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# Physical, functional, and psychosocial recovery from burn injury are related and their relationship changes over time: A Burn Model System study

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## ABSTRACT

**Objective:** While burn injuries can have dramatic effect on patients' physical health, they can also lead to intense psychological distress, loss of important social and role functioning, and alterations in outward appearance. We aimed to identify potential leading indicators of recovery in the post-discharge period following acute burn injury and hospitalization.

**Method:** Using data derived from the Burn Model System National Database, we identified five outcomes of interest measured at four time points (Pre-burn/Discharge, 6 months, 12 months, and 24 months post-discharge), including mental health, physical functioning, community integration, life satisfaction, and satisfaction with appearance. We applied cross-lagged panel analysis to the sample of 1052 injured patients admitted to burn intensive care units.

**Results:** Overall, there was little mean change in the five measures after the 6-month assessment. A time-varying panel model was superior to a time-invariant model, showing that the process of recovery itself may change over the course of two years post-burn. Physical functioning is an important predictor throughout this period, while satisfaction with appearance is quite predictive of other factors at discharge, but somewhat less predictive later. Overall mental health functioning is less predictive at discharge but at later intervals was a meaningful leading predictor of the other outcomes.

**Conclusions:** Recovery from burn injury is complex and the most important facets of recovery change over time. Future research should focus on developing treatments to help patients adjust to post-burn appearance in the early post-discharge period, and mental health interventions may be effective as patients progress in recovery.

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## 1. Introduction

Burn injuries impact patients in numerous and varied facets of their lives, including medical/physical wellbeing,

psychological health, and functional skills and performance. While the medical impacts are well studied and typically treated in outpatient care over a long period, psychological and functional outcomes are somewhat less commonly assessed in burn patients. In a review, van Baar et al. found large and

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varied effects of burn injury on functional outcomes across studies. While most burn patients do return to their pre-burn jobs, approximately 21–50% experience some kind of occupational difficulty due to the burn [1]. Estimates of the proportion of burn patients who are wholly unable to return to work following injury vary considerably, from less than 1% [2] to up to 15% [3]. Additionally, common psychiatric consequences include Posttraumatic Stress Disorder (PTSD), depression, and social withdrawal [4]. Rates of PTSD one year post-burn are especially high, ranging from 18% to 45% [5–9].

These domains of recovery—medical, functional, psychiatric—are inter-related in complex ways. Burn patients with pre-existing psychiatric disorders have greater psychiatric maladjustment following burns [10], significantly longer length-of-stay (LOS) on burn treatment inpatient units [11], and require more surgeries during their stay [12]. Psychiatric symptoms have long-term effects in burn patients, even after inpatient hospitalization: self-blame significantly predicted patient medical noncompliance in one study [13]; anxiety disorders predicted not returning to work within one year post-burn in another [14]; and individuals who experienced early post-trauma distress after burn had lower levels of physical functioning two months following hospitalization than other patients, in a third study [15]. Some evidence suggests that the psychological effects of burns may continue to grow in importance after discharge. For instance, Esselman [16] found that among individuals who did not return to work over the first year following burns, social and psychological were increasingly reported as the reasons for this, while Fauerbach et al. [15] found that in-hospital posttraumatic distress symptoms predicted subsequent worse adjustment. Visible scars resulting from burns have been associated with increased psychological problems [17], and functional disability is one of the primary predictors of poor psychosocial adjustment five years post burn [3]. Aside from the physical disability associated with burns to the hands and face, burns in these locations have also been linked to social isolation [17], and Macgregor [18] described the public's typical treatment of burn victims as “psychological and social death.” Another study of 72 burn patients found that even after controlling for medical factors, patients' negative perception of their injury significantly predicted time to wound healing [19]. The authors were only able to examine very coarse measures of potential mechanisms for this effect, however, so it is not clear how patient negative perceptions impact burn healing. Considering the interplay between physical and psychological recovery processes in burn injury, neither process can best be described in isolation from the other.

In the current study, we examined psychosocial outcomes of burns – including markers of mental health, physical functioning, life satisfaction, satisfaction with appearance, and community integration – and attempted to identify how these processes are inter-related over time. Our particular interest was in identifying outcomes that substantively predict later improvement or decrements in other psychosocial outcomes, as any such leading predictors can be targets for early intervention. We used data generated by the Burn Model System project, a multi-center collaboration to collect standardized outcome data collected over 2 years following burn injury. Our statistical model was a cross-lagged panel analysis

to determine the sequential relationships between these domains over time. In this model, the central research question is operationalized as: “Does severity of impact on one measure influence status on another measure at the next time point of assessment?” This method has a long history of use in similar data sets to identify potentially leading indicators of successful or slow recovery. Our measures of interest were Physical Component Score (PCS) and Mental Component Score (MCS) from the SF-12, life satisfaction, satisfaction with appearance, and community integration. Though we did not make any narrow hypotheses regarding the outcomes of these analyses, we anticipated that these factors would be highly reciprocally predictive across time, but that the pattern of predictions would vary with the passage of time.

## 2. Method

### 2.1. Participants

Participants were drawn from the Burn Model System (BMS) Database with burn years 2006–2015, meeting minimal inclusion criteria (age > 17). A total N of 1052 were included. The sample was predominantly male (72%), with age range 18–91, mean = 44.3, SD = 15.6. The majority of patients were White (66%), 15% were Black, 13% Hispanic, 1% Asian, and 1% identified as Multi-racial. The average length of stay in hospital was 32.4 days (SD = 44.8). The average total body surface area burned was 19.0% (SD = 17.6) with average TBSA requiring skin graft surgery 11.0% (SD = 14.3%).

### 2.2. Procedure

The Burn Model System database is a consortium of four major regional burn centers that have been collecting standardized data on burn patients for over 20 years, including long-term follow-up data when available. The data collection methods have been described in detail elsewhere [20]. Briefly, patients were approached during inpatient hospitalization for consent. Consenting individuals completed self-report questionnaires during their hospitalization, at discharge, and were followed for re-assessment at 6 months, 12 months, and 24 months post-discharge. The authors requested access to de-identified data according to the data sharing policies published by the Burn Model System program.

### 2.3. Measures

*Community Integration Questionnaire* (CIQ [21]), a 15-item measure of activity and social functioning level. The Burn Model System Database includes the 6-item Social Integration subscale, which focuses on activities completed outside the house and in social settings. This subscale has shown good to adequate internal consistency and is strongly correlated with other measures of social integration following injury [22,23]. In this study, the initial time point is patients' retrospective rating of the CIQ for pre-morbid functioning, which patients provided during their acute hospitalization. The Cronbach's alpha in this sample was .56.

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