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Prevalence and predictors of post-traumatic stress symptomatology among burn survivors: a systematic review and meta-analysis

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| Abstract: | <p>Burns can be a traumatic and stressful experience, although each patient may respond in very different ways. Objective: The aim of this study was to explore the variability on Post-traumatic stress disorder (PTSD) and Acute Stress Disorder (ASD) prevalence, and evaluate the specific weight of different variables on PTSD development among adult burn patients. Methods: A systematic review was carried out to explore the prevalence of ASD and PTSD and identify their predictors. Meta-analytical methods were used to explore the strength of association between PTSD and the latter. From an initial pool of 190 studies, 24 were used in the systematic review, and only 19 studies could be used for the meta-analysis due to different methodological limitations. Outcomes: The prevalence of ASD at baseline ranged from 2 to 30% and prevalence of PTSD ranged from 3 to 35% at 1 month, 2-40% between 3 and 6 months, 9-45% in the year post-injury and ranged 7-25% more than two years later. Life threat perception was the strongest predictor for PTSD occurrence, followed by acute intrusive symptoms and pain associated with burn injuries. Conclusions: Predictive variables identified in this research may be useful in targeting burn patients who are at risk for developing post-traumatic stress symptoms and stress related psychological symptoms.</p> |

Prevalence and predictors of post-traumatic stress symptomatology among burn survivors: a systematic review and meta-analysis

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**Prevalence and predictors of post-traumatic stress
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Abstract

Burns can be a traumatic and stressful experience, although each patient may respond in very different ways. **Objective:** The aim of this study was to explore the variability on Post-traumatic stress disorder and Acute Stress Disorder prevalence, and evaluate the specific weight of different variables on Post-traumatic stress disorder development among adult burn patients. **Methods:** A systematic review was carried out to explore the prevalence of acute and Post-traumatic stress disorder and identify their predictors. Meta-analytical methods were used to explore the strength of association between Post-traumatic stress disorder and the latter. From an initial pool of 190 studies, 24 were used in the systematic review, and only 19 studies could be used for the meta-analysis due to different methodological limitations. **Outcomes:** The prevalence of Acute Stress Disorder at baseline ranged from 2 to 30% and prevalence of Post-traumatic stress disorder ranged from 3 to 35% at 1 month, 2-40% between 3 and 6 months, 9-45% in the year post-injury and ranged 7-25% more than two years later. Life threat perception was the strongest predictor for Post-traumatic stress disorder occurrence, followed by acute intrusive symptoms and pain associated with burn injuries. **Conclusions:** Predictive variables identified in this research may be useful in targeting burn patients who are at risk for developing post-traumatic stress symptoms and stress related psychological symptoms.

Key words: *burn patients; post-traumatic stress; predictors; epidemiology; meta-analysis.*

1. Introduction

There is a wide variety of experiences that can result in a burn injury, including motor vehicle accidents, catastrophes or interpersonal violence. Although these experiences are very prevalent both in developed and developing societies, a significant proportion of people experiencing them will not develop psychological difficulties as a result ¹. However, as the incidence of burn and other traumatic injuries has grown in last decades ², there is a growing interest for the potential psychological distress derived from these events. Post-traumatic stress disorder (PTSD) is one of the most prevalent disorders that may result from these events, although its prevalence rates are particularly variable among burn injury patients. Depending on the time point of assessment, a review of the empirical data on psychological problems reported that PTSD may appear in 2 to 26% of burn patients within the first month, in a range of 8-33% at 3-4 months post-injury and 15-35 % may still met criteria one to two years after ³. Several studies point to possible international variability, with PTSD being diagnosed in one third of US and Japanese samples after burn injuries, in contrast with 15-20% of Dutch and Greek samples ⁴. Other authors also argue that burn injury may be due to the different combinations of psychometric instruments used ^{5,6}. Therein, a literature review of critical illnesses, including burn care patients ², reported a great variability of PTSD prevalence depending on the type of measure used. When researchers used diagnostic interviews, PTSD was found in 20–45% of patients; however the diagnosis ranged from 19 to 33% when using screening questionnaires. Different rates have been also reported between patients hospitalized for burn injuries in general hospitals compared to those admitted to specialized burn ⁷.

Predictors of post-traumatic stress symptomatology after traumatic exposure have been studied. Both a general review ⁸ and a meta-analysis made using samples of different traumatic events ⁹ underscore the role of biological factors, such as hyper-arousal responses, and cognitive mechanisms, such as perception and memory process occurring in the acute peritraumatic phases. A recent meta-analytic review ¹⁰ point to factors related to subjective experiences related to the event, such as low social support, peritraumatic fear, perceived life threat and co-morbid psychological problems, as factors closely related with PTSD development.

In the specific case of burn injuries, several reviews of the literature have been performed in relation with predictors of PTSD development, however, with little agreement. While objective factors such as the Total Body Surface Area (TBSA) burned, the length of hospital stay (LOS) or patients' gender, appear as stronger predictors of PTSD ¹¹, several studies also point to subjective variables, such as life threat perception, as significant risk factors for PTSD development ¹²⁻¹⁴, which in general are considered to be better predictors ⁶. Satisfaction with care and significant improvements in cures are also important subjective factors in the development of PTSD symptoms in these patients, as they may also affect the development of post-traumatic memories and thus the rehabilitation process ¹⁵. Despite this, empirical research about predictors of post-traumatic stress symptomatology following burn injuries has been said to have several limitations. While it is clear that PTSD prevalence shows great variability, findings in relation to predictive factors among traumatized patients, including burn patients, are often contradictory ¹ and have methodological limitations, especially in the recruitment process ¹⁶. Both factors make it difficult to build risk profiles for the early detection of PTSD.

Among all these studies and reviews, several theoretical frameworks are proposed to explain the different profiles of risk and resistance to post-traumatic symptomatology following burn injuries. Ozer and colleagues¹⁷ remind us of the role of memory, and thus the amygdale, the hippocampus and the hypothalamic–pituitary–adrenal (HPA) axis in both the development and maintenance of PTSD. Dalal and colleagues⁴ expand the idea of allostatic load to explain how an overload of the system during the aftermath of a burn injury can generate post-traumatic stress symptoms as a response to the traumatic experience itself. Allostasis is the adaptation that the body makes when facing stressful events, which involves the activation of several physiological systems in an attempt to maintain the stability of the body through the change process. When these allostatic systems are overloaded, the body is unable to cope with stressors. This model connects with cognitive models of post-traumatic stress disorder which emphasize the importance of individual ways of coping and also the appraisal of the event and its context¹⁸, such as the negative perceptions of the traumatic experience or its sequelae and the strength of associative memory. However, there is no convergence across studies on any consistent constellation of acute symptoms that may predict the further development of PTSD.

The aim of this study was to explore the variability of post-traumatic stress symptomatology prevalence and evaluate the specific weight of variables that may predict PTSD development among adult burn patients. Considering the heterogeneity of the studies, there is a need to sort the results in a manageable way. This meta-analytic review provides a critical analysis of the evidence found in the literature about post-

traumatic stress symptomatology and also provides clues to increase early detection of burn patients who are at risk of developing PTSD.

2. Method

2.1. Search strategy

An extensive literature search was conducted in an attempt to find all available studies carried with burn patients. The literature reviewed, included studies beginning from 1970 (onset of psychological effects of burns injuries research), through 2013. Three methods were used to track potentially relevant studies: (a) systematic inquiry of Internet resources such as PsychINFO, PILOTS and Medline (using “burn, trauma, AND PTSD” as main keywords) (b) specific search in specialized burn and trauma journals, and (c) snowballing review of references from identified studies.

2.2. Inclusion criteria

Inclusion criteria for studies were:

1. Burn injuries treated in clinical facilities.
2. Studies including prevalence of post-traumatic stress symptomatology measured with standardized measures.
3. Samples consisting exclusively of adult burn patients (> 16 years).

4. Data at least one month after injury (DSM-IV PTSD E criterion).
5. More than 50% of the sample was assessed within the same time period, to ensure minimal sample homogeneity.

After a title review of more than 2000 articles, over 250 studies were found and 190 studies were reviewed in detail. Finally, 29 articles met inclusion criteria, involving a total sample of 2312 patients, with a range of 23 to 428 patients per study.

An extra inclusion criterion for meta-analytic calculations was included. Only studies that offered bivariate statistics for PTSD predictors were considered. This data is necessary to compute the strength of association indices that can lead to calculate weighted effect sizes of the relation between predictive variables and post-traumatic outcomes.

2.3.Coding Procedure and meta-analysis sample

The following procedure was used in order to delimit which of these studies would be just used for the systematic review and which would be also appropriate for inclusion in the meta-analysis. If the same data was used in more than one article, they were considered as only one study, resulting in a sample of 24 studies. A final sample of 19 studies that included specific bivariate statistics for post-traumatic predictors was considered in the meta-analysis. In longitudinal design studies, in order to consider the specific conditions of the sample and predictors at each time points in the analysis, new cases for every different assessment moments from the same study were generated.

Furthermore, a great variability was found among evaluation time points. According to PTSD diagnosis criteria from the Diagnostic and Statistical Manual for Mental Disorders Fourth Edition Text Revision ¹⁹, diagnosis is considered “*acute stress symptomatology*” within the first month after burn injury. If symptoms persist at three months, PTSD is considered to be chronic, and at six months, it is considered the cut-off for delayed onset of post-traumatic symptoms after injury. Considering this criteria, and in order to unify the different symptom assessments found in the literature, the following time period categories were established: between first month and three months, between three and six months after burn injury occurrence, between six months and two years and finally, more than two years later. Predictive factors of PTSD were grouped in twenty-two categories in order to manage all the outcomes found in the review.

2.4. Meta-analytic statistical analysis

Only studies that used bivariate statistics [i.e. Odds Ratio, chi-square, t-tests, analysis of variance (ANOVA) or non-parametric equivalents] in relation with post-traumatic symptom prevalence and reporting statistical significant findings were included in the meta-analysis. The analysis was performed in two steps. In step one, studies that presented bivariate statistics (i.e. r , t , F , OR and χ^2) for predictive variables (e.g., gender, type of accident, life threat perception, level of pain during care, etc.) were converted to a unified strength of association index (i.e. “ r ”, no transformation was needed when the statistic was a Pearson product-moment correlation coefficient) using statistical software for strength of association calculation as the ones created by Dr

Becker from University of Colorado (<http://www.uccs.edu/~lbecker/>) and by Dr DeFife from the Emory University (<http://www.psychsystems.net/>). In step two, the weighted effect sizes for each predictive factor category was calculated using the method recommended by Field and Wright ²⁰. The mean effect size for every predictor was calculated including the results of all studies, in order to summarize all the strength of association indices.

3. Results

To our knowledge, there is no study before 1990 exploring PTSD prevalence in burn patients meeting inclusion criteria for our study. From the total pool of articles reviewed, 11 studies were done in the United States of America, three in Nordic Countries, three in the United Kingdom, three in the Netherlands, one in Germany, another one in Greece, one in Japan, another one in China and one was carried in Morocco (see Table 1).

-----PLEASE, INSERT TABLE 1 AROUND HERE-----

3.1. Methodological considerations

Considering the variability in the methods used across studies, some special considerations were taken into account before analyzing the different outcomes found.

Several studies from the review were excluded from the meta-analysis due to their limitations in PTSD assessment. In order to calculate the specific effect size of each predictor, data from bivariate correlations and PTSD prevalence should be indicated. For example, in the studies carried by Willebrand *et al.*¹³ and Fukunishi *et al.*^{15,21}, specific correlations of PTSD predictors were analyzed in relation with post-traumatic stress symptomatology, i.e. avoidance, intrusion and arousal symptoms individually. For that reason, these studies were not comparable with the rest of studies, which included only overall measures of PTSD. Another case is the study of Sveen *et al.*²², where none of the participants fulfilled criteria for PTSD. For that reason it was excluded from the analysis. In relation to predictor variables, the association between burn-specific attentional biases appeared as a possible predictor but it was only found to be statistically significant with sub-syndromal PTSD. For that reason, it was not included in the meta-analysis. Something similar happened with Meyer *et al.*²³, where predictors as female gender were associated with anxiety disorders in general, but not specifically with PTSD, so no predictive factor could be used in the analysis.

Regarding heterogeneity of methodologies, certain studies showed various difficulties when comparing them with others. As explained above, an ad-hoc time assessment classification was performed. In the study carried in Morocco by El hamaoui *et al.*²⁴, the assessment moment was very widespread, an average of eight years (SD=7.5 years) after the burn injury event. Therefore, we decided to include it in the analysis of the latest PTSD onset slot. Another case was Wallis *et al.*²⁵ which failed to clearly explain the assessment time points: “64% of patients < 6 months post-burn”. It was considered that it corresponded to the three to six months post-burn assessment category. Something similar happened with the study carried by Patterson *et al.*²⁶. The follow-up

point after discharge was not clearly stated (“range 10-240 days, median 40 days”), so it was considered that it corresponded to the one to three months assessment period group. In the work by Fauerbach *et al.*²⁷, a case was considered full PTSD when meeting all diagnostic criteria for that group at one or more of the three assessments (baseline, four months, and 12 months). Therefore, this study was included in the six to 24 months assessment group.

3.2. Post-traumatic symptomatology, ASD, and PTSD prevalence

A great variability was found in the literature, not only on the design and the time points of assessment, but also in the development of post-traumatic stress symptoms, PTSD prevalence, symptom measures and predictive variables also showed a significant variety. The main outcomes from the review are summarized in Table 1. The prevalence of ASD ranged from 2.2%²⁸ to 29.6%²⁹. Prevalence of PTSD ranged from 3.3%³⁰ to 35.1%³¹ during hospitalization, between 2.2%³⁰ and 40%³² 3-6 months later, between 9%³³ and 45.2 %³² around the year post-injury and ranged from 6.7%³⁴ to 25.4%³¹ more than two years after the burn injury time of occurrence. Some studies also indicated the prevalence of other psychiatric disorders. Depression was found in 2.2 % of the sample during the first weeks after burn and in 13.3% at three months²⁸, and even more than two years later, depression could range from 10%³⁴ to 55%²⁴. In relation to anxiety, it was found in 22.2% of patients at baseline and at three months post-burn²⁸ and finally, in 12% of the sample more than two years later³⁴.

3.3. Predictive factors

Table 1, shows the summary of the strength of association indices(r) and their weighted effect sizes (\bar{r}) of the predictive variables of PTSD in burn patients. There is a wide range of variables studied across literature as risk factors to develop stress symptoms. Therefore, they were classified in 22 categories and certain specific subcategories.

-----PLEASE, INSERT TABLE 2 AROUND HERE-----

From all the predictive factors analyzed, the predictor of PTSD with the strongest association was life threat perception ($r = 0.98$), followed by intrusion symptoms during acute care ($\bar{r} = 0.42$) and severity of pain ($\bar{r} = 0.39$).

Lifestyle factors, such as poor socioeconomic conditions of the patient ($\bar{r} = 0.37$) and being unmarried ($r = 0.28$), appeared also as important predictors of PTSD. Other predictive factors found, with certain strength of association with post-traumatic stress symptoms were previous mental health diagnosis ($\bar{r} = 0.28$) and other comorbid disorders during the recovery phase, such as Alcohol Use Disorders ($r = 0.37$), Acute Stress Symptoms ($\bar{r} = 0.29$), Substance Use Disorders ($r = 0.27$), Anxiety ($\bar{r} = 0.24$) and Depressive symptoms ($\bar{r} = 0.23$). A dissociation episode during the burn injury event ($\bar{r} = 0.33$) and negative emotions or distress ($\bar{r} = 0.32$) also seemed to be strongly related to PTSD development.

Objective variables such as age ($\bar{r} = 0.36$), TBSA ($\bar{r} = 0.26$), LOS ($\bar{r} = 0.23$), number of surgeries ($r = 0.20$) and gender ($\bar{r} = 0.20$) were not the most studied variables, nor the most predictive for PTSD development. In fact, across the literature reviewed they were frequently used as control variables.

Finally, variables with the lowest effect size were: attribution of responsibility for the burn injuries ($\bar{r} = 0.13$) and low narcissistic personality disorder symptoms ($\bar{r} = 0.17$).

Discussion

In line with other reviews, we found a great variability in PTSD prevalence across studies. Percentage of diagnosis in the sample was higher in older studies than in the more recent ones. It was hypothesized that this could happen in part because of the amelioration of burn injury care during last years by improving the medical quality of the recovery treatment of patients, allowing the process to be less painful and shortening hospital stays. Other cause of this variability may be the method of assessment. Higher prevalence rates were found when self-report questionnaires were used instead of clinical interviews. The same difference has been reported elsewhere², and seems to be related with the accuracy of the measurements used. The difference in sample size found in the literature, ranging from 23 to 428 patients depending on the study, could also have contributed to the variability in the resulting PTSD prevalence.

In line with previous literature¹³, according to the weighted effect sizes, the most powerful predictor of post-traumatic stress symptoms development in burn patients was found to be life threat perception during the burn injury event. Accordingly to other studies^{35,36} pain was also related to PTSD development in injured victims, including burns patients^{12,37}. The relationship between acute arousal and re-experiencing symptoms, and later post-traumatic symptoms, was influenced by pain level and supported the mutual maintenance theory of chronic pain and PTSD³⁵. In relation with

acute stress symptoms, they appeared as important predictors of post-traumatic stress symptoms development ^{31,38}, but intrusive symptoms in particular had the strongest association ^{29,32}. In analogy with pain, intrusion involves re-experiencing the traumatic event, consolidating therefore traumatic memories. The results of our review confirm the allostatic load hypothesis of Ozer and Dallal ^{4,17} as one of the most plausible explanations for post-traumatic symptoms development. The accumulated traumatic load may affect the individual ability to recover from the traumatic injury by leaving a negative mark in the memory. The role of the amygdale, the hippocampus and the hypothalamic–pituitary–adrenal (HPA) axis in both the development and maintenance of post-traumatic stress symptomatology would be due to a disproportionate adaptive response of our system in situations of significant danger. The combination of the intense fear caused by life threat perception, accompanied with severe pain and intrusive memories following the event, may increase the risk of an overloaded system response. It was hypothesized that these factors seems to mediate the relation between the perception of the traumatic event and its psychological consequences. This could explain why these factors appeared to be stronger predictors of PTSD development. Subjective factors, such as self-efficacy beliefs and fear perception, were found to be associated with PTSD symptoms in traumatic experiences ³⁹, so these individual issues should be considered in the screenings and treatments of patients in order to improve their quality of life. As other authors conclude ¹⁸, this model underscores the importance of cognitive processes during a traumatic experience and reminds that different interpersonal interpretations of the event and its context may be considered as determinant factors of successful recovery.

Although not so pronounced as the above variables, the importance of social and economic support for the prevention of psychological distress after a burn injury has been demonstrated. Fully satisfactory social functioning, with positive relationships, absence of feelings of shame, plenty of leisure arrangements and good future appraisal appeared as protector variables in front of post-traumatic stress development ^{11,40,41}. Therefore, available socioeconomic resources and stable social or family support could help to prevent PTSD symptoms. In this regard, staying in a positive mood and avoiding perceptions of distress and negative feelings, may be also one of the great challenges when trying to overcome post-traumatic stress symptoms ^{14,25,31,32,34}. In contrast, having a previous psychiatric disorder ^{31,33} or developing an additional comorbid mental health problem during the acute care period ^{12,24,29,33}, are both vulnerability factors for PTSD development.

We should stress several limitations of this study. There is a great variability in the methods used across the literature, leading to difficult-to-compare outcomes. Besides, results of the meta-analysis were limited by the data provided by the studies and the resulting effect size indices may be influenced by other moderating factors that were not reported. Therefore, future studies should still deepen in the relations between variables mediating post-traumatic stress susceptibility and the effectiveness of treatment programs that focus on these factors.

In conclusion, despite the variety of results found in the literature, it is clear that subjective variables related to the perception and memories of the traumatic event, such as life threat perception, acute intrusive symptoms and pain, are the strongest predictors of PTSD development in burned patients. As the severity of injuries is by far not the

best predictor, giving greater attention to the individual differences of patients and their context, may help preventing further psychological distress. It would be advisable to establish a routine schedule of psychosocial screening in burns units in order to early identify these vulnerability factors and offer suitable interventions.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Table 1. Main outcomes from the Systematic review

| | Reference | Design | N | Measures | Prevalence | Predictors |
|-------------------|---|--------------|---------------------------|---|--|---|
| Studies from USA: | | | | | | |
| 1. | (Patterson, Carrigan, Questad, & Robinson, 1990) | Longitudinal | 54 | An interview based on the checklist of the DSM. | PTSD 29.6% (baseline) and 9.1% (follow-up) | TBSA, LOS, female gender, and lack of responsibility for the injury. |
| 2. | (Roca, Spence, & Munster, 1992) | Longitudinal | 43 (31 at 4 months) | SCID, BDI, NEO and MMCI. | PTSD: 7.1% (baseline) and 22.6% (4 months) | Low openness and low narcissism. |
| 3. | (Perry, Difede, Musngi, Frances, & Jacobsberg, 1992) | Longitudinal | 51 (31 at 12 months) | SCID, POMS, IES and ISEL. | 35.3% met PTSD criteria at 2 months, 40% at 6 months and 45.2% at 12 months. | Lack of social support (at 2 months), intrusive thoughts (at 6 months) and avoidant thoughts (at 12 months). Emotional distress at all assessments. |
| | (J Difede & Barocas, 1999) | Longitudinal | 52 (31 at 12 months) | IES and SCID | PTSD 45.16% | Avoidance symptoms at baseline. |
| 4. | (Powers, Cruse, Daniels, & Stevens, 1994) | Longitudinal | 39 | SCID | 38% met PTSD criteria and 43% past or current PTSD. 74% of patients had re-experience symptoms for at least 1 month, but only 30% currently experienced flashbacks | Female gender. |
| 5. | (Fauerbach et al., 1997) | Longitudinal | 95 | SCID, BDI, the NEO-PI and BSHS-SV. | PTSD at discharge: 8.4%, at 4 months: 28%, and at 12 months: 20.4% | LOS and pre-burn affective disorder (but not anxiety disorder) and alcohol and drug use disorders. |
| 6. | (Ehde, Patterson, Wiechman, & Wilson, 2000) | Longitudinal | 172 (79 at 12 months) | A checklist based on the DSM and the Rand of MHI. | PTSD at 1 month 21.2% and 19.0% at 1 year | For PTSD at 1 month: Baseline stress symptoms and LOS. For PTSD at 1 year: PTSD symptoms at 1 month. |
| 7. | (Fauerbach, Lawrence, Schmidt, Munster, & Costa, 2000) | Longitudinal | 70 (40 at 12 months) | SCID, BDI, BSHS-SV and NEO-PI. | PTSD 25,71% at 4 or 12 months | Higher neuroticism and lower extraversion. |
| 8. | (JoAnn Difede et al., 2002) | Longitudinal | 83 (59 at 6 months) | BSI, CAPS, IES and SCID | ASD 21% and 36% PTSD at 6 months | ASD and anxiety or depression (distress measures), and avoidance, arousal and intrusive symptoms. |
| 9. | (McKibben, Bresnick, Wiechman Askay, & Fauerbach, 2008) | Longitudinal | 151 (71 at 24 months). | SASRQ, DTS and BSI. | ASD 23.6%, and 35.1, 33.3, 28.6, and 25.4% of the participants met PTSD criteria at 1, 6, 12, and 24 months, respectively. | Female gender, mental health treatment in the year before the burn, a high score on BSI, more burn-related operations and ASD. |

| | Reference | Design | N | Measures | Prevalence | Predictors |
|------------------------------|--|-----------------|---------------------------|---|---|---|
| 10. | (McGhee et al., 2011) | Cross-sectional | 47 | PCL-M | PTSD 27.7% | The pain levels. |
| Studies from Sweden: | | | | | | |
| 11. | (Willebrand, Andersson, & Ekselius, 2004) | Longitudinal | 34 | HADS, IES-R, LTE-Q (1 year and lifetime) and CTI. | Intrusion: mean 10.8, SD 9.0/ mean 13.6, SD 10.0. Avoidance: mean 8.6, SD 9.4/ mean 10.8, SD 11.8. Arousal: mean 3.4, SD 4.6/ mean 9.0, SD 8.2. | Early symptoms, subjective life threat, dissociative experience and avoidant coping. |
| | (Sveen, Dyster-Aas, & Willebrand, 2009) | Longitudinal | 38 | IES, SCID, HADS, LTE-Q and the Modified Emotional Stroop Task | None fulfilled criteria for PTSD, 18.4% had subsyndromal PTSD. | Burn-specific attentional bias, more previous life events, perceived life threat and larger burns. |
| 12. | (Dyster-Aas, Willebrand, Wikehult, Gerdin, & Ekselius, 2008) | Longitudinal | 73 (64 at 12 months) | SCID | ASD 9.5%. PTSD 9% at 12 months. | Lifetime affective disorder and lifetime substance use disorder. |
| Study from Finland: | | | | | | |
| 13. | (Palmu, Suominen, Vuola, & Isometsä, 2011) | Longitudinal | 107 (92 at 6 months) | SCID, IES. | 5.4% ASD and 2.2% PTSD at 6 months. | TBSA only correlates weakly with avoidance and intrusive symptoms at 6 months. |
| Studies from Netherlands: | | | | | | |
| 14. | (L. A. Taal & Faber, 1998) I | Longitudinal | 428 (174 at follow-up) | IES, SCL-PTSD, and BSHS-SV. | 33 % suffered severe PTSD symptoms, Mean IES-score 19.77 (SD = 17.57) | |
| | (L. Taal & Faber, 1998) II | Longitudinal | 174 | IES, SCL-PTSD, ADS, LS and BSHS-SV. | | Life threat perception and burn related feelings of intimate shame. |
| 15. | (Van Loey, Maas, Faber, & Taal, 2003) | Longitudinal | 301 (240 at 12 months) | IES, the ADS and BSPAS. | ASD 26% and PTSD 15% 1 year after. | Pain, peritraumatic dissociation, anxiety TBSA, gender and LOS, |
| 16. | (Van Loey, Van Son, Van der Heijden, & Ellis, 2008) | Cross-sectional | 90 | CIDI and IES. | PTSD 8% and partial PTSD in 13%. | Negative emotional state and responsibility attribution to impersonal relationships. TBSA and gender are related to partial PTSD. |
| Study from Germany: | | | | | | |
| 17. | (Wallis et al., 2006) | Cross-sectional | 55 | SCL, PSS, HADS, LOT, GSE, FKV-LIS and F-SozU-K-14. | PTSD 13% (baseline) and 25% at follow-up. | Distress (anxiety and depression). |
| Studies from United Kingdom: | | | | | | |
| 18. | (Williams & Griffiths, 1991) | Cross-sectional | 23 | HADS, IES. | PTSD 13%. | The visibility of the burn. |
| 19. | (J. Tedstone, 1998) | Longitudinal | 45 | IES, PENN, HADS, | No specific PTSD prevalence was indicated. | Emotion focused coping, low levels of |

| | Reference | Design | N | Measures | Prevalence | Predictors |
|---------------------|--|---|-------------------------|----------------------------|---|--|
| | | | | BCQ, and WCC. | | acceptance coping and a bleak outlook on the future. |
| | (J. E. Tedstone & Tarrier, 1997) | Longitudinal | 45 | HADS, IES, PENN. | ASD 2.22%, avoidance or intrusion 37.78% PTSD 8.89%, avoidance or intrusion 40%. | The most part of the cases had previous mental illness. No relationship was found with TBSA. |
| 20. | (Bisson, Jenkins, Alexander, & Bannister, 1997) | Longitudinal Randomised controlled trial | 103 | IES, CAPS and HADS. | PTSD 18.44% (3 months) and 19.41% (13 months). | Higher initial IES score and the length of Psychological Debriefing (PD) used with patients. |
| Study from Greece | | | | | | |
| 21. | (Madianos, Papaghelis, Ioannovich, & Dafni, 2001) | Longitudinal | 45 (30 at 12 months) | SCID and Langer Scale. | PTSD: 17.8% (21 days) and 20% (12 months). | The possibility of disfigurement |
| Studies from Japan: | | | | | | |
| 22. | (Fukunishi, 1999) | Longitudinal | 56 | SCID and an own interview. | PTSD 33.9% | Female gender and the degree of cosmetic disfigurement. |
| | (Fukunishi, 1998) | Cross-sectional | 56 | SCID | PTSD 33.9%. | Female gender and facial burn. |
| Study from China: | | | | | | |
| 23. | (Lu, Lin, Chou, & Tung, 2007) | Cross-sectional | 82 | MINI | PTSD 26.8%. | Female gender, unmarried, a lack of leisure arrangements, the need for counseling and psychological therapy. |
| Study from Morocco: | | | | | | |
| 24. | (El hamaoui, Yaalaoui, Chihabeddine, Boukind, & Moussaoui, 2002) | Cross-sectional | 60 | SCID, HDRS, HARS and GAF. | PTSD 23.3%. | Age, butane explosion, low social functioning, anxiety and depression symptoms. |

Note. **ADS** = Anxiety Dissociation Scale; **ASD** = Acute Stress Disorder; **BCQ** = Burn Concerns Questionnaire; **BDI** = Beck Depression Inventory; **BPSM** = Burn Psycho-Somatic Morbidity Scale; **BSHS-SV** = Burn Specific Health Scale - short version; **BSI** = Brief Symptom Inventory; **BSPAS** = Burn Specific Pain and Anxiety Scale; **CIDI** = Composite International Diagnostic Interview; **CTI** = Coping with Trauma Interview; **DTS** = Davidson Trauma Scale; **DSM** = Diagnostic and Statistical Manual of Mental Disorders; **FKV-LIS** = Freiburg Questionnaire of Coping with Illness; **F-SozU-K-14** = Social Support Questionnaire; **GAF** = Global assessment of functioning scale; **GSE** = General Self-Efficacy Scale; **HADS** = Hospital Anxiety and Depression Scale; **HARS** = Hamilton Scale for anxiety; **HDRS** = Hamilton Scale for depression; **IES** = Impact of Event Scale; **LOS** = Length of Stay; **ISEL** = Interpersonal Support Evaluation List; **LOT** = Life Orientation Test ; **LS** = Loneliness-scale ; **LTE-Q** = List of Threatening Events Questionnaire; **MHI** = Mental health Inventory; **MINI** = MINI International Diagnostic Interview; **MMCI** = Millon Multiaxial Clinical Inventory; **NEO-PI** = NEO Personality Inventory; **PCL-M** = PTSD checklist-military; **PD** = Psychological Debriefing intervention; **PENN** = Penn Inventory for Posttraumatic Stress Disorder; **POMS** = Profile of Mood States; **PSS** = Posttraumatic Stress Disorder Symptom Scale ; **PTSD** = Posttraumatic Stress Disorder; **SASQR** = Stanford Acute Stress Reaction Questionnaire; **SCID** = Structured Clinical Interview for DSM; **SCL-PTSD** = Symptom Checklist 90 for PTSD; **TBSA** = Total Body Surface Area burned; **WCC** = the Ways of Coping Checklist- Revised

Table 2. Strength of association index of PTSD impact variables

| Predictor | Time period of assessment | Reference | N | Strength of association index |
|--------------------------------|----------------------------------|--|------------|--------------------------------------|
| *Life Threat perception | PTSD at 6-24 months post-burn | (L. Taal & Faber, 1998) and (L. A. Taal & Faber, 1998) | 428 | r = 0.98 |
| Acute stress symptoms: | Early PTSD | (Ehde et al., 2000) | 172 | r = 0.31 |
| | | (McKibben et al., 2008) | 178 | r = 0.26 |
| | PTSD at 3-6 months post-burn | (JoAnn Difede et al., 2002) | 83 | r = 0.39 |
| | PTSD at 6-24 months post-burn | (Ehde et al., 2000) | 79 | r = 0.69 |
| | | (Bisson, Jenkins, Alexander, & Bannister, 1997) | 133 | r = 0.50 |
| | | Weighted effect size | 645 | $\bar{r} = 0.29$ |
| Avoidance | PTSD at 3-6 months post-burn | (Perry et al., 1992) | 40 | r = 0.45 |
| | | (JoAnn Difede et al., 2002) | 83 | r = 0.33 |
| | PTSD at 6-24 months post-burn | (Perry et al., 1992) | 31 | r = 0.62 |
| | | (J Difede & Barocas, 1999) | 31 | r = 0.36 |
| | | Weighted effect size | 185 | $\bar{r} = 0.35$ |
| *Intrusion | PTSD at 3-6 months post-burn | (Perry et al., 1992) | 40 | r = 0.63 |
| | | (JoAnn Difede et al., 2002) | 83 | r = 0.48 |
| | PTSD at 6-24 months post-burn | (Perry et al., 1992) | 31 | r = 0.56 |
| | | Weighted effect size | 154 | $\bar{r} = 0.42$ |
| *Pain | Early PTSD | (McGhee et al., 2011) | 47 | r = 0.41 |
| | PTSD at 6-24 months post-burn | (Van Loey et al., 2003) | 240 | r = 0.39 |
| | | Weighted effect size | 287 | $\bar{r} = 0.39$ |

| | | | | |
|---|-------------------------------|--|------------|------------------------------------|
| Poor socioeconomic conditions of patient | Early PTSD | (Perry et al., 1992) | 51 | $r = 0.34$ |
| | PTSD at 6-24 months post-burn | (Lu et al., 2007) | 82 | $r = 0.26$ |
| | | (L. Taal & Faber, 1998) and (L. A. Taal & Faber, 1998) | 428 | $r = 0.44$ |
| | PTSD after >2 years of burn | (El hamaoui et al., 2002) | 60 | $r = 0.26$ |
| | | Weighted effect size | 621 | $\bar{r} = 0.37$ |
| AUD | PTSD at 6-24 months post-burn | (Fauerbach et al., 1997) | 95 | $r = 0.37$ |
| Age | PTSD after >2 years of burn | (El hamaoui, Yaalaoui, Chihabeddine, Boukind, & Moussaoui, 2002) | 60 | $r = 0.36$ |
| Dissociation | PTSD at 3-6 months post-burn | (JoAnn Difede et al., 2002) | 83 | $r = 0.39$ |
| | | (Van Loey et al., 2003) | 240 | $r = 0.31$ |
| | | Weighted effect size | 323 | $\bar{r} = 0.33$ |
| Negative emotions or distress | Early PTSD | (Perry et al., 1992) | 51 | $r = 0.38$ |
| | | (McKibben et al., 2008) | 178 | $r = 0.43$ |
| | PTSD at 3-6 months post-burn | (Wallis et al., 2006) | 55 | $r = 0.57$ |
| | | (Perry et al., 1992) | 40 | $r = 0.43$ |
| | PTSD at 6-24 months post-burn | (Perry et al., 1992) | 31 | $r = 0.57$ |
| | PTSD after >2 years of burn | (Van Loey, van Son, van der Heijden, & Ellis, 2008) | 90 | $r = 0.49$ |
| | | Weighted effect size | 445 | $\bar{r} = 0.32$ |
| Unmarried patients | PTSD at 6-24 months post-burn | (Lu et al., 2007) | 82 | $r = 0.28$ |
| Previous psychiatric disorders | Early PTSD | (McKibben et al., 2008) | 178 | $r = 0.27$ |
| | | (Dyster-Aas, Willebrand, Wikehult, Gerdin, & Ekselius, 2008) | 73 | $r = 0.31$ |
| | | Weighted effect size | 251 | $\bar{r} = 0.28$ |

| | | | | |
|---------------------------------------|-------------------------------|--|------------|------------------------------------|
| SUD | PTSD at 6-24 months post-burn | (Fauerbach et al., 1997) | 95 | r = 0.27 |
| Stress treatment factors: | | | | |
| Acute Psychological debriefing | PTSD at 6-24 months post-burn | (Bisson et al., 1997) | 133 | r = 0.44 |
| Need for Psychotherapy | | (Lu et al., 2007) | 82 | r = 0.26 |
| Need for Counseling | | (Lu et al., 2007) | 82 | r = 0.37 |
| | | Weighted effect size | 297 | $\bar{r} = 0.27$ |
| Injured by explosion | PTSD after >2 years of burn | (El hamaoui et al., 2002) | 60 | r = 0.26 |
| TBSA | Early PTSD | (Perry, Difede, Musngi, Frances, & Jacobsberg, 1992) | 51 | r = 0.30 |
| | | (Patterson, Carrigan, Questad, & Robinson, 1990) | 54 | r = 0.53 |
| | PTSD at 3-6 months post-burn | (Palmu, Suominen, Vuola, & Isometsä, 2011) | 107 | r = 0.20 |
| | PTSD at 6-24 months post-burn | (Van Loey, Maas, Faber, & Taal, 2003) | 240 | r = 0.21 |
| | | Weighted effect size | 452 | $\bar{r} = 0.26$ |
| Anxiety symptoms | PTSD at 3-6 months post-burn | (JoAnn Difede et al., 2002) | 83 | r = 0.30 |
| | PTSD at 6-24 months post-burn | (Van Loey et al., 2003) | 240 | r = 0.28 |
| | PTSD after >2 years of burn | (El hamaoui et al., 2002) | 60 | r = 0.30 |
| | | Weighted effect size | 383 | $\bar{r} = 0.24$ |
| Depression symptoms | PTSD at 3-6 months post-burn | (JoAnn Difede et al., 2002) | 83 | r = 0.32 |
| | PTSD at 6-24 months post-burn | (Dyster-Aas et al., 2008) | 73 | r = 0.29 |
| | | (Fauerbach et al., 1997) | 95 | r = 0.24 |
| | PTSD after >2 years of burn | (El hamaoui et al., 2002) | 60 | r = 0.35 |
| | | Weighted effect size | 311 | $\bar{r} = 0.23$ |
| LOS | Early PTSD | (Patterson et al., 1990) | 54 | r = 0.45 |
| | | (Ehde, Patterson, Wiechman, & Wilson, 2000) | 172 | r = 0.25 |

| | | | | |
|--|-------------------------------|---|------------|------------------------------------|
| | PTSD at 6-24 months post-burn | (Fauerbach et al., 1997) | 95 | $r = 0.20$ |
| | | (Van Loey et al., 2003) | 240 | $r = 0.18$ |
| | | Weighted effect size | 561 | $\bar{r} = 0.23$ |
| Personality traits: | | | | |
| Low Openness | Early PTSD | (Roca et al., 1992) | 43 | $r = 0.34$ |
| | PTSD at 3-6 months post-burn | (Roca et al., 1992) | 31 | $r = 0.38$ |
| High Neuroticism | PTSD at 6-24 months post-burn | (Fauerbach, Lawrence, Schmidt, Munster, & Costa, 2000) | 70 | $r = 0.24$ |
| Low Extraversion | PTSD at 6-24 months post-burn | (Fauerbach et al., 2000) | 70 | $r = 0.22$ |
| | | Weighted effect size | 214 | $\bar{r} = 0.20$ |
| Female gender | Early PTSD | (Patterson et al., 1990) | 54 | $r = 0.24$ |
| | | (McKibben, Bresnick, Wiechman Askay, & Fauerbach, 2008) | 178 | $r = 0.18$ |
| | PTSD at 6-24 months post-burn | (Lu, Lin, Chou, & Tung, 2007) | 82 | $r = 0.22$ |
| | | (Van Loey et al., 2003) | 240 | $r = 0.21$ |
| | | Weighted effect size | 554 | $\bar{r} = 0.20$ |
| Number of surgeries | Early PTSD | (McKibben et al., 2008) | 178 | $r = 0.20$ |
| PD: Low narcissism | Early PTSD | (Roca, Spence, & Munster, 1992) | 43 | $r = 0.30$ |
| | PTSD at 3-6 months post-burn | (Roca et al., 1992) | 31 | $r = 0.35$ |
| | | Weighted effect size | 74 | $\bar{r} = 0.17$ |
| Burn injury attribution of responsibility | Early PTSD | (Patterson et al., 1990) | 54 | $r = 0.35$ |
| | PTSD at 6-24 months post-burn | (Van Loey et al., 2008) | 90 | $r = 0.48$ |
| | | Weighted effect size | 144 | $\bar{r} = 0.13$ |

Note. AUD = Alcohol Use Disorder; LOS= Length of stay; PD = Personality disorder; PTSD = Post Traumatic Stress Disorder; SUD = Substance Use Disorder; TBSA = Total Body Surface Area Burned.

**The 3 strongest predictors of PTSD*

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