



The impact of pruritus, pain, and burn severity on the mental health of burn survivors: A prospective study

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ABSTRACT

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To prospectively investigate the relationship between pruritus, pain, and total body surface area (TBSA) with the mental health of burn survivors during the first six months of recovery. In this prospective longitudinal study, 78 adult burn patients admitted to a specialized burn center were assessed at one, three, and six months post-injury. Mental health was assessed using the 28-item General Health Questionnaire (GHQ-28), while pruritus and pain intensity were evaluated using Numeric Rating Scales (NRS). Correlational and multiple linear regression analyses were performed to identify predictors of mental health. Significant improvements in mental health and reductions in pruritus intensity were observed over the six-month ($p < 0.001$). At all time points, poorer mental health (higher GHQ-28 scores) was positively associated with greater pruritus intensity, pain intensity, and TBSA; however, in multivariable analysis, only TBSA and pruritus intensity remained as independent predictors, while pain lost its significance. Specifically, Spearman correlations for pruritus were modest (month 1: $\rho = 0.227$, $p < 0.001$; month 3: $\rho = 0.283$, $p < 0.001$; month 6: $\rho = 0.221$, $p < 0.001$), whereas correlations for pain ($\rho = 0.566$ – 0.684 , $p < 0.001$) and TBSA ($\rho = 0.757$ – 0.885 , $p < 0.001$) were stronger. In multivariable analysis, TBSA and pruritus intensity were independent predictors of GHQ-28. Multiple regression analysis revealed that only TBSA and pruritus intensity were significant independent predictors of mental health scores across all follow-ups. These findings underscore the clinical importance of prioritizing aggressive and specialized management of pruritus, not only for physical comfort, but as an essential component of mental health care for this vulnerable population.

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1. Introduction

Burn injuries are a significant global health concern, ranking as the fourth most common type of trauma after traffic accidents, falls, and interpersonal violence [1]. Each year, about 180,000 people die from burns worldwide [2], while survivors face profound physical, psychological, and socioeconomic challenges [3]. Severe burns cause extensive systemic effects that complicate management. For instance, serum sodium variability has been identified as an independent predictor of mortality, alongside total body surface area (TBSA) and inhalation injury [4]. Although advances in acute care have improved survival [5], long-term outcomes remain compromised by persistent complications. Among these, chronic pruritus and pain are particularly distressing. Pruritus affects up to 87% of burn patients, sometimes lasting for years [6,7], and significantly disrupts sleep, daily functioning, and overall well-being [8]. Likewise, chronic pain—often neuropathic—remains common, with some survivors reporting pain even 12 years after injury [9,10]. These ongoing symptoms have a substantial impact on mental health. Depression and anxiety are highly prevalent among burn survivors [12,13], with studies confirming the link between pain and depression [14], as well as between pruritus and psychological distress [15]. Such problems not only hinder recovery but also worsen quality of life [16]. Despite growing evidence, most research has been cross-sectional, offering only static snapshots of these associations. To address this gap, the present study prospectively examined how pruritus, pain intensity, and TBSA are associated with the mental health of burn survivors during the first six months of recovery. By evaluating patients at one, three, and six months post-injury, this study aimed to identify the most important predictors of psychological distress and provide evidence for targeted interventions.

2. Materials and Methods

2.1 Study Design

A prospective longitudinal study was conducted at a specialized burn center in Rasht, North of Iran, during 2022. The study population comprised adult patients admitted for burn injuries.

The required sample size was estimated based on a previous study that reported a mean GHQ-28 score of 32.52 ± 16.06 in burn patients [17]. Using the formula for estimating a population mean, with a standard deviation (s) of 16.06, a 95% confidence level ($Z = 1.96$), and a desired margin of error (d) of 4, the initial sample size was calculated as follows:

$$n = \frac{\left(z_{1-\frac{\alpha}{2}}\right)^2 s^2}{d^2} = \frac{(1.96)^2 (16.06)^2}{16} \approx 62$$

Allowing for an anticipated 20% attrition rate, the target sample size was increased to 74. Ultimately, 78

consecutive eligible patients were recruited, and all completed the 1-, 3-, and 6-month follow-ups.

2.2 Inclusion and Exclusion Criteria

Inclusion criteria were age ≥ 18 years and TBSA between 10% and 60%. In practice, the enrolled patients had TBSA values ranging from 12% to 44%, as no eligible cases outside this range presented during recruitment; therefore, all analyses are based on this observed range. Both second and third-degree burns were eligible. In addition, two participants (2.6%) with localized fourth-degree burns, who met all other inclusion criteria, were also included in the analysis. Patients were excluded if they had a history of psychiatric disorders or suicide attempts, pre-existing chronic skin conditions, diabetes, renal failure, metabolic disorders, or cognitive impairments that would prevent them from completing the questionnaires. All participants provided informed consent before enrollment.

2.3 Procedure

The study protocol received ethical approval from the Institutional Review Board of Guilan University of Medical Sciences. Upon admission, eligible patients were identified and invited to participate in the study. After obtaining written informed consent, baseline demographic and clinical data were extracted from their medical records.

The study included a follow-up at three different times: one month, three months, and six months after the burn injury. At each time point, the participants were asked to fill out a set of questionnaires about their mental health, pain, and itching. Trained research staff were responsible for collecting the data to ensure its consistency and accuracy. Length of hospital stay in this study refers to the duration (in days) of the initial acute inpatient admission for burn care. It does not include subsequent outpatient visits or readmissions.

2.4 Measures

We used a standard checklist to obtain demographic information (age, gender, education level, and occupation) and clinical information (TBSA, degree of burn, length of hospital stay, anatomical location of the burn, and number of surgeries) from patient files. We used the following validated questionnaires to measure outcomes:

2.4.1 Mental Health

We used the 28-item General Health Questionnaire (GHQ-28) [18] to check on people's mental health. There are four subscales on this tool: somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression. A 4-point Likert scoring system (0-1-2-3) was employed, resulting in a total score ranging from 0 to 84. For all analyses in this study, higher scores were interpreted as indicating greater psychological distress,

which is associated with poorer mental health. It has already been shown that this questionnaire is reliable [19].

2.4.2 Pruritus (Itch)

The Yosipovitch Itch Questionnaire [20] was used to assess various aspects of pruritus, including its history, impact on sleep and daily activities, and subjective feelings. We also used a Numeric Rating Scale (NRS) to measure the severity of the itching. This was a single 11-point scale that went from 0 ("no itch") to 10 ("worst imaginable itch"). The reliability of the Persian version of this questionnaire has been previously established in an Iranian population [21].

2.4.3 Pain

The intensity of pain was measured using an NRS, an 11-point scale ranging from 0 ("no pain") to 10 ("worst imaginable pain").

2.5 Statistical Data Analysis

Multiple linear regression was used to identify independent predictors of GHQ-28 scores. Model assumptions (linearity, normality of residuals via plots and Shapiro–Wilk test, homoscedasticity, and multicollinearity) were checked; Variance inflation factors (VIF) > 5 indicated problematic collinearity. Influential cases were assessed using Cook's distance. Results are reported as B, SE, standardized β , t, p, and 95% confidence intervals (CIs). Pruritus intensity, pain intensity, and TBSA were entered as primary predictors; non-significant variables were removed to obtain the final model. Longitudinal changes in GHQ-28 and pruritus scores (at 1, 3, and 6 months) were tested with the Friedman test. Potential covariates (age, sex, education, hospital stay, surgeries) were examined but excluded from the final model as they were not significant. All analyses were performed using SPSS software (version 26.0; IBM Corp., Armonk, NY, USA), and p-values < 0.05 were considered statistically significant.

3. Results

3.1 Participant Flow

A total of 78 patients were enrolled in the study at baseline. All 78 participants completed the one-month, three-month, and six-month follow-up assessments, resulting in no attrition during the study period. Therefore, the final analysis was conducted on the complete dataset of 78 patients. A flow diagram illustrating the enrollment and follow-up of participants is presented in Figure 1.

3.2 Participant Characteristics

A total of 78 patients were included in the final analysis (Table 1). The demographic and clinical characteristics of the participants are summarized

below. The majority of participants were male (n = 45, 57.7%). The mean age was 31.56 ± 10.49 years. Regarding education, 44.9% of patients had a high school diploma, 34.6% had less than a high school education, and 20.5% had higher education.

The mean TBSA affected by the burn was $26.19\% \pm 8.16\%$, with a range from 12% to 44%. The most common burn degree was a combination of second- and third-degree burns (35.9%), followed by third-degree burns (33.3%) and second-degree burns (28.2%). The upper limbs were the most frequently affected anatomical region (34.6%). The average length of hospital stay was 4.50 ± 2.97 days, and the mean number of surgical operations was 1.19 ± 0.53 .

3.3 Changes in Mental Health and Pruritus over Time, and Pain-Related Findings

3.3.1 Mental Health and Pruritus

The longitudinal analysis revealed significant changes in the primary outcomes over the six-month follow-up period. As illustrated in Figure 2, there was a statistically significant improvement in mental health, accompanied by a concurrent decrease in pruritus intensity. The mean GHQ-28 score decreased from 43.46 ± 11.90 at one month to 18.29 ± 10.56 at six months ($p < 0.001$), while the mean itch NRS score fell from 7.50 ± 1.42 to 2.71 ± 1.21 over the same period ($p < 0.001$). No significant differences in itch intensity were found based on gender or burn degree at any time point (e.g., for month 1: $U = 778.00$, $p = .710$).

3.3.2 Pain

The mean pain intensity measured using the Numeric Rating Scale (NRS) was 6.14 ± 1.58 . There were no statistically significant differences in pain intensity based on gender or the degree of burn.

3.4 Relationships between Clinical Factors and Mental Health

Spearman correlation analyses between GHQ-28 scores and clinical variables at each time point are shown below. At one month: GHQ-28 scores (higher = worse mental health) were significantly and positively correlated with pruritus intensity ($r = 0.227$, $p < 0.001$), pain intensity ($r = 0.684$, $p < 0.001$), and TBSA ($r = 0.885$, $p < 0.001$). At three months: The positive correlations between GHQ-28 scores and pruritus ($r = 0.283$, $p < 0.001$), pain ($r = 0.566$, $p < 0.001$), and TBSA ($r = 0.757$, $p < 0.001$) remained significant. At six months: GHQ-28 scores continued to show strong positive correlations with TBSA ($r = 0.849$, $p < 0.001$), pain ($r = 0.603$, $p < 0.001$), and pruritus intensity ($r = 0.221$, $p < 0.001$).

3.5 Predictors of Mental Health

Multiple linear regression analysis was used to

identify independent predictors of GHQ-28 scores. In the six-month model, TBSA and pruritus intensity remained independent predictors of GHQ-28. For the six-month model, the regression coefficients were: TBSA ($B = 1.58$, $SE = 0.75$, standardized $\beta = 0.77$, $t = 2.08$, $p = 0.040$) and pruritus intensity ($B = 1.13$, $SE = 0.11$, standardized $\beta = 0.16$, $t = 10.05$, $p < 0.001$). The final model explained 83.2% of the variance in GHQ-28 scores ($R^2 = 0.832$; Adjusted $R^2 = 0.827$). It should be

noted that although the standardized β for TBSA is larger, the p-value for TBSA is borderline ($p = 0.040$); readers should therefore interpret the magnitude of the TBSA effect with some caution. Variance inflation factors (VIF) and 95% confidence intervals for regression coefficients are reported in Table 2 (see footnote). The standardized β coefficients for TBSA and pruritus intensity predicting GHQ-28 at six months are shown in Figure 3.

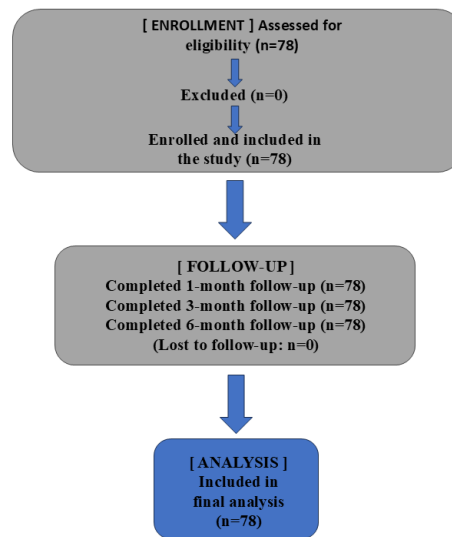


Figure 1. Flow diagram of participant enrollment and follow-up across the study period

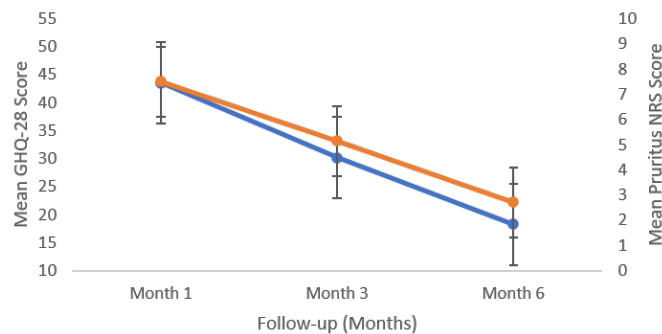


Figure 2. Longitudinal changes in GHQ-28 scores and pruritus intensity over the six-month follow-up

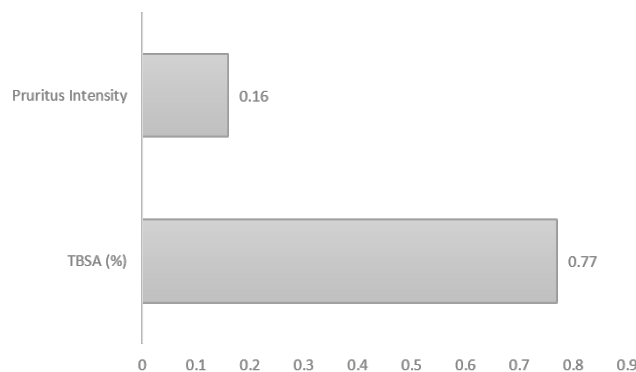


Figure 3. Standardized β coefficients for TBSA and pruritus intensity predicting GHQ-28 at six months. TBSA: $\beta = 0.77$ ($p = 0.040$); Pruritus: $\beta = 0.16$ ($p < 0.001$). Final model: $R^2 = 0.832$

Table 1. Demographic and Clinical Characteristics of Participants (N = 78)

Characteristic	Category	N (%) or Mean $\pm$ SD
Gender	Male	45 (57.7%)
	Female	33 (42.3%)
Age (years)		31.56 $\pm$ 10.49
Education Level	Less than High School	27 (34.6%)
	High School Diploma	35 (44.9%)
	Higher Education	16 (20.5%)
Burn Degree	Second Degree	22 (28.2%)
	Third Degree	26 (33.3%)
	Second and Third Degree	28 (35.9%)
	Fourth Degree	2 (2.6%)
TBSA (%)		26.19 $\pm$ 8.16
Length of Stay (days)		4.50 $\pm$ 2.97
Number of Surgeries		1.19 $\pm$ 0.53

* SD = Standard Deviation

Table 2. Multiple Linear Regression Analysis Predicting Mental Health (GHQ-28 Score) at Six Months

Variable	B	Std. Error	Standardized β	t	p-value
(Constant)	77.49	1.91	-	40.44	<0.001
TBSA (%)	1.58	0.75	0.77	2.08	0.040
Pruritus Intensity (NRS)	1.13	0.11	0.16	10.05	<0.001

* Note: Values are unstandardized coefficients (B) with standard error (SE), standardized β coefficients, t-statistics, p-values, and 95% confidence intervals (CIs). Six-month model: TBSA, B = 1.58 (95% CI: [0.09, 3.07]), β = 0.77, p = 0.040; Pruritus, B = 1.13 (95% CI: [0.91, 1.35]), β = 0.16, p < 0.001. Variance inflation factors (VIF) values were calculated during analysis but are not displayed here.

4. Discussion

This study prospectively investigated the relationship between pain, pruritus, and mental health in burn survivors over six-months. Our findings demonstrate a significant and persistent positive relationship between the severity of pruritus, TBSA burned, and psychological distress (poorer mental health) in patients. While the intensity of pruritus decreased and mental health improved over the follow-up period, both pain and pruritus were consistently correlated with mental health status. However, in the multivariable regression model, only TBSA and pruritus intensity remained as independent predictors of the outcome. TBSA showed a relatively stronger standardized effect size, although with borderline statistical significance (p = 0.040), suggesting a potentially important but less precise effect. In contrast, pruritus demonstrated a more modest effect size but with very robust statistical significance (p < 0.001), indicating a highly reliable predictor. Thus, while TBSA may exert a larger overall influence, pruritus represents a more consistent and clinically relevant target for intervention.

The improvement in mental health and the decrease in physical symptoms over time are in line with how people usually recover from a traumatic injury. But the main thing we found in our study is that there is a strong link between physical symptoms and psychological distress, which is in line with what other studies have found. The strong negative relationship between pruritus and mental health, in particular, backs up what McGarry et al. found, who also identified a significant association between these two variables [15]. Similarly, our results align with studies by Carillo et al. and Heydarikhayat et al., which have confirmed the negative impact of post-burn physical complications on psychological outcomes [17,21]. It is well known that

pruritus can persist for a long time after the initial injury. For example, Gauffin et al. found that almost half of their patients still had pruritus several years after their burn [22].

Although pain intensity showed strong correlations with GHQ-28 scores at all follow-up points, it did not remain an independent predictor in the multivariable model. This result suggests that the effect of pain on mental health may be mediated through or overshadowed by TBSA and pruritus. These results indicate that although pain showed strong correlations with mental health, it did not retain independent significance in the regression model. By contrast, TBSA and pruritus remained key predictors. Based on the beta coefficients, TBSA exerted a more substantial predictive effect, whereas pruritus, due to its persistent and distressing nature, remains of significant clinical importance. Although persistent pain can interfere with sleep, daily functioning, and trauma processing, thereby worsening anxiety and depression, our findings indicate that its effect on psychological distress did not remain independent once TBSA and pruritus were accounted for. This suggests that the impact of pain may be mediated or confounded by these other clinical factors. This is an important finding, as previous studies have demonstrated that burn survivors are at increased risk of developing psychiatric disorders such as posttraumatic stress disorder (PTSD) and depression, conditions that are frequently associated with the severity of the initial trauma and subsequent physical complications [23,24].

Our findings support the biopsychosocial model of health, which posits that biological factors (like TBSA and tissue healing), psychological factors (like coping mechanisms), and social factors interact to determine a patient's overall well-being. The high prevalence of pruritus (reported in up to 87–93% of patients in some studies) and its resistance to conventional treatments

suggest that its mechanism is multifactorial. Stress itself can exacerbate pruritus, creating a vicious cycle that significantly impairs quality of life, a central concern for burn survivors as noted by Lotfi et al. [25]. The strong predictive power of pruritus on mental health underscores the need for effective management of long-term sequelae, particularly those related to scar formation. As reviewed by Kazemzadeh in this journal, therapeutic agents such as fibrinolysin aim to improve scar outcomes by facilitating wound cleansing and accelerating healing, which may, in turn, alleviate persistent physical symptoms that contribute to psychological distress [26].

We acknowledge several limitations. First, the single-center design limits the generalizability of our findings. Second, there is a potential risk of multicollinearity among clinical predictors (e.g., TBSA, pain, pruritus). Although we assessed multicollinearity during model development and found no evidence of problematic values, detailed statistics were not displayed due to space limitations. Third, some outcomes, such as pain, pruritus, and GHQ-28, were based on self-reported measures and may therefore be subject to reporting bias.

This study demonstrates that greater intensity of pruritus, pain, and burn percentage were all significantly correlated with poorer mental health scores at one, three, and six months post-injury. However, in the multivariable analysis, only TBSA and pruritus intensity remained as independent predictors, whereas pain lost its independent significance. Thus, while pain is strongly associated with psychological distress, its effect is secondary to or mediated by other clinical factors. Among these, TBSA demonstrated a relatively larger effect but with less statistical certainty, whereas pruritus—due to its chronic, distressing nature and its highly consistent statistical association—represents a significant and reliable clinical target for intervention. Given that TBSA is a non-modifiable factor, these results underscore the immense importance of prioritizing the management of pruritus. Shifting the clinical approach from palliative care to aggressive, specialized treatment for pruritus, utilizing targeted medical therapies and specialized garments, is essential for improving the mental health and overall quality of life for burn survivors.

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Authors' contributions

Conceptualization and Study Design: M T and M M; Data Collection and Curation: Z MD; Formal Analysis and Interpretation: M E; Supervision: M T and A P; Writing – Original Draft: M M and P A; Writing –

Review & Editing: M S; All authors have read and approved the final version of the manuscript for publication.

Conflict of interest

No potential conflict of interest was reported by the authors.

Ethical declarations

This study was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1401.344). All participants provided written informed consent prior to enrollment in accordance with the Declaration of Helsinki.

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