

# Incidence of self-inflicted burn injury in patients with Major Psychiatric Illness<sup>☆</sup>

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## ABSTRACT

**Introduction:** Psychiatric disorders are mental illnesses that impair judgment, thought process and mood that can result in physical and emotional disability. According to DSM-IV, mental disorders increases risk of traumatic injury, particularly burn [1] (American Psychiatric Association, 2013). However, there are few studies that look at patients with pre-existing major psychiatric disorders and burn outcomes. We aim to assess the incidence and intentionality of burn injury in patients with pre-existing psychiatric disorders.

**Methods:** This is a retrospective study of patients admitted to the UNC Jaycee Burn Center from 2002 to 2015 and entered in the burn registry. Variables analyzed include basic demographics, insurance status, total body surface area (TBSA) of burn, Charlson comorbidity index (CCI), burn etiology, presence of inhalation injury, burn circumstance, intensive care unit (ICU) and hospital length of stay (LOS) and mortality. Chi-square, Analysis of Variance (ANOVA), Kruskal-Wallis test and Multivariate logistic regression was used to analyze the data.

**Results:** 11,650 adult and pediatric patients were entered in the burn registry from 2002 to 2015 and 494 (4.2%) adult and pediatric patients had preexisting major psychiatric illness (MPI). Within the large cohort of admitted burn patients, 90 (0.8%) patients presented with self-inflicted burn injuries. 41% of patients with SIB (n=37/90) had MPI. The incidence of self-inflicted burn injury (SIB) within the MPI (n=494) cohort was 7.5% (n=37). Mean age of patients with and without self-inflicted burn injury was 35.3 ( $\pm 11.6$ ) vs. 41.8 ( $\pm 17.3$ ), respectively. Mean TBSA was significantly higher in patient with SIB at 18.6 ( $\pm 16.5$ ) vs. 8.5 ( $\pm 12.2$ )  $p < 0.001$ . Non-white race had significantly higher rate of SIB compared to white cohort. There was no significant difference in mortality rates between SIB and Non-SIB (5.4% vs. 3.7%,  $p = 0.609$ ), respectively. Median Hospital LOS was significantly increased in patients with SIB compared to NSIB 31 (IQR=55) vs. 9 (IQR=20) days,  $p = 0.004$ . Multivariate logistic regression for predictors of self-inflicted burn injury showed that minorities were more likely to incur self-inflicted burn injury among patients with major psychiatric illnesses.

**Conclusion:** The incidence of self-induced burn injury in patients with MPI is low and of all the self-inflicted burn patients, 60% did not have a major psychiatric illness identified. Our findings emphasize the importance of identifying patients with MPI with or without self-induced injury that may benefit from more extensive psychiatric screening after burn and counseling, particularly minority patients as they may benefit from additional mental health counseling following severe burn.

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## 1. Introduction

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) defines a mental disorder as a syndrome with clinically significant disturbance in cognition, emotional regulation or behavior that can range from mild, moderate to severe impairment in underlying mental functioning [1]. Major psychiatric disorders include depression, schizophrenia, bipolar disorder, ADHD and autism. In the United States, 1 in 5 adults (43.8 million) experiences mental illness in any given year and 1 in 25 adults experience a serious mental illness that impairs or limits daily activities [2]. Furthermore, the prevalence of schizophrenia and bipolar disorders in the U. S. is 1.1% and 2.8%, respectively and 6.9% of the US population has experienced at least one major depressive episode in the past year [3,4].

There is an association between pre-existing psychiatric illness and severe burn with inpatient admission for intentional and non-intentional reasons. The relationship between major psychiatric illness and propensity for self-harm is clear [5]. Suicide and attempted suicide are common phenomena among patients with major psychiatric illness. Self-immolation is an attention seeking event which may have religious or political significance.

Self-inflicted burns (SIB) are an uncommon source of admission to the burn unit. According to the national burn repository, in a ten-year review, suspected intentional injuries (assault, abuse, self-inflicted) accounted for 5% of burn injury cases [6]. There are many studies that examine the prevalence of major psychiatric illness in self-inflicted burn patients [7-11]; however, there are limited studies that look at the incidence and factors associated with self-inflicted burns in patients with major psychiatric illnesses. We therefore sought to examine the incidence of self-inflicted burn injury in patients with pre-existing major psychiatric illness within a burn center population.

## 2. Methods

This is a retrospective study of burn patients admitted to the University of North Carolina Jaycee Burn Center from 2002 to 2015. The burn center is a 36-bed adult and pediatric unit that has been certified by the American Burn Association. Medical records of all patients were reviewed and recorded in the burn registry database. Major psychiatric illnesses were recorded based on ICD 9 and 10 codes obtained from the medical records from prior admissions and also from patient's history on admission to the burn center. Intentionality of burns was obtained from patient or family members on admission. Patients with unclear psychiatric history and undocumented self-harm status were not included in the study population.

Patient characteristics included sex, age, race, insurance status, % total body surface area (TBSA), burn circumstance (self-inflicted vs. other), burn type (scald vs flame), presence of inhalation injury and Charlson comorbidity index (CCI). Patients with and without self-inflicted burns were compared using Chi-square, Analysis of Variance (ANOVA) and Kruskal-Wallis test. Multivariate logistic regression was used to

estimate the odds of self-inflicted injury controlling for other confounders (age, TBSA, race, insurance status, mechanism of injury, and presence of inhalation injury). Major psychiatric illness (MPI) was documented as the presence of pre-injury major depressive disorder, bipolar disorder, schizophrenia, anxiety/panic disorder, borderline or antisocial personality disorder, and/or adjustment disorder/post-traumatic stress disorder. Self-inflicted burn injury was defined as injury to one's own body for the purpose of suicide or self-mutilation.

Statistical analyses were performed using the Stata IC/15.0 (StataCorp LP, College Station, TX). In all cases, a  $p$ -Value  $< 0.05$  was considered statistically significant. University of North Carolina Institutional Review Board approved this study.

## 3. Results

11,650 adult and pediatric patients were recorded in the burn registry from 2002 to 2015 (Table 1). For all patients, 69% were male and 31% female. Mean age was 31.8 years. There was almost an equal number of White (52%) and Non-White (48%) patients. 78% of patients had either Medicaid, self-pay, or other forms of insurance. Scald burn made up majority of burns (48%) followed by flame injury (42%), 6% of patients had inhalation injury. 494 (4.2%) patients had a pre-existing psychiatric disease and 0.8% of all patients suffered self-inflicted burn injuries. Overall, median Hospital and ICU LOS were 5 (IQR=9) and 3 (IQR=10) days, respectively.

494 adult and pediatric major psychiatric illness patients were included in this study (Table 2). Males represented 62% of the population with a mean age was 41.3 ( $\pm 17$ ) years. Whites comprised 67% of the MPI cohort. Majority of patients suffered flame injury (62%) followed by scald (38%). 7.5% suffered self-inflicted burns and 14% had inhalation injury. Mean CCI was 0.51 ( $\pm 1.05$ ) and mean TBSA was 9.3% ( $\pm 12.8$ ). 96% of the patient population survived burn injury with equal frequency of male and female patients. Overall mean ICU and Hospital LOS for MPI patients was 10 (IQR=24) and 7 (IQR=33) days, respectively.

Bivariate analysis (Table 3) was used to compare patients with self-inflicted burns (SIB) and patients with non-intentional burns (NIB). Of the 494 MPI patients, 37 patients had self-inflicted burns and the remaining comprised non-intentional burn injury ( $n=457$ ). Mean age of patients was 35.3 ( $\pm 11.6$ ) vs. 41.8 ( $\pm 17.3$ ) years in NIB,  $p=0.026$ . Mean TBSA in SIB patients was significantly higher at 18.6 ( $\pm 16.5$ ) vs. 8.5 ( $\pm 12.2$ ),  $p < 0.001$ . Although non-white patients accounted for only 33% of the MPI cohort, the incidence of SIB was significantly higher in the non-white cohort (51%),  $p=0.014$ . SIB patients had a significantly higher frequency of flame/fire injury (94.5%) compared to scald/other injury (5.5%),  $p < 0.001$ . Inhalation injury was significantly increased in SIB group (28% vs. 13%),  $p < 0.015$ . There were no statistically significant differences in mortality ( $p=0.609$ ), Charlson comorbidity index ( $p=0.381$ ), sex ( $p=0.159$ ), and ICU LOS ( $p=0.147$ ) between the two groups. Median Hospital LOS was higher in patients with SIB at 31 (IQR=55) vs. 9 (IQR=20) days,  $p < 0.004$ .

Bivariate analysis (Table 4) was also used to do a subgroup analysis of SIB patients with MPI and without MPI (NMPI). Of

**Table 1 – Patient characteristics for all patients.**

Patient characteristics (n=11650)	n	Mean (±SD) or %
Sex		
Male	8033	69%
Female	3616	31%
Age		
Overall		31.8 (±22)
Race		
White	6038	52%
Non-white	5610	48%
Insurance		
Medicaid	3110	27%
Medicare	1317	11%
Self-pay	2844	24%
Managed care	1259	11%
Other	3118	27%
Type of burn		
Flame	4827	42%
Scald	5631	48%
Other	1133	10%
Inhalation		
Inhalation injury	689	6%
No inhalation injury	10934	94%
CCI		
Overall mean		0.34
Psychiatric disorder		
Pre-existing	494	4.2%
None	11156	95.8%
Burn circumstance		
Self-inflicted	90	0.8%
Other	11560	99.2%
TBSA		
Overall mean		6.6 (±10.6)
Survival		
Overall	11301	97%
ICU LOS		
Overall median		3 (IQR=10)
Hospital LOS		
Overall median		5 (IQR=9)

CCI=Charlson comorbidity index. TBSA=total burn surface area.  
ICU LOS=intensive care unit length of stay.

the 90 SIB patients, 37(41%) patients had MPI and 53 (59%) had NMPI. Mean TBSA was higher in the NMPI, 33.2 (±35.3) vs. 18.6 (±16.5),  $p=0.022$ . MPI group was more likely to incur fire/flame burn compared to NMPI, 94.6% vs. 79%, respectively. Mortality was significantly higher in the NMPI compared to MPI patients (38% vs. 5.4%),  $p<0.001$ , respectively. Median Hospital LOS was higher in MPI group at 31 (IQR=55) vs. 5 (IQR=25),  $p=0.004$ .

Multivariate logistic regression (Table 5) was used to determine the odds ratio for self-inflicted burn injury in patients with MPI. Non-White race had a 2.4-fold increase in

self-inflicted burn injury compared to their White counterparts (OR=2.41, 95% CI=1.17–4.53,  $p<0.016$ ). Increase age with each decade showed a protective effect in self-inflicted burn injury (OR=0.81, 95% CI=0.66-0.99,  $p<0.046$ ).

#### 4. Discussion

In the US and Europe, the incidence of self-inflicted burn injuries ranges from 1–6% [10,11]. Our study demonstrates the incidence of self-inflicted burn injury in patients with major psychiatric illness to be 7.5%. These patients were younger, had a larger %TBSA, and were more likely to be non-white. The incidence of self-inflicted burns among patients admitted to burn units ranges widely with substantial inconsistency all over the world and some differences exist between the various countries, regarding the etiology, risk groups, and patterns of self-inflicted burns [12–14].

Although the incidence of SIB represents a small percentage of burn patients, the potential economic burden on hospital and health care services is high [15]. In a study looking at self-inflicted burn injury in an Australian burn unit, the average hospital length of stay for self-inflicted burn injury was 52 days compared to 12 days burn unit average [16]. Another study showed that 39% of self-inflicted burn patients underwent ICU admission, 70% needed surgery and more than 30% had % TBSA greater than 30% [17]. In the United Kingdom, a study looking at the epidemiology and financial implications of self-inflicted burns showed that the critical care cost of treating a self-inflicted burn patient was £225,000 vs. £338 for those not receiving critical care [18].

The presence of a pre-existing major psychiatric disorder in burn injury patients may present significant management challenges of the burn patient. The associated aberrant and erratic behaviors may compromise recovery. Patients may not adhere to medical and nursing advice and they may not be receptive of clinical procedures. In addition, there are associated social issues that pre-date the injury that may contribute to difficulties in discharge placement, thus prolonging hospitalization. Edwards et al. found that depression and anxiety were strong predictors of greater pain, more fatigue and physical dysfunction following burn injury which present treatment challenges [19].

Our patient demographics for self-inflicted burn injury are similar to other studies. Several studies looking at self-inflicted burn injury found that patients were more likely to be younger, have larger % TBSA, present with inhalation injury, incur flame burn and have longer hospital length of stay [20–23]. There are only a few studies that explored the relationship between race and ethnicity and incidence of self-inflicted burn injury. Reiland et al. [23] at the University of Alabama at Birmingham Burn Center found that self-inflicted burn patients were predominantly African American. Modan et al. [24] found that Asian and African Americans had a higher rate (77%) of self-inflicted burn injury and Hammond [25] found that majority of his patient population were Hispanic (51%) compared to their White counterparts. These results are similar to our study findings; however, other studies have shown a majority Caucasian population in their self-inflicted burn injury group [12,20,26,27]. The high rate of pre-existing major psychiatric illness in

**Table 2 – Demographic and injury characteristics of patients with Major Psychiatric Illness (MPI).**

Patient Characteristics (n=494)	n	Mean (±SD) or %
Sex		
Male	307	62%
Female	187	38%
Age		
Overall		41.3 (±17)
Race		
White	331	67%
Non-white	163	33%
Insurance		
Medicaid	133	27%
Medicare	111	22%
Self-pay	119	24%
Managed care	43	18%
Other	88	9%
Mechanism		
Fire/flame	308	62%
Scald/other	186	38%
Inhalation		
Inhalation injury	70	14%
No inhalation injury	423	86%
CCI		
Overall mean		0.51 (±1.05)
Burn circumstance		
Self-inflicted	37	7.5%
Other	457	92.5%
TBSA		
Overall mean		9.3 (±12.8)
Survival		
Overall	475	96%
By sex		
Male	296	96%
Female	179	96%
By Race		
White	320	96.6%
Non-white	155	95%
ICU LOS		
Overall median		7 (IQR=33)
Hospital LOS		
Overall median		10 (IQR=24)

CCI=Charlson comorbidity index. TBSA=total burn surface area.  
ICU LOS=intensive care unit length of stay.

Caucasians may be attributable to increased access to mental health. Whether minorities have an inherent predisposition for self-inflicted burn injury remains to be delineated, however, minorities have less access to mental health care and therefore less likely to have a pre-existing diagnosis and treatment. It is imperative that minority patients with NMPI and SIB be actively screened at the time of presentation.

Lack of access to psychiatric care resources may increase the predisposition for self-inflicted burn injury. Adults with severe mental disorders are more likely to be uninsured and less likely to have access to mental health services compared to those with insurance [28,29]. Vick et al. also found that individuals with mental illness are more likely to live in poverty and have lower family incomes compared to those without mental illnesses [30]. In our study, a significant proportion of the self-inflicted patients (n=16/37, 43%) were uninsured or self-pay. According to a 2011 Kaiser Foundation Survey of Mental Health Financing in the United States, uninsured or self-payers pay 62% of their total mental health expenditures out-of-pocket compared to 6% and 25% for Medicaid and Private-insured, respectively [31]. Patients are less likely to seek psychiatric resources if out-of-pocket costs are high. These access barriers prevent early recognition and results in late presentation of patients to mental health providers resulting in missed opportunities for treatment and suicide or self-harm prevention.

In our subgroup analysis, we also found that 59% of patients with NMPI presented with self-inflicted burns. Although self-harm is not a mental illness, it can be a symptom of a major psychiatric illness [32,33]. Self-inflicted burn patients may not be aware of an associated diagnosis of a mental health condition. This finding also underscores the importance of mental health counseling and intervention in all patients with self-inflicted burns regardless of major psychiatric illness.

## 5. Limitations

Although our study had strict inclusion criteria, the patient population for self-inflicted burns is small. A larger patient sample may be needed to further delineate the racial and cultural predisposition to self-harm. The retrospective nature of our database precludes information on reports of previous self-harm, previous burn injuries, psychiatric disease severity and social demographics which limits the study to provide more information on patient psychiatric condition. Furthermore, there may be under-reporting of self-harm among burn injury psychiatric patients for fear of being shamed, labelled or treated differently.

## 6. Conclusion

The incidence of self-induced burn injury in patients with MPI is low and of all the self-inflicted burn patients, 60% did not have a major psychiatric illness identified. Our findings emphasize the importance of identifying patients with MPI with or without self-induced injury that may benefit from more extensive psychiatric counseling after burn, particularly minority patients. Furthermore, active therapy of major psychiatry illness within the burn unit with the assistance of the psychiatric team is imperative so as to reduce hospital length of stay.

## Conflict of interest

The authors have no conflict of interest.

**Table 3 – Bivariate analysis of intentional burn patients with Major Psychiatric Illness (MPI) (n=494) (Self-inflicted vs. Others (NIB)).**

	Self-inflicted (n=37)	Others (n=457)	p-Value
Age (mean)	35.3 (±11.6)	41.8 (±17.3)	0.026
TBSA (mean)	18.6 (±16.5)	8.5 (±12.2)	<0.001
CCI (mean)	0.68 (±1.5)	0.49 (±1.0)	0.381
Sex			0.159
Male	27 (73%)	280 (61%)	
Female	10 (27%)	177 (39%)	
Race			<0.014
White	18 (49%)	313 (68%)	
Non-white	19 (51%)	144 (32%)	
Insurance			0.277
Medicaid	8 (22%)	125 (27%)	
Medicare	4 (11%)	107 (23%)	
Self-Pay	16 (43%)	103 (23%)	
Managed care	4 (11%)	39 (9%)	
Other	5 (13%)	83 (18%)	
Mechanism			<0.001
Flame/fire	35 (94.6%)	273(60%)	
Scald/other	2 (5.4%)	184(40%)	
Inhalation injury	10 (28%)	60 (13%)	0.015
Mortality rate	2 (5.4%)	17 (3.7%)	0.609
ICU LOS (median)	18.5 (IQR=40.5)	6 (IQR=32)	0.147
Hospital LOS (median)	31 (IQR=55)	9 (IQR=20)	0.0004

CCI=Charlson comorbidity index. TBSA=total body surface area. ICU LOS=intensive care unit length of stay.

**Table 4 – Bivariate analysis comparing self-inflicted burn patients with and without Major Psychiatric Illness (MPI) (n=90).**

	MPI (n=37 (41%))	NMPI (n=53 (59%))	p-Value
Age (mean)	35.3 (±11.6)	40.3 (±16.2)	0.114
TBSA (mean)	18.6 (±16.5)	33.2 (±35.3)	0.022
Race			0.462
White	18 (49%)	30 (57%)	
Non-white	19 (51%)	23 (43%)	
Mechanism			0.031
Flame/fire	35 (94.6%)	42 (79%)	
Scald/other	2 (5.4%)	11 (21%)	
Inhalation injury	10 (28%)	22 (42%)	0.167
Mortality rate	2 (5.4%)	20 (38%)	<0.001
ICU LOS (median)	18.5 (IQR=40.5)	2 (IQR=42)	0.075
Hospital LOS (median)	31 (IQR=55)	5 (IQR=25)	0.004

CCI=Charlson comorbidity index. TBSA=total body surface area. ICU LOS=intensive care unit length of stay.

**Table 5 – Predictors of self-inflicted injury in patients with Major Psychiatric Illness (MPI).**

Variables	Adjusted odds ratio, 95% confidence interval (CI)	p-Value
Age	0.81 (0.66-0.99)	0.046
Race	2.41 (1.17-4.53)	0.016

CCI=Charlson comorbidity index. TBSA=total body surface area. ICU LOS=intensive care unit length of stay.

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