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Assault and Substance Abuse Characterize Burn Injuries in Homeless Patients

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Abstract

The homeless are at an increased risk for traumatic injury, but little is known about the injury etiology and outcome of homeless persons who sustain burn injuries. In this study, we analyze patient and injury characteristics of homeless persons admitted to a regional burn center. This is a retrospective cohort study of patients admitted to our burn center between 1994 and 2005. A total of 3700 adult patients were admitted during the study period and, of these, 72 (1.9%) were homeless. The cohort of homeless patients was compared with domiciled adult patients admitted during the same time period, analyzing baseline patient and injury characteristics and injury outcomes. Overall, homeless patients had more extensive burn injuries than domiciled patients (17.8% vs 11.2%TBSA, $P < .001$) and overall longer lengths of hospital stay (22 vs 12 days, $P < .001$). The homeless population also had significantly higher rates of alcohol (80.6% vs 12.8%, $P < .001$) and drug abuse (59.4% vs 12.8%, $P < .001$), history of mental illness (45.2% vs 11.0%, $P < .001$), and injury by assault (13.9% vs 2.0%, $P < .001$). Homeless patients tended to have more severe injuries; higher rates of substance abuse and mental illness; increased incidence of assault by burning; and longer lengths of hospital stay. Hospitalization of a homeless patient following injury may provide a unique opportunity to address co-occurring substance abuse and mental illness and approach injury prevention to improve patients' outcomes and reduce injury recidivism.

Traumatic injury is a leading cause of hospitalization for homeless patients.[1–6] In an analysis of 18,864 admissions of homeless adults to New York City's public general hospitals, trauma was most common cause of admission behind substance abuse, mental illness, respiratory problems, and HIV/AIDS.[1] Traumatic injury in the homeless shows an increase in hospital stay and increased complication rate over comparable domiciled populations.[1,6] In addition, injury is a leading cause of mortality amongst the homeless.[7–12]

Only one study in the literature specifically addresses the risk factors of thermal injury across an urban homeless population.[13] Therefore, very little is known about the incidence, etiology, and outcomes specific to burn injury in homeless patients. Homeless patients are more likely at risk for increased severity of burn injury and adverse outcomes following injury, given the shared association with the risk factors of higher prevalence of substance abuse, mental illness, and poor baseline health status.[14–20] In addition, assault—a common

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etiology of nonburn trauma—may also be a more common mechanism of burn injury across homeless populations.[2,13,21–23]

The purpose of this study was to examine the patient and injury characteristics of homeless patients admitted to our burn center and compare these characteristics with a larger cohort of domiciled patients. We hypothesized that homeless patients were likely to have more severe injuries, higher rates of substance abuse and mental illness, and longer lengths of hospital stay.

METHODS

Study Overview

This is a retrospective cohort study comparing the baseline patient and injury characteristics and outcomes of homeless patients admitted to our burn center with domiciled adult patients. Approval for conduct of this study was obtained from our Institutional Review Board.

Study Population and Data Sources

We performed a retrospective review of all homeless patients admitted to our regional burn center from 1994 to 2005. Data were obtained from our burn center registry and our National Institute on Disability and Rehabilitation Research (NIDRR) burn injury database. Briefly, the burn center registry contains demographic, injury, and outcome characteristics of all patients admitted to our burn center since 1974. The NIDRR database contains more detailed information regarding patients, their injuries, and outcomes, which is collected as part of a national multicenter burn outcome research program.[24] For homeless patients, missing database information was supplemented by review of patient medical records.

Homeless status was ascertained from the NIDRR database and medical record review. According to database criteria, homelessness was defined as lack of consistent and reliable housing at the time of injury. In addition, patients with discharge status classified as shelter, street, or institution and location of injury not at home were selected for chart review to determine possible homeless status.

After confirmation of homeless status, data on baseline patient and injury characteristics including age, sex, race, total body surface area burned (%TBSA), presence of inhalation injury, and payer status were collected for each patient. Circumstances surrounding injury, history of substance abuse and mental illness were obtained from the NIDRR database.[24] Substance abuse (alcohol and/or drugs) history was based on self-reported use or treatment within the past year. Mental illness was defined by self-reported clinical diagnosis or applicable prescription medicines in the past year. Additional homeless patient data were ascertained through patient chart review including admission alcohol and drug screen results, clinical diagnosis of mental illness, and information regarding discharge disposition and hospital readmission. Finally, we examined the outcomes of overall mortality rate, hospital length of stay (LOS), number of burn surgeries, and total hospital charges from our burn center registry. Hospital charges included only charges related to their hospital course at the burn center.

Data Analysis

The patient, injury, and outcome characteristics of the homeless patients were compared with the larger cohort of all domiciled adult patients (≤18 years) admitted during the same study period. We further compared the homeless cohort with a subset of domiciled patients who were either classified as having a payer status of Medicaid or uninsured at time of

admission to potentially identify patient, injury, and outcome characteristics particular to homeless patients and independent of socioeconomic status. This subpopulation was limited to patients 18 to 67 years of age to match the age range of the homeless cohort.

Total hospital charges were also compared between homeless and domiciled patients. From the homeless patients with complete charge data, we selected a matching domiciled cohort based on gender, date of admission, age (±5 years), and TBSA (±5% TBSA).

All data were analyzed using STATA 9.0 (College Station, TX) software. Chi-square or Fisher's exact tests were used to compare discrete variables; a *t*-test was used to compare continuous variables across two populations; and Wilcoxon signed-rank test was used to compare paired cohort hospital charge data. Multivariate linear regression analyses were performed to adjust for potential confounding variables associated with hospital LOS. A *P* value of <.05 was considered significant.

RESULTS

Of the 3700 adult patients admitted to our burn center from 1994 through 2005, 72 patients (1.9%) were identified as homeless at the time of burn injury. Their baseline patient and injury characteristics, as well as those of the larger cohort of domiciled patients admitted during the same time period, are shown in Table 1.

Compared with the general domiciled population, a greater number of homeless patients were male (84.7% vs 74.7%, $P = .05$) and had larger mean percent total body surface area (%TBSA) burned (17.8 vs 11.2, $P < .001$). The incidence of inhalation injury was similar between homeless and domiciled patients (7.0% vs 6.8%, $P = .92$). Homeless patients were more likely than domiciled patients to be non-Caucasian (33.3% vs 17.6%), resulting in a significantly different distribution of ethnicities ($P = .001$). A majority of our homeless patients were from King County (66.7%), a surrogate assessment of those patients from the Seattle metropolitan area; however, there was no statistically significant difference in the distribution of those homeless patients coming from out of state, when compared with all domiciled patients (4.2% vs 7.3%, $P = .21$).

Patient payer status is shown in Table 2. The majority of homeless patients had Medicaid (59.7%) or no insurance (40.3%) at the time of hospital admission. No homeless patients had commercial insurance.

The circumstances of injury are summarized in Table 2. Compared with the general domiciled population, homeless patients had a significantly higher proportion of burns due to assault (13.9% vs 2.0%, $P < .001$). However, the domiciled population had an increased proportion of self-inflicted burns over the homeless population (3.5% vs 1.4%, $P = .33$). The predominant etiology of burn injury in the homeless population was fire or flame (75.0%, results not shown).

The prevalence of substance abuse and mental illness in the study populations are shown in Table 2. Compared with the general population, homeless patients were more likely to have a history of alcohol abuse (80.6% vs 12.8%, $P < .001$), drug abuse (59.4% vs 13.1%, $P < .001$), and mental illness (45.2% vs 11.0%, $P < .001$). A blood alcohol level was performed on 32 (43.2%) of the homeless patients upon admission; 47% of these patients tested positive; and their median concentration was 224 mg/dl (range, 14–479 mg/dl). Of the homeless patients with mental illness, those with defined clinical diagnoses include depression (57.7%), schizophrenia (23.1%), and bipolar disorder (11.5%). Two patients had co-occurring posttraumatic stress disorder along with depression, at the time of injury.

Patient outcomes are summarized in Table 3. The overall mortality rate was statistically similar between homeless and domiciled populations (9.7% vs 6.0%, $P = .19$). Homeless patients, surviving to discharge, had longer mean LOS when compared with the domiciled population (23.2 vs 12.4 days, $P < .001$). When controlling for burn size, the homeless patients still had a significantly longer LOS (3.3 vs 2.0 days/%TBSA, $P = .006$). To better define the association between homeless status and LOS, we performed a multivariate linear regression analysis adjusting for the potential confounders of %TBSA, age, and presence of inhalation injury (Table 4). Even after adjustment for these confounders, homeless status was still significantly associated with increased LOS ($P < .001$).

Homeless and domiciled patient disposition status is summarized in Table 5. The majority of domiciled patients were discharged home (88.5%), whereas homeless patients were most commonly discharged to temporary housing with friends or family (32.3%) or to a respite or shelter facility (27.7%). Within a year of discharge, 23.1% of homeless patients (n = 15) were readmitted at an average of 1.9 times. Of those readmitted, 53.3% were readmitted for their burn injury; 20.0% were for an unrelated trauma injury; and all other readmissions were for unrelated cellulitis, infection, and alcohol rehabilitation.

Next, we performed an analysis of hospital charges. Mean hospital charges in the homeless cohort were higher than the domiciled population, yet the difference did not reach statistical significance ($91,965 vs $54,103, $P = .23$). The median hospital charges were also higher in the homeless population, and this difference was statistically significant ($28,033 vs $20,526, $P = .04$).

Finally, we compared the injury and outcome characteristics of the homeless patients with the subset of domiciled patients serving as a surrogate for lower socioeconomic status (n = 1468) as described in the methods section above. Both patients groups had a statistically similar payer status distribution ($P = .55$). Homeless patients had larger burn sizes (17.8% vs 10.7%, $P < .001$, Table 1), higher rates of assault (13.9% vs 2.9%, $P < .001$, Table 2), higher mortality rates (9.7% vs 3.1%, $P = .003$, Table 3), and overall longer LOS per %TBSA burn (3.1 vs 2.0 days/%TBSA, $P = .01$, Table 3). The rate of self-inflicted burns was higher among the domiciled Medicaid or uninsured cohort, though not reaching statistical significance (1.4% vs 5.8%, $P < .12$, Table 2).

DISCUSSION

Homeless patients admitted to our burn center had more severe injuries, increased incidence of assault, higher rates of substance abuse and mental illness, and longer hospital stays than domiciled patients and patients of the Medicaid or uninsured subpopulation. These findings are consistent with the injury and outcome characteristics of homeless patients who sustain nonburn trauma.[1–3,5,21,25]

One of the most significant findings of this study is the high rate of assault as the etiology of burn injury in homeless patients (13.9%). Several studies looking at homeless populations have reported a higher susceptibility to general violence and victimization amongst homeless persons and have attributed the high rate to various risk factors including proximity to high crime areas, previous victimization, mental illness, and substance abuse.[21,22,26,27] The notion that assault by burning may be related to substance abuse[23] or mental illness is supported by this study. Those domiciled patients that were assaulted vs all other circumstances exhibited a nearly 3-fold increased presence of alcohol abuse (12.3% vs 36.4%, $P = .001$), drug abuse (12.3% vs 45.0%, $P < .001$), and mental illness (10.7% vs 25.0%, $P = .04$). Injury by assault may not only commonly result in more severe injuries but

may also impact long-term injury outcomes. For example, both burn injury and general assault have associations with posttraumatic stress and other psychological sequelae.[26,28–30]

The homeless population in the study also had higher rates of mental illness and alcohol and substance abuse than domiciled patients, regardless of burn etiology. These findings of increased rates of substance abuse and assault are consistent with the few studies that consider homeless patients and thermal injury.[13,23] Frostbite risk has been clearly linked to homeless status and alcohol abuse.[13,31] In this study, we did not consider cold injuries, skin diseases, and other nonburn admissions to our burn center. Alcohol abuse and mental illness have been shown to impact outcomes after burn injury, increasing length of hospitalization and in-hospital complications.[15–20] In addition, patients with a history of substance abuse tend to be at higher risk for other injury complications, such as nosocomial infections, which can further lengthen hospital stay and increase risk for adverse outcome.[5,14,27,32]

In this study, we examined four outcomes: LOS, total number of burn operations, mortality, and hospital charges. The average LOS was significantly longer for homeless patients, even after adjustment for burn size. Hospital charges were also higher in the homeless population, after controlling for injury size (%TBSA), age, date of admission, and gender in assembling a matching cohort. As discussed above, both the increased LOS and hospital charges may be attributable to co-occurring and complicating factors, such as substance abuse and mental illness assessed in this study, baseline poor health status, and/or complications due to injury. In addition, homeless patients often need to be near full recovery of their burn wounds due to arranging housing with family and friends, respite care admitting requirements, and lack of wound care resources in shelters or on the street. This prolonged hospitalization for even uncomplicated wound care may explain the finding of homeless status as an independent predictor of increased length of hospitalization on multivariate regression and the relatively insignificant difference in overall hospital cost. The similarities in overall mortality between homeless and domiciled patients were not surprising given the overall low rate of mortality following burn injury.[33]

We also compared the cohort of homeless patients with the subpopulation of domiciled patients that has Medicaid and uninsured payer status. This subpopulation serves as a surrogate for lower socioeconomic status to better understand differences attributable to being homeless rather than merely being of low income or unqualified for health insurance. Although we only assume the uninsured category to be heavily weighted by individuals in the lower socioeconomic stratum, even those with insurance, employment, and housing are at risk of financial instability and homelessness upon burn injury requiring admission. The comparison shows that homeless patients had significantly more severe injuries, longer LOS, and increased mortality. These differences are likely attributable to the impact of homelessness, substance abuse, and mental illness on injury severity and outcome as discussed above.

The findings of this study not only provide insight into the characteristics and outcomes of burn injury in homeless patients, but also suggest potential opportunities for interventions to improve the lives of homeless people. Hospital admission following injury may be the only contact that a homeless person has with the health care system and may present the only opportunity to address issues of substance abuse and untreated mental illness. Therefore, homeless patients may benefit substantially if health care providers can properly diagnose, treat, and make community resource referrals during the injury admission. Gentilello et al[34–36] have demonstrated that alcohol interventions during the hospital admission following trauma can be highly effective in reducing hospital costs and injury recidivism. Based on these findings, the American College of Surgeons has recently mandated that level I and II trauma centers identify patients who are problem drinkers, and level I trauma centers must

have the capability to provide an intervention to maintain verification.[37] In addition, extending beyond the inpatient setting, injury prevention programs including assertive case and discharge management, supportive housing with integrated health services, and partnerships between health-care providers, public safety, local governments, and community groups may reduce the risk for injury in the homeless.[38 − 43]

There are several potential limitations to this study. First, ascertainment of homeless status proved challenging in several instances. There were several patients who were not assigned homeless status in the database but were found to be homeless during the medical record review (as described in the Methods section). This finding suggests that there may be patients misclassified as domiciled in this study. In addition, the definition of homeless can vary. The NIDRR database defines homelessness based on living situation at the time of injury. However, this definition would not include persons on the verge of homelessness with marginal housing and/or those with a strong social support network who may share the same risk factors for injury as the homeless and may indeed spend most of the day living amongst the homeless. Finally, our databases have limitations. For example, data on circumstances surrounding injury, substance abuse, and mental illness were limited to the NIDRR database for the domiciled population. We assumed this subset would fairly represent the entire domiciled population. However, the NIDRR population tends to have more extensive injuries,[24] lending to a more conservative bias. In addition, given the retrospective nature of this study, we had limited long-term outcome data on both the domiciled and homeless patients. Follow-up data on functional status and psychological health could provide additional insight into the impact of homelessness on long-term outcomes following burn injury.

CONCLUSIONS

Homeless patients admitted to our burn center had a higher rate of substance abuse, mental illness, incidence of assault by burning, and longer lengths of hospital stay. These observations are consistent with existing nonburn trauma literature on homeless patients, as well as the known risk for abuse and victimization of homeless persons. Hospitalization of a homeless patient following injury may provide a unique opportunity to address co-occurring substance abuse and mental illness and approach injury prevention to improve patients' outcomes and reduce injury recidivism.

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Table 1

Baseline patient and injury characteristics

Patient and Injury Characteristics	Homeless (n = 72)	All Domiciled (n = 3628)	*P*	Medicaid/Uninsured (n = 1468)	*P*[*]
Age, mean ± SD	40.3 ± 10.7	41.8 ± 16.8	.47	37.1 ± 11.9	.02
Sex: male, no. (%)	61 (84.7)	2709 (74.7)	.05	1097 (74.7)	.05
Ethnicity, no. (%)			<.001		<.001
White	48 (66.7)	2985 (82.4)		1194 (81.4)	
African-American	6 (8.3)	174 (4.8)		90 (6.1)	
Hispanic	5 (6.9)	192 (5.3)		80 (5.5)	
Asian/Pacific Islander	0	178 (4.9)		59 (4.0)	
Native American	13 (18.1)	66 (1.8)		32 (2.2)	
Other/multiracial	0	27 (0.8)		12 (0.8)	
%TBSA, mean ± SD	17.8 ± 22.9	11.2 ± 15.1	<.001	10.7 ± 14.1	<.001
Inhalation injury, no. (%)	5 (7.0)	243 (6.8)	.92	96 (6.6)	.88

[*]When compared with homeless patients.

Table 2

Additional patient and injury characteristics

	Homeless	All Domiciled	*P*	Medicaid/Uninsured	*P**
Payer status, no. (%)	n = 72	n = 3628		n = 1468	
Commercial insurance†	0	1657 (47.0)	<.001	0	.55
Noncommercial insurance‡	43 (59.7)	1247 (35.4)		928 (63.2)	
Uninsured	29 (40.3)	545 (15.5)		540 (36.8)	
Other	0	75 (2.1)		0	
Circumstances surrounding injury, no. (%)	n = 72	n = 1189		n = 413	
Unintentional/other	61 (83.7)	1112 (94.5)	<.001	377 (91.3)	<.001
Assault	10 (13.9)	23 (2.0)		12 (2.9)	
Self-inflicted	1 (1.4)	42 (3.5)		24 (5.8)	
Co-occurring condition, no./n (%)					
Alcohol abuse	54/67 (80.6)	141/1103 (12.8)	<.001	84/389 (21.6)	<.001
Drug abuse	38/64 (59.4)	141/1080 (13.1)	<.001	117/379 (30.9)	<.001
Mental illness	28/62 (45.2)	118/1062 (11.0)	<.001	63/372 (16.9)	<.001

*When compared with homeless patients.

†Commercial Insurance includes private, Health Maintenance Organization, and labor and industries coverage.

‡Noncommercial includes Medicare and Medicaid coverage.

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Table 3

Patient outcomes

Outcome	Homeless (n = 72)	All Domiciled (n = 3628)	*P*	Medicaid/Uninsured (n = 1468)	*P**
LOS (d), mean ± SD	23.2 ± 28.7	12.4 ± 17.8	<.001	13.1 ± 19.1	<.001
LOS/%TBSA, d/%TBSA, mean ± SD	3.3 ± 5.7	2.0 ± 3.6	.006	2.0 ± 3.6	.005
No. burn operations, mean ± SD	1.3 ± 2.2	0.6 ± 1.3	<.001	0.6 ± 1.4	<.001
Mortality, no. (%)	7 (9.7)	217 (6.0)	.19	46 (3.1)	.003

* When compared with homeless patients.

LOS, length of stay.

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Table 4

Multivariate linear regression analysis of factors impacting hospital length of stay

Variables	*β*-Coefficient (95% CI)	*P*
%TBSA	1.14 (1.10–1.18)	<.001
Age	0.14 (0.11–0.17)	<.001
Homeless	5.68 (2.66–8.71)	<.001
Inhalation injury	9.83 (7.64–12.01)	<.001

CI, confidence interval.

Table 5

Disposition of homeless patients surviving to discharge

Discharge Location	No. (%)
Home of family and friends	21 (32.3)
Respite or shelter facility	18 (27.7)
Street	9 (13.9)
Transfer to other acute care facility	9 (13.9)
Skilled nursing facility	3 (4.6)
Against medical advice	3 (4.6)
Incarceration	2 (3.1)