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Association between catastrophizing, postoperative pain, and injury severity in soldiers injured during the first year of the war in Ukraine: a cross-sectional study

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Aims: The aim of this study was to investigate the association between catastrophizing, postoperative pain, and injury severity following war-related injuries among soldiers injured during the first year of the war in Ukraine.

Methods: This cross-sectional study included 135 patients with war-related injuries treated at the Center of Thermal Trauma and Reconstructive Surgery of the Vinnytsia regional University hospital in Ukraine between August 2022 and November 2022. Following surgical treatment, patients' catastrophizing was assessed using the Ukrainian version of the Pain Catastrophizing Scale (UA-PCS) and correlated with the pain levels assessed with the numerical rating scale (NRS), and the scores obtained with Injury Severity Score (ISS) and the Combat Exposure Scale (CES). The potential pre-existing traumatic events in a participant's lifetime were assessed with The Life Events Checklist for DSM-5 (LEC-5).

Results: Multiple regression analyses showed no significant association between the PCS total score and demographic variables of age, gender, marital status, education, duration of military service, or time from injury. Only 3.6% of the variance in the catastrophizing scores was accountable for the contribution of independent demographic variables. We found a moderate positive correlation between catastrophizing scores (including all the subscales) with pain NRS, ISS, and CES scores. The pain NRS, ISS, and CES scores account for 43.4% of the variability of PCS scores. Previous traumatic events did not contribute to the catastrophizing scores.

Conclusion: Our study describes a positive association between catastrophizing, sustained injuries, combat exposure, and postoperative pain. Since our sample consists of injured soldiers that were young and healthy before suffering major war-related polytrauma, our study offers a unique perspective, different from all other previous studies in which catastrophizing was investigated in a civilian population.

Keywords: catastrophizing; postoperative pain; war injuries; soldiers; military personnel; Ukraine

Introduction

Pain catastrophizing is one of the main psychosocial factors influencing the determinants of the pain experience, such as increased pain intensity, distress, and health impairment. Pain catastrophizing is often defined as an exaggerated negative cognitive-affective response towards anticipated and experienced pain [1, 2].

Catastrophizing is associated with many important pain-related outcomes. Numerous previous studies confirmed that it is a significant predictor of future pain and accompanied disability [3-5]. That cognitive style is also proven to be a predictor of post-traumatic stress disorder (PTSD) [6, 7].

Most of the available data related to pain catastrophizing and its potential consequences are related to the civilian population. Very little is known about the catastrophizing in military personnel and even less about its consequences in wounded soldiers. Seligman et al. showed that soldiers higher in catastrophic thinking and experiencing higher combat intensity are more likely to develop PTSD than those low on both [8]. In pre-deployed USA National guard personnel reporting pain symptoms, frequent catastrophizing was associated with higher rates of depression, PTSD, alcohol dependence, and somatization-like illness [9].

Considering the personal and societal burden of PTSD, it is crucial to investigate all the factors that can lower PTSD. This is especially important since catastrophic thinking can be modified through therapy while early detection of catastrophizing behavior and prompt treatment benefit the rehabilitation and recovery of wounded soldiers [10].

This study investigated the association between catastrophizing, postoperative pain, and injury severity following war-related injuries among soldiers injured during the first year of the war in Ukraine.

Material and methods

Study design

This was a cross-sectional study.

Ethics

The study was approved by the Ethics Committee at the National Pirogov Memorial Medical University. After signing informed consent, the participants received the printed questionnaires which were filled out after the surgical management of the wounds. Each questionnaire was coded with a number and anonymized patient data were entered into a spreadsheet.

Setting and Participants

The study was conducted between August 2022 and November 2022. During those three months, the study participants were recruited among patients admitted to Vinnytsia re-

gional University hospital and treated at the Center of Thermal Trauma and Reconstructive Surgery. The Vinnytsia regional University hospital has 1000 beds while the Center of Thermal Trauma and Reconstructive Surgery has 50 surgical beds and 9 intensive care beds. Since the beginning of the Russian aggression on Ukraine, the Vinnytsia regional University hospital has been accepting patients with war injuries from all over Ukraine. The average number of admitted patients by the Center is 200 per month with average hospitalization of three days after which the patients are transferred to the rehabilitation center. The inclusion criteria were any type of war-related mine-explosive or gunshot wounds. The exclusion criteria were any other medical condition associated with acute and chronic pain besides the pain resulting from the war injury, current alcohol or drug-related dependency, and the presence of primary psychiatric symptoms and somatic symptoms requiring treatment.

Procedures and instruments

Participants were recruited following their surgical treatment at the Center of Thermal Trauma and Reconstructive Surgery. All instruments were administered on the same day.

A demographic questionnaire contained questions about age, gender, education, marital status, duration of military service, and time from injury.

A Numerical Rating Scale (NRS) was used to measure the participant's level of pain [11]. The scale ranges from 0 (indicating the absence of pain) to 10 (the most intense pain possible). Patients were asked to estimate their level of pain based on the numbers contained on the scale.

The Injury Severity Score (ISS) is one of the most widely used trauma scoring systems, which proved to be a good predictor of morbidity and mortality and a guide for the evaluation of trauma care [12]. The injury severity scoring is done by using the Trauma Chart to grade all injuries for a given patient. The ISS is obtained by summing the squares of the highest Abbreviated Injury Score (AIS) code in each of the three most severely injured regions. Injuries with AIS scores of 1 or 2 are minor and rarely cause death, those with scores of 3, 4, and 5 have increased severity, while injuries with AIS scores of 6 are considered incompatible with life. The ISS scores range from 0 to 75.

Pain catastrophizing was assessed using the Ukrainian version of the Pain Catastrophizing Scale (UA-PCS) [13], a translated and validated version of the original PCS developed by Sullivan et al. [14]. The PCS is a 13-item self-report inventory that measures the extent to which people catastrophize in response to pain. The 13 items of the PCS are rated on 0–4 Likert-type scales (0= not at all; 4= all the time) and items are summed to create a total score (items 1–13), rumination score (items 8–11), magnification score (items 6, 7, and 13), and helplessness score (items 1–5 and 12).

The Combat Exposure Scale (CES) was used to assess wartime stressors experienced by participants. Participants were asked to reply based on their exposure to various combat situations, such as firing rounds at the enemy and being on dangerous duty. The scale is a 7-item self-report measure with items rated on a 5-point frequency scale (1= "no" or "never" to 5= "26+ times" or "51+ times"), 5-point duration (1= "never" to 5= "7+ months"), or

45-point degree of loss (1= “none” to 45= “76% or more”) scale. The total CES score (ranging from 0 - 41) is calculated by using a sum of weighted scores, which can be classified into one of five categories of combat exposure ranging from “light” to “heavy” [15].

To screen for potential pre-existing traumatic events in a participant’s lifetime that could lead to changes in catastrophizing regardless of a current injury, we used The Life Events Checklist for DSM-5 (LEC-5) [16]. The scale is a 17-item self-report measure with items listing stressful events that happened to people during their whole life. For each event, the checklist offers 5 options indicating that: a) it happened to you personally; b) you witnessed it happen to someone else; c) you learned about it happening to a close family member or close friend; d) you were exposed to it as part of your job (for example, paramedic, police, or military); e) you’re not sure if it fits; or f) it doesn’t apply to you [16].

Since the LEC-5 scale does not yield a total score or composite score, we categorized participants’ previous traumatic life events into six groups: accidental violence, interpersonal violence, sexual violence, war-related violence, death/suffering events, and other types of stressful events. The classification was made according to the slightly modified classification published previously [17]. First, accidental violence included experience or witness of a natural disaster (e.g. flood, earthquake) (item 1 on LEC-5 scale), fire or explosion (item 2), transportation accident (e.g. car accident) (item 3), a serious accident at work, home, or during any activity (item 4), exposure to a toxic substance (item 5). Second, interpersonal violence included experience or witness of physical assault (e.g. being attacked, beaten up) (item 6) and assault with a weapon (e.g. threatening with firearms, a knife, being shot or stabbed) (item 7). Third, sexual violence included experience or witness of sexual assault (e.g. rape, attempted rape, made to perform any type of sexual activity through force or threat of harm) (item 8), and any other unwanted or uncomfortable sexual experience (item 9). Fourth, war violence included those who experience or witness combat or exposure to a warzone (in the military or as a civilian) (item 10) and captivity (e.g. being held hostage or as a prisoner of war) (item 11). Fifth, death/suffering events included experience or witness of life-threatening illness or injury (item 12), sudden human suffering (item 13), sudden violent death (item 14), sudden accidental death (item 15), or serious injury, harm or death participant caused to someone else (item 16). Sixth, comprised of any other very stressful event or experience (item 17).

Statistics

The percentage of missing data at the variable level was very low (from 0.7% to 4.4%). The normality of the data was tested with the Shapiro-Wilk test. Data were analyzed using descriptive statistics. For ordinal scales, we used a t-test, and for nominal (educational level, marriage status) we used the chi-square test. A chi-square test was also used to examine the association between gender and pre-existing traumatic events. Internal consistency of the UA-PCS was assessed with Cronbach’s alpha. Although there was a linear association between the two variables, we opted for Spearman coefficient calculations since the NRS scores are not continuous variables. Therefore, pairwise correlations and multiple regression analyses were carried out to investigate the contribution of NRS, CES, and ISS scores to the severity of catastrophizing coping behavior. For pairwise Spearman’s correlations,

we applied the Bonferroni multiple-comparisons correction procedure in which the type I error for each test equals the target overall type I error level (in our case 0.05) divided by the number of tests. Data from descriptive statistics were expressed as mean±standard deviation. Statistical significance was set at $P<0.05$. Analyses were performed using the SPSS version (IBM SPSS Statistics, Ver. 22, New York, USA).

Results

In our study, we included 135 participants. All participants were injured soldiers and almost all injuries (89%) happened on the frontline while the remaining 11% of injuries happened during attacks on the civilian infrastructure behind the front lines. Although it is considered that the major source of soldier attrition in recent conflicts are not battle injuries but more ordinary causes similar to those encountered in civilian life [18], in our sample all participants suffered injuries specific to war.

The sample comprised mostly men (n=114, 84.4%) with an average age of 36 years. Women participants (n=21, 15.6%) were significantly younger than men, with an average age of 31 years (t(133)=3.197, $P<0.0017$) (**Table 1**). Almost all participants had secondary and tertiary education (only one soldier, a man, had none or primary education). There were 48% men and 62% women with secondary school and 51% men and 38% women with voca-

Table 1. Demographic, combat exposure, catastrophizing, injury, and postoperative pain-related information are presented for men and women separately*

	Men	Women	Total
Gender	114	21	135
Age (years±SD)	36±7	30.9±4.9†	35.2±6.9
Education (no.)			
None or primary education	1	0	1
Secondary education	55	13	68
Vocational/tertiary	58	8	66
Marital status (no.)			
Married/cohabitating	98	13	111
Single	11	7	18
Divorced/separated	4	1	5
Widowed	1	0	1
Duration of the military service (months±SD)	2.8±0.4	2.5±0.5†	2.8±0.4
Time from injury (days±SD)	142.4±27.9	132.9±30.5	140.9±28.4
Pain NRS	7.7±1	7.7±0.8	7.7.±1
ISS	51.6±6.7	46.5±7.2†	50.8±7
Combat exposure scale (score±SD)	29.7±6.6	24.8±4.1†	28.9±6.5
PCS-T	44.4±5.3	43.9±4.7	44.4±5.2
PCS-R	13.7±2	13.8±1.8	13.7±2
PCS-M	10±1.5	9.6±1.4	10±1.5
PCS-H	20.8±2.8	20.5±2.7	20.7±2.8

*Abbreviations: SD – standard deviation, NAS – Numerical rating scale, ISS – Injury severity score, PCS-T – Total catastrophizing score, PCS-R – Rumination subscale, PCS-M – Magnification subscale, PCS-H – Helplessness scale.
†Significant difference between men and women at the P<0.001 level.

tional/tertiary education. The observed difference in education between men and women was not significant. The majority of the participants were married or cohabitating (n=111, 82%), 13% were single, while the remaining 4% were divorced, separated, or widowed. There were no differences between men and women regarding marital status (**Table 1**).

Duration of military service was longer for men participants (t(133)=3.935, *P*<0.001), while the time between injury and filling out the survey was the same in men and women. The NRS score was the same in both men and women, while the ISS and CES were higher in men compared to women [respectively, (t(133)=3.148, *P*<0.002 and t(132)=3.289, *P*<0.001]. The catastrophizing total score and scores of all three subscales were the same in men and women.

For the current study, the UA-PCS scale was found to have good to excellent internal reliability. Cronbach's alpha (internal reliability) for the UA-PCS was α=0.88 for a 13-item total score, α=0.84 for helplessness, α=0.56 for magnification, and α=0.69 for rumination subscale. The intraclass correlation coefficients of the agreement for the reproducibility were 0.87, 0.82, 0.54, and 0.82, respectively.

Multiple regression analyses showed no significant association between the PCS total score and demographic variables of age, gender, marital status, education, duration of military service, or time from injury (all *P*>0.05). This was expected since only 3.6% of the variance in the catastrophizing score (dependent variable) was accountable for the contribution of independent demographic variables. Likewise, none of the obtained correlations between the PCS subscales and the specified demographic variables were significant.

Pairwise Spearman's correlation showed a moderate positive correlation of catastrophizing scores with NRS score (r=0.551, *P*<0.0001), ISS score (r=0.525, *P*<0.0001), and weaker correlation with CES scale (r=0.365, *P*<0.0001). For the CES subscales weak positive correlation was observed for the rumination and magnification subscale, while the helplessness showed a moderate correlation with NRS, ISS, and CES scores (**Table 2**).

Table 2. Pairwise correlation among the measures of catastrophizing scores, combat exposure, pain, and injury severity*

	Correlation (r)					
Measure	1	2	3	4	5	6
1. PCS-T	-	-	-			
2. Pain NRS	0.551†	-	-			
3. ISS	0.525†	0.571†	-			
4. CES	0.365†	0.226†‡	0.292†	-		
5. PCS-R	0.775†	0.262†	0.335†	0.230†‡	-	
6. PCS-M	0.769†	0.381†	0.404†	0.322†	0.490†	-
7. PCS-H	0.879†	0.558†	0.518†	0.481†	0.481†	0.565†

*Abbreviations: PCS-T – Total catastrophizing score, NRS – Numerical rating scale, ISS – Injury severity score, CES – Combat exposure scale, PCS-R – Rumination subscale, PCS-M – Magnification subscale, PCS-H – Helplessness scale.
†Correlation is significant at the 0.001 level (two-tailed).
‡Correlation is not significant following Bonferroni correction at the 0.00238 level.

A multiple regression analysis was conducted to test out the contribution of combat exposure, postoperative pain, and injury severity to the severity of catastrophizing symptoms. Results showed that the NRS, ISS, and CES scores account for 43.4% (adjusted R square) of the variability of PCS scores. The overall regression was statistically significant (F(3.127)=34.3, *P*<0.001). Intercorrelations between PCS scores and NRS, ISS, and CES scores were significant (**Table 3**).

When we performed multiple regression separately for men and women participants, the results remained similar, except the intercorrelations between PCS scores and ISS and CES scores were not significant.

Table 3. Summary of regression analysis of catastrophizing (PCS score, dependent variable) explained by postoperative pain NRS, ISS, and CES scores*

Model	Unstandardized coefficient B	SE	Beta Coefficient	t-value	*P*
Pain NRS	1.709	0.423	0.326	4.043	0.000
ISS	0.236	0.060	0.319	3.926	0.000
CES	0.172	0.055	0.217	3.144	0.002

*Abbreviations: NRS – Numerical rating scale, ISS – Injury severity score, CES – Combat exposure scale, SD – standard deviation.

To control how previous stressful life events impacted participants' catastrophizing, we tested their previous exposure to traumatic life events. The full results of the LEC-5 are presented in **Table 4**. Since this scale does not provide a composite score and since it investigates different types of stressful events, we merged those events into six categories (**Table 5**).

Almost all of the participants in our sample, both men and women, reported experiencing previous stressful life events (**Table 4**). Most of them reported experiencing ≥1 traumatic event belonging to the category of accidental violence, war violence, death/suffering events, and other types of violence. Women participants did not experience interpersonal violence compared to 6.1% of men exposed to that kind of violence.

Sexual violence was mostly experienced by women. Almost 71% of women reported experiencing ≥1 sexual traumatic event, compared to less than 2% of men (*P*<0.001) (**Tables 4** and **5**). This difference accounts for a higher cumulative trauma burden in women.

In the group of women that experienced sexual violence, the average catastrophizing score was 45.1±4.8, while in the group that did not experience that kind of violence, the average score was 40.8±2.7. However, this difference was not significant, giving us only an indication for further investigation of the influence of traumatic sexual violence events on catastrophizing scores.

Discussion

In this study, we did not find a significant association between the PCS total score and demographic variables of age, gender, marital status, education, duration of military service,

Table 4. The number of pre-existing traumatic events covering the entire life (growing up as well as adulthood) of wounded soldiers study sample listed within the Life Events Checklist for DSM-5 (LEC-5)

Event	Happened to me, n (%)		Witnessed it, n (%)		Learned about it, n (%)		Part of my job, n (%)		Not sure, n (%)		Doesn't apply, n (%)		*P*
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
1. Natural disaster	0	0	0	2 (9.5)	11 (9.6)	3 (14)	0	0	22 (19)	6 (29)	81 (71)	11 (52)	0.006
2. Fire or explosion	10 (8.8.)	0	51 (45)	15 (71)	25 (22)	1 (4.8)	7 (6.1)	0	77 (68)	4 (19)	4 (3.5)	1 (4.8)	0.122
3. Transportation accident	0	0	8 (7)	0	53 (46)	10 (48)	5 (4.4)	3 (14)	26 (23)	6 (29)	22 (19)	2 (9.5)	0.230
4. Serious accident at work, home, or during recreational activity	3 (2.6)	0	33 (29)	4 (19)	42 (37)	11 (52)	1 (0.9)	2 (9.5)	18 (16)	4 (19)	16 (14)	0	0.047
5. Exposure to a toxic substance	0	0	2 (1.8)	0	8 (7)	0	1 (0.9)	0	47 (41)	10 (48)	56 (49)	11 (52)	0.692
6. Physical assault	30 (26)	3 (14)	70 (61)	15 (71)	7 (6.1)	3 (14)	4 (3.5)	0	3 (2.6)	0	21 (18)	0	0.387
7. Assault with a weapon	111 (97)	20 (95)	2(1.8)	1 (4.8)	0	0	0	0	0	0	0	0	0.633
8. Sexual assault	0	2 (9.5)	0	11 (52)	3 (2.6)	3 (14)	0	0	34 (30)	3 (14)	77 (68)	5 (24)	**0.000***
9. Other unwanted or uncomfortable sexual experience	0	0	0	3 (14)	0	5 (24)	0	0	33 (27)	1 (3.8)	81 (71)	12(57)	**0.000***
10. Combat or exposure to a war-zone	111 (97)	19 (95)	1 (1.8)	1 (61)	0	0	0	0	2 (1.8)	1 (4.8)	0	0	0.270
11. Captivity	6 (5.3)	3 (14)	96 (84)	16 (76)	10 (8.8)	1 (4.8)	1 (0.9)	0	1 (0.9)	1 (4.8)	0	0	0.326
12. Life-threatening illness or injury	52 (46)	8 (38)	36 (32)	9 (43)	13 (11)	4 (19)	4 (3.5)	0	1 (0.9)	0	5 (4.4)	0	0.659
13. Severe human suffering	21 (18)	3 (14)	74 (65)	14 (67)	14 (12)	2 (9.5)	2 (1.8)	0	0	0	1 (0.9)	1 (4.8)	0.644
14. Sudden violent death	20 (18)	1 (4.8)	67 (59)	18 (86)	17 (15)	2 (9.5)	0	0	2 (1.8)	0	7 (6.1)	0	0.207
15. Sudden accidental death	3 (2.6)	3 (14)	63 (55)	10 (48)	20 (18)	3 (14)	3 (2.6)	0	8 (7)	4 (19)	17 (15)	1 (4.8)	0.062
16. Serious injury, harm, or death you caused to someone else	97 (85)	15 (17)	12 (11)	4 (19)	3 (2.6)	1 (4.8)	0	0	0	1 (4.8)	2 (1.8)	0	0.109
17. Any other very stressful event or experience	7 (6.1)	2 (9.5)	52 (46)	11 (52)	35 (31)	2 (9.5)	1 (0.9)	4 (19)	15 (13)	0	4 (3.5)	2 (9.5)	**0.000***

Table 5. The cumulative number of participants experiencing at least one stressful event listed under each of six categories describing pre-existing traumatic events in soldiers' lifetime. The data from The Life Events Checklist for DSM-5 (LEC-5) are grouped into six categories

	Happened to, witnessed by, or learned about it, or part of the job		Not sure / doesn't apply	
Gender	Men	Women	Men	Women
Accidental violence	107 (94.7%)	21 (100%)	6 (5.3%)	0
Interpersonal violence	7 (6.1%)	0	107 (93.9%)	21 (100%)
Sexual violence	15 (14.2%)	15 (71.4%)	99 (86.8%)	6 (28.6%)
War violence	114 (99.1%)	20 (97.2%)	0	1 (4.8)
Death/suffering events	114 (100%)	21 (100%)	0	0
Other	95 (81.6%)	19 (90.5%)	19 (18.4%)	2 (9.5%)

or time from injury. Only 3.6% of the variance in the catastrophizing scores was accountable for the contribution of independent demographic variables. We found a moderate positive correlation between catastrophizing scores (including all the subscales) with pain NRS, ISS, and CES scores. The pain NRS, ISS, and CES scores account for 43.4% of the variability of PCS scores.

Pain catastrophizing is one of the important psychosocial factors that have become increasingly recognized as an important moderator and determinant of the pain experience [2]. Our study has confirmed a positive association between catastrophizing and postoperative pain. Previous work across numerous samples consistently demonstrates a positive association between catastrophizing and postoperative pain [3, 5, 19]. Catastrophizing seems to exacerbate the individual's experience of pain, creating a risk for heightened pain reports over time [20, 21].

Compared to those previous studies, our sample consisted of wounded soldiers treated in tertiary care due to the extensive polytrauma and requiring repeated surgical interventions. To our knowledge, our study is the first one describing the association between catastrophizing and postoperative pain in injured soldiers. This is important since war-related injuries account for significant pain and suffering. In our study, trait measures of pain catastrophizing adequately capture variance in postoperative pain report because the referent event was close to the moment of measurement. The only similar study described the experiences of the US service member returning from the military operation in Iraq and Afghanistan [10]. Those soldiers were engaged in effective pain-coping strategies [10] that can be defined as a person's cognitive and behavioral efforts to reduce, minimize, master, or tolerate the internal and external demands that exceed a person's resources [22]. Soldiers showing catastrophizing coping strategies are more likely to develop chronic pain, depression, PTSD, alcohol dependence, and somatization-like illnesses [9].

The specific sample in our study allowed us to additionally investigate the association between catastrophizing and war-injury severity and combat exposure. Both measures showed a positive correlation with catastrophizing scores, while the weakest correlation was observed for combat exposure. Interestingly, the helplessness subscale showed the highest correlation with postoperative pain, injury severity, and combat exposure scores. The combined contribution of those variables accounted for a large proportion of the variance in the catastrophizing scores (43.4%). So those variables can act as potential predic-

tors of postoperative pain, underscoring the importance of catastrophizing as a coping strategy in our sample of wounded soldiers. These results add to the importance of combat exposure to catastrophizing symptoms. In previous studies, the soldiers who experienced the most intense combat had almost 4 times the risk of PTSD compared with those who did not experience combat stressors [8].

Surprisingly, our results show that there were no differences in catastrophizing scores between men and women from our sample. This is not consistent with the findings of others that repeatedly confirmed that women were scoring higher than men on the catastrophizing scale in clinical and experimental research [14, 23, 24]. The difference in age between men and women in our sample likely cannot explain this result, since the catastrophizing coping style seems to emerge at a young age under the influence of parents [25]. Despite the fact that pain catastrophizing has traditionally been conceptualized and measured as a trait-like or dispositional variable, a few recent studies have assessed it in a state-like, situation-specific manner [2]. The context of catastrophizing may be responsible for erasing the gender differences in our sample. Gender may have less of an effect on catastrophizing in severely wounded soldiers compared to the general population examined in previous studies. In the case of wounded soldiers, catastrophizing probably does not have desirable interpersonal consequences in terms of signaling their distress to others and seeking help in coping with pain.

It is also worth emphasizing that we did not find an association between catastrophizing and education levels. In previous studies, pain catastrophizing was associated with less formal education [26], and in our sample, this was not the case. The reason for this discrepancy is probably the lack of participants with none or primary education in our sample.

To avoid the influence of potential pre-existing stressful life events experienced by patients in our sample we tested its influence by controlling it with the LEC-5 checklist. We found that the prevalence of trauma exposure amongst participants in this study was significantly higher than in prior research, with 97% of participants having been exposed to ≥1 traumatic event. Previous prevalence studies have found that 70.4% of people worldwide had experienced ≥1 traumatic event in their lifetime [27]. In the same study, Ukraine was the highest-ranking county, with 84.6% of study participants experiencing ≥1 traumatic event. Our results can be attributed to the specific nature of our sample since Ukrainian people have been exposed to acts of Russian aggression since 2014 [28]. Regardless of high levels of previous exposure to the stressful life events in our sample, these events did not influence catastrophizing scores. The important finding in our sample was the higher exposure to sexual violence among women participants. Although women participants with previous exposure to sexual violence had higher catastrophizing scores compared to those without such experience, this difference was not significant, giving us only indications for possible further studies on the influence of previous sexual traumatic events on catastrophizing scores. This is important because it was shown in previous studies that responders who reported experiencing sexual violence were 4.4. times more likely to report lifetime suicide attempts and 5.8 times more likely to report suicidal ideation [17].

Our study has several limitations. First, because our results are correlational, it is impossible to establish a causal link between catastrophizing and other observed factors like injury severity or level of combat exposure. Catastrophizing can lead to higher degrees of pain or be a result of severe pain, injury severity, or level of combat exposure. However, there are valid conceptual and empirical arguments for saying that catastrophizing and pain are different but associated concepts [29]. From previous studies, we can conclude that catastrophizing predicts future pain, emotional distress, and disability after controlling for current levels of pain intensity [29, 30]. If the concept of catastrophizing is identical to the pain phenomenon, the effect of controlling pain should have made the contribution of catastrophizing negligible. Second, in our study, we were not able to control for depression, which is, after catastrophizing, the second most important psychosocial contributor to pain and pain-related disability. This is important since the prevalence of depression in the military is higher than in the general population because military life involves significant stressors like deployment, combat, and relocations [31].

Our results suggest that more attention to reducing postoperative pain is needed in wounded soldiers high in catastrophizing thinking. Identifying soldiers high on catastrophizing thinking could lower their risk of developing PTSD and improve combat outcomes. Choosing soldiers low in catastrophizing thinking for intense combat exposure could lead to lower casualties, less human suffering, and lower healthcare costs [8].

The possible steps to reduce postoperative pain and suffering, improve quality of life, and return to duty in injured soldiers during combat include immediate and aggressive treatment of catastrophizing and other factors known to exacerbate pain. Treatment of catastrophizing includes validation of the individual's experience of pain and acknowledgment that pain creates a foundation for improved coping. Treatment plans should be tailored to the wounded soldiers taking into account comorbidities [10].

In summary, our findings add to a large body of literature suggesting an association between catastrophizing and postoperative pain but in a specific sample of injured soldiers. Since the injured soldiers were young and healthy individuals before suffering major war-related polytrauma, they are distinct from the population described in civilian studies on catastrophizing. Thus, this study provides a rare insight into the association between catastrophizing, sustained injuries, combat exposure, and postoperative pain. For the first time, we show the association between catastrophizing coping strategies and injury severity and combat exposure. However, the contribution of these factors to the severity of catastrophizing symptoms is moderate. The results of the present study reveal a lack of gender differences in catastrophizing. These findings underscore the importance of early detection of catastrophizing and may have important implications for postoperative pain assessment and treatment in military personnel.

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