

The Prevalence and Course of Posttraumatic Stress Disorder Symptoms in Partners of Burn Survivors

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Research

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Abstract

Background

Partners of burn survivors may develop posttraumatic stress disorder (PTSD) symptoms in the aftermath of the burn event. This longitudinal study examined the prevalence, course and potential predictors of partners' PTSD symptoms up to 18 months postburn.

Methods

Participants were 111 partners of adult burn survivors. In a multicenter study, PTSD symptoms were assessed with the Impact of Event Scale-Revised (IES-R) during hospitalization of the burn survivor, and subsequently at 3, 6, 12 and 18 months postburn. Partners' appraisal of threat to the burn survivor's life, anger, guilt and level of rumination were assessed in the hospital as potential predictors of (long-term) PTSD symptoms in an exploratory piecewise latent growth model.

Results

At the time of hospitalisation, 30% of the partners reported acute PTSD symptoms in the clinical range, which decreased to 4% at 18 months postburn. Higher acute PTSD symptoms were related to the presence of perceived life threat and higher levels of anger, guilt, and rumination. Over time, mean levels of PTSD symptoms decreased, especially in partners with high levels of acute PTSD symptoms, perceived life threat and rumination. From 3 months onward, PTSD symptoms decreased less in partners of more severely burned survivors. At 18 months postburn, higher levels of PTSD symptoms were related to more severe burn injuries and initial perception of life threat.

Conclusions

One in three partners of burn survivors reported clinical levels of acute PTSD symptoms shortly after the hospital admission, of which the majority recovered over time. This study showed that perceived life threat, feelings of anger and guilt, and rumination may indicate the presence of acute PTSD symptoms, whereas more severe burns and initial perception of life threat predict long-term PTSD symptom levels. The results highlight the need to offer psychological help to partners to alleviate acute elevated stress levels, which in turn may enhance the quality of support partners can provide to the burn survivor.

Background

Family members are an important source of support for patients with burns in the acute phase. As early as 1971, their pivotal role in the adaptation process was recognized: *'Every patient in this study who was attended by his spouse or close family member during the early course of his hospitalization cited his or her presence as the single most important factor in sustaining him during that difficult period [1]*. More recent studies echo the importance of family members and especially partners, in supporting the burn survivor to enhance recovery both during the acute phase and after discharge from the hospital, when

partners may take on the role of caretaker of the patient [2-5]. Back home, the burn survivor needs to adapt and self-manage social, physical, and emotional challenges [6] as a consequence of the burns. It is important to investigate partners' psychological state, among other reasons, because it may affect their capacity to support the patient in this process.

Given the traumatic nature of a burn event and its potential life threat, partners are at risk of developing posttraumatic stress disorder (PTSD) regardless of whether or not they witnessed the incident [7]. For example, a recent study in spouses and close relatives of burn survivors reported clinically relevant acute PTSD symptoms prevalence rates of 29% at admission to the burn unit and 15% at discharge [3]. A study in parents and spouses of burn survivors showed a prevalence rate of 52% at admission, which decreased to 25% at 6 to 8 months postburn [8, see also 9]. In the intensive care unit (ICU) literature, prevalence rates of acute PTSD symptoms ranged between 14% and 72%, decreasing to 23.6% to 36.2% at 12 months and 14% at 24 months [10-14]. However, no burn or ICU studies are available that document PTSD symptom trajectories exclusively in partners, even though differences in PTSD symptom levels between partners, parents and other relatives have been reported [3, 10, 15]. Partners are often the first and most important source of support for the burn survivor and may face unique issues such as difficulties in reconnecting emotionally to the patient [16]. Therefore, focussing specifically on partners may add unique and practically relevant insights into PTSD symptom trajectories and predictive factors.

With respect to potential predictors of PTSD symptoms, a meta-analysis in a variety of PTSD samples showed that demographic variables were predictive in some populations but not in other, and that the strongest and most robust effects were found for peri- and post-trauma factors [17], but research on these factors in partners is limited. Previous research in family members of burn survivors showed that women and younger family members had higher PTSD symptom levels; and these associations were also reported in the ICU literature [3, 10, 15]. Burn related factors such as the presence of facial burns, length of hospital stay, ventilated days and total body surface area (TBSA) burned were not significantly associated with PTSD symptoms in a mixed sample of partners and other family members [3]. However, in the pediatric burn literature, larger TBSA was related to higher levels of PTSD symptoms in parents [18, 19].

With respect to potential peri-trauma factors, perceived life threat associated with the burn is of interest. Perceived life threat is incorporated within the model of pediatric medical stress and is associated with the development of PTSD [20]. For instance, perceived life threat in parents of children with burns was associated with higher PTSD symptoms [18, 19, 21]. However, Bond and colleagues [3] found no association between perceived life threat of partners and close relatives with PTSD symptoms. But, given the large body of evidence pointing towards a detrimental emotional impact of life threat on family members, it is hypothesized that the presence of perceived life threat predicts more PTSD symptoms in partners.

Trauma-related emotions, such as anger and guilt, are also associated with PTSD symptoms in various trauma-exposed samples [22-24]. Likewise, the burn literature describes guilt, and, to a lesser extent anger,

as common reactions to burns in family members [e.g. 2, 25, 26]. Empirical evidence on the relation between guilt, anger and PTSD symptoms in relatives of burn survivors comes almost entirely from the pediatric burn literature [8, 18, 19, 21, 27-29]. However, emotions of partners of burn survivors are also relevant and the extent to which they constitute risk factors for prolonged PTSD symptoms in this group should be known.

With regard to post-trauma factors, dysfunctional coping strategies such as rumination may occur [30, 31]. Rumination involves a recurrent focus on the causes and consequences of the trauma and related 'what-if' questions [32] and may be a way to avoid thinking about traumatic memories and associated thoughts and feelings [33, 34], thereby maintaining PTSD [30, 35]. Negative emotions such as guilt have been linked to rumination in parents of children with burns, underscoring the relevance to investigate this maladaptive coping style in family members of burn survivors [25].

The aim of the current longitudinal study was to investigate both acute PTSD symptoms in partners of adult burn survivors during hospitalisation and chronic PTSD symptoms up to 18 months postburn. Based on the literature, it was expected that acute symptoms would be relatively high in the hospital, but would subsequently decrease over time. The predictive value of demographic variables, burn severity, perceived life threat, anger, guilt, and rumination for PTSD symptoms in partners was explored.

Methods

Inclusion

The data from this study were part of a larger project in three Dutch and three Belgian burn centres that focused on the social impact of burns. Previous work focused on PTSD symptoms and quality of life in burn survivors themselves [36]. Patients and their partners were recruited between October 2013 and October 2015 and followed for 18 months. Inclusion criteria for patients were: hospital stay of >24 h following the burn event, age of 18 years or older and proficiency in Dutch. The latter two criteria also applied to partners. Exclusion criteria were: psychiatric problems that interfere with the comprehension of questionnaires (e.g., psychosis, cognitive problems), and inhalation injury without external burns. The first criterion also applied to partners.

Sample and missing data

A total of 120 partners enrolled in the study. Of these partners, 111 (92.5%) completed the predictor measures and PTSD symptom measures in the hospital (denoted as T1) and were included in the final analyses. The excluded partners (n = 9) comprised relatively more men (n = 5, 62.5%) compared to the included partners (n = 22, 19.8%), $\chi^2(1) = 7.75, p = .02$, but did not differ significantly ($p > .05$) from included partners with respect to age, number of surgeries, or any of the five PTSD measurements.

Over time, missing data on some of the PTSD measurements was present. The number of partners that completed (at least 19 of the 22 items of the) PTSD measures at 3, 6, 12 and 18 months was 94 (84.7%),

90 (81.1%), 76 (68.5%) and 79 (71.2%) respectively. Sixty-nine (62.2%) partners completed all five measurements. Respondents lost to follow-up did not differ from those participating in the study at 18 months in terms of gender, $\chi^2(1) = 0.03, p = 1.00$, number of surgeries, $t(109) = -0.15, p = .88$, total body surface area affected, $t(118) = -0.23, p = .82$, and acute PTSD symptoms at T1, $t(109) = -0.03, p = .98$, but drop-outs were significantly younger, $M = 39.0$ versus $M = 45.8, t(109) = -2.36, p = .02$. Little's Missing Completely At Random (MCAR) test in the final sample showed that missing data were random, $\chi^2(72) = 81.63, p = .21$.

Procedure

Patients and their partners were invited to participate in the study by a local researcher while patients stayed in the burn center. After they received oral and written information about the study, they provided written informed consent. Patients and partners completed T1 during hospitalisation of the patient and the follow-ups at 3, 6, 12 and 18 months postburn (T2 to T5) by postal mail. The study was approved by ethics boards in the Netherlands and Belgium (NL44682.094.13 and B670201420373).

Measures

Post-Traumatic Stress Disorder Symptoms. The Impact of Event Scale-Revised (IES-R) [37] was used to assess partners' PTSD symptoms. The IES-R is a self-report questionnaire with 22 items that measure symptoms in the past week. Answers were given on a 5-point Likert scale and summed to obtain a total score ranging from 0-88, with scores of 33 and higher indicating a possible diagnosis of PTSD [38]. If at least 19 of the 22 items were completed, sum scores were calculated based on the mean of the completed items. The IES-R has been validated in Dutch trauma populations and showed good psychometric properties [39]. Reliability of the IES-R in the current study was excellent, with Cronbach's alpha between .94 and .96, at the five measurements. Partners' PTSD symptoms were assessed during hospitalization of the patient, and at 3, 6, 12 and 18 months postburn.

Subjective appraisal of life threat and emotions. Partners reported their appraisal of the life-threatening nature of the injury through a single question (yes/no): "At any time, did you think your partner would not survive the burn event?" Psychometric properties of this item were not assessed, but previous studies have supported the validity of the measure [e.g. 40]. Emotions directly related to the burn event were assessed with the following question: "To what extent do the following emotions apply when you think about the accident that caused the burn?". From the assessed emotions, guilt and anger were evaluated in the present study. Answers were rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (a lot). This measure was previously used in burn studies [19, 21] and was assessed during hospitalisation of the burn survivor.

Rumination. The rumination scale of the Cognitive Emotion Regulation Questionnaire (CERQ) [41] was used to assess to which extent partners use this cognitive coping strategy in response to their partner's burn event. The rumination scale comprises four items, e.g. "I am preoccupied with what I think and feel about what I experienced". Answers were rated on a 5-point Likert scale ranging from 1 '(hardly) ever' to 5

'(hardly) always'. In the current study, mean scores on the rumination scale ranged from 1 to 4.75. The Dutch version of the CERQ demonstrated good factorial validity and reliability (Cronbach's $\alpha = .83$) in the general population [41]. Cronbach's alpha in this study was .87. Partners' rumination was assessed during hospitalisation of the burn survivor.

Burn characteristics. Number of surgeries, total body surface area (TBSA) burned, length of stay in the hospital, and whether the patient received mechanical ventilation (yes/no, duration) were recorded from the patient's medical file. Number of surgeries indicates the number of skin graft procedures that was required to cover the wounds and is considered an indicator of burn severity. TBSA is the estimated percentage of the body covered with partial and full thickness burns.

Statistical analysis

Descriptive analyses were conducted in IBM SPSS v24. The potential predictors were correlated with PTSD symptom scores at each time point. Longitudinal trajectories of PTSD symptoms among partners of burn survivors were estimated using linear growth curve modeling (LGM) in Mplus 8.3 [42]. Full information maximum likelihood (FIML) was used to handle missing data in the main analyses, because Little's MCAR test showed that data were missing completely at random. To account for the non-normality of some of the variables, Maximum Likelihood (ML) estimation with bootstrapped confidence intervals was used with 10,000 draws.

To find a model that best described the data, the adequacy and model fit of different growth models was evaluated. The slope growth factors represented the timing of the measurements since the burn event. Because a standard growth model with a single intercept plus linear slope did not fit the data well, and, to our knowledge, this was the first study to apply such a model to data on partners, we decided to explore a series of models to identify the best fitting curve. A complete overview of the consecutively evaluated models can be found in an additional file [see Additional file 1], including model fit, warnings and conclusions for each model. The results section provides a summary of this process and a choice for a final model. Note that because of the explorative nature of our approach, in the discussion section we highlight the need for replication of our model.

The predictors included in the final model were gender, number of surgeries, perceived life threat, anger, guilt and rumination. Age was not included in the final model, because addition of this variable resulted in an inadequate model with a bad fit (see Additional file 1, models 8-12) – again, replication in future research is needed. Anger, guilt and rumination were grand mean centered to aid interpretation of the intercept and slope estimates. Model fit was evaluated with the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA). Models with a TLI and CFI >0.90 and RMSEA <0.08 indicate an acceptable fit, and models with TLI and CFI values >0.95 and RMSEA values <0.05 indicate good fit to the data [43, 44].

To evaluate the association of the predictors with PTSD symptoms 18 months postburn, a multiple regression analysis was performed in Mplus in two steps. In the first step, all predictors were added to the

regression. In the second step, to evaluate prediction of the baseline-adjusted change of PTSD symptoms, PTSD symptoms at T1 was included in the model to correct for initial levels of PTSD symptoms.

Results

Descriptive analyses

The sample of 111 partners included predominantly women ($n = 89, 80.2\%$), and had a mean age of 43.8 years ($SD = 14.0$, range: 19-76). Mean TBSA burned of the burn survivor was 10.4% ($SD = 11.4$, range: 1.0-75.0), mean length of stay at the hospital was 20.2 days ($SD = 23.6$, range: 1 - 175), and 16 burn survivors (14.4%) needed mechanical ventilation (mean number of days was 9.6, $SD = 12.4$, range 1 – 39). Figure 1 shows the means of the IES-R subscales and total sum score over time. Table 1 shows the number and percentage of partners scoring above the clinical cut-off at each measurement.

At the time of hospitalisation, 29.7% of the partners experienced PTSD symptoms within the clinical range, which decreased to 10.6% 3 months postburn, and 3.8% 18 months postburn. Mean symptom scores and subscale scores in partners were highest during hospitalisation of the patient, were roughly halved at three months post burn and decreased further up until 18 months postburn. Of the three subscales, mean levels of intrusions were higher than mean levels of avoidance and hyperarousal over time, Wilks' Lambda = .48, $F(10, 260) = 11.51, p < .001$.

Table 1. Descriptives and Bivariate Pearson Correlation Matrix of Study Variables and PTSD Symptom Levels

	1	2	3	4	5	6	7	8	9	10
1 Age										
2 Surgeries	.08									
3 Anger	.12	.06								
4 Guilt	.02	.03	.18							
5 Rumination	-.02	.12	.22*	.13						
6 PTSD T1	.10	.14	.40**	.27**	.61**					
7 PTSD T2	.24*	.09	.47**	.20	.60**	.74**				
8 PTSD T3	-.01	.15	.36**	.07	.43**	.55**	.68**			
9 PTSD T4	.17	.17	.23*	.16	.35**	.43**	.58**	.70**		
10 PTSD T5	.12	.25*	.17	.01	.32**	.51**	.59**	.58**	.75**	
N	111	111	111	111	111	111	94	90	76	79
Mean	43.8	1.2	1.5	0.7	2.2	25.0	12.4	9.2	8.1	6.5
Gender ¹	41.8	0.8	0.9	1.1	2.1	21.0	8.9	3.2	4.1	5.1
Male (n = 22)	44.3	1.3	1.6	0.6	2.3	26.0	13.2	10.7	9.1	6.8
Female (n = 89)										
Life threat ¹	43.6	2.0	2.2	0.7	2.7	41.5	23.0	17.0	15.1	13.9
Yes (n = 27)	43.9	0.9	1.2	0.7	2.1	19.7	9.3	6.8	6.5	4.4
No (n = 84)										
SD	14.0	2.1	1.4	1.1	0.9	17.9	13.8	11.3	11.3	10.1
Median	45.0	1.0	1.0	0.0	2.0	21.0	7.5	5.0	4.0	2.0
N IES-R ≥ 33 ²						33.0	10.0	7.0	3.0	3.0
% IES-R ≥ 33 ²						29.7	10.6	7.8	3.9	3.8

* p<.05; ** p<.01

PTSD=Post-traumatic Stress Disorder symptoms;

T1 = in hospital, T2 = 3 months, T3 = 6 months, T4 = 12 months, T5 = 18 months postburn;

IES-R=Impact of Event Scale-Revised;

¹ Sample size at T1;

² An IES-R score ≥ 33 reflects PTSD scores within the clinical range.

During hospitalization of the burn survivor, the majority of the partners (69.4%) reported at least some level of anger (mean intensity was 1.5, SD = 1.4), and 36.9% reported feelings of guilt (mean intensity was 0.7, SD = 1.1). Twenty-seven participants (24.3%) perceived their partner's life to be in danger. Perceived life threat was significantly associated with the need for mechanical ventilation, $\chi^2(1) = 20.04$, $p < .001$, with 69% of the partners of mechanically ventilated burn survivors perceiving life threat.

Correlations between PTSD symptoms and the continuous predictor variables are shown in Table 1. Age showed on average low correlations and insignificant relations with PTSD symptoms. Notable was that the correlations of number of surgeries with PTSD symptoms were low, but reached statistical significance at 18 months. Among the peri-trauma factors, anger was moderately correlated up to 6 months, and showed lower correlations after that time, whereas guilt was only significantly correlated to PTSD symptoms at T1. Rumination showed moderate to high correlations with PTSD symptoms across the time span. Statistically significant associations were observed between rumination and anger. Table 1 also showed that partners who perceived the burn survivor's life to be in danger had consistently higher means for PTSD symptoms at each measurement moment than partners who did not (Cohen's d ranged from 0.74 - 1.30). Also, partners who the burn survivor's life to be in danger scored on average higher on number of surgeries for the burn survivor ($d = 0.5$), anger ($d = 0.7$), and rumination ($d = 0.7$).

Longitudinal growth modeling

A 'simple' growth model with a single linear slope and without predictors did not fit the data well ($\chi^2(10) = 92.57$, $p < .001$; RMSEA = .273; CFI/TLI = .648), so a series of models was tested to explore which model had the best fit to the data (see Additional file 1 for all results). These series included models with quadratic and cubic effects, but a piecewise linear growth model fitted the data best. This piecewise growth model for partners' PTSD symptoms consisted of an intercept, one slope modelling the change between hospital admission and 3 months postburn, and a second slope modelling the change between 3 and 18 months postburn. The 'knot' for the two slopes was set at 3 months postburn: Mean PTSD symptoms showed a steep decline between hospitalisation and 3 months and a smaller decline afterwards (see Figure 1); this timepoint is in line with the diagnostic criteria on chronicity of PTSD symptoms [45]. The piecewise growth model without predictors showed mixed results with regard to model fit, $\chi^2(6) = 20.89$, $p = .002$; RMSEA = .150; CFI = .936; TLI = .894. The addition of the predictors resulted in a model with an acceptable model fit, $\chi^2(18) = 32.09$, $p = .021$; RMSEA = .084; CFI = .958; TLI = .907, and the results of the model are shown in Table 2. This final model accounted for 70% of the variance in acute PTSD symptoms, 36% of the variance around the decline of PTSD symptoms in the first three months, and 42% of the variance around the decline of PTSD symptoms after 3 months. A significant negative correlation between the intercept and slope 1 indicated that the higher the acute PTSD symptom levels, the steeper the decline in PTSD symptoms between hospital admission and 3 months postburn.

With regard to the intercept, the significant associations reflected that partners who perceived the burn survivor's life to be in danger, who experienced more anger or guilt, or who ruminated more showed higher acute PTSD symptom levels. With regard to slope 1, partners who perceived the burn survivor's life to be in danger showed a sharper decline of PTSD symptoms between hospitalisation and 3 months postburn. A similar pattern for partners who reported more rumination shortly after the burn event was not statistically significant ($p = .08$). The results for slope 2 showed that partners of more severely burned survivors showed a smaller reduction in PTSD symptoms, and, partners who reported more rumination shortly after the burn event showed a sharper decline in PTSD symptoms between 3 and 18 months.

Table 2. <i>Piecewise Linear Growth over Time: Predictors of PTSD Symptoms</i>					
	Estimate	SE	95% CI	<i>p</i>	<i>R</i> ²
Correlations					
Intercept with Slope 1	-.63	0.13	[-0.88; -0.38]	<.001	
Intercept with Slope 2	-.08	0.30	[-0.66; 0.50]	.79	
Slope 1 with Slope 2	-.09	0.48	[-1.04; 0.85]	.85	
Regression estimates					
Intercept	19.05	2.53	[14.08; 24.01]	.00	.70
Gender ¹	3.34	2.82	[-2.19; 8.87]	.24	
Surgeries	-0.18	0.56	[-1.27; 0.91]	.75	
Life threat	14.51	3.76	[7.14; 21.88]	<.001	
Anger	1.86	0.94	[0.03; 3.69]	.05	
Guilt	3.33	1.01	[1.35; 5.32]	.001	
Rumination	8.68	1.52	[5.71; 11.66]	<.001	
Slope 1 ²	-40.50	10.14	[-60.37; -20.63]	.00	.36
Gender ¹	1.31	11.36	[-20.96; 23.58]	.91	
Surgeries	0.12	1.73	[-3.28; 3.51]	.95	
Life threat	-27.79	12.73	[-52.74; -2.84]	.03	
Anger	0.28	3.68	[-6.93; 7.50]	.94	
Guilt	-5.40	4.49	[-14.20; 3.41]	.23	
Rumination	-10.13	5.75	[-21.41; 1.14]	.08	
Slope 2 ³	-1.66	1.62	[-4.84; 1.51]	.31	.42
Gender ¹	-2.72	1.85	[-6.35; 0.91]	.14	
Surgeries	0.59	0.30	[0.002; 1.18]	.05	
Life threat	0.23	2.39	[-4.45; 4.91]	.92	
Anger	-1.10	0.71	[-2.49; 0.29]	.12	
Guilt	-0.85	1.06	[-2.93; 1.24]	.42	
Rumination	-2.80	1.03	[-4.82; -0.78]	.01	

PTSD=Post-traumatic Stress Disorder;

¹ male is the reference category; ² 0-3 months postburn; ³ 3-18 months postburn;

Multiple Regression of PTSD symptoms at 18 months

Table 3 displays the results of the regression analysis of PTSD symptoms at 18 months postburn. Without controlling for acute PTSD symptoms, partners who had perceived the burn survivor's life in danger and partners of more severely burned survivors showed higher PTSD symptoms at 18 months postburn. A trend indicating that partners who reported more rumination shortly after the burn event showed higher PTSD symptoms at 18 months postburn was not statistically significant ($p = .07$). Corrected for initial PTSD symptoms (step 2), only number of surgeries remained significant and predicted a lower reduction of PTSD symptoms at 18 months.

Table 3. Multiple Regression Results Predicting PTSD Symptoms at 18 Months Postburn (n=79).				
Variable	Estimate	SE	95% CI	p
Step 1				
Gender ¹	-0.63	2.74	[-6.01; 4.74]	.82
Surgeries	0.82	0.36	[0.11; 1.53]	.02
Life threat	7.05	3.05	[1.07; 13.04]	.02
Anger	0.24	0.89	[-1.51; 1.99]	.79
Guilt	0.02	1.01	[-1.97; 2.00]	.99
Rumination	2.24	1.25	[-0.22; 4.69]	.07
Step 2				
Acute PTSD symptoms T1	0.26	0.13	[0.01; 0.51]	.04
Gender ¹	-1.02	2.74	[-6.39; 4.35]	.71
Surgeries	0.72	0.34	[0.04; 1.39]	.04
Life threat	3.78	3.29	[-2.66; 10.22]	.25
Anger	-0.37	0.97	[-2.27; 1.54]	.71
Guilt	-0.54	1.20	[-2.89; 1.81]	.65
Rumination	-0.44	1.73	[-3.83; 2.94]	.80
PTSD=Post-traumatic Stress Disorder; T1 = in hospital; R ² for the model is .31; ¹ male is the reference category.				

Discussion

To our knowledge, this is the first study that examined the level, course and predictors of PTSD symptoms in exclusively partners of burn survivors with a follow-up for 18 months. Results showed that about 30% of the partners reported PTSD symptoms within the clinical range shortly after the burn injury. Perceiving the burn survivor's life to be in danger, experiencing more anger and guilt, and higher levels of rumination were related to more acute PTSD symptoms. Within the first three months, PTSD symptoms decreased steeply on average, especially if initial stress was high and/or partners had perceived the burn survivor's life to be in danger. Partners who showed initially more rumination, showed a higher decrease in PTSD symptoms between 3 and 18 months. Burn severity, indicated by number of surgeries, was not associated with the early phases of PTSD symptoms, but did predict long-term symptoms. Perceived life threat was also related to higher PTSD symptoms at 18 months post-burn.

About one in three partners experienced severe clinical PTSD symptom levels during hospitalisation. These rates dropped to 11% at three months, and 4% at 12 and 18 months. The prevalence rate in the acute phase fits with earlier empirical findings in partners of burn survivors [3], but the chronic rates are lower than reported in the ICU literature. However, particularly life threat, a predictor in this study, may be more frequent in the ICU population, inducing severe PTSD symptoms in more partners. The significant correlation between mechanical ventilation (indicative of ICU status) and perceived life threat supports this interpretation. Also, longitudinal ICU studies comprised a mixture of partners, parents and other family members, and PTSD cut-offs varied widely [e.g. 10, 15] which could partly explain the difference in chronic prevalence rates. Prevalence rates of PTSD symptoms in mothers of children with burns are considerably higher than in our (mostly female) sample, ranging from 50% during hospitalization and decreasing to 19% at 18 months postburn [18, 19]. So, our focus on partners of burn survivors added unique insights in PTSD symptom trajectories in this population. In line with the broader psychological trauma literature [46], it showed that over time, most partners recovered from initial symptoms or seem resilient.

The results of the piecewise growth model indicated that the role of age and gender in PTSD symptoms of partners was minor. In contrast, previous research in the burn and ICU literature did find some associations with female gender and younger age [3, 10]. It should be noted that our sample consisted of predominantly women and of middle aged participants, which may have reduced the power to find significant gender and age differences. In support of our findings, the larger trauma literature showed that, although female gender is often related to higher PTSD symptoms, demographic factors have smaller effects on PTSD symptoms than peri- and post-trauma factors [17].

Burn severity, as operationalized by number of surgeries was not associated with PTSD symptoms in the acute phase, which supports earlier results in family members [3]. However, in the longer term, burn severity predicted a higher level and a lower decrease in PTSD symptoms over time, which is in line with earlier research in burn patients [47], and limited the return to pre-injury levels of health related quality of life [36]. More severe burns may be accompanied by a long recovery process including scar maturation

and functional limitations, which may hamper the recovery of PTSD symptoms in partners or lead to additional PTSD symptoms. Future studies may investigate this by examining the quality of PTSD symptoms (e.g., what event is represented in intrusive memories).

The results are a first indicator of the relevance of appraisal of life threat, and also anger and guilt, as indicators of PTSD symptoms in partners of burn survivors. Perceiving the burn survivor's life to be in danger has also been identified as a risk factor for acute PTSD symptoms in the pediatric burn literature [18, 19, 21]. However, our findings contrast the study of Bond and colleagues [3] that found no such effect, possibly due to their small and mixed sample of family members. Perceived life threat was also related to a stronger decrease in PTSD symptoms in the first 3 months. After three months, acute life threat has abated for virtually all cases, which may partly explain the reduction in PTSD symptoms. Still, higher PTSD symptom levels in partners with perceived life threat persisted at 18 months postburn, which may suggest that partners perceive a higher sense of vulnerability to adverse events for a longer period of time after the trauma.

The mean level of guilt was low in the sample, indicating that most partners did not experience guilt, or only to a limited extent, whereas anger was more common and of higher intensity. This contrasts previous results in parents of children with burns that showed higher levels of guilt, indicating that guilt is a more common emotion in parents [18, 19] compared to partners. In accordance to these previous studies, higher levels of anger and guilt in partners during the hospitalisation phase were related to higher levels of acute PTSD symptoms. Anger and guilt were not related to the rate of decline in PTSD symptoms over time or to PTSD symptoms at 18 months. However, research in parents showed that *persistent* anger was longitudinally associated with PTSD symptoms [48] and future research may investigate whether this also holds for partners. Hospital staff should pay attention to the occurrence of these emotions in partners shortly after a burn injury, because of the association with higher acute PTSD symptom levels and because of the association with life threat, which may intensify the initial stress response.

This study supports the concurrent link between rumination and acute PTSD symptoms, in line with the literature [30]. Rumination was earlier found to be associated with a higher frequency of intrusions and overall PTSD [35, 49]. As posited by Ehlers and Clark [30], rumination in response to intrusions may prevent change in the trauma memory and inhibits modification of trauma appraisals. No clear evidence was found for a lasting effect of initial rumination on PTSD symptoms, as it was only marginally significantly related to PTSD symptoms at 18 months. As the current research only focussed on initial levels of rumination, future research may investigate whether persistent rumination is associated with long-term PTSD symptoms in partners.

Strengths of the present study include the focus on partners, the longitudinal design with early recruitment (in the hospital) and relative long follow-up, and assessment of emotional and cognitive factors. However, some limitations of this study should be noted. First, the model construction was performed in an exploratory way. Although the piecewise growth model fits the specified chronicity

criteria for PTSD [45], future research is warranted in order to replicate this model in partners. Second, although the sample size was relatively large compared to earlier studies that included only a subset of partners, a larger sample size would have allowed for the simultaneous investigation of more predictors. For example, information on the presence of partners at the accident, and information concerning responsibility and cause of the burn event could be investigated in larger samples. Also, the inclusion of more male partners would have increased the generalizability of findings to men. Third, PTSD symptoms were assessed with a valid and reliable self-report questionnaire, but questionnaires typically overestimate PTSD rates compared to a clinical interview [50].

This study yields some potential clinical implications. First, it shows that partners were particularly affected during the critical care phase. Early interventions and psychoeducation in partners with high acute PTSD symptom levels may improve stress management and emotion regulation and may reduce PTSD symptoms in the short-term with possible positive consequences for the long-term [51]. Furthermore, family members want to be well-informed on what to expect and how to take care of the patient [52]. As PTSD symptoms may affect partners' comprehension and retention of information [7], presenting uniform information at multiple occasions and in diverse modes may be necessary to ensure adequate uptake. Future research may investigate the impact of PTSD symptoms on the ability to provide support to the injured partner and identify ways to enhance the quality of partner's support during this stressful time. Future research may also study interpersonal processes between burn survivors and partners, as these may play a role in the development of PTSD symptoms within couples [18, 19, 21].

Conclusions

In conclusion, partners of burn survivors are at risk to experience a high level of acute traumatic stress during hospitalisation of the patient, but the majority recovers from PTSD symptoms within the first six months. This study indicates that perceived life threat, feelings of anger and guilt, and rumination may point to an acute traumatic stress response in partners, and that more severe burns and initial perception of life threat may indicate a risk at long-term elevated PTSD symptoms.

Abbreviations

CERQ : Cognitive Emotion Regulation Questionnaire

CFI : Comparative fit index

FIML : Full information maximum likelihood

ICU : Intensive care unit

IES-R : Impact of Event Scale-Revised

LGM : Linear growth curve modelling

MCAR : Missing Completely At Random

ML : Maximum Likelihood

PTSD : Posttraumatic stress disorder

RMSEA : Root mean square error of approximation

TBSA : Total body surface area

TLI : Tucker-Lewis Index

Declarations

Ethics approval and consent to participate

All participants to the study provide written informed consent. The study was approved by ethics boards 'METC Noord-Holland' in the Netherlands and 'Commissie voor Medische Ethiek Universiteit Gent' in Belgium (NL44682.094.13 and B670201420373).

Consent for publication

Not applicable.

Availability of data and materials

The data analysed during the current study are not publicly available due to them containing information that could compromise participant privacy, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

EB, RS, and NL designed the study and analysed and interpreted data. EB drafted the initial article. RS, RG, IE, and NL provided feedback on the manuscript and revised the article. All authors read and approved the final manuscript.

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Figures

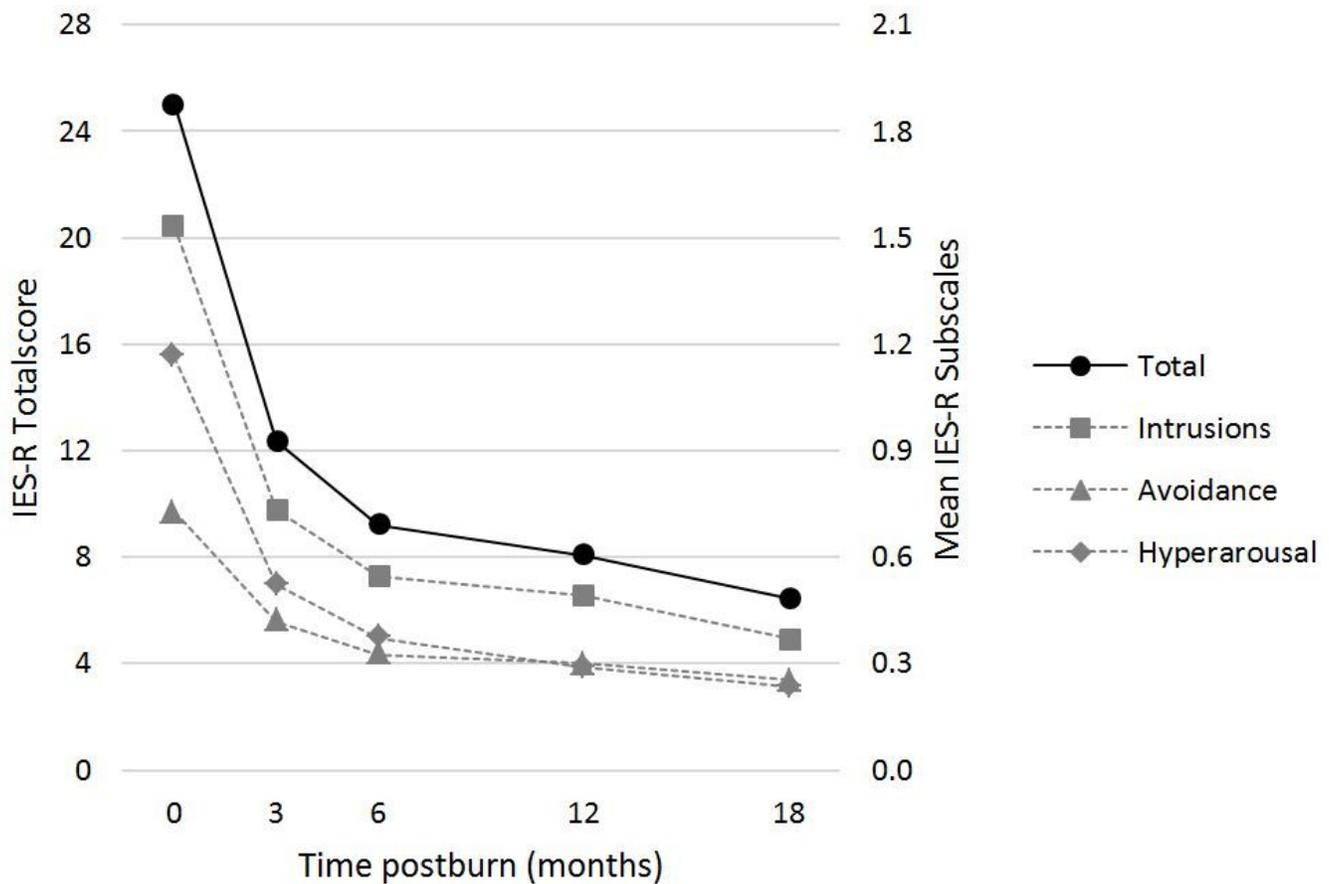


Figure 1

Observed Total score and Mean Levels of Intrusions, Avoidance and Hyperarousal Symptoms over Time, assessed with the Impact of Event Scale-Revised (IES-R).

Supplementary Files

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