature review emphasizes the intersection of the three domains unique to this study: moral injury, political participation, and veteran activism.

Moral injury and morally injurious events

Moral injury often occurs in extreme conditions of war where familiar moral norms collapse and cease to provide the necessary anchors of human behavior. These circumstances, usually conceptualized as potentially morally injurious events (PMIEs), may lead to moral injury (MI) and comprise incidents of "perpetrating, failing to prevent, bearing witness to, or learning about acts that transgress deeply held moral beliefs and expectations [(3): 695]." PMIEs embrace distinct incidents: perpetration and betrayal events. While perpetration events may include severe moral and legal transgressions (e.g., mass murder), most comprise ethically permissible acts of killing (e.g., self-defense). There are two categories of perpetration events. *Perpetration-by-self* (self-perpetration) denotes acts of commission (e.g., killing or injuring) by the morally distressed or injured combat soldier. *Perpetration-by-others* (other-perpetration) signifies acts of omission in the face of killing by members of one's unit during an action where the morally injured soldier witnessed the act and/or was unable to prevent it (4).

In contrast, betrayal-based events occur when trusted authorities, such as military commanders or political leaders, pursue morally transgressive policies that betray or undermine the trust and faith soldiers have in these same authorities (5, 6). Betrayal may come when commanders or leaders issue orders that violate soldiers' conceptions of 'what's right,' abuse their authority, or take futile action that leads to needless death and injury (1). Circumstances may multiply and intensify PMIEs. These include leadership flaws, commanders' failure to provide guidance in morally complex situations, indiscriminate or inhuman enemy tactics, and disruptive civilian-military relations. In the context of civil-military relations, soldiers may also construe the violation of their expectations from members of society as a form of betrayal (7). For example, soldiers could feel that despite their expectations, their compatriots do not appreciate the sacrifices they are making to protect them. In these circumstances, moral injury develops in those soldiers who feel profoundly betrayed by the same society that relies on them in times of war.

Shame, guilt, and anger drive moral injury (8). While many moral transgressions may precipitate guilt, the guilt related to moral injury arises when a person inflicts harm on another and then perceives themselves as a bad person (9, 10). In response, the guilty person often tries to remedy the wrongdoing by undertaking measures to minimize the damage caused (11). Related to guilt, shame arises following a moral transgression or demonstration of incompetence whereby one is shown to be inadequate (12), often resulting in feelings of worthlessness and inferiority (13–16) accompanied by attempts to hide or withdraw. Responses to guilt and shame may also lead individuals to acknowledge their or their in-group's (compatriots') responsibility, apologize or ask forgiveness, or offer reparation or compensation [e.g., (17, 18)]. Anger and frustration arise following experiences of unfairness, betrayal, or injustice. While frustration often generates anger, frustration is a distinct emotion when one cannot operate as he wants (19: 15–17). Both frustration and anger might trigger the motivation to attack, humiliate, and seek retribution against the agent of injustice. Frustration, anger, and retribution-seeking characterize the reactions of many soldiers when they face enemy threats or institutional betrayal [(1): 114, also (20)].

The potential of PMIEs to precipitate moral injury depends on their severity. A holistic view suggests that PMIEs cause moral distress because they compel agents to choose between two conflicting moral values when agents are forced into a choice incompatible with their moral inclinations (21, 22). The less compatible one's actions, the more morally transgressive they become, and increasingly likely to cause moral injury (23).

Perceptions of a just world, personal beliefs about the goodness of self/others (3, 24, 25) , moral foundations, and other personality traits (26, 27), cause injurious events to develop into full-fledged MI. As a result, the moral distress resulting from PMIEs may range from moral injury accompanied by withdrawal, self-handicapping and depreciation, and self-harm to less severe but no less disturbing moral unease and anguish [(28, 29), for review].

Treatment for moral injury encourages self-forgiveness and compassion through cognitive-behavioral and other psychotherapies and proactive behavior characterized by making amends (3, 30, 31) and resilience training (32). In most cases, these treatments are directed by clinicians, but in the instances described here, they are self-directed and emerge as social and political activism to make amends.

Morally injurious events, amends making, and social and political activism

In the wake of moral injury, "amends making" denotes personal behavioral changes that focus on social repair, "righting a wrong," and allow veterans to "reconnect with their lives and feel like a contributing member of society" (3, 33). Within the constellation of emotions characterizing moral injury, guilt and, to a lesser extent, shame are the principal drivers of making amends (3). To expiate guilt and mitigate moral injury, affected veterans are often encouraged to formulate an "amends plan" or a work agenda that includes pro-social behavior such as devoting time to family, friends, and co-workers, visiting fallen soldiers' graves, charitable work, community volunteering, or repartitions for those directly affected by one's conduct in war (34, 35).

While guilt and shame encourage amends-making, anger and frustration lead one to seek justice and compensation (36). Frustration arises with feelings that external conditions have deprived persons of their basic entitlements. Frustration and anger motivate political participation and social activism to seek justice (37) or regain lost entitlements [(19): 15–18]. Participatory responses include protest activity and nonviolent civil resistance that, if unsuccessful, may lead to aggressive political participation, such as civil disobedience, violent demonstrations, and riots.

We suggest that organized social activism and political participation are an extension of amends-making, social repair, and other activities intended to change existing social structures at the domestic or international level. Social activism is distinctly pro-social and focuses on works designed to aid and improve affected populations, whether one's own or another's. Social activism embraces volunteerism, community engagement, education, legal aid, charitable work, and other service-oriented activities. In contrast, political participation addresses the locus of governmental or corporate power to affect change through institutional channels. Political participation includes voting, petition writing, mass protest, political advocacy, boycotts, and party organization (38).

While studies consistently show how military service strengthens political participation by conferring the necessary skills, networks, collective responsibility, and civic pride (39–41), the impact of combat-related moral distress and moral emotions such as anger, shame, and guilt is unclear. Commenting on the corrosive effects of betrayal-based moral injury, Shay (42) speculated that "unhealed combat trauma devastates the civic and political life of the returning veteran" for whom moral injury has "obliterated the capacity for trust," rendering political struggle a "hollow charade." But few, if any, studies have explored the relationship between combat-related MI, social activism, and political participation.

Nevertheless, the emotional components of combat-related moral distress overlap with social activism and political participation as individuals become socially and politically active to enhance personal growth and empowerment, increase self-worth (43), fulfill a sense of responsibility or mission, make a difference or leave a legacy (44). While guilt primarily drives amends-making, the extent to which guilt affects political behavior turns on the difference between individual and collective guilt and a careful distinction between political participation aimed at protest and social activism and actions geared toward melioration, restitution, and compensation.

Although individual guilt is not a common motivator of political action, protest, or online activism (45), collective guilt elicits feelings of blame and responsibility for injustices visited by one's in-group on an out-group (through racial discrimination or military occupation, for example). Subsequent behavior is marked by restitution or compensation, civic engagement, volunteer work or collective action (46, 47). Each component of collective guilt-driven social activism is integral to amends making. Alongside collective guilt, however, are expressions of collective *pride* and *anger*. Taking pride in one's in-group or nation's achievements or confronting those threatening a group's values, life, or property motivates political activism, ranging from protest, boycott, censure, and public advocacy to verbal abuse and physical attacks directed against opponents (48). The role of these emotions emerges in stark relief in the context of veteran's social activism and political participation.

Political participation among veterans

Except for Shay's speculative remarks, no study investigates the relationship between moral injury and veterans' subsequent political participation and social activism. Understanding that perpetration-based moral injury exacerbates feelings of shame and, particularly, guilt to encourage amends-making among affected veterans, we hypothesize a similar association between guilt, particularly collective guilt, and social activism characterized by charitable work, volunteering, community engagement, and the pursuit of social justice for the victims of soldiers' actions in combat. In their study of Danish veterans returning from Afghanistan, Brænder and Andersen (49) explain how the dehumanization of Afghan civilians increases the motivation to serve society by entering public service. They do not describe moral injury but instead consider "the idea of making a difference for society as a whole (p. 474)." In this way, public service can be construed as a form of amends-making that aids compatriots at home instead of assisting those civilians harmed abroad during military operations.

At the same time, however, betrayal-based moral injury arouses anger and frustration that may be directed toward two sources: compatriot military organizations or domestic or foreign institutions perceived as threats. In the first case, soldiers may feel betrayed by their military superiors or political leaders for poor decision-making, moral recklessness, abuse, unnecessary death and injury to compatriots and enemies, and negligence toward veterans. Among 1960s Black veteran activists, Parker (50) highlights deep-seated grievances stemming from racial discrimination during military service and an unfulfilled sense of entitlement to civil rights and equality upon returning home. Intense feelings of betrayal and anger directed against the military and government drove conventional but dangerous forms of political participation, such as voting and attending political meetings. Schrader's (51) account describes how

veterans demilitarize and "reinscribe" their patriotism to protect their nation by pursuing a social justice agenda by engaging in antiwar and anti-corporate protests (e.g., Occupy Wall Street). There is no reason, however, that conservative-leaning veterans might similarly redefine their nationalism to defend entrenched military and political agendas. Here, betrayal comes from without, from domestic organizations or foreign governments who disparage a nation's armed forces or military campaigns. In both instances, anger rather than guilt or shame is the dominant response to betrayal MI and a motivator of political action aimed at refuting prevailing criticisms of wartime killing. Building on these arguments, the data offered here suggest that distinct experiences (perpetration or betrayal events), culpable agents (self, other, military, foreign or domestic), and emotions (shame, guilt, anger, or frustration) affect how soldiers interpret morally injurious events and take up subsequent social and political activism as they reintegrate into civilian life.

Methodology

This study investigates the relationship between PMIEs, the intense emotions they elicit, and political participation among 13 politically active veterans. Our sample, $n = 13$, corresponds with studies that suggest that 6–12 interviews suffice to identify categories (52, 53).

Participants

Twelve of the 13 participants were male. Our participants were social and political activists who served in an infantry or combat unit interacting with the Palestinian civilian population. Participants were at least one year after their discharge. Participants' ages ranged from 25 to 49 at the time of the interview, with a mean of 33.5. All interviewees served as reservists in the Israel Defense Forces (IDF) and were politically or socially active at the time of the interview. Interviewees were engaged in advocacy, raising awareness campaigns, protests, educational projects, and online activity. Interviews were conducted between 2020 and 2021. As the research began during the COVID-19 pandemic, interviews were conducted via Zoom using a snowball sample. Snowball sampling identifies index individuals, collects information from each, and asks them to refer others suitable for the study. Snowball sampling is best suited when subjects are difficult to reach, or a sufficient sample is unlikely to be obtained from random sampling (54). This method enabled us to confirm respondents' social and political activity. Before the interview, respondents completed the Moral Injury Symptom Scale (55). They were then invited to an open conversation where they were asked to share their military experiences and describe how these experiences influenced their choice of becoming politically and socially active. They were not introduced to the term "moral injury" or PMIEs and were only asked to share, "What do you take from your military service? Is there something you would have done differently? Are there any particular incidents that you remember affected you?" In their responses, they brought up incidents that left their mark. The University of Haifa ethics committee approved this research.

Analysis

To unpack moral injury constructs, quantitative and qualitative studies often build on semi-structured interviews (24, Williamson et al., 2020) (1). As a qualitative study, we opted to use in-depth interviews and grant complete freedom to participants. This enabled us to learn about their motives and behaviors and let interviewees feel comfortable sharing their experiences (56, 58). Open conversations further allowed us to identify each respondent's perspective to interpret wartime events (59, 60). Interviews were collected and transcribed, and interviewees' names were anonymized. The names that appear below are random names assigned to respondents to ensure their privacy. We translated the interviews from Hebrew to English with minimal editing for clarity.

The analysis was conducted by the authors, we divided the data into two categories. (1) A humanitarian perspective in which respondents placed blame on themselves or their group for the morally transgressive events we identified. (2) A national security perspective in which respondents placed blame on the enemy for the transgressive event. Then, we coded data for PMIE types, including self-perpetration, other-perpetrated events, and betrayal events.

PMIEs give rise to various affective and cognitive states among soldiers experiencing these events. Affectively, soldiers may exhibit intense guilt, shame, anger, or empathy, as they interpret events in ways ranging from military necessity and defense to domination, exploitation, ingratitude, and futility. Disparate PMIEs coupled with differing emotions and event interpretations precipitate motivations for political and social activism, including making amends, exercising social responsibility, or demonstrating national commitment (protest, volunteering, aiding victims of war) and social responsibility (lobbying, education). These factors—PMIE type, affective and cognitive states, affect the motivation for participation and social activism, including public protest, legal advocacy and lobbying, education, and volunteer work.

Results

The results emphasize two complementary sets of findings. The first finding broadens the spectrum of morally injurious events to embrace two narratives of morally injurious events drawing from humanitarian and national security concerns, respectively. Each reflects disparate emotional attributes ranging from guilt and shame to anger, frustration, and pride, the latter hitherto unnoticed in accounts of moral injury. Six interviewees adopted a humanitarian perspective. Four interviewees adopted a national security interpretation of events. Three more expressed ambiguous feelings and swayed between a humanitarian and a national security perspective. The second discussion illuminates how moral injury and distress coupled with each narrative drive political participation and social activism among veterans.

Two narratives of morally injurious events

During their military service, the interviewees engaged enemy combatants, conducted house searches, guarded checkpoints, and patrolled contested territory. Despite the similarity of events,

interview data reveal two prevailing narratives—"humanitarian" and "national security"—veterans adopted to interpret their experiences. Table 1 shows the division of interviewees' perspectives.

The humanitarian narrative draws from the intense moral and psychological difficulty of killing in war. In this narrative, veterans hold themselves or their in-group (e.g., nation or society) morally responsible for perpetrating, witnessing, or failing to prevent a morally transgressive action such as killing or injuring civilians, violating human rights, or placing others at unnecessary risk. Feelings of disproportionate and indiscriminate killing as part of an oppressive enterprise of military occupation over civilian society intensify moral distress and apprehension. In contrast, the national security narrative draws on self-defense and blames an out-group (e.g., their adversary or a third party) for leaving combat soldiers with no choice but to act in ways that trigger moral anguish. In this view, Israeli military control over the West Bank is an essential component of Israel's struggle for existence. National security-oriented veterans expressed a keen sense of mission. Their moral agony was the result of being forced to act in a morally contentious way as a reaction to the enemy's desire to destroy the Jewish state through unrelenting terrorism and unlawful warfare (e.g., human shields). Thus, when describing their experiences, these veterans focused on the harm they strive to prevent despite the complex circumstances on the ground.

TABLE 1 Division of interviewees' PMIE and perspectives.

	Event(s) described	Interpretation
Dan	Other-perpetrated	National security
Alon	Other-perpetrated	National security
Tal	Other-perpetrated	National security
Ronny	Other-perpetrated	Humanitarian
Moshe	Other-perpetrated/ betrayal	Ambiguous
Oren	Other-Perpetrated/ betrayal	National security
Gal	Self-perpetrated/other-perpetrated/betrayal	Humanitarian
Yossi	Self-perpetrated/other-perpetrated/betrayal	Humanitarian
Guy	Self-perpetrated	Ambiguous
Nir	Self-perpetrated	Ambiguous
Eyal	Self-perpetrated	Humanitarian
Aviv	Self-perpetrated	Humanitarian
Eran	Self-perpetrated	Humanitarian

The humanitarian narrative of PMIEs

Confronting self-perpetrated, potentially morally injurious events, other-perpetrated events, and acts of betrayal, interviewees adopting a humanitarian narrative to interpret their experience immediately reveal intense conflict. On one hand, they describe their motivation to join the army to defend their country. On the other, their motivation to fight was tempered by extreme moral disquiet because circumstances demanded that they operate in ways that violated their inner moral compass. Each action or event reveals a distinct phenomenology.

Self-perpetrated actions

Self-perpetrated actions comprise shooting at enemy combatants or other military targets, utilizing violence, conducting house searches, and searching civilians unnecessarily. Here, the most severe acts required lethal force and included the killing of others. Feeling reluctantly placed in these situations, some interviewees took full responsibility for the harm they inflicted on the "enemy." These circumstances triggered moral turmoil as some interviewees felt like "thugs," believing their actions "corrupted their moral consciousness," and realized their actions were unjustified. Eran, a sniper participating in an ambush to capture a suspected terrorist, describes his apprehension:

> "I told myself, this is crazy. This man is smoking a cigarette and does not realize he has a red dot on his head. In another second, he's going to die. You know, you are looking at a man's last moments, not in a movie. It is reality, and you are doing it. Immediately after we killed him, there is a second of joy. We did what we came to do, but it's also very, very frightening. […] and all the while, there's the thought that we killed a human being. That's a disturbing thought."

This description focuses on the moral transgression of violating the humanitarian, moral code prohibiting killing. Typical of the humanitarian narrative, it pays little attention to the circumstances that led to killing a person, any appeal to self-defense, or a cost–benefit analysis that might justify or defend the outcome.

Alongside killing, more moderate experiences such as chaotic and harshly conducted house searches also triggered moral distress. House searches require soldiers to forcibly enter a home, often very late at night, to search for terrorists or interrogate the house members to identify potential collaborators. Confrontations between soldiers and civilians quickly turn nasty. Moral anguish grows as soldiers exercise authority over an enemy viewed as weak and vulnerable and, as a result, perceive the searches as increasingly unjustifiable. Ronny, who often joined military operations, described such a case:

> "In our case, we did not enter the house. We just told them to come out to the entrance. And then, I saw the children. I could see that they hated us, and rightly so. I mean, we are earning that hatred. The house I remember most was one with three children aged 3–10. I told myself that I am raising the next generation of terrorists here because I am teaching them that Israelis are people with rifles and helmets and loaded with military equipment, while they [the children], by definition, were innocent. I think that I felt guilty and most of all, I just did not want to be there. I did not want to be part of this thing."

As in the previous depiction, the interviewee overlooks the mission's necessity (incapacitating the enemy) to focus on the moral burden of frightening children and humiliating their father in the middle of the night.

Other-perpetrated actions

In other-perpetrated actions, soldiers witnessed their unit's members performing morally questionable acts they could not prevent. Gal, witnessed military operations firsthand and describes such an event:

> "There is an element of "we will educate them; we will punish them. They will learn a lesson." There was a case where a Molotov cocktail was thrown on the road. And someone gave instructions to close all the shops, which is like shutting down Allenby Street [a main thoroughfare] in Tel Aviv. They [Israeli soldiers] shout on the loudspeaker and throw stun or tear gas grenades. In one case, our officer sounded amused. He told everyone that his soldiers threw a stun grenade, and everyone ran out like mice. I felt a lot of anger. I thought I was the only one feeling that way, so I did not speak up. I did not share because it is clear what the social codes are."

Responding to the question, "How did that make you feel," Gal said, "I was ashamed for being there; I could not do anything. Gal's description contains two essential elements of soldiers' experiences. First, it focuses on the disproportionate and indiscriminate use of power. Second, the soldier emphasized the central role of internal social codes regulating soldiers' relations with one another. Soldiers often avoid sharing their emotional distress because they fear a social backlash. Harboring these feelings amplifies their grievances. Apart from dealing with the moral discomfort of the situation, they feel misunderstood, out of sync with others, alienated and excluded, and left with no choice but to remain silent. This case also demonstrates how perpetration-by-others intertwines with betrayal. Gal's moral distress stems from not speaking up in the face of moral transgressions by others. But Gal also hints at betrayal by comrades, trusted commanders, the army, and society.

Betrayal

Betrayal describes broken trust in close relationships. Combat soldiers place significant trust in their commanders or comrades-in-arms. Therefore, betrayal from trusted commanders may bring profound and debilitating harm to the person betrayed. Moshe, described this broken trust in one operation during which his commander jeopardized the entire team.

> "In one operation, I was astonished by the lack of ethics in the unit I was assigned. And I warned about it at every possible opportunity. From the beginning, I noticed the unit commander's lack of transparency; he did not tell his superiors the actual state of readiness of the force. After preparing for one operation for ten months, I knew that there was no chance of carrying out the mission successfully. I saw how the commander lied to his superiors, falsely reporting that the force was prepared. I saw how soldiers around me remained silent in the face of these lies, and I had a very, very, very hard time with it. We had a personal conversation with the head of the intelligence unit. He knew there were problems, and I told him I had no idea why we were going. The commander is simply lying to his superiors. In retrospect, I realized the head of Intelligence asked the unit commander to stop the operation. He did not stop it. And our force was exposed, and we had a very difficult encounter with enemy combatants."

Despite knowing this, neither Moshe nor other unit members confronted their commander. Interestingly, while this description can easily be viewed as a tactical mistake by the unit leadership, Moshe emphasized the lack of ethics, trust, and transparency and blamed his commanders for irresponsibility, incompetence, and moral dishonesty, which triggered acute moral distress.

Yossi, described the loss of trust in the system:

> "My commander said, let us use the opportunity. We have extra MAGAV (Border Police) teams that entered the village with us. We can join forces and open a checkpoint between two Palestinian villages. I said OK, but why? The commander replied that Palestinian drug dealers are using this route, and we want to show them that we are here. He instructed us: "Stay there for two hours and leave." It was the middle of the night, it was dark, we could not see anything, and were opening a checkpoint and waiting. A truck passed, and we stopped it for inspection. No one told us what we were looking for. And then, there was another car with a family, and it suddenly hit me. I remember thinking, I am risking my life, but I am not defending Israel. I tried to remember why I got drafted. To defend Israel and defend my family and friends, and I just cannot see the connection—I know for a fact there's no connection."

While describing this incident, Yossi's anger was glaring. He blamed his commander for risking his life unnecessarily. His thoughts focused on how the actions he was required to perform conflicted with his motivation to join the army, a contradiction that triggered feelings of broken trust in the system and betrayal. He felt he was lied to and forced to perform a mission unrelated to the country's security.

This section shows how a humanitarian interpretation of events triggered intense moral discomfort characterized by shame, guilt, embarrassment, and remorse. In contrast, soldiers adopting a national security narrative acknowledge the significance of their duties and the necessity of their actions. However, they suffer from anger and frustration with the situation they are forced to confront.

The national security narrative of PMIEs

In the national security interpretation group, the national security narrative focused on successfully prosecuting a complex war on terror. Here, soldiers appreciated their mission's complexity but blamed the enemy (the out-group) for the unlawful use of human shields, attacks on civilians, failure to wear uniforms, and abuse of medical vehicles that compelled the Israeli soldiers to use deadly force and endanger civilian lives. Frustration with the enemy's unethical and unlawful tactics that endangered soldier's lives, and anger from criticism and charges of excessive force were the dominant emotions interviewees displayed. Frustration and anger played out in self and other-perpetrated actions and betrayal.

Self-perpetrated actions

While using force remained morally troubling, participants who adopted the national security narrative were primarily concerned with complying with their professional duties, completing their mission,

protecting their fellow combatants, and adhering to the military code of conduct. In the following case, Dan describes how NOT opening fire triggered moral distress because it meant risking his team members.

> "I had a situation where I had a target (a terrorist) in my sight. I knew how to hit a "target" from 100 meters, but there was the risk of people being hit nearby. I chose not to shoot but to ask for permission, and I did not get permission. The Major General was on the other end of the line. He asked me, 'Are you sure you can hit from 100 meters without hitting civilians?' I can never be 100% sure. He told me, 'So I do not approve.' It was not an easy decision for me because, in real-time, you never know if your friend will get shot and killed by the enemy. You're supposed to respond to fire. It is the IDF's leading value, *perseverance in the mission, and dedication to the pursuit of victory*. That is a core value!"

This description offers an extraordinary example of broken values rarely addressed in MI literature that usually focus on killing as a morally transgressive action. Here, the potential implications of not shooting became a source of moral distress for Dan because it meant that he was not doing his job, violating the values he adopted as a soldier, and risking the lives of his friends.

Incidents like house searches described earlier were also mentioned by soldiers who adopted a national security interpretation. In these cases, soldiers acknowledged the difficulty of entering a house in the middle of the night, but they viewed their actions as necessary:

> "You gather all the members of the house after scanning the house itself. The house is not chosen because its occupants were incriminated but because of its location with a view over vital territory. For example, you can go into a house because you have information about a smuggling tunnel that you can watch over from that house. So, you occupy the house to protect your comrades working in the tunnel. But you terrify a family that had done nothing wrong. They are innocent, as far as you know. There is no reason for them to suffer except that they live in a house that is essential to completing the mission."

Dan commented on this experience saying that while it was an unpleasant situation, he did not suffer any guilt—"I know why we were there, and I knew we did the best we could." Placing the mission at the forefront diverted attention to the enemy's actions, thereby mitigating feelings of guilt. Nevertheless, focusing on the enemy's behavior to interpret events triggered deep frustration for being entangled in situations where soldiers were unable to "win." The following description by Nir, illustrates the moral discomfort soldiers might experience when exercising authority.

> "One rainy night, I caught a young boy who was trying to smuggle eggs. He had a cart full of eggs. I turned to the agricultural unit responsible for coming to pick up such smuggled merchandise, but they did not want to come because it was the middle of the night. They told me that the eggs must be destroyed. They told me that I was not allowed to destroy the eggs; the kid had to destroy them himself. I explained to him assertively that he must destroy the eggs. He started crying and breaking all the eggs on the road. I remember it vividly. I stood there with my rifle pointed toward that poor kid until he destroyed all his eggs. I think he had thousands of eggs there. I hated it. It was awful and so frustrating. Specifically, I hated my subordinate soldiers, who were so insensitive."

Nir felt it necessary to explain that he had no other choice and knew his actions were necessary. He explained that if he let the kid go on with the merchandise, it would have gotten to Israel without proper inspection and could potentially become a health risk. At the same time, he thought that the kid would probably be beaten when he got home for losing all the merchandise. These incidents match the PMIE in which one is forced to perform a morally disturbing act. Nir's story could easily fit the humanitarian narrative, but he justified his actions with national security obligations. His testimony illustrates the moral struggle soldiers face when their commitment to national security conflicts with their humanitarian principles. In this case, Nir's commitment to national security won over his humanitarian inclinations as he forced a child to destroy all the merchandise he was carrying.

Other-perpetrated actions

From the national defense narrative, the concepts of perpetration-by-others and betrayal differ markedly from the humanitarian narrative. Among those viewing events through the prism of national defense, the 'others' in other-perpetrated actions are the enemy. Dan, for example, describes his pride at accomplishing a difficult mission further imperiled by the enemy's "dirty" tactics:

> "Generally speaking and considering the highly complicated challenges facing the IDF how the enemy used civilians as human shields and exploited UN facilities, ambulances and the Red Crescent symbol for terrorism, I think we can be *very proud* of ourselves and very proud of the way we handled the situation."

For participants who mentioned these actions, the enemy's odious conduct put their unit members at risk and left little room for remorse or regret for their behavior during combat. However, these participants felt that the military code of ethics sometimes tied their hands as they fought an enemy trying to kill them and their friends. Alon, described:

> "We were constantly engaged in arresting terrorists, you know, terrorists with blood on their hands. We arrested the head of Hamas in Qalqilya and Tukaram in complex operations. Many stones and rocks were thrown at us. We often endangered ourselves. Often, the team risked going into alleys. Even though we had a clear indication (of where the suspect was) and it was possible to shoot him from the air, we did not because it was a dense urban neighborhood. I'm very proud of how we handled these situations, which, to begin with, is a shitty situation."

In these cases, the enemy commits acts that the Israeli soldier defines as morally transgressive. Structurally, these acts are no different than those described by the humanitarian narrative. In each instance, an enemy or commander violates the soldier's deeply held moral convictions. However, the soldier's ability to maneuver or respond in each case vastly differs. When confronted with a commander who lied and risked the lives of his troops, Moshe castigated himself for remaining silent and suffered as a result. Alon

and Dan, however, cannot speak out and rebuke their enemy. All they can do is conduct themselves in ways that create moral distress by needlessly endangering their comrades. While expressing a solid commitment to the army and the country, soldiers who interpreted events through national-security narratives were, therefore, not immunized against moral unease, agony, and distress.

Betrayal

Viewing events through the prism of national defense, interviewees also displayed a unique sense of betrayal. Betrayal is commonly the result of fractured trust in commanders or political leaders. Among many national security respondents, however, betrayal reflected criticism by local civilians or the international community. Public reactions may trigger feelings of betrayal when soldiers feel their sacrifice is unappreciated and their actions harshly criticized. While the IDF enjoys widespread legitimacy in Israel, soldiers sometimes face criticism from citizens from different social sectors. As Oren, recalled:

> "One time, I returned home after being away for two weeks. I lived then in an ultra-Orthodox neighborhood in Haifa. Some people started throwing stones at me. I ran after them to the synagogue, went to the rabbi and told him, "Have you no shame!?" I get back home after two weeks defending this country and getting stoned [by the enemy] every day and come back here to my house to be stoned by my own people. YOU are fighting ME? I am here for you. It is very, very, very difficult. It's terrible. It was one of the hardest experiences of my life. The least you expect is that when you return home, people will smile at you and that you will feel loved."

There is a subtextual description of social betrayal here, mainly due to Oren's deep commitment to his country. This commitment created an unspoken expectation not fulfilled by one segment of society and intensified his emotional backlash. As he acknowledges, "It's one of the hardest experiences of my life." In 2017, the case of Eleor Azaria, a young combat medic who violated the rules of engagement and humanitarian law when he shot and killed a wounded and unarmed terrorist suspect generated a similar sense of betrayal. Although Azaria was tried and punished, there was sharp criticism from some segments of the public who berated the military, the press, and international rights organizations for their lack of support for soldiers sent to risk their lives for their country (61).

It is important to note that the neat division offered here is not dichotomous. Interpretations of morally injurious events were not entirely consistent. Some interviewees blamed their commanders for betrayal but acknowledged the value of their military service. Others saw their actions as necessary but still felt disquieted about the circumstances and reality imposed upon them. While the humanitarian and national security narratives described here might easily fit left and right political narratives, data from interviewees suggest that left and right narratives are an over-simplistic pattern to characterize the moral conflict soldiers might experience. Sometimes, left-wing veterans voiced their patriotism and concern for their country's national security, while right-wing veterans expressed humanitarian concerns.

To investigate how interviewees' expressions of moral distress mapped onto clinical measures of moral injury, 11 of 13 interviewees completed the Moral Injury Symptom Scale, Military Short Form (55), a 10-item scale to symptoms related to moral injury. The MISS registers moral injury on a scale of 10–100 (each question 1–10); The higher the score, the greater the degree of moral injury. Average scores were lower for national security, higher for humanitarian, and mid-range for the mixed narrative (27 [$n = 3$]; 43 [$n = 5$]; 31 [$n = 3$]).

While the humanitarian narrative scores approach the US average,[1] the national security respondent scores reflect lower levels of scale-measured injury. Drawing on the interview data, we suggest that those espousing a national security orientation toward PMIEs suffer a different kind of moral trauma that existing moral injury scales do not measure entirely.

Despite disparate narratives and dominant emotions, the interviews highlight a clear direction of interpretation. Interviewees either blamed themselves or others for their morally contentious actions during combat. Self-blame triggered shame and guilt for committing or failing to prevent moral transgression. Other-oriented blame triggered anger and frustration. Anger arose when unlawful and unethical enemy tactics compelled soldiers to act in morally controversial ways. Frustration arose with being misunderstood by compatriots and delegitimized for their actions. These interpretations and the subsequent emotions shaped these veterans' social activism and political participation as they return to civilian life.

From morally injurious events to political and social participation

Humanitarian and national security narratives shape Israeli political discourse and affect soldiers' perceptions and, indeed, their entire military service when they confront potentially morally injurious events on the battlefield. Following discharge, interviewees reveal how their interpretations of morally injurious events encourage political participation and social activism. The following section is divided into two parts that explain how humanitarian and national security interpretations of morally injurious events motivate social activism and political participation.

Humanitarian narrative activism (1): making personal amends

Social activism brings a sense of self-esteem, empowerment, and well-being that activists derive from assisting others and contributing to society (56). We address these personal benefits as mechanisms of self-compensation because they elevate social activists' moral standing, allow soldiers to rebuild what their military service had broken, or help them justify their actions to themselves or others.

Following his discharge, Ronny—who participated in house searches and had many interactions with the Palestinian civilian population—currently engages in dialogue initiatives between Israelis

1 These scores were lower than the average score of 50 in Koenig et al.'s (53) larger sample (n =427). However, it is difficult to compare a small sample of politically active veterans with a larger sample of veterans and active-duty personnel with symptoms of PTSD, anxiety, and depression, among whom the lack of community involvement was moderately associated with moral injury. Items 6, 7 and 10 were reversely coded when calculating the final MISS score.

and Palestinians, operates educational activities, collects testimonials from combat soldiers, and conducts online activity against Israel's presence in the West Bank—illustrates this point.

> "I felt that I had broken something, and now I needed to fix it. I was part of this system of the army whose idea was to oppress people, and I wanted to be part of the effort to fix and end the occupation… (Through my activity) I feel that I have returned to the experience of the army and rectify it, and this motivates me the most."

In this case, the "broken something" recalls morally injurious events. In another instance, the triggering event was betrayal. Moshe, who earlier described his commanders' betrayal, explained how feelings of social responsibility motivated him to demonstrate leadership to compensate for his inability to protest his commanding officers' morally contentious orders.

> "I believe that a person's happiness is measured by his loyalty to his values. I measure myself and the people around me by their courage. For me, courage is how much a person adheres to his inner truth in a chaotic environment, and I think that was what motivated me. I felt that I had to stick to my truth. After I saw the dishonesty in my unit, I struggled to uncover it (after following orders). I stood up to the immense pressure from my peers and my superiors in the military to reveal the truth, and that made me feel brave. Similarly, when I stand up to all the social pressure in civil activism, it makes me feel brave."

In this case, Moshe described how betrayal by his superior commander motivated political activism by allowing him to demonstrate his courage to stand up and struggle for his values.

Humanitarian narrative activism (2): consciousness raising

A sense of personal responsibility was another prominent theme. Taking responsibility for military actions that contributed to Israel's ongoing occupation of the West Bank, some veterans turned to anti-occupation activism to alleviate the moral burden they carried from the disturbing events encountered during their military service. Asked if he felt responsible for the condition of the Palestinian population, Yossi responded:

> "[I have] direct responsibility – that's how I feel. Not only because I am a citizen of the country responsible for these violations, but today, I look at it mainly from the perspective of the Palestinians. For me, the most serious issue here is Palestinians' human rights. I think this is my direct responsibility, both because I am a tax-paying citizen and because I know [the Palestinian living conditions]. Whoever knows this bears responsibility, and I was also a part of it. The combination of these makes it something I just cannot help but act against. In my view, I have taken part in something that I do not agree with in any way, and the least I can do is fight against it and use my advantage to try to turn it around."

Those such as Ronny, and Yossi, who interpreted their experience as perpetrated by their in-group and shared their shame and guilt for being part of their occupying force, were motivated by a desire to change Israeli society from the inside and end the occupation. Respondents emphasized their need "to do something for society," rectify the harms they witnessed or inflicted, and take responsibility for the ongoing occupation to which they contributed. Their activism comprised publicly sharing their combat experiences, conducting frank dialogue with future draftees, and sharing their military experiences online. While these activities might express fierce social criticism and anti-government activity, activists explain how they perform these activities on behalf of Israeli society. For example, Eran, who shared his experiences as a sniper and held a very critical stance on Israel and IDF, said:

> "I do it (activism) to repair the place where I live. To some extent, I am an Israeli patriot. I have a very hard time with Israel. I do not sing the national anthem. The flag makes me sick, but I want to fight for this place because this is my place, this is the one piece of land in the world I am part of and a society that I am part of. Although it is a sick society, I need to fix it. The Israeli Zionist society is founded on a racist concept. At its core, Zionism has amazing precepts, but it is a romantic and social movement that attained this piece of land through colonialism. And basically, we are sick because we think we deserve more… I feel that I have a responsibility because of what I did in the service but also because of how I grew up. I had a wonderful family and an incredible childhood. Today, I say that since I have so much, I must give something back."

This description depicts a stark paradox highlighting the wide variation of emotions that motivate veteran activism in Israel. Very often, anti-occupation activism elicits public backlash, particularly in Israel, because many Israelis object to anyone interpreting IDF actions as anything less than militarily necessary for Israel's survival. Any other perspective is to distort reality. However, this interviewee explained how his activity was motivated by a social commitment *to* Israeli society, the same society that accuses many activists of undermining its social fabric. This paradox appeared in many interviews with activists who blamed their in-group for the moral transgressions they experienced and now engage in social and political activism critical of Israel.

In his interview, Aviv shared how he used excessive force against the civilian population during his service just because he commanded more power than the local inhabitants. He emphasized how he grew up in a violent society that influenced his behavior during the service. When asked about the motives for his online social activism against the occupation and his participation in high school educational initiatives, he answered:

> "I want to change something in Israeli society and know what I want to change. Because I grew up in a very violent environment. I know what I want. It is not about a Zionist leftist ethos—The people I grew up with in my neighborhood were people who went to beat Arabs on Holocaust Memorial Day. I know that these people were not bad people. It's simply the Israeli climate. If I want to change something, it's that people do not grow up into something like that."

Aviv expressed worries about his own society and adopted a critical approach that he hopes will awaken his society's consciousness

about the government's policies towards Palestinians. Feelings of social responsibility also urged activists to engage in domestic protests against the government's policies as part of one's civic duty.

Humanitarian narrative activism (3): public protest

Veterans perceived social activism as part of their civic duty to maintain Israel as a democratic state. Emphasizing this sense of civic responsibility, some interviewees believed their activism was a social expectation of military service. Complying with this expectation was rewarding for these activists. Moshe, who served in an elite unit and previously described his feelings of betrayal, said, "Because of my role in the military, I feel that it is expected of me to continue this role through social activism. In being active and fighting and dealing with a chaotic social reality, I demonstrate courage. It makes me feel good. It feels fulfilling."

Each form of activism is a reaction to combat-related morally injurious events and their subsequent interpretation via a humanitarian or national security narrative prism. Viewing their combat experiences through a humanitarian lens, activists laid blame upon themselves and their in-group. To expiate the resulting shame and guilt, veterans undertook social and political activism to make personal amends and raise awareness about the injustices perpetrated by the army through educational activities, online discourse, and public protest. In contrast, veterans adopting a national security narrative blamed the out-group, that is, the enemy, for the immorality of their wartime behavior. Combining social responsibility with a commitment to justify rather than atone for the morally transgressive acts they, their colleagues, or their government perpetrated, these veterans engaged in public advocacy at home and abroad. Their activism brought them to refute attempts to delegitimize Israel, expose the enemy's unlawful and unethical military tactics, justify Israel's military strategy, foster patriotism through education, and boost the country's good name. In each case, veterans hope to set the record straight in the face of defamatory accusations.

National security activism (1): neutral information advocacy

Hoping to present a more balanced view of Israel's military policy, some veterans adopt a neutral stance. Rather than vigorously advocating for Israeli policies directly, they chose to share their unvarnished combat experience. When asked about their decision to forego forceful advocacy in favor of publicizing his personal impressions, Tal described:

> "There are two main reasons [for this decision]: first, I am not a psychologist, but I think it's human nature: you want the person in front of you to understand your experience so they can understand you. Second, it seems to me that many times people share their experiences because they believe that talking about them will bring about a change in other people or political change. I share an experience from my military service with the expectation that someone will behave differently or that he will change his opinions. On the other hand, we also want to encourage people to be politically active. At the political level, it becomes much more complicated."

This testimony illustrates how activists seek to explain the difficulty and ambiguity of their combat experiences. Tal shared these by referencing an incident he had at a checkpoint at the height of the Second Palestinian uprising (2000–2005). He described how he saw a child carrying a bag. His partner stopped the child for inspection and saw a ticking bomb inside the bag. Tal said that instinctively, he felt an urge to protect the child he thought was no more than 7 years old. He shared the conflict between the urge to protect the child and the anger of being placed in this situation. He emphasized how speaking about his military service enabled him to convey the complexity of the situation, which, he claimed, is often oversimplified and erroneously judged by others:

> "I share because I want people to see the moral dilemma. I do not share because I'm looking for approval because I am very comfortable with what I did. And if I had made the wrong decision, the results would probably have been different. I want people to understand how complex it is. It's not black and white."

National security activism (2): pro-active information advocacy

In contrast to neutral advocacy, pro-active advocacy reinforces a national security agenda to unmask Israel's enemy's "real face" and to enlist international support. Rather than straightforwardly making amends, activists advocate on behalf of Israel. Anger and frustration spur political activism to contest unfair judgments, enhance understanding of Israeli policy, or confront the hypocrisy veterans see in some progressive social circles. Veteran activists undertook proactive information advocacy as part of the same feeling of civic responsibility that sustained their military service. Dan described how he risked the lives of his friends to spare the lives of innocent civilians by avoiding collateral harm during combat. In civilian life, Dan engaged in pro-Israel advocacy in Europe and the US. He describes his motives as follows:

> "There's this anger that motivates you. You know how things work and see how you are depicted by external spectators (e.g., foreign journalists, diplomats, and politicians). So, my anger was against these people who distort reality without understanding the real situation we faced as soldiers."

External spectators' moral judgment infuriated some respondents who interpreted morally injurious events as the enemy's fault. These activists often engaged in political advocacy to defend the Army's actions and express national pride. One interviewee, for example, said:

> "I have no problem with what I did, but it angered me when people from the outside criticized me as an aggressor while overlooking the aggressive and manipulative actions of the other side. For this reason, I felt it necessary to expose their true face and advocate for the justice of our cause."

Explanations of Israel's actions range from clarifying the terror threats Israel faces to revealing the enemy's combat tactics of using children as human shields, taking cover in civilian houses, and hiding ammunition in medical vehicles and UN facilities. As a combat soldier, Alon described a military operation to capture a suspected terrorist who was hiding with his wife and children. Responding to how the situation made him feel, he said: "You realize that you are at an inherent disadvantage despite your weapons because you are

bound by specific moral codes, and your enemy takes advantage of this. In his civilian life, Alon conducted pro-Israel advocacy and volunteered to aid Holocaust survivors. He describes his activism as a civic duty:

> "It's simply the dissonance between how we are perceived compared to what I and my unit did. So, I think advocacy is a civic duty because this activity (advocacy) benefits the State of Israel. For example, if I come to a university campus to prevent students from passing anti-Israel regulations or participate in a debate, and the audience gets to hear from a former combat soldier and a commander, they might change their opinion. I have a chance to influence the future generation here."

National security activism (3): patriotic education

Political advocacy is also conveyed as an educational endeavor. While advocacy primarily targeted an international audience, patriotic activists also sought to raise awareness within Israeli society. Activists initiated lectures, appeared in high school classes to encourage students to serve in combat units, provided data about the origins of the conflict, and offered accounts of their military experiences.

> "I initiated a project in my high school. I got into every classroom and talked to students. I explained to them how to get to every unit in the Army and why it is worth going there. I described the best units and the experiences they will have wherever they serve. Two years later, I learned that the school had the highest enlistment rate in combat units in the school's history."

While it is difficult to determine whether the activists successfully encouraged students to serve in combat units, the description of his advocacy demonstrates the close connection between serving in the army and persuading others to serve in the Army.

Discussion

As they serve in combat, soldiers confront potentially morally injurious events (PMIEs). The emotions these events evoke during and after military service and the subsequent kind of activism they undertake are mediated by the narratives they utilize to interpret combat trauma. The discussion engages four topics: (1) how morally injurious combat events, multiple narratives, and their attending emotions spur political activism and affect veterans' political reintegration into civilian life, (2) the contribution of the data to the debate surrounding veteran activism, (3) emerging directions in the treatment of moral injury through political participation and social activism and, (4) an overview of the study's limits and impact on future research.

Moral injury, political activism, and civilian reintegration: the role of mediating narratives

Interviewees described several types of PMIEs that confirm the distinctions among self-perpetrated events, other-perpetrated events, and betrayal. Table 2 summarizes these distinctions and associated attributes. When events are self-perpetrated, the morally culpable agent is the active combatant. In other perpetrated acts, the culpable others were often commanders or comrades whose actions aroused feelings of betrayal or shame among some interviewees. Sometimes, interviewees faced social ingratitude or hostility for their actions. In these cases, feelings of betrayal arose from interviewees' feelings that society failed to meet their expectations. Some interviewees also revealed how the culpable "others" were enemy agents who abused civilian immunities by recruiting human shields or using medical vehicles for military purposes. Such tactics placed the combat soldiers in an impossible situation by forcing them into morally transgressive behavior or rendering it impossible to complete their mission successfully. In each case, returning soldiers felt compelled to defend themselves in the face of criticism that some interpreted as betrayal. The pivotal role of culpable enemy agents is a significant finding that broadens the scope of PMIEs. Second, the data highlight two distinct humanitarian and national security narratives veterans use to interpret potentially morally injurious events. The humanitarian perspective is typical of morally injurious events recorded to date. In contrast, enemy-perpetrated events dominate the national security narrative and offer a singular contribution to the typology of moral injury.

Despite the novelty and significance of a dual-narrative interpretation of PMIEs, one may ask whether the national security narrative documents moral distress at all. This question deserves a brief comment. Because veterans adopting the national-security paradigm often place moral responsibility for transgressive acts on an enemy outgroup, one may cogently ask whether they perceive any moral transgression if veterans assign culpability to the other side. In their interviews, these activists suggest that the ethical dilemmas they experienced during their military service were not associated with their own actions. Instead, they were imposed by their enemies.

Blaming the other side suggests a process of moral disengagement whereby agents dissociate themselves, undermine the severity of their actions, or dehumanize the victim to resolve a moral dilemma they experience (62). Yet, it became evident during the interviews that the ethical dilemmas they experienced were not entirely resolved despite moral disengagement. Interviewees claimed to have acted congruently with their moral beliefs. However, these experiences still motivated their political activity, indicating that assigning culpability to the enemy does not necessarily resolve the moral conflicts soldiers experience when subject to outgroup-initiated PMIEs. Instead, such experiences may trigger anger and frustration that activists alleviate through political participation and social activism.

Finally, the data document very different ranges of emotions and subsequent political activism associated with each narrative and PMIE. Members of each group sought activities as part of a personal growth process following traumatic experiences that triggered shame, guilt, anger, and frustration. Humanitarian activists sought to alleviate these feelings, particularly shame and guilt, by demonstrating a commitment to human rights and social justice. On the other hand, national security-minded activists responded to anger and frustration with an urgent need to defend their actions and reinforce their patriotism. Factors explaining one's preference for one narrative or another to explain morally challenging events may turn on such antecedent factors as political ideology, religiosity, culture, social consciousness, and personality traits. The interviews outline an underlying psychological mechanism that translates moral injury into

TABLE 2 Summary of findings: moral injury and political activism.

PMIE	Narrative	Emotions	Culpable party	Activism
Self-perpetrated	Humanitarian	Shame, guilt	In-group: self or compatriots	Personal amends Conscientiousness raising
	National security	Anger, frustration	Out group: enemy, international community	Neutral and offensive information advocacy Patriotic education
Other-perpetrated/betrayal	Humanitarian	Anger	In-group: self or compatriots	Public protest
	National security	Anger, frustration	Out group: enemy, international community	Neutral and offensive information advocacy Patriotic education

political activism whereby differing narratives characterized by in-group or out-group orientations mediate potentially morally injurious events and help explain ensuing types of social and political activism as veterans return to civilian life.

The data in this study suggest alternative paradigms of moral injury that may not be sensitive to the standard diagnostic instruments (such as the MISS), one that may compel clinical researchers to develop additional moral injury evaluation instruments. Investigating the antecedent conditions of narrative building remains the topic of future study.

Veteran activism

The benefits of offering veterans amends-making plans to expiate guilt and shame conform with this study's results. The results also reinforce the published data corroborating the dominant emotions behind veteran activism (guilt, anger, and frustration) and the ensuing forms of political participation (protest) and social activism (volunteerism and education). While earlier studies differentiated between amends making (e.g., among soldiers returning from Afghanistan) and aggressive political protest (e.g., among Black veterans returning from Vietnam) (39–41, 50, 49), this study fleshes out two distinct narratives that help explain prior findings and serve as a starting point to study veteran activism further.

This study also offers a starting point to reflect on the role of veteran activism in a democratic society. When soldiers go to war, their compatriots expect a reckoning of sorts for killing in war, and postwar civil society is replete with ceremonies, medals, and customs to recognize combatants' contribution and sacrifice, and assuage their guilt (63). It was Shay's view that soldiers overcome with moral anguish from betrayal would develop such extreme distrust in state institutions that they would eschew democratic participation. Our study challenges this view. Soldiers betrayed by the state come back full of anger and indignation and dive into political protest. But this is not all. Shay did not consider that soldiers morally injured by self-perpetrated violations of humanitarian norms would channel their guilt and shame into social activism, volunteerism, and consciousness-raising to make amends for their actions. Nor did he or the psychologists treating moral injury leave room for soldiers whose moral anguish stems from the actions of their enemies whom they feel compel them to compromise their ethical values in defense of their country. These soldiers direct their anger and frustration into advocacy and education to defend their actions.

As the moral injury and moral distress resulting from combat gain growing recognition, compelling questions arise about how discharged service personnel reintegrate into civilian life. While researchers and clinicians take due note of how morally injurious combat experiences affect soldiers' personal and family life, little research examines how combat trauma impacts a community's political life and discourse. More than 3 million American soldiers supported the fighting in Iraq and Afghanistan during 20 years of warfare (64). In October 2023, Israel mobilized more than 300,000 reservists to augment its standing army (65). Many millions fight in other nations and other wars. As they return to the political arena, some veterans undertake intense social activism and political participation, and their impact reverberates beyond their numbers. They bring diverse political ideologies that direct their efforts toward numerous forms of social repair. Some seek to remedy the material harms of war directly, while others look to repair the reputational harms war has brought to their community. Together, these camps, both distinct and overlapping, one seeking amends, the other justification, cannot but enrich postwar discourse that may strongly influence a nation's decisions to undertake future wars.

Treatment for moral injury and combat-related moral distress

The central role of guilt and shame as motivators of social activism emerges when one considers the therapeutic value of social activism to help veterans by enabling post-traumatic growth (PTG). Facilitated by social activism and other interventions, PTG highlights the perceptual changes an individual undergoes within himself, his philosophy of life, and his relationships with others following a traumatic experience (66). PTG includes various phases wherein a person regains a new meaning to their life, self-reliance, and cognitive transformations that shift their consciousness from viewing themselves as a victim to viewing themselves as a praiseworthy survivor. Social activism, charitable work, and community volunteerism are intense among some veterans (67), and evidence suggests that these activities improve PTG and strengthen resilience among veterans and other trauma-affected populations (68–70). These findings are echoed in Schrader's (51) interview-based research that shows how different kinds of activism,

including anti-government, environmental, and social justice activism, alleviated the trauma soldiers experienced during their deployment in Iraq and Afghanistan. However, at other times, trauma may encourage people to seek reconciliation or redemption through social contribution to what's "good," permitting veterans to regain a sense of humanity by contributing to society and defying the inhumanity of war. Or it may also be the case that other, more conservative, veterans act on the pride and purpose of their service to challenge domestic and international criticism and denigration. In either case, political participation and social activism offer potentially effective means to mitigate the effects of moral injury and combat trauma. They remain a topic of further investigation.

Limitations and future directions

Although limited, the interview data encourage additional hypothesis testing through large survey experiments [e.g., (71)]. The data in this study help explain how combat trauma and potentially morally injurious events inform and motivate politically and socially active veterans. A broader survey experiment can tell us the extent to which morally injured veterans engage in activism and enrich the democratic process. The data also support the identification of amends-making with the protest activism and volunteerism of veterans adopting a humanitarian narrative of PMIEs. At the same time, the data also highlight the tendency of betrayed veterans to adapt their activism to the source of their betrayal, whether of the humanitarian or national security bent. In this way, the data suggest a mechanism that links interpretations of PMIEs to political participation and enriches our understanding of veteran activism. Following armed conflict, nations may ignore the lessons of war or bring them to the center of public discourse. When vibrant democracies choose to engage, the voices of veteran activists are indispensable.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee of the University of Haifa. Approval number 447/19. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AL: Investigation, Writing – original draft, Writing – review & editing, Conceptualization. MG: Investigation, Writing – original draft, Writing – review & editing.

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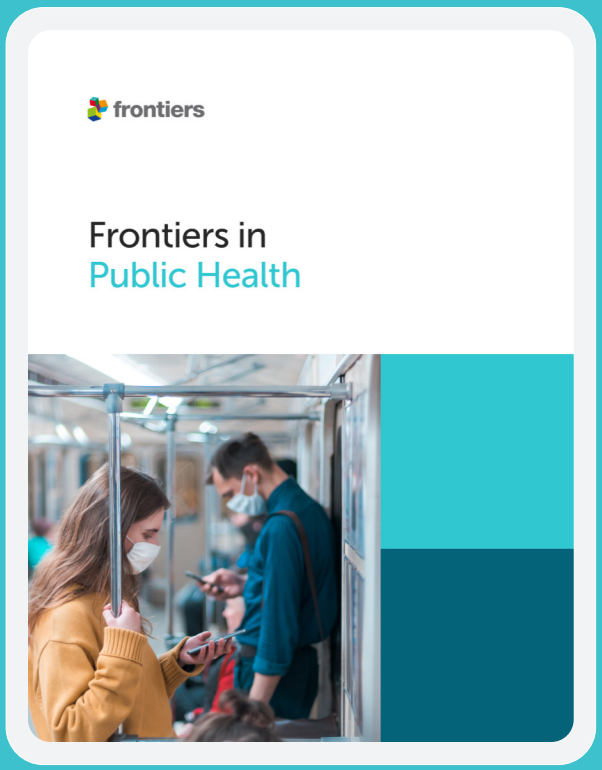

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