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Research Paper

Predictors of a PTSD diagnosis following the Beirut port explosion: Comparing the direct and indirect effects of exposure to trauma

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ABSTRACT

Objective: The Beirut Port explosion on August 4, 2020, led to widespread devastation and significant psychological impacts, including the development of psychological disorders like PTSD. This study investigates the predictors of PTSD following this event, focusing on the differences between direct and indirect exposure to trauma

Methods: The sample consisted of 743 Lebanese participants. The DSM-5 revised criteria for indirect exposure, including secondary traumatic stress, are considered. Measures included the PCL-5, DASS-21, RFQ-8, and CD-RISC-10.

Results: The study confirms that both direct and indirect exposures contribute to PTSD development, with direct exposure linked to more severe PTSD symptoms. It also highlights the importance of demographic factors like gender and age in PTSD prevalence, with women and younger individuals more susceptible to PTSD in indirect exposure scenarios.

Conclusions: Protective factors like mentalizing and resilience are discussed, revealing their complex relationship with trauma exposure. Our findings have significant implications for developing targeted prevention and intervention strategies for different trauma exposure types and subpopulations.

1. Introduction

On the 4th of August 2020, Beirut was shaken by a blast, as 2700 kg of ammonium nitrate exploded in a warehouse at the Beirut Port, devastating the city center (Rigby et al., 2020). The explosion led to the death of 218 individuals, wounding more than 6000 others, and causing billions of dollars in material damage leaving more 300,000 homeless (Maamari et al., 2020). One cannot report on the loss of lives and belongings without discussing the psychological impact of this disaster on the community and country as a whole (Lee et al., 2020). The literature consistently highlighted mild-to-moderate levels of psychological distress following such events, with a significant minority of individuals later developing psychological disorders, such as anxiety, depression, or post-traumatic stress disorder (deRoon-Cassini et al., 2010; Norris et al., 2002).

1.1. Direct versus indirect exposure to trauma

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013) reviewed the definition of a traumatic event (Criterion A) and modified the criteria relating to indirect exposure, to include exposure to details of the trauma as part of someone's professional activities. This has been coined as secondary traumatic stress as it relates to the emotional distress of hearing about the traumatic event rather than experiencing it firsthand. This comes in line with the literature highlighting traumatic symptoms in individuals who are indirectly exposed to traumatic details, despite not meeting the threshold for a diagnosis of PTSD (Cieslak et al., 2013; Sprang et al., 2019).

The literature on trauma converges in finding that the severity of post-traumatic stress disorder (PTSD) symptoms is significantly correlated to the type of exposure to the event (Eytan et al., 2004; Koenen et al., 2002; Neuner et al., 2004). More specifically, both direct and indirect exposure to a traumatic event have been found to contribute to the development of PTSD (Hansen et al., 2017; Marshall et al., 2007). However, indirect exposure to trauma was found to be correlated with a lower severity of PTSD symptomatology when compared with direct exposure to the same trauma (Neria et al., 2007; Pietrzak et al., 2014;

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Sprang et al., 2019; Sprang and Steckler, 2023).

Interestingly, Sprang and Steckler (2023) found that in a sample of individuals indirectly exposed to trauma, there was a predominance of intrusion–arousal/reactivity symptoms. These findings were found to be important given that, if continuously experienced, the intrusive thoughts and the re-experiencing of the trauma could lead to decreased emotion regulation, thus predisposing individuals to potential psychopathology (Smith and Alloy, 2009; Tominaga et al., 2020). In other words, individuals indirectly exposed to trauma are also at risk of developing PTSD (Elwood et al., 2011; Ortlepp and Friedman, 2002). It is therefore crucial to explore possible precipitating factors as well as protective factors of trauma, in the cases of both, direct and indirect exposure to trauma (May and Wisco, 2016). This will pave the way for the development of refined and individualized prevention and intervention plans depending on the subpopulation and on the type of trauma exposure.

1.2. Demographic predictors of PTSD

Investigating predictors of PTSD in demographic factors within adult samples, studies consistently found that more severe exposure, proximity to the traumatic event, female gender, and prior psychiatric diagnoses, were significant predictors of an increased likelihood of developing PTSD in adults (Elwood et al., 2009; Heron-Delaney et al., 2013; Norris et al., 2002; Shih et al., 2010; Tohme et al., 2024). Honing in on gender differences in PTSD prevalence, the literature points to females being at a higher risk of developing symptoms than males (Ditlevsen and Elklit, 2010; Farhood et al., 2016). In a similarly tragic event in Toulouse France, an Ammonium Nitrate factory exploded in 2001. Investigating the mental health repercussions of this event, Rivière et al. (2008) found that 19 % of women and 8 % of men in the immediate proximity of the factory met the threshold for a PTSD diagnosis, whereas individuals who resided further away from the explosion site scored lower on PTSD symptomatology, 8 % and 2 % for women and men respectively. In an attempt to elucidate such gender differences, scholars posited that females tend to have a lower threshold to trauma, whereby they might be more likely than males to perceive distressing and threatening events as traumatic (Chung et al., 2018; Marthoenis et al., 2019). Similarly, and in line with other studies (Craig and Sprang, 2014; Thompson et al., 2014), female gender was found to predict higher distress scores than male, leading to significant impairment in daily lives (i.e. intrusion symptoms), despite not meeting the threshold for a PTSD diagnosis, in indirectly exposed groups.

Differentiating PTSD predictors between those directly exposed to the trauma and those indirectly exposed, age was found to be negatively correlated with PTSD symptomatology in the group of individuals indirectly affected by trauma. It was hypothesized that, with time, people learn to find adaptive ways of coping with indirect trauma, thus increasing self-efficacy and confidence in one's ability to face adversity (Sprang and Steckler, 2023).

Exploring pre-trauma risk factors of PTSD, a multi-country World Health Organization study pinpointed the importance of accounting for a history of having PTSD and/or other mental health difficulty as these factors were found to be the most significant predictors of a PTSD diagnosis following a recent trauma (Kessler et al., 2014). This is in line with the sensitization hypotheses positing a decrease in the sensitivity threshold to stressors following prior psychiatric diagnosis, leading to more susceptibility to subsequent stressors, especially when faced with recurrent stressful events (Breslau, Peterson, and Schultz, 2008; Post and Weiss, 1998). More specifically, people diagnosed with depressive or anxiety disorders were more likely to recall negative details of a traumatic events than those with no prior diagnosis, which constitute a risk factor to the development of traumatic symptomatology (Schraedley, Turner, and Gotlib, 2002).

Lastly, it is important to account for an additional factor, having lost someone because of a traumatic event, when assessing PTSD. Indeed, Nickerson et al. (2014) highlighted the importance of identifying differential symptomatology between PTSD and grief, as the found specific symptom patterns for the group experiencing trauma and grief combined, compared to those solely experiencing trauma. The authors argue for revised guidelines for working with this population.

1.3. Protective factors: Mentalizing and resilience

The American Psychological Association (2018) defined resilience as the "process and outcome of successfully adapting to difficult or challenging life experiences, especially through mental, emotional, and behavioral flexibility and adjustment to external and internal demand." Previous studies have pinpointed its moderating effect, modifying the relation between trauma exposure and mental health difficulties, such as depression or anxiety (Friborg et al., 2006; Pietrzak et al., 2010). However, it is important to mention that the association between resilience and trauma was found to be influenced by other factors, such as exposure to traumatic events that was found to promote resilience for some, while demoting it for others (Agaibi and Wilson, 2005; Wingo et al., 2010). For instance, a study conducted following the Fukushima Daiichi Nuclear Power Plant explosion found that resilience was negatively correlated with the impact of trauma (Maeda and Oe, 2017), putting individuals at a higher risk of developing mental health difficulties, reaching the threshold for PTSD (Rainey et al., 2014; Scali et al., 2012; Snyder and Heinze, 2005). In other words, it can be argued that changes in resilience scores could play a mediating role between trauma exposure and trauma-related psychopathology (Fossion et al., 2013; Wu et al., 2021).

Another protective factor against trauma is mentalizing, the "mental process by which an individual implicitly and explicitly interprets the actions of himself and others as meaningful on the basis of intentional mental states such as personal desires, needs, feelings, beliefs, and reasons" (Bateman and Fonagy, 2004, p. xxi). Mentalizing was theorized to influence one's ability to emotionally work through the trauma thus playing a protective role in facing trauma. Studies have concluded that genuine mentalizing was positively correlated with healthy emotion regulation (i.e. working through the emotional reactions following a traumatic event) and adaptive coping in facing adversity (Fonagy and Bateman, 2016; Greenberg et al., 2018; Luyten et al., 2012). Specifically, higher mentalizing was found to facilitate individuals' awareness of emotional difficulties and stressors, thus playing a central role in overcoming the hardship following traumatic events (Fonagy and Bateman, 2016; Stein, 2006).

Similarly to resilience research, it was found that trauma-related events could reduce mentalizing, possibly also weakening resilience, rendering individuals at an increased risk of resorting to unhealthy emotion regulation strategies and developing traumatic symptomatology (Allen, 2012; Fonagy and Bateman, 2016; Lemma and Levy, 2012). These deficits in mentalizing could be temporary and manifested during, or right after, the traumatic event, thus playing the role of a defense mechanism. At times, these deficits could become more pervasive, in instances of cumulative trauma, leading to more long-lasting emotion dysregulation (Ritschel et al., 2021), in which case, it is common to see mentalizing deficits and biases in a person's overall interpretation of emotional cues, perceiving others as threatening as a result of continuous unresolved trauma (Sharp et al., 2012). Less is known about the protective power of resilience and mentalizing when comparing samples based on the type of exposure to the traumatic event.

1.4. The current study

The Lebanese population has been and still is subjected to a multitude of traumatic and potentially traumatic events, starting, in its modern history, from the Lebanese Civil War between 1975 and 1990, through a number of smaller armed conflicts, to the more recent economic and financial crises ongoing since 2019 leading to a collapse in

the economy, the COVID-19 pandemic and its subsequent lockdowns, culminating in the Beirut Port explosion in 2020 and the current war in Gaza and south Lebanon. A recent meta-analysis exploring the prevalence of PTSD in Lebanon highlighted the importance of accounting for cultural factors in understanding PTSD symptoms (El Hajj, 2021). Indeed, Lebanon has been described as a collectivistic culture, whereby it is crucial not to solely account for direct exposure, but also explore the role of collective loss and community distress, in other words collective trauma, which could influence PTSD symptomatology (Bosqui, 2020; Kerbage and Elbejjani, 2021).

Furthermore, a study found no significant differences in PTSD scores between groups of people directly and indirectly exposed to a tsunami in India. It was posited that, as a collectivistic culture, despite the indirectly exposed group not experiencing the tsunami themselves, they were still exposed to the damage and loss, and equally feared the reoccurrence of trauma as those directly experiencing the tsunami, which would explain that both groups scored highly on the PTSD scale (Kar et al., 2014). In Lebanon, a systematic review focusing on PTSD among the Lebanese population and Syrian refugees revealed that PTSD is multifactorial in nature, often involving war-related events. While no significant difference were found in PTSD rates between males and females, results revealed female gender as one of several risk factors for developing PTSD, along with marriage, older age, and exposure to war (El Husseiny et al., 2023).

Based on the above, the aims of this study were to 1) compare the prevalence of mental health symptomatology across the directly and indirectly trauma exposure groups according to the DSM-5 guidelines, and 2) explore predictors of PTSD symptomatology in demographic factors namely gender, age, relationship status, having been previously diagnosed with a psychological disorder, knowing of people killed or injured, having moved houses, mentalizing, and resilience, comparing individuals having been directly exposed with those having been indirectly exposed to the Beirut Port explosion.

2. Method

2.1. Participants

The study included a total of 743 participants, encompassing 504 individuals (67.8 %) directly exposed to the Beirut Port explosion and 239 participants (32.2 %) indirectly exposed, based on Criterion A for PTSD (i.e., direct exposure, witnessing the trauma, learning that a relative or close friend was exposed to the trauma, or indirect exposure as part of one's professional duties). Data focusing on solely on individuals directly exposed to the explosion was analyzed and published in a previous study (Tohme et al., 2024). Gender distribution showed 109 (14.7 %) male participants and 634 (85 %) female participants. The average age of participants was 27.4 years (SD = 7.3). Approximately 18.2 % of participants reported a diagnosis of a psychological disorder, while 81.8 % did not report any. Concerning property loss, 27.7 % of participants reported experiencing this, with 31.3 % in the direct exposure group and 20.3 % in the indirect exposure group reporting such losses. A significant portion of the sample (66.9 %) reported experiencing serious injury or having someone close killed due to the Beirut Port explosion. Demographic details are presented in Table 1. The Two exclusion criteria were being outside Lebanon at the time of the explosion and being under the age of 18 at the time of the explosion.

Table 1
Demographic Characteristics of the Sample.

		Direct Exposure N (%)	Indirect Exposure N (%)	Total N (%)
Gender				
	Male	76 (15 %)	33 (13.7 %)	109 (14.7 %)
	Female	428 (84.8 %)	206 (85.5 %)	634 (85 %)
Age		Mean 27.8 SD 7.7	Mean 26.6 SD 6.5	Mean 27.4 SD 7.3
Marital Status				
	Single	230 (45.5 %)	124 (51.5 %)	354 (47.5 %)
	In a relationship	129 (25.5 %)	47 (19.5 %)	176 (23.6 %)
	Married	134 (26.5 %)	68 (28.2 %)	202 (27.1 %)
	Divorced	12 (2.4 %)	2 (0.8 %)	14 (1.9 %)
Education level	Secondary	6 (1.2 %)	5 (2.1 %)	11 (1.5 %)
	BA	273 (54.1 %)	125 (51.9 %)	398 (53.4 %)
	Masters	196 (38.8 %)	95 (39.4 %)	291 (39 %)
	PhD	17 (3.4 %)	9 (3.7 %)	26 (3.5 %)
	Other	13 (2.6 %)	7 (2.9 %)	20 (2.7 %)
Previous Psychiatric Diagnosis	Yes	97 (19.2 %)	39 (16.2 %)	136 (18.2 %)
	No	408 (80.8 %)	202 (83.8 %)	610 (81.8 %)
Property loss	Yes	158 (31.3 %)	49 (20.3 %)	207 (27.7 %)
	No	347 (68.7 %)	192 (79.7 %)	539 (72.3 %)
Moved out	Yes	50 (9.9 %)	12 (5 %)	62 (8.3 %)
	No	455 (90.1 %)	229 (95 %)	684 (91.7 %)
Serious injury/ killed	Yes	328 (65 %)	171 (71 %)	499 (66.9 %)
	No	177 (35 %)	70 (29 %)	247 (33.1 %)

2.2. Measures

The *PTSD Checklist for DSM-5* [PCL-5] (Blevins et al., 2015) is a 20-item self-report questionnaire assessing PTSD symptoms experienced by individuals at least a month following exposure to a traumatic event. Individuals obtain a total severity score ranging between 0 and 80. The authors suggested a cut-off score of 33 for a probable diagnosis of PTSD (Weathers et al., 2018), while subsequent validation studies have recommended a variety of cutoff scores ranging from as low as 28 to as high as 37 (Ashbaugh et al., 2018; Blevins et al., 2015; Ghazali and Chen, 2018; Salleh et al., 2021). Given that there are no recommendations specific to the population targeted for this study, we decided to use the initial cut-off score of 33. The PCL-5 is reported to possess high indices of reliability, convergent and discriminant validity (Blevins et al., 2015; Sveen et al., 2016), with a Cronbach alpha of 0.93 for this study.

The *Depression Anxiety Stress Scale* [DASS-21] (Lovibond AND Lovibond, 1995) is a 21-item self-report scale measuring depression, anxiety, and stress symptoms. Participants are provided with a list of items such as "I couldn't seem to experience any positive feelings at all," and are asked to rate their level of agreement on a 3-point Likert scale with 0 = Did not apply to me at all, and 3 = Applied to me very much, or most of the time. Each of the depression, anxiety, and stress subscales contain 7 items, with higher scores for each indicating higher depression/anxiety/stress, under the following categories: Normal, mild, moderate, severe, and extremely severe. The DASS-21 was shown to have good psychometric properties with an overall Cronbach alpha of $\alpha = 0.96$, indicating excellent internal consistency (Thiyagarajan et al., 2022), with a Cronbach alpha of 0.94 for this study

The *Reflective Functioning Questionnaire* [RFQ] (Fonagy et al., 2016) is an 8-item self-report scale measuring mentalizing capacities. Items are

scored on a 7-point Likert scale ranging between 1, Strongly Disagree, and 7, Strongly Agree. Scores are computed based on 2 subscales, the 'Certainty about Mental States' (RFQc; "I always know what I feel") and the 'Uncertainty about Mental States' (RFQu; "People's thoughts are a mystery to me"), with lower scores on the RFQc and higher scores on the RFQu reflecting deficits in mentalizing, hypermentalizing and hypomentalizing respectively. The long version of the RFQ has been found to have good internal reliability (Cronbach's $\alpha = 0.82$) and convergent construct validity, correlating positively with measures of allied (but not equivalent) constructs, such as cognitive empathy, $r = 0.48$, $p < .001$ (Fonagy et al., 2016). Fonagy et al. (2016) recommend the use of the RFQ-8 as a screening tool for research purposes, showing satisfactory reliability for this study with a Cronbach alpha of 0.61 for RFQc and 0.67 for RFQu.

The *Connor-Davidson Resilience Scale* [CD-RISC-10] (Campbell-Sills and Stein, 2007; Connor and Davidson, 2003) is a 10-item self-report questionnaire assessing resilience. Items ("I am able to adapt when changes occur") are scored on a 4-point Likert scale ranging from 0, not true at all, to 4, true nearly all the time. Total scores are obtained by summing all scores, yielding a total score ranging between 0 and 40, with higher scores reflecting greater resilience. The CD-RISC-10 has shown convergent validity with other resilience measures (Joyce et al., 2018; Sarubin et al., 2015), with a Cronbach alpha of 0.93 for this study.

Demographic questions were also asked to collect data about gender, age, relationship status, having lost someone/property as a result of the explosion, and having a previous psychiatric diagnosis.

2.3. Procedure

The authors secured ethical approval to conduct this study from the Institutional Review Board of the university (LAU.SAS.PT3.4/Sep/2020). An online survey using Google forms was circulated via social media platforms such Whatsapp, LinkedIn, and Instagram, with the generous help of several active members of these platforms. Data was collected between September 7th 2020 and October 27th 2020, between 5 and 12 weeks after the explosion. Informed consent was obtained at the start of the questionnaire, highlighting the possibility to withdraw from the study at any point.

2.4. Data analysis

The study used IBM SPSS Statistics version 29 for a comprehensive examination of participant data, encompassing demographics, mental health prevalence, and the impact of direct and indirect exposure of the Beirut port explosion. Descriptive statistics provided an initial overview of the participant cohort. To gauge the psychological impact of trauma, the Depression, Anxiety, and Stress Scale (DASS-21) and Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) were administered. Prevalence rates for depression, anxiety, and stress were determined using established category cutoffs, shedding light on post-traumatic mental health challenges.

Gender-based analyses, employing means and standard deviations, allowed for a nuanced examination of psychological distress within both direct and indirect exposure groups. Linear regression models were applied to identify predictors of PCL-5 scores, exploring relationships between demographic variables, exposure status, and other characteristics. This advanced analysis provided insights into the complex factors influencing posttraumatic stress severity.

Finally, four linear regression models were conducted to assess the relationship between nine predictors (four continuous variables: Age, RFQu, RFQc, Resilience; and five categorical variables: Gender, Relationship status, being previously diagnosed with a psychological disorder, Knowledge of people killed/injured, Moved house) and the PCL-5 score. The analysis aimed to distinguish between clinically significant (score >33) and not significant (score <33) PCL-5 outcomes in both direct and indirect exposure scenarios.

3. Results

The initial exploration of the study focused on assessing the prevalence of depression, anxiety, and stress using the DASS-21, along with the examination of posttraumatic stress symptoms through the PCL-5. Table 2 includes the mental health conditions explored, categorized by severity levels, to provide a deeper understanding of the prevalence of these conditions among participants with direct and indirect exposure.

In the case of depression, we observe that a higher number of participants reported experiencing higher levels of severity in the directly exposed group, namely 175 females and 19 males fell into the "Extremely Severe" category, which shows a significant burden of depressive symptoms among these participants. Similarly, when examining anxiety in the directly exposed group, we found that a higher number of participants reported experiencing anxiety symptoms across all severity levels, with 93 females and 6 males scoring in the "Extremely Severe" category. Regarding stress, we observe that a considerable number of participants experienced stress-related symptoms across all severity levels for the direct group, with 145 females and 18 males in the "Extremely Severe" category.

Lastly, 189 females and 30 males reported clinically significant scores in the directly exposed group by scoring above the clinically significant threshold of the PCL-5, indicating the presence of PTSD symptoms. (Table 2).

Table 3 presents the means and standard deviations for key study variables stratified by gender and exposure categories. Findings revealed significant differences between males and females, shedding light on distinct patterns of psychological distress namely depression, anxiety, stress, mentalization and resilience. In the direct exposure group, females exhibited significantly higher scores on the PCL-5, indicating elevated posttraumatic stress levels compared to males. Additionally, female participants demonstrated greater resilience, as evidenced by higher scores on the CD-RISC-10. Notably, gender differences were also observed in depression, anxiety, and stress levels, emphasizing the nature of psychological responses to direct trauma. In the indirect exposure group, gender disparities persisted, with females again showing higher PCL-5 scores, signifying increased psychological distress. While the resilience difference, as measured by CD-RISC-10, was marginally significant, it highlighted the enduring impact of gender on coping mechanisms in the aftermath of trauma. Similarly, to the direct exposure group, indirect exposure conditions revealed gender-related variations in depression, anxiety, and stress levels.

In the analysis of clinically significant PCL-5 scores (scores >33, Table 4), Model 1 (data analysis section above) focused on direct exposure. This model, based on 210 observations, demonstrated statistical significance ($F(9, 200) = 3.99$, $p < .0001$), suggesting that at least one independent variable significantly impacted the dependent variable (PCL-5). The model explained approximately 15.24 % of the variance in the PCL-5 scores. Importantly, age ($\beta = -0.11$, $p = .18$), gender ($\beta = 0.99$, $p = .603$), and relationship status ($\beta = -1.38$, $p = .305$) did not show significant predictive power. Interestingly, knowing people who were killed or injured showed a significant negative association with PCL scores ($\beta = -2.36$, $p = .042$). However, RFQu was identified as a significant positive predictor, indicating that higher scores in this dimension are linked to elevated PCL-5 scores ($\beta = 3.26$, $p = .003$).

Conducted on a dataset of 79 observations examining clinically significant PCL-5 scores with indirect exposure, Model 2 did not exhibit statistical significance ($F(9, 69) = 1.21$, $p = .3016$). The explained variance (R-squared) was approximately 13.66 %, indicating a limited impact of the independent variables on the PCL-5 scores. Age showed a negative association with PCL-5 scores ($\beta = -0.32$, $p = .042$), suggesting that as individuals' age increases, their PCL-5 scores tend to decrease. Additionally, having a previous diagnosis was associated with higher PCL-5 scores ($\beta = 5.36$, $p = .04$), while no significant predictive relationship was found for gender, relationship status, or other predictors in this exposure group.

Table 2
Prevalence of Depression, Anxiety, and Stress (DASS) and PCL-5 per Category Cutoffs.

		Direct Exposure N (%)		Indirect Exposure N (%)		Total N (%)	
		Male	Female	Male	Female	Male	Female
Depression	Normal	22 (22.9 %)	74 (77.1 %)	11 (23.4 %)	36 (76.6 %)	33 (23.1 %)	110 (76.9 %)
	Mild	5 (11.9 %)	37 (88.1 %)	3 (15 %)	17 (85 %)	8 (12.9 %)	54 (87.1 %)
	Moderate	16 (16.8 %)	79 (83.2 %)	6 (13 %)	40 (87 %)	22 (15.6 %)	119 (84.4 %)
	Severe	14 (18.2 %)	63 (81.8 %)	6 (16.7 %)	30 (83.3 %)	20 (17.7 %)	93 (82.3 %)
	Extremely severe	19 (9.8 %)	175 (90.2 %)	7 (7.8 %)	83 (92.2 %)	26 (9.2 %)	258 (90.8 %)
Anxiety	Normal	39 (22.4 %)	135 (77.6 %)	19 (20.7 %)	73 (79.3 %)	58 (21.8 %)	208 (78.2 %)
	Mild	10 (14.7 %)	58 (85.3 %)	6 (12.0 %)	44 (88.0 %)	16 (13.6 %)	102 (86.4 %)
	Moderate	13 (13.3 %)	85 (86.7 %)	6 (12.8 %)	41 (87.2 %)	19 (13.1 %)	126 (86.9 %)
	Severe	8 (12.3 %)	57 (87.7 %)	1 (4.2 %)	23 (95.8 %)	9 (10.1 %)	80 (89.9 %)
	Extremely severe	6 (6.1 %)	93 (93.9 %)	1 (3.8 %)	25 (96.2 %)	7 (5.6 %)	118 (94.4 %)
Stress	Normal	24 (27.9 %)	62 (72.1 %)	15 (25.4 %)	44 (74.6 %)	39 (26.9 %)	106 (73.1 %)
	Mild	10 (18.2 %)	45 (81.8 %)	0 (0.0 %)	27 (100.0 %)	10 (12.2 %)	72 (87.8 %)
	Moderate	12 (9.7 %)	112 (90.3 %)	4 (9.1 %)	40 (90.9 %)	16 (9.5 %)	152 (90.5 %)
	Severe	12 (15.8 %)	64 (84.2 %)	8 (16.7 %)	40 (83.3 %)	20 (16.1 %)	104 (83.9 %)
	Extremely severe	18 (11.0 %)	145 (89.0 %)	6 (9.8 %)	55 (90.2 %)	24 (10.7 %)	200 (89.3 %)
PCL-5	Below 32	46 (16.1 %)	239 (83.9 %)	25 (16.0 %)	131 (84.0 %)	71 (16.1 %)	370 (83.9 %)
	Clinically significant (score >33)	30 (13.7 %)	189 (86.3 %)	8 (9.6 %)	75 (90.4 %)	38 (12.6 %)	264 (87.4 %)

Note. PCL-5 = PTSD Checklist for DSM–5.

Table 3
Means and Standard Deviations for the Study Variables by Gender for both the direct and indirect exposure.

	Variables	Male Mean (SD)	Female Mean (SD)	*t* value	df	*p* value
Direct Exposure	PCL-5	27.30 (17.41)	31.88 (16.56)	2.127	100.576	.036*
	CD-RISC-10	24.39 (10.72)	31.60 (11.30)	5.357	106.766	.001***
	DASS-Depression	3.04 (1.56)	3.53 (−1.51)	−2.55	101.509	.012*
	DASS-Anxiety	2. 11 (1.35)	2.8 (−1.54)	−4.047	112.37	.001***
	DASS-Stress	2.87 (1.59)	3.43 (−1.42)	−2.9	97.412	.005**
	RFQc	0.74 (0.57)	0.8 (−0.63)	- 0.797	109.916	.42
	RFQu	0.71 (0.69)	0.81 (−0.64)	−1. 133	99.751	.26
Indirect Exposure	PCL-5	19.42 (19.34)	28.66 (15.71)	−2.609	39.054	.013*
	CD-RISC-10	28.18 (13.02)	32.8 (10.26)	−1.966	38.627	.056
	DASS-Depression	2.85 (1.58)	3.52 (1.51)	−2.274	41.863	.028*
	DASS-Anxiety	1.76 (1.06)	2.43 (1.38)	−3.236	51.2	.002**
	DASS-Stress	2.7 (1.67)	3.17 (1.49)	−1.534	40.645	.133
	RFQc	0.89 (0.64)	0.72 (0.58)	1.431	40.827	.16
	RFQu	0.67 (0.69)	0.82 (0.59)	−1. 114	39.845	.272

Equal variances not assumed. PCL-5 = PTSD Checklist for DSM–5; CD-RISC-10 = Connor-Davidson Resilience Scale; DASS = Depression, Anxiety, Stress Scale; RFQc = Reflective Functioning Certainty About Mental States subscale; RFQu = Reflective Functioning Uncertainty About Mental States subscale.
* $p<.05$.
** $p<.01$.
*** $p<.001$.

For clinically not significant PCL-5 scores (scores <33, Table 5), Model 3 focused on direct exposure. With a dataset of 285 observations, Model 3 showed statistical significance ($F(9, 275) = 3.02$, $p = .0019$), implying the influence of at least one independent variable on the PCL-5 scores. However, the explained variance was relatively lower at 8.99 %. In this model, gender was identified as a significant predictor, with being female associated with higher PCL-5 scores ($\beta = 3.92$, $p = .004$). Additionally, the variable "Moved house" was a significant predictor, with a positive association ($\beta = 3.95$, $p = .038$), indicating that people who moved out due to the destruction of their property were associated with an increase in PCL-5 scores. However, age, relationship status, and other predictors did not show significant predictive relationships.

Based on 156 observations, Model 4, which explored clinically not significant PCL-5 scores with indirect exposure, demonstrated statistical

Table 4
Linear Regression models predictors of the clinically significant PCL-5 scores.

		Variables	Coefficient	Std error	t value	p value	95 % CI
PCL clinically significant (score >33)	Model 1	Age	−0.11	0.08	−1.34	.18	[−0.28, 0.05]
	Direct Exposure	Gender	0.99	1.9	0.52	.603	[−2.76, 4.74]
		Relationship Status	−1.38	1.34	−1.03	.305	[−4.04, 1.27]
		Previously Diagnosed	1.53	1.45	1.06	.292	[−1.32, 4.39]
		Know of people killed/injured	−2.36	1.3	−1.81	.042*	[−4.93, −0.21]
		Moved house	2.35	1.81	1.3	.195	[−1.21, 5.92]
		RFQc	−0.76	1.34	−0.57	.571	[−3.41, 1.88]
		RFQu	3.26	1.09	2.98	.003**	[1.1, 5.41]
		Resilience	−0.12	0.09	−1.42	.158	[−0.3, 0.05]
	Model 2	Age	−0.32	0.19	−1.71	.042*	[−0.7, −0.05]
	Indirect Exposure	Gender	−5.35	4.39	−1.22	.227	[−14.1, 23.4]
		Relationship Status	−1.07	2.49	−0.43	.668	[−6.06, 3.9]
		Previously Diagnosed	5.36	2.8	1.91	.04*	[−10.95, −0.23]
		Know of people killed/injured	−0.07	2.63	−0.03	.977	[−5.34, 5.18]
		Moved house	−2.33	4.89	−0.48	.635	[−12.1, 7.43]
		RFQc	−1.58	2.84	−0.56	.578	[−7.25, 4.08]
		RFQu	−1.55	2.08	−0.75	.458	[−5.7, 2.59]
		Resilience	−0.05	0.15	−0.36	.724	[−0.36, 0.25]

PCL-5 = PTSD Checklist for DSM–5; RFQu = Reflective Functioning Uncertainty About Mental States subscale; RFQc = Reflective Functioning Certainty About Mental States subscale.
* $p < .05$.
** $p < .01$.
***$p < .001$.

Table 5
Linear Regression models predictors of the clinically not significant PCL-5 scores.

		Variables	Coefficient	Std error	t value	p value	95 % CI
PCL clinically not significant (score <33)	Model 3	Age	0.08	0.07	1.24	.218	[−0.05, 0.23]
	Direct Exposure	Gender	3.92	1.36	2.88	.004**	[1.23, 6.6]
		Relationship Status	0.58	1.08	0.54	.59	[−1.55, 2.72]
		Previously Diagnosed	0.65	1.44	0.45	.654	[−2.2, 3.5]
		Know of people killed/injured	0.78	1.1	0.71	.477	[−1.38, 2.96]
		Moved house	3.95	1.89	2.09	.038*	[0.22, 7.68]
		RFQc	−0.71	0.94	−0.76	.45	[−2.57, 1.14]
		RFQu	2.14	1.07	1.99	.047*	[0.02, 4.26]
		Resilience	0.05	0.07	−0.69	.493	[−0.19, 0.09]
	Model4	Age	0.003	0.11	0.03	.977	[−0.22, 0.23]
	Indirect Exposure	Gender	6.78	1.94	3.48	.001**	[2.92, 10.63]
		Relationship Status	1.06	1.55	0.68	.495	[−2.01, 4.14]
		Previously Diagnosed	3.73	2.06	1.81	.043*	[0.35, 7.82]
		Know of people killed/injured	−1.51	1.59	−0.95	.344	[−4.66, 1.63]
		Moved house	3.46	3.56	0.97	.332	[−3.57, 10.5]
		RFQc	0.91	1.33	0.69	.491	[−1.71, 3.55]
		RFQu	4.4	1.44	3.06	.003*	[1.55, 7.25]
		Resilience	−0.17	0.08	−1.93	.045*	[0.34, 0.003]

PCL-5 = PTSD Checklist for DSM–5; RFQu = Reflective Functioning Uncertainty About Mental States subscale; RFQc = Reflective Functioning Certainty About Mental States subscale.
* $p < .05$.
** $p < .01$.
***$p < .001$

significance ($F(9, 146) = 5.30$, $p < .0000$), indicating a collective impact of the independent variables on the PCL-5. The model explained approximately 24.61 % of the variance in the PCL-5 scores. Being female was identified as a significant predictor of higher PCL-5 scores ($\beta = 6.78$, $p = .001$). Having a previous diagnosis and RFQu scores were also significant predictors, indicating a potential link with elevated PCL-5 scores. Interestingly, a high score on the CD-RISC-10 resilience scale was associated with lower PCL-5 scores ($\beta = -0.17$, $p = .045$), suggesting that as resilience increases, the expected PCL-5 score decreases.

4. Discussion

This study was the first to investigate differences in mental health symptomatology between Lebanese individuals directly and indirectly exposed to the Beirut Port explosion which shook the Lebanese capital on August 4th 2020. The first aim of this study was to comparatively explore the prevalence of anxiety, depression, stress, and PTSD, between individuals directly to those indirectly exposed to the Beirut Port explosion. Results suggest that being directly exposed to the trauma has a profound effect on individuals, particularly in terms of depressive symptoms, reported stress, and PTSD symptoms. Indeed, results showed that individuals directly exposed to the trauma scored significantly higher than those indirectly exposed to the explosion on all mental health variables. This is in line with previous studies suggesting that those indirectly exposed to a traumatic event tend to have lower severity traumatic symptomatology (Neria et al., 2007; Pietrzak et al., 2014; Sprang et al., 2019; Sprang and Steckler, 2023). However, it is important to note that those individuals nevertheless experienced traumatic

symptoms, thus possibly constituting a risk factor to developing a later PTSD diagnosis, if exposed to other stressors (Cieslak et al., 2013; Sprang et al., 2019).

The second aim of this study was therefore to compare predictors of PTSD for the clinically significant sample between individuals directly and those indirectly exposed to trauma, in order to identify differential risk factors. Results revealed that, for the directly exposed group, hypomentalizing, the inability to reflect on the mental states of the self and others, emerged as a significant positive predictor, indicating that higher scores in this dimension are linked to elevated PCL-5 scores, in line with the literature. Indeed, deficits in mentalizing reflect an inability to process the emotional and/or cognitive impact of trauma, affecting emotion regulation capacities, thus putting the person at risk of developing PTSD (Fonagy and Bateman, 2016; Luyten et al., 2012). Surprisingly, the loss of someone as a result of the trauma predicted lower PCL-5 scores in this group. It can be argued that, in line with Nickerson et al. (2014), it is important to account for the grief of losing someone before setting a PTSD diagnosis, as grief and prolonged grief symptoms could overshadow traumatic symptomatology. The type of defense mechanisms used in the aftermath of trauma exposure can also be of influence. It is beyond the scope of this paper to explore this argument, but it is interesting for future studies to further investigate differences between PTSD symptomatology between individuals who have lost a loved one and those who have not, in addition to directly experiencing a traumatic event.

For the clinically significant sample indirectly exposed to the trauma, different PTSD predictors emerged, namely being younger and having a prior psychiatric diagnosis constituted risk factors for scoring higher on the PCL-5 (>33), but hypomentalizing did not significantly contribute to the model. For the latter, it can be argued that indirect exposure, i.e. being continuously exposed to the adverse details of the traumatic events, triggers different coping mechanisms than being directly exposed once, to the traumatic event. In other words, with age and experience, individuals build more confidence and self-efficacy in their ability to manage trauma-related emotions, thus becoming able to regulate their emotions, decreasing PTSD symptomatology (Sprang and Steckler, 2023). This can be rendered more difficult if a person had a prior psychiatric diagnosis, in line with the sensitization hypothesis arguing a lower sensitivity threshold to stressors in those instances, putting the person at an increased susceptibility to subsequent minor stressors, especially when faced with repeated exposure to traumatic details (Breslau, et al., 2008; Post and Weiss, 1998).

Investigating predictors of PTSD for the non-clinically significant sample, results for the directly exposed group revealed that female gender, hypomentalizing, and having moved home as a result of the explosion predicted higher PCL-5 scores. For the indirectly exposed non-clinically significant group, female gender, hypomentalizing, being previously diagnosed with a psychiatric disorder, and lower resilience scores were found to be significant predictors of PCL-5 scores. It is interesting to discuss the significant predictive power of female gender for the non-clinically significant sample only. This is in line with some studies positing that females tend to be more sensitive to distressing events, perceiving them as threatening, thus scoring higher on perceived distress due to intrusion PTSD symptomology, without necessarily reaching the threshold for a PSTD diagnosis (Chung et al., 2018; Craig and Sprang, 2014; Marthoenis et al., 2019). This finding can also be explained from a cultural perspective, as it can be argued that women, in collectivistic inclined cultures such as Lebanon, are expected to care for the family and maintain group harmony. In other words, women are expected to mentalize the collective, requiring working through and regulating their emotions first, in order to care for others, which could explain the sub-threshold PTSD scores, as well as the higher resilience scores than males, despite higher mental health difficulties scores. Indeed, measures of resilience include statements regarding one's ability to stay focused under pressure, and to handle negative emotions. This could shed light on the significant predictive roles of low resilience and hypomentalizing, as both resilience and genuine mentalizing are necessary prerequisites for healthy coping with traumatic events. This should be seen with caution as it might reflect that women are continuously using all their cognitive and affective capacities to work through their emotions, putting them at higher risk of reaching a PTSD diagnosis with increased stressors.

Our findings have important clinical implications for prevention and intervention programs in high-risk/cumulative traumas contexts. From a prevention perspective, psychoeducation groups could be formed in high-risk contexts, targeting specific populations, i.e. young adults, and women, explaining the impact of trauma, emotion regulation strategies promoting mentalizing and resilience, focusing on hands on applications of these intervention using real-life traumatic scenarios. These groups could also work on helping individuals identify signs of traumatic symptomatology as a way to promote early intervention. In the wake of trauma, interventions could focus on both, individuals directly and indirectly exposed to trauma, targeting the significant predictive constructs highlighted above. Such interventions can focus on identifying breaks in mentalizing for those directly exposed to trauma, as a way to help them work through the emotions related to the traumatic experiences. It would also be important to approach grief carefully in these conditions, to be mindful of the individual grieving process, and to be aware of possible defenses at play as these might cover symptoms of PTSD and delay their expression. It is also crucial to set up individualized interventions promoting mentalizing for women indirectly exposed to trauma, as this group was found to be most vulnerable to PTSD, especially in instances of low resilience and mentalizing. One last recommendation from this study might be the need to create a separate cutoff score for individuals indirectly exposed to trauma to avoid them falling in the cracks of the diagnostic system and develop PTSD-related symptoms years after the traumatic event, without getting proper diagnoses and treatments.

Despite the uniqueness of this study, it is important to interpret the results in light of some limitations. First, this study was cross-sectional which limits the understanding of the interplay between constructs across the years, whether pre-or post-trauma factors. Future research could follow-up individuals to explore long-term effects of trauma on mental health correlates. Second, data collection relied on self-report questionnaires solely, which tends to be more prone to being affected by the individual's current state of mind. It would be interesting to explore women's perception of trauma and their coping mechanisms using qualitative analyses, as this would provide more insight regarding the cultural influences on PTSD and its symptomatology. Third, it was beyond the scope of this study to explore the unique effect of grief on PTSD symptoms, as well as to explore the impact of cumulative trauma on the findings.

To conclude, this study is the first to shed light on the differential predictive factors of PTSD, in Lebanese individuals directly and indirectly exposed to the traumatic events of August 4th 2020. Despite both groups showing significant mental health difficulties, those directly exposed scored significantly higher on depression, anxiety, and PTSD, than those indirectly exposed. Results showed different models explaining PTSD symptomatology, differentiating between predictors amongst those scoring above and below the PCL-5 PTSD threshold. Findings highlighted the importance of taking a cultural approach to understanding coping with trauma and inform possible prevention and intervention strategies in a country colored by ongoing political and economic instability.

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Rudy Abi-Habib: Writing – review & editing, Methodology,

Conceptualization. **Wissam Kheir:** Writing – review & editing, Writing – original draft, Formal analysis. **Pia Tohme:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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