



Prevalence and course of posttraumatic stress disorder symptoms in partners of burn survivors

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ABSTRACT

Background: Partners of burn survivors may develop posttraumatic stress disorder (PTSD) symptoms in response to the potential life threatening nature of the burn event and the burn survivor's medical treatment.

Objective: This longitudinal study examined the prevalence, course and potential predictors of partners' PTSD symptoms up to 18 months post-burn.

Methods: Participants were 111 partners of adult burn survivors. In a multi-centre study, PTSD symptoms were assessed with the Impact of Event Scale-Revised during the acute phase and subsequently at 3, 6, 12 and 18 months post-burn. Partners' appraisal of life threat, anger, guilt and level of rumination were assessed as potential predictors of PTSD symptoms in an exploratory piecewise latent growth model.

Results: Acute PTSD symptoms in the clinical range were reported by 30% of the partners, which decreased to 4% at 18 months post-burn. Higher acute PTSD symptoms were related to perceived life threat and higher levels of anger, guilt, and rumination. Over time, mean symptom levels decreased, especially in partners with high levels of acute PTSD symptoms, perceived life threat and rumination. From three months onward, PTSD symptoms decreased less in partners of more severely burned survivors. At 18 months post-burn, higher levels of PTSD symptoms were related to higher acute PTSD symptoms and more severe burns.

Conclusions: One in three partners reported clinical levels of acute PTSD symptoms, of which the majority recovered over time. Perceived life threat, feelings of anger and guilt, and rumination may indicate the presence of acute PTSD symptoms, whereas more severe burns predict long-term PTSD symptom levels. The results highlight the need to screen for acute PTSD symptoms and offer psychological help to partners to alleviate acute elevated stress levels if indicated.

Prevalencia y evolución de síntomas de trastorno de estrés postraumático en parejas de sobrevivientes de quemaduras

Antecedentes: Las parejas de sobrevivientes de quemaduras pueden desarrollar síntomas de trastorno de estrés postraumático (TEPT) en respuesta a la naturaleza potencialmente mortal de las quemaduras y al tratamiento médico del sobreviviente de quemaduras.

Objetivo: Este estudio longitudinal examinó la prevalencia, el curso y predictores potenciales de los síntomas de TEPT de la pareja hasta 18 meses después de la quemadura.

Métodos: Los participantes fueron 111 parejas de adultos sobrevivientes de quemaduras. En un estudio multicéntrico, los síntomas de TEPT se evaluaron con la Escala de Impacto de Eventos Revisada durante la fase aguda y posteriormente a los 3, 6, 12 y 18 meses de la quemadura. La apreciación de las parejas de la amenaza de vida, ira, culpa y nivel de rumiación fueron evaluados como posibles predictores de síntomas de TEPT en un modelo exploratorio de crecimiento latente por partes.

Resultados: El 30% de las parejas informó síntomas de TEPT agudo en rango clínico, que disminuyó a un 4% a los 18 meses después de la quemadura. Los síntomas agudos más altos de TEPT se relacionaron con la percepción de una amenaza para la vida y mayores niveles de ira, culpa y rumiación. Con el tiempo, los niveles promedio de síntomas disminuyeron, especialmente en parejas con altos niveles de síntomas agudos de TEPT, amenaza vital percibida y rumiación. A partir de los 3 meses, los síntomas del TEPT disminuyeron menos en las parejas de los sobrevivientes con quemaduras más graves. Pasados 18 meses de la quemadura, los niveles más altos de síntomas de TEPT se relacionaron con síntomas de TEPT agudos más altos y quemaduras más graves.

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关键词

烧伤; 创伤后应激障碍; 情绪; 反刍; 配偶; 生命威胁

HIGHLIGHTS

- One in three partners reported clinical levels of acute PTSD symptoms, which decreased to 4% at 18 months post-burn.
- Perceived life threat and higher levels of anger, guilt and rumination predicted higher acute PTSD symptoms.
- Over time, PTSD symptoms decreased less in partners of more severely burn survivors.

Conclusiones: Una de cada tres parejas informó niveles clínicos de síntomas agudos de TEPT, de los cuales la mayoría se recuperó con el tiempo. La percepción de amenaza a la vida, los sentimientos de ira y culpa y la rumiación pueden indicar la presencia de síntomas agudos de TEPT, mientras que quemaduras más graves predicen síntomas de TEPT a largo plazo. Los resultados resaltan la necesidad de realizar tamizaje para síntomas agudos de TEPT y ofrecer ayuda psicológica a las parejas para aliviar los niveles elevados de estrés agudo, si está indicado.

烧伤幸存者伴侣中创伤后应激障碍症状的患病率和病程

背景: 烧伤幸存者的伴侣可能会因潜在威胁生命的烧伤事件和烧伤幸存者的医疗出现创伤后应激障碍 (PTSD) 症状。

目的: 本纵向研究考查了烧伤后18个月内伴侣的PTSD症状的患病率, 病程和可能的预测因素。

方法: 参与者为111名成年烧伤幸存者的伴侣。在一项多中心研究中, 在烧伤后急性期以及3, 6, 12和18个月时, 使用修订版事件影响量表对PTSD症状进行了评估。在探索性分段潜在增长模型中, 伴侣对生命威胁, 愤怒, 内疚和反刍的评估作为PTSD症状的潜在预测因素。

结果: 30%的伴侣报告了临床范围内的急性PTSD症状, 烧伤后18个月降至4%。较高的急性PTSD症状与感知到的生命威胁以及较高的愤怒, 内疚和反刍有关。平均症状水平随时间下降, 尤其在有高水平急性PTSD症状, 感知到的生命威胁和反刍的伴侣中。从3个月起, PTSD症状减轻幅度在严重烧伤幸存者的伴侣中较小。烧伤后18个月时, 较高水平的PTSD症状与较高的急性PTSD症状和更严重的烧伤相关。

结论: 三分之一的伴侣报告了临床水平的急性PTSD症状, 其中大多数随时间恢复。感知到的生命威胁, 愤怒和内疚感以及反刍可能表明会出现PTSD症状, 而更严重的烧伤则预测了长期PTSD症状水平。结果突出了筛查急性PTSD症状并为伴侣提供心理帮助的必要性, 以缓解万一有指征升高的急性应激水平。

1. Background

Admission to a burn centre may be distressing for the partner of the patient and may affect psychological wellbeing. Besides the potential life threat of the burn event, sources of distress entail for example monitoring of the patient's vital symptoms, mechanical ventilation and the patient may be unrecognizably bandaged. Studies in partners of survivors of critical illness show that posttraumatic stress disorder (PTSD) symptoms in response to these medical applications may occur (Gawlytta et al., 2020; Petrinc & Daly, 2016). Furthermore, family members, especially partners, are an important source of support for patients with burns, both during the acute phase and after discharge from the hospital, when partners may take on the role of caretaker of the patient (Bäckström, Willebrand, Sjöberg, & Haglund, 2018; Bayuo & Wong, 2020). It is therefore important to investigate partners' psychological state, for both their own wellbeing and because it may affect their capacity to support the patient in this process.

The burns literature shows that PTSD symptoms in patients occur in up to 30% (Hobbs, 2015). But also their partners are at risk of developing PTSD. A study in spouses and close relatives of burn survivors reported acute PTSD symptoms prevalence rates of 29% at admission to the burn centre in 31 spouses and 15% at discharge in 20 spouses (Bond, Gourlay, Desjardins, Bodson-Clermont, & Boucher, 2017). In the longer term, a prevalence rate of 65% in 37 spouses was reported (Zheng et al., 2020). In the intensive care unit (ICU) literature, prevalence rates of acute PTSD symptoms in partners and close relatives ranged

between 14% and 72%, decreasing to 23.6% to 36.2% at 12 months and 14% at 24 months (Alfheim et al., 2019; Kentish-Barnes et al., 2015; Kulkarni et al., 2011; L. Pillai, Aigalikal, Vishwasrao, & Husainy, 2010; L. V. Pillai et al., 2006). However, to our knowledge, no longitudinal burn or ICU studies document PTSD symptom trajectories exclusively in partners. Treating partners and other relatives as a homogeneous group may leave specific patterns or predictors unnoticed. Indeed, differences in PTSD symptom levels between partners, parents and other relatives have been reported (Alfheim et al., 2019; Bond et al., 2017; Petrinc & Daly, 2016). Therefore, focussing specifically on partners may add unique insights into PTSD symptom trajectories and may assist the identification of specific predictive factors for partners in need of psychological support.

With respect to potential predictors of PTSD symptoms, a meta-analysis in a variety of samples showed that demographic variables were predictive in some populations but not in other (Brewin, Andrews, & Valentine, 2000), which supports the necessity to study homogeneous populations. Previous research in family members of burn survivors and patients at the ICU showed that women and younger family members had higher PTSD symptom levels (Alfheim et al., 2019; Bond et al., 2017; Petrinc & Daly, 2016), a finding supported by the broader PTSD literature (Brewin et al., 2000). Furthermore, burn related factors such as facial burns, length of hospital stay, ventilated days and total body surface area (TBSA) burned were not significantly associated with PTSD symptoms (Bond et al., 2017). However, in the paediatric burn literature, larger TBSA burned

was related to higher levels of PTSD symptoms in parents (Bakker, van der Heijden, van Son, & van Loey, 2013; Egberts, van de Schoot, Geenen, & van Loey, 2017). Consequently, we hypothesized an association between burn severity and PTSD symptoms in partners.

Stronger and more robust effects were found for cognitive factors, such as trauma appraisals. The cognitive model (Ehlers & Clark, 2000) posits that when the trauma is processed in a way that produces a sense of current threat, people are vulnerable to persistent PTSD. In the DSM-5, appraised life threat is part of Criterion A, indicating one of the factors that can elicit PTSD (Ursano et al., 2004). When life threat is not appraised as a time-limited event and with global negative implications, it may maintain PTSD symptoms (Ehlers & Clark, 2000). Although one study found no association between perceived life threat of partners and close relatives with acute PTSD symptoms (Bond et al., 2017), a larger body of evidence points towards a detrimental impact of life threat in PTSD occurrence after injury (Timmer-Murillo, Hunt, Geier, Brasel, & deRoon-Cassini, 2020). Therefore, it is hypothesized that perceived life threat predicts more PTSD symptoms in partners.

Negative appraisals of the trauma and/or its aftermath are proposed to maintain PTSD by producing negative emotions (Ehlers & Clark, 2000). Trauma-related emotions, such as anger and guilt, are associated with PTSD symptoms in various trauma-exposed samples (Lommen, Engelhard, van de Schoot, & van den Hout, 2014; McLean & Foa, 2017; Orth & Wieland, 2006), but have not been studied often in partners of critically ill patients. Guilt, and, to a lesser extent anger, are common reactions to burns in family members (Kornhaber, Childs, & Cleary, 2018; Rossi, da Vila, Zago, & Ferreira, 2005). Guilt relates to a negative evaluation of a person's specific behaviour (McLean & Foa, 2017); parents of children with burns may feel guilty because they were unable to prevent the burn event (Hawkins, Centifanti, Holman, & Taylor, 2019), but guilt may also occur in partners of critically ill patients (Gawlytta et al., 2020). Anger, a negative emotional state related to specific cognitive distortions and physiological changes (McLean & Foa, 2017) was reported by burn survivors and parents of children with burns and was shown to be related to PTSD symptoms (Egberts et al., 2017; van Loey, van Son, van der Heijden, & Ellis, 2008). However, the occurrence and extent to which these emotions constitute risk factors for PTSD symptoms in partners should also be known to assess whether these emotions are relevant to screen for in partners.

Dysfunctional coping strategies, for example rumination, are also presented as a factor that maintains PTSD through negative appraisals (Ehlers & Clark, 2000; Seligowski, Lee, Bardeen, & Orcutt, 2015).

Rumination involves a recurrent focus on the causes and consequences of the trauma and related 'what-if' questions (McLaughlin & Nolen-Hoeksema, 2011) and may be a way to avoid thinking about traumatic memories and associated thoughts and feelings (Bishop, Ameral, & Palm Reed, 2018; Michael, Halligan, Clark, & Ehlers, 2007), thereby maintaining PTSD (Ehlers & Clark, 2000; Szabo, Warnecke, Newton, & Valentine, 2017). 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 (Kornhaber et al., 2018).

The aim of the current longitudinal study was to investigate both acute PTSD symptoms in partners of burn survivors in the acute phase and chronic PTSD symptoms up to 18 months post-burn. Based on the extant literature, it was expected that symptoms would be relatively high during the acute phase, but would subsequently decrease over time. Furthermore, we hypothesized that demographic variables, burn severity, perceived life threat, higher levels of anger, guilt, and rumination would predict PTSD symptoms in partners over time.

2. Methods

2.1. Inclusion

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 described patients' PTSD symptoms and quality of life (Boersma-van Dam, van de Schoot, Hofland, Engelhard, & van Loey, 2020). 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).

2.2. Procedure

The study was approved by ethics boards in the Netherlands and Belgium (NL44682.094.13 and B670201420373). Patients and their partners were invited to participate in the study by a local researcher during hospitalization. After they received oral and written study information, they provided written informed consent. Partners completed T1 in the acute phase ($M = 21$ days post-burn; $Mdn = 15$ days post-burn) and the follow-ups at 3, 6, 12 and 18 months post-burn (T2 to T5) by postal mail (with

Mdn = 99, 198, 379, 562 days post-burn for the respective time points).

2.3. Sample and missing data

Of the 266 patients included in this study, 71 reported they had no partner and eight patients had missing data. Of the remaining 187 patients with a partner, 120 (64.2%) partners enrolled in the study and 111 (59.4%) completed the predictor measures and PTSD symptoms measures at T1 and were included in the analyses. Comparing the 111 participating partners with the 76 that did not participate or had missing values, partners of male patients were more likely to participate in the study ($n = 89/138$, 64.5%) than partners of female patients ($n = 22/49$, 44.9%), $\chi^2(1) = 5.76$, $p = .02$, but no statistically significant differences ($p > .05$) were found with respect to TBSA burned, number of surgeries and age of the patient.

The number of partners that completed (at least 19 of the 22 items of the) PTSD measures at T2 – T5 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 were significantly younger ($M = 39.0$) than those with complete data ($M = 45.8$), $t(109) = -2.36$, $p = .02$, but no statistically significant differences ($p > .05$) were found with respect to gender, the patient's number of surgeries, patient's TBSA burned, and acute PTSD symptoms at T1. Little's Missing Completely At Random (MCAR) test in the final sample showed that missing data were random, $\chi^2(72) = 81.63$, $p = .21$.

2.4. Measures

2.4.1. Posttraumatic stress disorder symptoms

The Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997) was used to assess partners' PTSD symptoms. The IES-R is a 22-item self-report questionnaire that measures three symptom clusters of PTSD, that is, intrusion, avoidance and hyper-arousal symptoms, in the past week. Answers were given on a 5-point Likert scale and summed to obtain a total score, with scores ≥ 33 indicating a possible diagnosis of PTSD (Creamer, Bell, & Failla, 2003). 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 was validated in Dutch trauma populations and showed good psychometric properties (Olde, Kleber, Hart, & Pop, 2006). Reliability of the IES-R in the current study was excellent, with Cronbach's alphas from .94 to .96, at the five measurements. Partners' PTSD symptoms were assessed in the acute phase, and at 3, 6, 12 and 18 months post-burn.

2.4.2. Subjective appraisal of life threat and emotions

Partners reported their appraisal of the life-threatening nature of the injury through the question: 'At any time, did you think your partner would not survive the burn event? (yes/no). And if so, at what time?' Previous studies have supported the validity of the measure (e.g. Kassam-Adams, Fleisher, & Winston, 2009). 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 (fear, sadness, horror, shame, guilt, anger), guilt and anger were evaluated in the latent growth model, because these emotions were deemed most relevant in previous burn research in parents (Bakker et al., 2013; Egberts et al., 2017) and thereby enable a comparison of the results in partners and parents. Answers were rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (a lot) during the acute phase of the burn injury.

2.4.3. Rumination

The rumination scale of the Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski & Kraaij, 2007) was used to assess the partners' level of rumination. The rumination scale comprises four items, for example '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'. The Dutch version of the CERQ demonstrated good factorial validity and reliability (Cronbach's $\alpha = .83$) in the general population (Garnefski & Kraaij, 2007). Cronbach's alpha in this study was .87. Partners' rumination was assessed during the acute phase of the burn injury.

2.4.4. Burn characteristics

Number of surgeries, total body surface area (TBSA) burned, length of stay in the hospital, and mechanical ventilation (yes/no) 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 burned is the estimated percentage of the body covered with partial and full thickness burns. Presence at the burn event was self-reported by the partner.

2.5. Statistical analysis

Descriptive analyses were conducted in IBM SPSS v24. Potential predictors were correlated with PTSD symptom scores at each time point. Longitudinal trajectories of PTSD symptoms among partners were estimated using latent growth modelling (LGM) in Mplus 8.3 (Muthén & Muthén, 1998-2017). 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, including model fit, warnings and conclusions for each model. Because of the explorative nature of our approach, model replication is warranted.

The predictors included in the model were gender, number of surgeries, perceived life threat, anger, guilt and rumination. Age was not included in the model, because addition of this variable yielded bad fit indices (see Additional file 1, models 8–12). Anger, guilt and rumination were grand mean centred to aid interpretation of 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). TLI and CFI >0.90 and RMSEA <0.08 indicate an acceptable model fit; TLI and CFI values >0.95 and RMSEA values <0.05 indicate good fit to the data (Kline, 2011).

To evaluate the association of the predictors with PTSD symptoms at T5, a multiple regression analysis was performed 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 additionally included.

3. Results

3.1. Descriptive analyses

The 111 partners were mostly women ($n = 89$, 80.2%) and the mean age was 43.8 years ($SD = 14.0$, range: 19–76). The burn survivor's mean TBSA burned was 10.4% ($SD = 11.4$, range: 1.0–75.0), mean length of hospital stay was 20.2 days ($SD = 23.6$, range: 1–175),

Table 1. Descriptive statistics of partner's emotions in acute phase.

	<i>N</i>	Mean	<i>SD</i>	Median	% >0*
Fear	110	2.2	1.3	2	88.2
Sadness	111	2.6	1.3	3	94.6
Horror	108	1.0	1.3	0	46.3
Anger	111	1.5	1.4	1	69.4
Shame	111	0.2	0.7	0	13.5
Guilt	111	0.7	1.1	0	36.9

*percentage scoring ≥ 1 on a scale from 0 (not at all) to 4 (a lot).

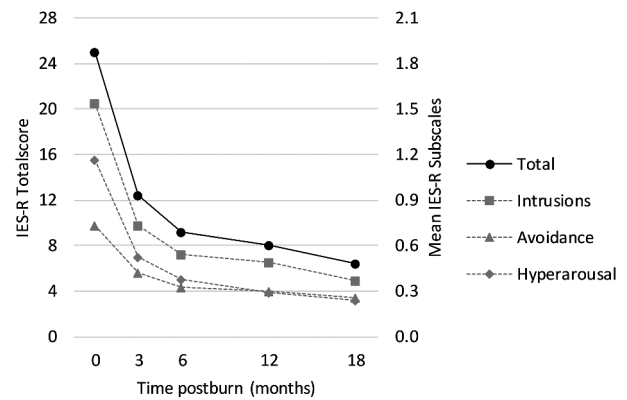


Figure 1. Observed Total Score and Mean Levels of Intrusions, Avoidance and Hyperarousal Symptoms over Time, assessed with the Impact of Event Scale-Revised (IES-R).

and 16 burn survivors (14.4%) needed mechanical ventilation. Figure 1 shows the means of the IES-R subscales and total sum score over time.

At T1, 29.7% of the partners experienced PTSD symptoms within the clinical range, which gradually decreased to 10.6%, 7.8%, 3.9% and 3.8% at T2 – T5. Mean symptom scores were highest at T1, roughly halved at T2, and further decreasing over time. 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 presents descriptive statistics of partners' emotions. The majority experienced fear, sadness and anger. Horror was reported by half of the partners, and guilt and shame were reported by a minority. Twenty-seven participants (24.3%) had perceived their partner's life to be in danger at some point (e.g. the moment the patient was on fire, learning that the patient was exposed to a burn event or was admitted to a dedicated burn centre, or during the ICU period). Perceived life threat was associated with mechanical ventilation, $\chi^2(1) = 20.04$, $p < .001$; 69% of the partners of mechanically ventilated burn survivors perceived life threat. Thirty nine percent of the partners were present at the moment of the burn event. Partners who were present reported higher levels of rumination ($t(103) = 2.11$, $p = .04$) and guilt ($t(103) = 2.11$, $p = .04$), but did not show more acute PTSD symptoms or anger ($p > .05$).

Correlations between PTSD symptoms and predictors are shown in Table 2. Age showed low correlations with PTSD symptoms. Notably, the correlations of number of surgeries with PTSD symptoms were low, but reached statistical significance at 18 months. Anger was moderately correlated up to T2. Guilt was only significantly correlated to PTSD symptoms at T1. Rumination showed moderate to high correlations with PTSD symptoms across the time span and was also related to anger. Partners who perceived life threat, had on average higher

Table 2. Descriptive statistics and bivariate Pearson correlations of study variables.

	1	2	3	4	5	6	7	8	9	10
1 Age										
2 Surgeries	.08									
3 Anger T1	.12	.06								
4 Guilt T1	.02	.03	.18							
5 Rumination T1	-.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**	
<i>n</i>	111	111	111	111	111	111	94	90	76	279
Mean	43.8	1.2	1.5	0.7	2.2	25.0	12.4	9.2	8.1	6.5
<i>SD</i>	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

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

PTSD = Post-traumatic Stress Disorder symptoms; T1 = acute phase, T2 = 3 months, T3 = 6 months, T4 = 12 months, T5 = 18 months post-burn.

scores than partners who did not for PTSD symptoms (Cohen's d ranged from 0.74 to 1.30), anger ($d = 0.7$), rumination ($d = 0.7$), and patient's number of surgeries ($d = 0.5$).

3.2. Latent growth modelling

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 were tested to explore which model had the best fit to the data (see Additional file 1). 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 T1 and T2, and a second slope modelling the change between T2 and T5. The 'knot' for the two slopes was set at T2: Mean PTSD symptoms showed a steep decline between T1 and T2 and a smaller decline afterwards (see Figure 1). 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 predictors yielded an acceptable model fit, $\chi^2(18) = 32.09$, $p = .021$; RMSEA = .084; CFI = .958; TLI = .907 (Table 3). This final model explained 70% of the variance in acute PTSD symptoms, 36% of the variance in the first three months, and 42% of the variance after T2. A significant negative correlation between the intercept and slope 1 indicated that higher acute PTSD symptom levels were associated with a steeper decline in PTSD symptoms between T1 and T2.

With regard to the intercept, perceived life threat, more anger, guilt or rumination was associated with higher acute PTSD symptom levels. With regard to slope 1, perceived life threat was associated with a sharper decline of PTSD symptoms between T1 and T2 and a trend was shown for rumination ($p = .08$). The results for slope 2

Table 3. Piecewise latent growth model results.

	Estimate	SE	95% CI	p	R^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 ^a	3.34	2.82	[-2.19; 8.87]	.24	
Surgeries	-0.18	0.56	[-1.27; 0.91]	.75	
Life threat T1	14.51	3.76	[7.14; 21.88]	<.001	
Anger T1	1.86	0.94	[0.03; 3.69]	.05	
Guilt T1	3.33	1.01	[1.35; 5.32]	.001	
Rumination T1	8.68	1.52	[5.71; 11.66]	<.001	
Slope 1 ^b	-40.50	10.14	[-60.37; -20.63]	.00	.36
Gender ^a	1.31	11.36	[-20.96; 23.58]	.91	
Surgeries	0.12	1.73	[-3.28; 3.51]	.95	
Life threat T1	-27.79	12.73	[-52.74; -2.84]	.03	
Anger T1	0.28	3.68	[-6.93; 7.50]	.94	
Guilt T1	-5.40	4.49	[-14.20; 3.41]	.23	
Rumination T1	-10.13	5.75	[-21.41; 1.14]	.08	
Slope 2 ^c	-1.66	1.62	[-4.84; 1.51]	.31	.42
Gender ^a	-2.72	1.85	[-6.35; 0.91]	.14	
Surgeries	0.59	0.30	[0.002; 1.18]	.05	
Life threat T1	0.23	2.39	[-4.45; 4.91]	.92	
Anger T1	-1.10	0.71	[-2.49; 0.29]	.12	
Guilt T1	-0.85	1.06	[-2.93; 1.24]	.42	
Rumination T1	-2.80	1.03	[-4.82; -0.78]	.01	

PTSD = Post-traumatic Stress Disorder; T1 = acute phase; ^amale is the reference category; ^b0-3 months postburn; ^c3-18 months postburn.

showed that more severe burns were associated with a smaller reduction in PTSD symptoms, and, more rumination was associated with a sharper decline in PTSD symptoms after T2.

3.3. Multiple Regression of PTSD symptoms at 18 months

To investigate the relevance for long-term PTSD symptoms, a regression analysis of early predictors of PTSD symptoms at 18 months was performed (Table 4). Without controlling for acute PTSD symptoms, perceived life threat and more severe burns predicted higher PTSD symptoms at T5. A trend for rumination was shown ($p = .07$). Corrected for acute PTSD symptoms (step 2), only number of surgeries predicted a lower reduction of PTSD symptoms.

Table 4. Multiple regression results predicting PTSD symptoms at 18 months post-burn ($n = 79$).

Variable	Estimate	SE	95% CI	<i>p</i>
Step 1				
Gender ^a	-0.63	2.74	[-6.01; 4.74]	.82
Surgeries	0.82	0.36	[0.11; 1.53]	.02
Life threat T1	7.05	3.05	[1.07; 13.04]	.02
Anger T1	0.24	0.89	[-1.51; 1.99]	.79
Guilt T1	0.02	1.01	[-1.97; 2.00]	.99
Rumination T1	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 ^a	-1.02	2.74	[-6.39; 4.35]	.71
Surgeries	0.72	0.34	[0.04; 1.39]	.04
Life threat T1	3.78	3.29	[-2.66; 10.22]	.25
Anger T1	-0.37	0.97	[-2.27; 1.54]	.71
Guilt T1	-0.54	1.20	[-2.89; 1.81]	.65
Rumination T1	-0.44	1.73	[-3.83; 2.94]	.80

PTSD = Post-traumatic Stress Disorder; T1 = acute phase; R^2 for the model is .31; ^amale is the reference category.

4. Discussion

To our knowledge, this is the first study that examined the level, course and predictors of PTSD symptoms exclusively in partners of burn survivors with an 18-month follow-up. Results showed that 30% of the partners reported PTSD symptoms within the clinical range in the acute phase. Perceived life threat, more anger and guilt, and higher levels of rumination were related to more acute PTSD symptoms. Within the first three months, PTSD symptoms decreased on average, especially if initial stress was high and/or partners perceived life threat. Partners who showed initially more rumination, showed a higher decrease in PTSD symptoms after three months. Acute PTSD symptoms and burn severity, indicated by number of surgeries, predicted higher PTSD symptoms in the longer term.

About one in three partners experienced acute PTSD symptoms. These rates dropped to 11% after three months, and 4% at 12 and 18 months. The prevalence rate in the acute phase fits with earlier findings in partners of burn survivors (Bond et al., 2017), but the chronic rates are lower than reported in the ICU literature (Petrinec & Daly, 2016).

However, ICU studies comprised a heterogeneous group of partners, parents and other family members, and PTSD cut-offs varied (e.g. Alfheim et al., 2019; Petrinec & Daly, 2016) which may partly explain the difference in prevalence rates. A significant correlation between mechanical ventilation (indicative of ICU status) and perceived life threat may suggest that life threat may be more frequent in ICU populations, inducing PTSD symptoms in more partners. In line with the broader psychological trauma literature (Galatzer-Levy, Huang, & Bonanno, 2018), our study showed that over time, most partners recovered from initial PTSD symptoms or were resilient.

The results of the piecewise growth model indicated a minor role of gender in PTSD symptoms of partners,

whereas the burn and ICU literature described associations with female gender (Alfheim et al., 2019; Bond et al., 2017; Zheng et al., 2020). However, our predominantly female sample may be underpowered to find significant effects of gender. Burn severity, indicated by number of surgeries, was not associated with PTSD symptoms in the acute phase, but in the longer term, predicted a lower decrease in PTSD symptoms over time, in agreement with earlier research (Attoe & Pounds-Cornish, 2015; Bond et al., 2017). More severe burns likely cause more scars and functional limitations, affecting quality of life (Boersma-van Dam et al., 2020), which may hamper the recovery of PTSD symptoms in partners. Future studies may investigate the content of intrusive memories (e.g. what event is represented in intrusive memories) to reveal whether scars may act as reminder to the burn event.

The results indicate the relevance of appraisal of life threat, and also anger and guilt, as indicators of PTSD symptoms in partners of burn survivors. Perceived life threat was related to more acute PTSD symptoms and a stronger decrease in PTSD symptoms over time. After the acute phase, when life threat has abated for virtually all cases, PTSD symptoms may decrease accordingly. Perceived life threat predicted higher PTSD symptom levels at 18 months post-burn, but not after controlling for acute PTSD symptoms. This suggests an indirect long-term effect of life threat through acute stress symptoms. This assumption is consistent with Ehlers and Clark's (2000) model, which states that PTSD symptoms can become persistent when trauma processing leads to negative appraisals of the trauma and/or its sequelae (e.g. overestimating the probability of future harm) and from poor elaboration or contextualization of the trauma memory. The findings fit with earlier studies showing that perceived life threat is a predictor of PTSD symptoms (Giannoni-Pastor, Eiroa-Orosa, Fidel Kinori, Arguello, & Casas, 2016; Kassam-Adams et al., 2009; Timmer-Murillo et al., 2020), and that peri-traumatic processes indirectly affect long-term PTSD symptoms through acute PTSD symptoms (Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003).

About two in three partners reported anger, whereas about one in three partners reported guilt. Compared to mothers of children with burns, the prevalence rate of anger in partners is comparable, but the prevalence of guilt was around 45% lower (Egberts et al., 2020). This may be explained by partners feeling less responsible for the burn event than mothers. Guilt was more common in partners who were present during the burn event. Possibly, they felt more helpless and may evaluate their behaviour more negatively, which is related to guilt feelings (McLean & Foa, 2017). This points to the relevance to consider guilt in partners who witnessed the event. Higher levels of anger and guilt in partners were related to

higher levels of acute PTSD symptoms but were not related to the rate of decline in PTSD symptoms. These findings confirm previous studies indicating that the presence of early trauma-related emotions not necessarily predicts chronic PTSD and that *persistent* anger was longitudinally associated with PTSD symptoms (Egberts et al., 2020), in concert with DSM-5 criteria pointing to the risk of persistent emotions (American Psychiatric Association, 2004). In sum, the current study reveals differences across trauma-populations in the extent to which specific emotions occur and its contextual factors.

This study supports the concurrent link between rumination and acute PTSD symptoms. Rumination was earlier found to be associated with a higher frequency of intrusions and overall PTSD (Laposa & Rector, 2012; Szabo et al., 2017). As posited by Ehlers and Clark (2000), rumination in response to intrusions may prevent change in the trauma memory and inhibits modification of trauma appraisals. No evidence was found for a lasting effect of initial rumination on PTSD symptoms, which may be an indication of state rumination. As reported by Szabo et al. (2017), trait rumination may be a more powerful predictor of PTSD symptoms and suggests that measuring rumination at a later time point may yield more predictive power. 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, and assessment of emotional and cognitive factors relatively shortly after the burn event, which makes it unlikely that these reports were affected by retrospective bias or changes in the interpretation of the event (e.g. Engelhard & McNally, 2015). However, some limitations of this study should be noted. First, the model construction was performed in an exploratory way. Therefore, model replication is warranted. Second, the sample size was relatively small considering the complex statistics which may affect statistical power, and the inclusion of more male partners would have increased the generalizability of the findings to men. Third, rumination was measured in general and shortly after the burn event. An assessment at a later time might have increased predictive power. Last, pre-existing psychological problems were not reported, nor did we inquire after social support or professional psychosocial support received by the partner post-burn. Considering the multi-centre study design, professional support may have differed across the study locations.

This study yields some potential clinical implications. First, it shows that partners were particularly affected during the early phase, and also three months later, when one in ten partners experienced PTSD symptoms. Early interventions and psychoeducation in

partners with acute PTSD symptom levels may improve stress management and emotion regulation (American Psychiatric Association, 2004). For instance, online education and interventions may be considered for partners (Gawlytta et al., 2020). Future research may study interpersonal processes between burn survivors and partners, as dyadic associations have been reported in survivors of critical illness and their partners (Rosendahl, Brunkhorst, Jaenichen, & Strauss, 2013).

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author, NVL. The data are not publicly available due to the uniqueness of the data. Burns are treated in a limited number of dedicated burn centers in the Netherlands and Belgium, which may compromise the privacy of research participants.

Disclosure statement

No potential conflict of interest was reported by the authors.

Ethics approval and consent to participate

All participants to the study provided 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).

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