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Psychological Distress After Major Burn Injury

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Abstract

Objective—To track the prevalence and stability of clinically significant psychological distress and to identify potentially modifiable inhospital symptoms predictive of long-term distress (physical, psychological, and social impairment).

Method—We obtained data from the Burn Model Systems project, a prospective, multisite, cohort study of major burn injury survivors. The Brief Symptom Inventory (BSI) was used to assess symptoms in-hospital (n = 1232) and at 6 (n = 790), 12 (n = 645), and 24 (n = 433) months post burn. Distress was examined dimensionally (BSI's Global Severity Index (GSI)) and categorically (groups formed by dichotomizing GSI: T score ≥63). Attrition was unrelated to in-hospital GSI score.

Results—Significant in-hospital psychological distress occurred in 34% of the patients, and clinically significant and reliable change in symptom severity by follow-up visits occurred infrequently. Principal components analysis of in-hospital distress symptoms demonstrated “alienation” and “anxiety” factors that robustly predicted distress at 6, 12, and 24 months, controlling for correlates of baseline distress.

Conclusions—This is the largest prospective, multisite, cohort study of patients with major burn injury. We found that clinically significant in-hospital psychological distress was common and tends to persist. Two structural components of in-hospital distress seemed particularly predictive of long-term distress. Research is needed to determine if early recognition and treatment of patients with in-hospital psychological distress can improve long-term outcomes.

Keywords

burn injury; psychological distress; prevalence; burn model systems; predictors; prospective

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Introduction

Burn injuries are frequent and disabling problems in most areas of the world, resulting in approximately 1 million emergency department visits, 50,000 hospital admissions, and a 5% mortality rate in the United States (US) alone (1,2). The prevalence and distribution of risk factors, causes, and burn agents differ widely across categories such as age, gender, and ethnocultural background (2). Major burns, defined by the American Burn Association (ABA), in terms of percentage of total body surface area burned (TBSA), location, or secondary complications (3), may result in pain, shock, sepsis, and dysregulation of the hypothalamic-pituitary-adrenocortical axis and immune system (2,4). The guiding aims of the ongoing, prospective, multicenter burn model systems (BMS) study are to investigate the prevalence and course of secondary complications and functional impairments and to improve the outcomes of individuals who sustain major burn injury (5).

Psychological distress is among the most frequent and debilitating complications post burn injury. Preliminary reports using the BMS dataset indicated that one third of patients with major burns ($n = 162$) had clinically significant psychological distress at the time of discharge (6), and the mean level of psychological distress in the BMS sample (7) was significantly higher than that reflected in published data from a normative sample (8). In addition, psychological distress in-hospital predicted significantly greater physical impairment for at least 1 year post burn (6). Clinically significant psychological distress also accounted for substantial variance in concurrently assessed quality of life at 2 (58%), 6 (68%), and 12 (51%) months post burn injury (9). Severe psychological distress is an important secondary complication of major burn injuries, with long-term consequences.

Stress disorders and depression are prevalent. For example, acute stress disorder (ASD) has been reported in 18% to 26% in Greek (10), US (11), and Dutch (12) samples. Posttraumatic stress disorder (PTSD) has been observed in one third of Japanese (13) and US (11) samples between 3 and 6 months post burn, and 15% to 20% of Dutch (12) and Greek (10) samples at 1 year. PTSD was more common among Veterans Administration patients with extensive burns than among those with spinal injuries, amputations, major chest trauma, heart failure, or cardiac arrest (14). In an Australian sample, high levels of distress during a major brush fire was more strongly associated with PTSD symptoms than were sociodemographic or preexposure psychological variables (15). Finally, clinically significant symptoms of depression were reported by 23% in a US sample (16) and 27% in a British sample (17) at 2 years; and 20% of Greek patients with burn injuries had a depressive disorder at 2 years (10).

Distress may manifest in other forms as well. Body image dissatisfaction appears common in patients with burn injuries (18). Sleep disturbances occur frequently among in-patients with burns, e.g., nightmares in 39% and significant sleep problems in 75% (19–21). Furthermore, many adult Swedish (22) and US (23) burn survivors continue to report nightmares (30% to 43%) and insomnia (37%) between 1 and 11 years post burn. Sleep problems, PTSD symptoms, and scar-related problems were highly intercorrelated in a Dutch sample (24).

Accumulating evidence suggests that psychological distress symptoms have a short- and long-term impact on health, function, and quality of life. Prolonged functional impairment has been associated with sleep disturbance (25), subsyndromal PTSD (23,26,27), depression (16,28), body image dissatisfaction (29), and syndromal PTSD (11,30). The presence of such a wide range of symptoms and syndromes is not at all unexpected given the plethora of stressors for patients with burns (e.g., burn event, losses, pain, repeated painful procedures, disfiguring injury, unfamiliar surroundings).

The current study fills an important gap in the literature by reporting the prevalence of clinically significant psychological distress during hospitalization and over the first 2 years post burn in a large-scale, prospective, multisite cohort. The primary objectives of this study are to track the prevalence and stability of distress over time and to identify potentially modifiable acute-stage symptoms that predict long-term distress among individuals surviving major burn injury. We hypothesized that clinically significant distress at baseline would be a risk factor for such distress at follow-up and that some early symptoms may be particularly associated with long-term distress. If confirmed, individuals at risk for long-term distress could be identified in-hospital, thus providing an early opportunity for secondary prevention.

Methods

Participants

Participants were recruited from consecutive patients (≥16 years old), who were admitted to one of three regional burn centers between May 1, 1994 and June 1, 2000 (5) and who met the ABA criteria for major burns (3). The Institutional Review Boards at Johns Hopkins University, University of Texas, Southwestern Medical Center, and University of Washington reviewed and approved the local study protocols. Participants were assessed at discharge (n = 1232) and at scheduled follow-up visits at 6 (n = 790), 12 (n = 645), and 24 (n = 433) months post burn injury.

Most participants were employed at the time of injury (72%). Injury circumstances were categorized as work-related (28.6%), nonwork, nonintentional (64%), or suspected abuse or assault (7.4%). Most participants were male (79.3%) and either Caucasian American (71.8%) or African American (24.5%). The average age of study participants was 38.6 years (standard deviation (SD) = 13.9). Baseline comorbid conditions were common (26%); 5.6% had preburn physical disabilities, and, during the year before the burn injury, 14.6% had abused alcohol, 9.3% had abused drugs, and 8% had sought mental health treatment. Injury agents included flame (70%), scalding (10.9%), and grease (8.7%). The average TBSA burned was 18.7% (SD = 16.0). Approximately 78% required one or more surgeries, with an average TBSA requiring autologous skin grafting of 8.5% (SD = 11.0). Hand injuries were present in 84.4%, and 52% had burns involving the face, head, or neck. Amputations were performed in 5.1% and >40% had joint contractures at discharge.

Conclusions relating to the generalizability of findings are, to a large degree, based on the comparability of the sample to the population from which it is drawn. The population to which the results from this sample are intended to generalize is that group of patients

admitted to regional burn centers with an injury that meets the criteria for having sustained an ABA-defined major burn injury. Two of the three centers were able to provide data contrasting eligible patients who consented with those eligible patients who did not. Of the 780 eligible patients admitted to the University of Texas burn center during the study period, 483 (66.2%) consented to the study. Those who consented were comparable to those who declined on gender (male gender: 82.2% versus 73.3%), race (White: 62.1% versus 59.5%), age (37.9 years versus 43.8 years), TBSA (22.3% versus 22.1%) and TBSA-full thickness (8.4% versus 8.6%). Similarly, of the 389 eligible patients admitted to the Johns Hopkins burn center during the study period, 210 (53.9%) consented to the study. Those who consented were comparable to those who declined on gender (male gender: 72.9% versus 69.1%), race (White: 59% versus 68.5%), age (33.7 years versus 43.9 years), TBSA (15.1% versus 19.2%) and TBSA-full thickness (5.8% versus 5.1%).

Furthermore, the BMS sample is comparable, in many respects, to the 10-year cohort reported in the National Burn Registry (NBR) for the period 1995 to 2005 (31). The NBR has ≥ 126,000 individual records on patients with burn injuries from hospitals in 30 states and the District of Columbia. Seventy percent of the NBR patients were male, with a mean age of 33 years; 62% were Caucasian and 18% African American. Forty-three percent of the burns occurred in the home, and 78.5% resulted from flames or hot liquids. In contrast to the current study that recruited only patients with major burn injuries, in the NBR roughly two thirds of the sample had burns covering <10% TBSA.

Sample Attrition and Incomplete Data

The proportion of the original sample (n = 1232) participating at 6-, 12-and 24-month follow-up visits, respectively, was 64.1% (n = 790), 52.4% (n = 645), and 35.1% (n = 433). Repeated measurements on the Brief Symptom Inventory (BSI) (8) were missing at follow-up on some additional participants, further reducing the proportion of the original sample available for some analyses to 56% (n = 689), 45% (n =550), and 30% (n = 373) at 6, 12, and 24 months. Sample reduction due to attrition or missing data were not related to in-hospital distress, as measured by T score on the Global Severity Index (GSI) of the BSI, at 6 [$t(1230) = -1.80$; $p > .07$)] or 24 [$t(1230) = -1.42$;$p > .16$)] months. Although sample reduction at 12 months was differentially related to baseline GSI [$t(1230) = -1.99$; $p < .05$)], the mean value of in-hospital GSI T scores for the retained sample at 12 months (56.9 ± 11.30) was not substantially smaller than that for those lost to follow-up or with incomplete data (58.2 ± 11.87) (Cohen's effect size = 0.11).

Importantly, in calculating study attrition, a conservative definition of “missing data” was adopted, such that anyone who had an initial baseline BSI and was missing ≥1 BSI was counted as having missing data. Of note, the BSI was dropped from the longitudinal database as of June 1, 2000 according to the recommendation of the BMS Executive Committee (5). Participants were not administered the BSI after that date, even if it had been administered at an earlier assessment. Hence, 450 of the individuals with a baseline BSI record could not provide a complete series (i.e., BSI = baseline, 6 months, 12 months, and 24 months) by design.

Measures

Brief Symptom Inventory (BSI) (8)—BSI, a 53-item version of the Symptom Checklist 90-Revised (32), measures the severity of psychological distress over the previous 7 days. Respondents rate how much they were distressed by each symptom using a 5-point Likert scale (0 = not at all; 4 = always). The BSI has good internal consistency and retest reliability (8). The GSI is the BSI's most sensitive index of psychological distress (33), and it has been shown to discern among clinical and normative populations (34). The GSI was dichotomized at T score ≥63 (high distress) versus T score <63 (low distress). This GSI cut-off has been shown to be a valid and reliable marker for the presence of a significant psychiatric condition (i.e., clinically significant psychological distress) warranting evaluation and possible intervention (8) and has been used in other large-scale, multisite studies in injured populations (35). Rather than gold standard, structured clinical interviews, a self-report psychological assessment tool, was used primarily because the large-scale, long-term, multisite nature of the study obviated a formal diagnostic approach.

Demographic, Injury, and Treatment Variables

The following were obtained by chart review: inhalation injury requiring endotracheal intubation; percent TBSA burned; percent TBSA grafted; presence of deep partial-thickness or full-thickness burn injuries to the hands; surgery and hand surgery; and burn-related amputations.

Limitations in Range of Motion (ROM)—The presence of a limitation in ROM in one or more joints was determined at the time of discharge using the criteria established by the American Medical Association (36).

Preburn Medical History—The presence of significant medical conditions was evaluated by self-report as part of the routine history and physical examination on admission to the burn centers. The data dictionary for the BMS project has defined a significant medical condition as “medical problems that might alter the course of recovery from the burn (e.g., diabetes, COPD, coronary artery disease, asthma)” (5); COPD referred to chronic obstructive pulmonary disease. The Principal Investigator at each study site was responsible for adjudicating cases that were not given as examples in the data dictionary (e.g., renal disease). The presence of psychiatric conditions for which patients sought professional treatment in the year before the injury was assessed by a single question.

Preburn Disability Compensation—Social security disability compensation at the time of the burn injury was used as a marker for preexisting disabling conditions.

Preburn C-A-G-E Brief Alcohol and Drug Screening Tools—These frequently used self-report scales have four items that serve as screening tools for alcohol and drug use disorders. The C-A-G-E exhibited good sensitivity and specificity (37,38) and has shown good validity in medical settings (39). In this study, we used a cut-off of 2 on separate alcohol and drug C-A-G-E's to indicate a probability of alcohol or drug use disorders during the year before the injury.

Procedure

Trained personnel administered the BSI, along with other measures, using standard procedures. The follow-up protocol involved first scheduling an in-person interview; appointments were rescheduled if the first appointment was missed, or if data were incomplete. If contact was not yet made or data gathering not yet completed, this was followed by a first mailing, then a second mailing to nonresponders, and, finally, a search for new address, phone number, or listed contacts. The allowable period of time to complete the assessment at a given follow-up was defined as starting 1 month before the actual date, and ending 2 months after the actual date. This redundancy was built into the design to attempt to maximize data collection, because problems in this population have historically resulted in excess attrition (problems include frequent address changes due to home/property destruction, loss of job, opportunity elsewhere, avoidance of reminders of the injury and hospitalization, and fear of collection agency contact) (40). During the index hospitalization, the research assistants assessed symptoms of psychological distress during the week before discharge (i.e., baseline). Follow-up BSI assessments at 6, 12, and 24 months post burn assessed symptoms during the week before the respective assessment.

Statistical Analyses

Recent ongoing debate has centered on the relative advantages of dimensional versus categorical approaches to formulating psychiatric problems (41). Although categorical approaches (i.e., discrete, discontinuous diagnoses) to psychiatric diagnoses assume a qualitative difference between those with and without a given diagnosis, dimensional approaches (i.e., continuous distribution from normal to abnormal) assume the difference is one of quantity. To date, most researchers have used measures of symptoms and syndromes based on the underlying assumption that there are consistencies across symptom severity (e.g., severity of depression symptoms) and diagnostic constructs (e.g., major depressive disorder). In keeping with recent expert recommendations, this study uses categorical and continuous data to retain data on clinical severity and relevance without sacrificing statistical accuracy and power (42).

The association of categorical sample descriptors with high distress group status (GSI T score ≥63) was examined using either χ^2 or Fisher's exact statistics, and continuous variables were examined using t tests.

The association between high distress at baseline and at subsequent assessments was examined using the odds ratio (OR). Additionally, the clinical significance and reliability of change (i.e., in either direction) of each individual's GSI score between baseline and follow-up were examined using the Reliable Change Index (RCI), which ascertains clinically significant and reliable change, taking into account both continuous (i.e., quantitative—minimum amount of change) and categorical (i.e., qualitative—critical change value) indicators of distress (43,44).

In the following set of analyses, the sole inclusion criterion for baseline BSI symptoms was a medium effect size on the basis of the Spearman ρ correlation ($r \geq 0.24$) between the item and dichotomized GSI score (T score <63 versus ≥63) at all 4 points of assessment (45). The

rationale for focusing on these items was to direct attention to the most robust predictors of long-term distress, recognizing that this method is susceptible to chance findings within this sample. The 15 items selected in this manner were subjected to a principal components factor analysis with varimax rotation, to elucidate core features of the phenomena. The criteria for factor extraction were the Kaiser test (i.e., eigenvalue >1), parallel analysis, and the scree test (46-48). Unit weighted scores on the two derived factors were used in regressions (see list of included items in Table 1). A second principal components factor analysis used all 53 BSI items to determine whether the structure of the 15 items differed substantially from that of all 53 items and to assess the general comparability of regression results using both methods. Results of the logistic regressions are expressed as Nagelkerke R^2 statistics, and results of the hierarchical linear regressions are expressed as R^2 and change in R^2 statistics.

Multiple hierarchical logistic regressions used factor scores derived from the in-hospital distress symptoms to predict high distress (versus low distress) at 6-, 12-, and 24-month follow-up visits. Hierarchical linear regressions were also conducted with the BSI's continuous GSI score regressed on the same factor scores. The sample descriptors differing across the distress group at discharge (baseline) were entered as covariates in the logistic and linear regressions to establish the unique contribution of in-hospital distress symptoms in predicting distress at follow-up (see Table 2 for list of descriptors associated with distress group at discharge).

Statistical analyses were conducted using Statistical Package for the Social Sciences software, release 14.0 (49) and Stata Statistical Software, release 9 (50).

Results

Criterion Group Comparisons

As shown in Table 2, the high and low distress criterion groups differed on several baseline variables. Relative to the low distress group, the high distress group was disproportionately female, non-Caucasian, nonmarried, unemployed before the burn, and had fewer hand burns. In addition, in the year before the burn, the high distress group had a higher prevalence of mental health treatment, probable alcohol use disorder, and probable drug use disorder. The average age of patients in the high [mean age = 39.94 ± 11.4] and low (mean age = 38.43 ± 15.1) Distress groups did not differ significantly [mean difference = –0.51; 95% confidence intervals (CI) = –2.04–1.02]. The average burn size of patients in the high (mean TBSA = 18.75 ± 15.6) and low (mean TBSA = 18.65 ± 16.2) distress groups did not differ significantly (mean difference = –0.10; 95% CI = –2.04–1.84).

Prevalence and Persistence of Clinically Significant Psychological Distress

Overall, the proportion of the sample in the high distress group was extremely stable: discharge (33.8%: 416/1232), 6 months (34.8%: 275/790), 12 months (35.3%: 231/645), and 24 months (34.2%: 148/433).

We examined the number and proportion of cases transitioning between distress groups from the time of discharge to follow-up assessments, and changes in group status from 6-month to 12-month follow-ups, from 12-month to 24-month follow-ups, etc., were also examined.

The stability of clinically significant distress across time can be estimated by calculating the risk for high distress at follow-up given high distress at discharge. The OR for having high distress at 6 months was nine times as high among those who had high distress at discharge, compared with those who had low distress at discharge (OR = 8.98; 95% CI 6.2-12.9). The OR for having high distress at 12 months was over six times as high among those who had high distress at discharge compared with those who had low distress at discharge (OR = 6.35; 95% CI 4.3–9.4). The OR for having high distress at 24 months was seven times as high among those who had high distress at discharge compared with those who had low distress at discharge (OR = 7.10; 95% CI 4.4–11.5). Thus, there was a great risk of retaining high distress at follow-up given high distress at discharge.

Clinically Significant and Reliable Change

Although the risk was great for remaining in the same distress group at follow-up than one was in at discharge, there were individuals who changed groups. Given sources of error such as measurement unreliability and small fluctuations in distress of no clinical relevance, clarification is necessary regarding what proportion of these changes in group status represented change of sufficient magnitude to be considered reliable and clinically significant. The RCI was computed for each individual using the raw score on the GSI and a cut-off for clinical significance based on established mean and SD values for outpatient and nonpatient samples (51). RCIs were computed for differences between GSI at discharge and at 6-, 12-, and 24-month follow-up using standard methods (43, 44). If the RCI value is > 1.96 or < – 1.96, and the change in an individual's GSI score from the time of discharge to follow-up crosses the critical change value, then the difference is deemed to be both clinically significant and reliable (44).

Among the 684 participants with BSI data at both discharge and 6 months, clinically significant and reliable change was seen in only 80 (11.7%) subjects, with approximately equal numbers of these moving from low distress to high distress (n = 41) and moving from high distress to low distress (n = 39). Among the 545 participants with BSI data at both discharge and 12 months, clinically significant and reliable change was seen in only 70 (12.8%) subjects, with approximately equal numbers of these moving from low distress to high distress (n = 34) and vice versa (n = 36). Finally, among the 373 participants with BSI data at both the discharge and 24-month assessments, clinically significant and reliable change was seen in 45 (12.1%) subjects; again, roughly equal numbers of these moved from low distress to high distress (n = 26) and vice versa (n = 19).

Data on participants who completed the BSI at discharge and at least one other follow-up, and who made reliable and clinically significant changes, were further examined to quantify the number of changes, the timing of the change, and the representation of the change as, for instance, change representing clinical improvement (i.e., moving from being a “case” to being a “noncase”) or decline (i.e., moving from being a “noncase” to “case”). In sum, relatively few changed (n = 110), and very few changed more than once (n = 14), but, among

those who did change, most did so at the first available follow-up. Additionally, of those who changed, about half changed in each possible direction. Details of these changes are available on request.

Exploring the Structure of Acute Symptoms Predicting Follow-up Distress Group

The first principal components analysis included the 15 baseline BSI items selected as consistent predictors of high distress. The first 3 eigenvalues were 6.38, 1.23, and 0.80. In a parallel analysis of 1000 random datasets with the same number of "subjects" and "items," the 95th percentile values of the first 3 random data eigenvalues were 1.24, 1.18, and 1.15. Thus, both the "eigenvalues >1 rule" and parallel analysis suggested that two components should be retained. The scree plot also suggested that two components should be retained (or three, if one includes the "elbow"). Table 1 shows the varimax-rotated loadings for this 15-item, two-factor solution. The first rotated factor accounted for 27.3%, and the second, 23.3%, of the item variance. Only 10 of the 15 items had loadings ≥0.6 and no double-loadings. We created unit-weighted scales with these 10 items for further analyses, and we named the factors "Alienation" (6 items) and "Anxiety" (4 items). These scales were moderately correlated (Spearman's $\rho = 0.51$).

An additional principal components analysis was performed on all 53 baseline BSI items. Unlike studies using smaller samples, in which factor analyses on the full BSI yielded only one eigenvalue >1 (52), here there were nine eigenvalues >1. The first six eigenvalues were 18.04, 2.54, 1.70, 1.46, 1.42, and 1.26. In a parallel analysis, the 95th percentile values of the first six random data eigenvalues were 1.51, 1.45, 1.42, 1.39, 1.36, and 1.34. Thus, parallel analysis suggested that five components could be retained. However, in the varimax-rotated five-factor solution, the last factor contained only one item without double-loadings. In addition, the scree plot suggested that only three or four components should be retained. Table 1 shows the varimax-rotated loadings for the 53-item, four-factor solution (32 items retained with factor loadings ≥0.5). The first four varimax-rotated factors accounted for 16.8, 11.9, 9.5, and 6.6% of the item variance (total = 44.8%). We created unit-weighted scales with these 32 items for further analyses, and we named the factors "Alienated-Suspicious-Depression" (13 items), "Hyperarousal" (9 items), "Phobic Anxiety" (8 items), and "Hostile Destructive-ness" (2 items). The four factors were moderately intercorrelated (Spearman's ρ range = 0.31–0.69).

Predicting Follow-up Distress Group Using In-hospital Distress Symptoms

One important objective of this study was to identify a smaller subset of key somatic, affective, and cognitive symptoms of distress that, when present at the time of discharge, predict subsequent distress. Factor scores from the 10-item, two-factor model and the 32-item, four-factor model from discharge BSI's were used to predict total BSI at the 6-month, 12-month, and 24-month follow-up periods. This was approached in two ways: logistic regression was used to predict clinically significant distress (high versus low distress) at follow-up and linear regression was used to predict "continuous" GSI T scores at follow-up.

In the logistic analyses, the eight sociodemographic and burn variables that were associated with distress at baseline (Table 2) were entered as a block, and the BSI factor scores were

entered as a second block. If any BSI factors seemed to be nonsignificant in the presence of the variables entered in block 1, these were tested using likelihood ratio tests, and the nonsignificant factors were removed. Thus, only factors that predicted subsequent distress at the same time controlling for possible confounder variables were retained.

In all logistic analyses involving the two-factor model, Hosmer-Lemeshow goodness-of-fit statistics were nonsignificant (evidence of acceptable fit). Controlling for the variables in block 1, baseline Alienation and Anxiety each predicted clinically significant distress at all three follow-up visits. The Nagelkerke R^2, an estimate of distribution of outcome accounted for by the predictor variables, was substantially higher when these baseline distress factor scores were included in the models. At 6, 12, and 24 months, the estimates of R^2 including these distress factors were 0.35, 0.25, and 0.31, respectively (without the distress factors, R^2 = 0.09, 0.06, and 0.07, respectively). Table 3 shows the effects of scale unit and SD differences in baseline factor scores on the likelihood of subsequent distress, using odds ratios. Because the factor scales have different ranges, the interpretation of results for these scores is facilitated using odds ratios for an SD increase (53).

Similarly, in all logistic analyses involving the four-factor model, Hosmer-Lemeshow goodness-of-fit statistics also suggested acceptable fit. Higher baseline Alienated-Suspicious-Depression and Hyperarousal scores predicted higher odds of high distress at all three follow-up visits. At 6, 12 and 24 months, the estimates of R^2 including these distress factors were 0.32, 0.25, and 0.29, respectively (again, without the distress factors, R^2 = 0.09, 0.06, and 0.07, respectively). At the 6-and 12-month follow-up periods, using Phobic Anxiety instead of Hyperarousal in the model also provided a decent fit.

Finally, these analyses were repeated using hierarchical linear regression analyses. These models regressed total GSI T scores at each follow-up period on factor scores from the two-factor and the four-factor solutions (Table 4). For each regression equation, the eight sociodemographic and burn variables associated with distress were entered in step 1, and either a) the factor scores from the two-factor solution (Alienation and Anxiety) or b) some combination of the factor scores from the four-factor solution (Alienated Depression, Hyper-arousal, Phobic Anxiety, and Hostile Destructiveness) was entered in step 2. Results indicate that, consistent with the logistic regression analyses, factor scores from both the two-factor and four-factor models added unique variance in the prediction of GSI scores at 6-, 12-, and 24-month follow-up visits, after adjusting for the influence of baseline correlates of the distress group. After removing nonsignificant factors, the Alienated-Suspicious-Depression and Hyperarousal factors were retained. Further, the significance of the four-factor regression model was not reduced by removing the Hostile Destructiveness and Phobic Anxiety factor scores.

Discussion

This is the largest prospective cohort study of patients with major burn injury. We found that clinically significant psychological distress is common and often persists for at least 2 years in this population. Furthermore, distress experienced in hospital after major burn injury is characterized by partially separable symptom components, two of which uniquely predict

clinically significant distress at follow-up (Alienation or Alienated-Suspicious-Depression, and Anxiety or Hyper-arousal).

Some individuals who were in one distress group at the baseline assessment (i.e., either above or below the cut-off for clinically significant psychological distress) changed to the opposite group at subsequent assessments. However, distress changed to a clinically significant and reliable degree from discharge to each of the three follow-up assessments for only approximately 12% of the total sample, with an almost equal split between increased and decreased distress. As recently recommended (41,42), these observations were possible because computing the RCI takes into account both discrete (i.e., critical value; cut-off score) and continuous (i.e., minimal change) indicators of change.

The 45% of this sample experiencing psychological distress sometime during the 2-year study substantially exceeds the 10% point prevalence of severe distress in the adult, nonpatient, normative sample (8), and the 12-month period prevalence of “any psychiatric disorder” in community dwelling adults (29.5%) (54). The 33% point prevalence at the time of discharge and each follow-up visit suggests that approximately 16,500 of the 50,000 new burn cases each year will experience distress at these time points. In unrelated samples, 54% of burn survivors met the criteria for a mood, anxiety, or substance use diagnosis in the first year after burn injury (30), and significant depressive symptoms were present in 22.6% at 2 years post burn (16). Also, significant PTSD symptoms were present in 30% to 40% of nonburn trauma survivors in the first year post injury (55).

The high prevalence and chronic nature of distress in this population are a substantial public health concern. Importantly, death by suicide, suicide attempts, and suicidal ideation are predicted by chronic pain, which is common among burn survivors (56,57). Acute pain among burn patients at the time of hospital discharge is also predictive of long-term suicidal ideation (58), and chronic pain reduces burn-specific quality of life and increases the risk of unemployment (59). Treating pain may be an important avenue for reducing acute and chronic symptoms of distress.

Many different aspects of the post burn environment can be distressing at different stages, such as painful dressing changes and aversive physical therapy procedures (4), significant alterations in body image during the rehabilitation period (18), as well as stigmatizing reactions from others (60). It is notable that our inhospital Anxiety or Hyperarousal factors predict long-term distress, given previous work suggesting that poststressor sympathetic activation is a predictor of later PTSD (61,62). Our Alienation or Alienated-Suspicious-Depression factors, which also substantially predicted long-term distress, contained items that may reflect perceived social disconnectedness stemming from social reactions to one's role in the burn event or to one's changed appearance (60) and that could impede others from providing salubrious social support (63).

It would be good to have external validation of the factors (i.e., relationships between these factors and other factors including psychiatric diagnoses, etc.). The Anxiety factor from the two-factor solution seems to be largely a distillation of PTSD symptoms. The four-factor model factors of Arousal and Phobic Anxiety also seem to be related to PTSD. The

Alienation factor is less clear, although the association of depression and alienation in this component seems consistent with interpersonal loss or strain in the setting of disfiguring injury and perceived stigmatizing responses. Other measures directly assess these constructs, such as dimensional measures of PTSD symptoms, and social distress measures (e.g., body image dissatisfaction, perceived stigmatization) that, if assessed concurrently with the BSI, might help to clarify the meaning of the named BSI factors. Unfortunately, data necessary to explore this issue are not available.

An important aim of this investigation was to identify modifiable symptoms of acute psychological distress that predict subsequent episodes of psychological distress. Factor scores from both the two-factor and four-factor solutions from inhospital BSI (Table 1) predicted the dichotomized (Table 3) and the continuous (Table 4) measure of distress up to 2 years later, even when statistically controlling the effects of the descriptors related to distress at baseline (Table 2). A brief measure composed of the items in these factor solutions may be useful, although it is important to replicate the obtained factor structure and its predictive value.

It is important to note that these anxiety, depression, and alienation symptoms are often present in traumatic distress (64–66), social anxiety (67), body image problems (68), and depression (69), and that each of these conditions has good evidence-based treatments. It might be beneficial to develop and test an intervention protocol with modules addressing the groupings of symptoms observed here. A viable regimen could involve either antidepressants or cognitive-behavioral therapy, or a combination of the two in either concurrent or stepped fashion (70).

Several significant limitations in our study must be noted. First, participant dropout was high, thus lowering confidence in the obtained evidence. The consistently observed high attrition in this population suggests the need to develop novel approaches to retention (40). Second, unmeasured factors such as preburn characteristics (e.g., resilience, personality, coping style, medications and details of acute treatment, formal lifetime and current psychiatric diagnoses and treatments, family psychiatric history) and trauma-related factors (e.g., trauma severity) could affect results. Third, although this prospective, longitudinal study provides valid and reliable evidence, it cannot be assumed that in-hospital distress is causally related to distress at follow-up. Finally, preinjury psychological distress was not measured using the same instrument used post burn (i.e., BSI) but by self-report regarding treatment in the prior year. Distress and treatment-seeking are not perfectly related.

The higher distress among certain groups observed here is consistent with previous studies in the burn literature (6,7,12,16). Although women are burned much less often than men, psychological distress is more prevalent among women. Being single, having a history of drug or alcohol use, and having preburn mental health treatment were also significant predictors of distress. The development and testing of interventions in the future should take these risk factors into consideration.

The results of this study indicate that clinically significant psychological distress during hospitalization for major burn injury is common and usually persistent. Thus, it is important

that acute distress be understood as a marker for poor overall functional outcome post burn injuries. Given its prevalence, persistence, and impact on functional outcome, research is needed to evaluate whether treating acute symptoms of psychological distress will reduce long-term impairment.

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Glossary

TBSA	total body surface area
BMS	burn model systems
PTSD	posttraumatic stress disorder
ASD	acute stress disorder
BSI	Brief Symptom Inventory
ROM	range of motion
GSI	Global Severity Index (of the BSI)
OR	odds ratio
RCI	Reliable Change Index
SD	standard deviation
CI	confidence interval

Table 1

Results of Principal Component Analyses, First of 15 BSI items Correlated with Distress Group (Two-Factor Solution), and Second, All 53 BSI items (Four-Factor Solution): Varimax Rotation With Kaiser Normalization

BSI Items Loading on Either Solution BSI Item # and Content	Components: 2 Factor Solution (15 items—10 retained)		Components: 4 Factor Solution (53 items—32 retained)			
	Alienation	Anxiety	Alienated Suspicious Depression	Hyper-Arousal	Phobic Anxiety	Hostile Destructiveness
51. Feeling that people will take advantage of you if you let them	.741		.654			
48. Others not giving you proper credit for your achievements	.741		.621			
44. Never feeling close to another person	.676		.615			
21. Feeling that people are unfriendly or dislike you	.666		.578			
53. The idea that something is wrong with your mind	.658		.560			
50. Feelings of worthlessness	.624		.647			
22. Feeling inferior to others			.614			
35. Feeling hopeless about the future			.594			
16. Feeling lonely			.582			
14. Feeling lonely even when you are with people			.553			
52. Feelings of guilt			.546			
46. Getting into frequent arguments			.534			
20. Your feelings being easily hurt			.527			
1. Nervousness or shakiness inside		.733		.601		
38. Feeling tense or keyed up		.700		.514		
25. Trouble falling asleep		.670		.563		
15. Feeling blocked in getting things done		.638				
23. Nausea or upset stomach				.581		
2. Faintness or dizziness				.563		
11. Poor appetite				.561		
30. Hot or cold spells				.544		
37. Feeling weak in parts of your body				.538		
6. Feeling easily annoyed or irritated				.511		
12. Suddenly scared for no reason					.628	

BSI Items Loading on Either Solution BSI Item # and Content	Components: 2 Factor Solution (15 items—10 retained)		Components: 4 Factor Solution (53 items—32 retained)			
	Alienation	Anxiety	Alienated Suspicious Depression	Hyper-Arousal	Phobic Anxiety	Hostile Destructiveness
31. Having to avoid certain things, places, or activities because they frighten you					.610	
8. Feeling afraid in open spaces or on the streets					.606	
45. Spells of terror or panic					.576	
28. Feeling afraid to travel on buses, subways, or trains					.572	
43. Feeling uneasy in crowds, such as shopping or at a movie					.555	
19. Feeling fearful					.551	
47. Feeling nervous when you are left alone					.542	
40. Having urges to beat, injure, or harm someone						.591
41. Having urges to break or smash things						.548
Number of Items in component	6	4	13	9	8	2

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Table 2

Comparison of In-Hospital High and Low Distress Groups on Key Demographic, Comorbidity, and Injury Variables

Factor	Low Distress (GSI <63)		High Distress (GSI ≥63)		χ^2
	n (953)[a]	% (66.5)[a]	*n* (249)[a]	% (33.5)[a]	
Gender					7.79*
Male	652	68.4	301	31.6	
Female	147	59.0	102	41.0	
Caucasian					9.92*
Yes	593	69.3	263	30.7	
No	200	59.7	135	40.3	
Married					10.81*
Yes	406	71.2	164	28.8	
No	380	62.2	231	37.8	
Employed					5.69*
Yes	590	68.5	271	31.5	
No	204	61.3	129	38.7	
Hand injury					9.60*
Yes	571	69.3	253	30.7	
No	220	60.1	146	39.9	
Face, head, or neck injury					0.23
Yes	414	67.0	204	33.0	
No	371	65.7	194	34.3	
Surgery required					0.91
Yes	619	65.8	322	34.2	
No	165	69.0	74	31.0	
Inhalation injury					0.08
Yes	82	65.1	44	34.9	
No	704	66.4	357	33.6	
Preburn mental health treatment					52.26*
Yes	31	33.0	63	67.0	

Factor	Low Distress (GSI <63)		High Distress (GSI ≥63)		χ^2
	n (953)[a]	% (66.5)[a]	*n* (249)[a]	% (33.5)[a]	
No	720	69.7	313	30.3	
Alcohol CAGE					46.93 *
Positive	71	43.3	93	56.7	
Negative	677	70.6	282	29.4	
Drug CAGE					13.44 *
Positive	53	51.0	51	49.0	
Negative	698	68.7	318	31.3	

GSI = Global Severity Index.

* $p \leq .005$.

[a] Sample numbers vary due to missing data and percentages reflect proportion of available sample size.

Table 3

Results of Logistic Regression Analyses Relating Baseline Psychological Distress to High Levels of Psychological Distress (GSI Cut-Off ≥63)

Psychological Distress BSI Factor Scores at Baseline	6 Months		12 Months		24 Months	
	Crude OR[a] (95% CI)	Adj. OR[b] (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)
Two-factor model						
Alienation						
Unit increase	1.4 (1.3–1.5)	1.3 (1.2–1.4)	1.3 (1.2–1.4)	1.2 (1.1–1.3)	1.3 (1.2–1.5)	1.2 (1.1–1.4)
SD increase	3.1	2.4	2.4	1.9	2.8	2.1
Anxiety						
Unit increase	1.3 (1.2–1.4)	1.2 (1.1–1.3)	1.3 (1.2–1.3)	1.1 (1.1–1.2)	1.3 (1.2–1.4)	1.2 (1.1–1.3)
SD increase	2.5	1.7	2.2	1.6	2.6	1.9
Four-factor model						
Alienated depression						
Unit increase	1.1 (1.1–1.2)	1.1 (1.1–1.2)	1.1 (1.1–1.2)	1.1 (1.1–1.2)	1.1 (1.1–1.2)	1.1 (1.0–1.1)
SD increase	3.0	2.7	2.6	2.3	2.7	2.0
Hyperarousal						
Unit increase	1.1 (1.1–1.2)	1.0 (1.0–1.1)	1.1 (1.1–1.2)	1.0 (1.0–1.1)	1.1 (1.1–1.2)	1.1 (1.0–1.1)
SD increase	2.2	1.3	2.1	1.3	2.4	1.7
Phobic anxiety						
Unit increase	1.2 (1.2–1.3)	—	1.2 (1.1–1.3)	—	1.1 (1.1–1.2)	—
SD increase	2.6		2.2		1.9	
Hostile destructiveness						
Unit increase	1.7 (1.3–2.3)	—	1.4 (1.1–1.8)	—	1.5 (1.1–2.1)	—
SD increase	1.5		1.4		1.4	

GSI = Global Severity Index; BSI = Brief Symptom Inventory; OR = odds ratio; CI = confidence interval; SD = standard deviation; — = not included in model.

[a] Univariate association between factor score and high psychological distress.

[b] Multivariate association between factor score and high psychological distress, after adjusting for all remaining factor scores in the model and the eight sociodemographic and burn variables associated with baseline distress (see Table 1).

Table 4

Results of Hierarchical Linear Models Regressing Factor Scores on GSI Total Scores

Outcome Variable	Step	Two-Factor Model		Four-Factor Model	
		R^2	R^2 Change	R^2	R^2 Change
GSI score at 6-months	1	.098	.098**	.098	.098**
	2a	.327	.229**	.303	.205**
	2b			.302	.204**
	2c			.303	.204**
	2 days			.302	.204**
GSI score at 12-months	1	.073	.073**	.073	.073**
	2a	.267	.194**	.251	.178**
	2b			.248	.174**
	2c			.251	.178**
	2 days			.248	.174**
GSI score at 24-months	1	.065	.065*	.065	.065*
	2a	.294	.299**	.267	.201**
	2b			.265	.200**
	2c			.267	.201**
	2 days			.265	.200**

GSI = Global Severity Index; Step 1 = eight sociodemographic and burn variables; Step 2a = factor scores from two-factor solution (Alienation and Anxiety) or four-factor solution (Alienated-Suspicious-Depression, Hyperarousal, Phobic Anxiety, Hostile Destructiveness); Step 2b = Hostile Destructiveness removed from the model; Step 2c = Phobic Anxiety removed from the model; Step 2 days = Hostile Destructiveness and Phobic Anxiety removed from the model.

* $p < .05$;

** $p < .01$.