

Burns and Mental Health

A Matched Cohort Study

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Objective: To determine the association between burns and hospitalization for mental health disorders up to 3 decades later.

Background: Burns are associated with pain, disability, and scarring, but the long-term impact on mental health is unclear.

Methods: We analyzed a cohort of 23,726 patients with burns aged ≥ 10 years who were matched to 223,626 controls from Quebec, Canada, between 1989 and 2022. The main exposure was admission for a burn. We followed patients during 3,642,206 person-years of follow-up to identify future hospitalizations for psychiatric disorders, substance use disorders, and suicide attempts. We estimated adjusted hazard ratios (HRs) with 95% CIs for the association between burns and subsequent mental health hospitalization using Cox proportional hazards regression.

Results: Patients with burns had a 1.76 times greater risk of mental health hospitalization over time (95% CI: 1.72–1.81), compared with controls. Associations were present regardless of burn site, but were greatest for burns covering $\geq 50\%$ of the body (HR: 3.29, 95% CI: 2.61–4.15), third-degree burns (HR: 2.04, 95% CI: 1.94–2.14), and burns requiring skin grafts (HR: 2.00, 95% CI: 1.90–2.10). Compared with controls, patients with burns had more than two times the risk of hospitalization for eating

disorders (HR: 3.14, 95% CI: 2.50–3.95), psychoactive substance use disorders (HR: 2.27, 95% CI: 2.17–2.39), and suicide attempts (HR: 2.42, 95% CI: 2.23–2.62). Risks were particularly elevated within 5 years of the burn but persisted throughout follow-up.

Conclusions: Burns are associated with an increased risk of hospitalization for mental health disorders up to 30 years later.

Keywords: attempted suicide, burns, hospitalization, mental disorders, skin transplantation, substance-related disorders

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Burns are a major cause of morbidity,¹ but the long-term impact on mental health is poorly understood. An estimated 7 to 11 million individuals sustain burn injuries each year,^{1,2} including severe burns that have implications for mental health. Many burns require intensive treatment and repeated surgical interventions associated with prolonged hospitalization.¹ Although 98% of patients with burns survive,² many suffer permanent loss of function, disfigurement, and chronic pain, with potential to impact not only physical health, but also long-term mental health.^{1,3} Dissatisfaction with body image is common and may impact social interaction and reintegration in society.³ Loss of property or loved ones in fires may further compound the psychosocial impact. The potential for burns to negatively affect mental health is significant, but the long-term psychiatric burden has not been studied.

Most studies have focused on mental health in the short-term period after a burn.^{4,5} An analysis of 1530 patients reported that mental health visits were frequent up to 3 years after a major burn, especially visits for substance use, mood, and anxiety disorders.⁴ However, patients were compared with the period preceding the burn, not with controls who had no burns. While 2 cohort studies of a total of nearly 20,000 patients found that burn survivors tended to have a greater risk of mental health disorders than controls, patients were followed for no more than 5 years.^{5,6} An analysis of 421 burn survivors suggested that self-reported mental health deteriorated over time up to 20 years later, but mental health disorders were not assessed.³ Our objective was to examine whether burn injuries were associated with the long-term risk of mental health hospitalization during three decades of follow-up.

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The data that support the findings of this study can be accessed from the Institut de la statistique du Québec (<https://www.stat.gouv.qc.ca/recherche/#/accueil>).

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METHODS

Study Design and Population

We conducted a matched cohort study of patients aged ≥ 10 years who were hospitalized for burns in Quebec, Canada between April 1989 and March 2022. We obtained data on the patients from the Maintenance and Use of Data for the Study of Hospital Clientele registry, which contains discharge summaries of all admissions and day surgeries in hospitals. The data cover the entire population because health care is publicly funded in Quebec and most patients require at least one minor hospital intervention in their lifetime. Each discharge summary includes patient characteristics such as age, sex, and up to 41 diagnoses and 35 interventions.

We extracted all patients with burns and matched them with up to 10 controls of the same age and sex at the time of hospitalization. We used controls that were representative of the population, selected from patients admitted for the medical or surgical management of appendicitis, vasectomy, cataract surgery, or delivery of a pregnancy. We followed the patients over time for up to 33 years after their first admission to identify subsequent mental health hospitalizations. We did not include patients who died at the first admission or lacked a unique patient identifier.

Burns

The main exposure was hospitalization for a burn of the external body surface, identified using the ninth and 10th revisions of the International Classification of Diseases (ICD-9: 941–946, 948, and 949; ICD-10: T20–T25 and T29–T32). We categorized burns by body surface area ($<10\%$, 10% – 19% , 20% – 29% , 30% – 39% , 40% – 49% , and $\geq 50\%$), degree (first, second, or third degree), site (head and neck, trunk, arm, hand, leg, and multiple sites), and cause (fire, heat and hot substance, chemical, electrical, explosion and other mechanical force, transport-related, and others). We included burns of any degree in the calculation of total body surface area. We also identified patients who required skin grafts.

Mental Health Outcomes

The main outcome was hospitalization for a mental health disorder during follow-up. We identified hospitalizations for psychiatric disorders, including depression, bipolar, stress and anxiety, eating, psychotic, and personality disorders. We also identified admissions for alcohol, tobacco, and psychoactive substance use disorders (opioids, cannabis, cocaine, stimulants, hallucinogens, sedatives and hypnotics, and others), as well as suicide attempts. We used the ICD to identify mental health admissions, following codes used in previous research.^{7,8} The ICD resembles the coding system of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.⁸

Covariates

We considered potential confounders, including preexisting psychiatric disorders, substance use disorders, and suicide attempts requiring hospitalization any time between 1989 and the start of follow-up, socioeconomic disadvantage measured as quintiles of material deprivation based on neighborhood education, income, employment,⁷ and rural residence. These factors have the potential to be associated with burns and mental health. As matching was

computationally intensive, we used adjustment to account for these confounders.

Data Analysis

We calculated the rate of mental health hospitalization per 1000 person-years and the cumulative incidence at 33 years of follow-up. We estimated hazard ratios (HRs) and 95% CIs for the association of burns with future mental health admissions using stratified Cox proportional hazard regression models. We defined the time scale as the number of days between the start of follow-up and the first mental health admission, death, or study end on March 31, 2022. We adjusted the models for preexisting mental health disorders, socioeconomic disadvantage, and rural residence and accounted for death as a competing outcome. We censored patients who were never admitted for a mental health disorder by the end of the study and verified the proportionality of hazards using survival curves.

We examined associations according to body surface area burned, degree, site, cause, and use of skin grafts. We also assessed how the age and sex of patients with burns affected the risk of mental health hospitalization and if burns were more strongly associated with certain types of mental disorders. Finally, we determined whether the association with mental health hospitalization changed over time (<5 , 5 – 9 , 10 – 14 , and ≥ 15 years after the burn). In sensitivity analysis, we analyzed patients with and without preexisting mental health disorders separately.

We performed the analysis in SAS version 9.4 (SAS Institute Inc.). The study conformed to the Tri-Council Policy Statement for Ethical Conduct of Research Involving Humans in Canada. Informed consent was not required from patients and data were de-identified. The review board of our institution waived ethics review.

RESULTS

There were 23,726 patients with burns and 223,626 matched controls followed for a total of 3,642,206 person-years during the study (Supplemental Digital Content Table S1, <http://links.lww.com/SLA/F54>). The mean length of follow-up was 12.1 years for patients with burns and 15.0 years for controls. Among patients with burns, 8346 (35.2%) had a mental health admission during follow-up, compared with 39,801 (17.8%) controls. Patients with burns were more likely to be socioeconomically disadvantaged, have preexisting mental health disorders, and be from rural areas compared with controls. Patients with burns and controls were equally distributed across age, sex, and time periods.

Patients with burns had an elevated risk of mental health admission over time (Table 1). For every 1000 person-years, patients with burns had 29.1 mental health admissions compared with 11.9 among controls, for an adjusted HR of 1.76 (95% CI: 1.72–1.81). All types of burns were associated with mental health hospitalization. Burns covering more than 40% of the body were associated with more than three times the risk of mental health hospitalization compared with controls, whereas burns covering 20% to 39% of the body were associated with two times the risk. Any degree of burn was associated with mental health hospitalization, although patients with third degree burns had the greatest risk compared with controls (HR: 2.04, 95% CI: 1.94–2.14). All burn sites were associated with a greater risk of mental health admission, although burns to the arm

TABLE 1. Association Between Burns and Subsequent Mental Health Hospitalization

	No. of patients	No. of Mental Admissions	Incidence per 1000 person-years (95% CI)	HR (95% CI), Patients with Burns vs Matched Controls	
				Unadjusted	Adjusted*
Any burn					
Yes	23,726	8346	29.1 (28.4–29.7)	2.41 (2.36–2.47)	1.76 (1.72–1.81)
No (matched control)	223,626	39,801	11.9 (11.7–12.0)	Reference	Reference
Body surface area (%)					
< 10	20,115	7065	29.1 (28.4–29.7)	2.36 (2.30–2.42)	1.71 (1.67–1.76)
10–19	1866	563	24.2 (22.3–26.3)	2.24 (2.05–2.46)	1.73 (1.57–1.90)
20–29	843	318	30.1 (27.0–33.6)	2.98 (2.63–3.37)	2.12 (1.86–2.41)
30–39	426	168	32.5 (27.9–37.8)	3.26 (2.73–3.89)	2.50 (2.08–3.00)
40–49	206	99	40.4 (33.2–49.2)	4.24 (3.34–5.39)	3.19 (2.47–4.12)
≥ 50	270	133	49.2 (41.5–58.3)	4.57 (3.70–5.63)	3.29 (2.61–4.15)
Degree of burn					
First	1184	470	34.2 (31.3–37.5)	2.56 (2.31–2.84)	1.75 (1.57–1.94)
Second	10,270	3364	25.7 (24.9–26.6)	2.27 (2.19–2.36)	1.65 (1.59–1.71)
Third	5876	2089	30.5 (29.2–31.8)	2.67 (2.54–2.80)	2.04 (1.94–2.14)
Unspecified	6396	2423	32.6 (31.4–34.0)	2.39 (2.29–2.50)	1.74 (1.67–1.83)
Site†					
Head and neck	4736	1530	29.3 (27.8–30.8)	2.72 (2.57–2.88)	1.94 (1.83–2.06)
Trunk	5226	1885	37.0 (35.4–38.7)	2.81 (2.67–2.95)	2.04 (1.94–2.15)
Arm	5227	1848	33.5 (32.0–35.0)	2.96 (2.81–3.11)	2.12 (2.01–2.23)
Hand	6567	2238	29.2 (28.0–30.5)	2.73 (2.61–2.86)	1.92 (1.83–2.02)
Leg	7305	2516	31.1 (30.0–32.4)	2.45 (2.34–2.56)	1.82 (1.74–1.91)
Multiple sites	8606	2816	25.6 (24.7–26.6)	2.42 (2.33–2.52)	1.81 (1.74–1.89)
Unspecified	2917	1081	31.1 (29.3–33.0)	2.18 (2.04–2.33)	1.71 (1.60–1.84)
Cause†					
Fire	5225	2024	34.4 (32.9–35.9)	3.27 (3.11–3.44)	2.26 (2.15–2.38)
Heat and hot substance	5613	1824	29.0 (27.7–30.4)	2.24 (2.13–2.36)	1.71 (1.63–1.80)
Chemical	1077	332	23.7 (21.3–26.4)	2.40 (2.14–2.69)	1.92 (1.70–2.16)
Electrical	1666	356	12.3 (11.0–13.6)	1.32 (1.19–1.47)	1.24 (1.11–1.38)
Explosion and other mechanical force	2511	710	19.5 (18.1–20.9)	2.02 (1.87–2.19)	1.65 (1.52–1.79)
Transport-related	912	228	18.5 (16.2–21.0)	1.95 (1.69–2.24)	1.59 (1.38–1.84)
Other	6881	2944	39.7 (38.2–41.1)	2.54 (2.43–2.64)	1.71 (1.64–1.78)
Skin graft					
Graft	6345	2105	28.3 (27.1–29.5)	2.52 (2.40–2.64)	2.00 (1.90–2.10)
No graft	17,381	6241	29.3 (28.6–30.1)	2.38 (2.31–2.45)	1.69 (1.64–1.74)

*Adjusted for preexisting mental health disorders, socioeconomic disadvantage, and rural residence.

†Not mutually exclusive.

and trunk stood out more than burns to the leg. Fire-related burns were associated with twice the risk of mental health hospitalization (HR: 2.26, 95% CI: 2.15–2.38), but electrical, chemical, and other causes were also associated with this outcome. Patients who required skin grafts were more likely to be hospitalized for mental health disorders over time.

Patients with burns were at risk of all types of mental health disorders (Table 2). Burns were strongly associated with hospitalization for eating disorders (HR: 3.14, 95% CI: 2.50–3.95), psychotic disorders (HR: 2.43, 95% CI: 2.29–2.58), and personality disorders (HR 2.42, 95% CI: 2.29–2.56). Associations were also present with depression, bipolar, stress, and anxiety disorders. Patients with burns were at risk of substance use disorders, including opioids (HR: 2.26, 95% CI: 2.02–2.53), cannabis (HR: 2.42, 95% CI: 2.20–2.66), sedatives (HR: 2.09, 95% CI: 1.91–2.29), and alcohol (HR: 2.14, 95% CI: 2.05–2.24). Patients with burns were 2.42 times more likely to be hospitalized for a suicide attempt (95% CI: 2.23–2.62).

Risk of mental health hospitalization varied with age (Table 3). Burns at ages 20 to 39 years (HR: 2.01, 95% CI: 1.92–2.11) and 40 to 64 years (HR: 1.88, 95% CI: 1.81–1.95) were associated with the greatest risk of mental health hospitalization. These age groups were most at risk of psychiatric and substance use disorders. Burns at 40 to 64 years were strongly associated with admission for suicide attempts (HR: 3.03, 95% CI: 2.65–3.46). Male and female patients with burns had similar risks of mental health hospitalization over time.

The first 5 years after a burn was when patients had the most rapid rise in mental health admissions (Fig. 1). Mental health hospitalization rates at 5 years were more than three times greater among patients with burns compared with controls (242.2 vs 74.2 per 1000). Nevertheless, rates remained elevated up to 3 decades later.

Regression models confirmed that burns were associated with mental health hospitalization throughout follow-up (Table 4). Compared with controls, patients with burns had 2.45 times the risk of mental health hospitalization

TABLE 2. Association Between Burns and Type of Mental Health Hospitalization

	No. of patients		Incidence per 1000 person-years (95% CI)		HR (95% CI), Patients With Burns vs Matched Controls	
	Burn	Matched Control	Burn	Matched Control	Unadjusted	Adjusted*
Psychiatric disorder	5553	23,113	17.6 (17.1–18.1)	6.6 (6.5–6.7)	2.59 (2.52–2.67)	1.79 (1.73–1.84)
Depression	1902	8199	5.3 (5.0–5.5)	2.2 (2.2–2.3)	2.28 (2.18–2.39)	1.53 (1.45–1.60)
Bipolar disorder	1087	2982	3.0 (2.8–3.1)	0.8 (0.8–0.8)	3.56 (3.35–3.79)	1.89 (1.76–2.02)
Stress or anxiety disorder	3127	14,488	9.0 (8.7–9.3)	4.0 (4.0–4.1)	2.15 (2.07–2.23)	1.49 (1.43–1.55)
Eating disorder	112	170	0.3 (0.2–0.4)	0.0 (0.0–0.1)	6.22 (5.04–7.68)	3.14 (2.50–3.95)
Psychotic disorder	1647	3582	4.6 (4.3–4.8)	1.0 (0.9–1.0)	4.46 (4.23–4.70)	2.43 (2.29–2.58)
Personality disorder	1902	4239	5.3 (5.1–5.6)	1.1 (1.1–1.2)	4.57 (4.36–4.80)	2.42 (2.29–2.56)
Substance use disorder	5944	26,051	18.6 (18.1–19.0)	7.4 (7.4–7.5)	2.48 (2.41–2.55)	1.74 (1.69–1.79)
Psychoactive drug, any	2284	5987	6.4 (6.1–6.7)	1.6 (1.6–1.7)	3.91 (3.75–4.09)	2.27 (2.17–2.39)
Opioids	413	1052	1.1 (1.0–1.2)	0.3 (0.3–0.3)	3.79 (3.43–4.20)	2.26 (2.02–2.53)
Cannabis	608	1419	1.6 (1.5–1.7)	0.4 (0.4–0.4)	4.26 (3.91–4.63)	2.42 (2.20–2.66)
Cocaine	484	1056	1.3 (1.2–1.4)	0.3 (0.3–0.3)	4.54 (4.13–4.99)	2.33 (2.09–2.60)
Stimulants	401	750	1.1 (1.0–1.2)	0.2 (0.2–0.2)	5.37 (4.83–5.97)	2.86 (2.53–3.23)
Hallucinogens	52	91	0.1 (0.1–0.2)	0.0 (0.0–0.0)	5.63 (4.19–7.56)	2.75 (1.94–3.91)
Sedatives and hypnotics	671	1584	1.8 (1.7–1.9)	0.4 (0.4–0.4)	4.16 (3.84–4.50)	2.09 (1.91–2.29)
Other drug	67	221	0.2 (0.1–0.2)	0.1 (0.1–0.1)	2.88 (2.25–3.69)	1.25 (0.94–1.66)
Alcohol	2736	8501	7.7 (7.5–8.0)	2.3 (2.3–2.4)	3.33 (3.20–3.46)	2.14 (2.05–2.24)
Tobacco	4013	18,837	11.6 (11.2–12.0)	5.3 (5.2–5.3)	2.17 (2.10–2.24)	1.53 (1.48–1.59)
Suicide attempt	855	1808	2.3 (2.2–2.5)	0.5 (0.5–0.5)	4.74 (4.41–5.09)	2.42 (2.23–2.62)

*Adjusted for preexisting mental health disorders, socioeconomic disadvantage, and rural residence

within 5 years (95% CI: 2.37–2.53), 1.30 times the risk at 5 to 9 years (95% CI: 1.22–1.38), 1.14 times the risk at 10 to 14 years (95% CI: 1.05–1.24), and 1.17 times the risk after 15 years (95% CI: 1.09–1.25). This trend was present for all mental health outcomes.

In sensitivity analyses, patients with burns and preexisting mental health disorders had 2.37 times the risk of subsequent mental health hospitalization compared with controls (95% CI: 2.26–2.49), whereas patients with no preexisting mental health disorder had 1.47 times the risk (95% CI: 1.42–1.52; Supplemental Digital Content Table S2, <http://links.lww.com/SLA/F54>).

DISCUSSION

In this study of 247,352 patients with 3.6 million person-years of follow-up, patients admitted for burns had a considerably elevated risk of mental health admission up to 3 decades later. Risks were high regardless of the burn site, but were greatest for third-degree burns, burns covering more than 40% of the body, and fire-related burns. Patients requiring skin grafts were particularly at risk. Burns were

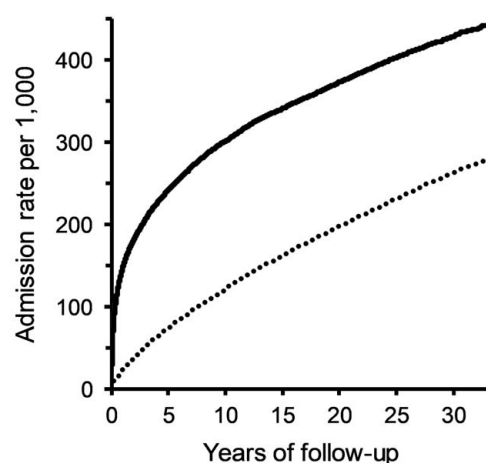
associated with all types of mental health disorders, including eating disorders, psychotic disorders, substance use disorders, and suicide attempts. Risks were highest for patients with burns between age 20 and 64 years, but were also present for burns between 10 and 19 years and at 65 years of age or more. The first 5 years after a burn was the period of greatest risk, although associations persisted up to 33 years later. The findings suggest that patients with burns have a considerable mental health burden after their injury, and would benefit from long-term mental health care and support.

Burns are complicated injuries that tend to require multimodal management, including critical care, airway and lung management, and surgical care.⁹ Smoke inhalation and hypoxia may cause extensive damage. Patients may lose massive amounts of fluids and require volume repletion in an intensive care setting.⁹ Patients may also need partial or full-thickness excisions and repeated skin grafts.¹⁰ Flaps may be necessary if deep structures are affected.¹¹ These procedures may create deficits in areas that were not initially burned. Healing times may be long and postsurgical infections may be common.

TABLE 3. Association Between Burns and Mental Health Hospitalization by Age and Sex

	HR (95% CI),* Patients With Burns vs Matched Controls			
	Psychiatric disorder	Substance use disorder	Suicide attempt	Any Mental Health Admission
Age at burn (yr)				
10–19	1.44 (1.28–1.63)	1.63 (1.45–1.84)	2.17 (1.74–2.70)	1.54 (1.39–1.71)
20–39	1.98 (1.87–2.10)	1.99 (1.88–2.10)	2.07 (1.82–2.35)	2.01 (1.92–2.11)
40–64	2.04 (1.95–2.14)	1.74 (1.67–1.82)	3.03 (2.65–3.46)	1.88 (1.81–1.95)
≥ 65	1.32 (1.24–1.40)	1.41 (1.31–1.51)	2.20 (1.44–3.37)	1.38 (1.31–1.46)
Sex				
Male	1.79 (1.72–1.86)	1.75 (1.69–1.81)	2.24 (2.01–2.50)	1.78 (1.72–1.83)
Female	1.78 (1.71–1.87)	1.71 (1.63–1.80)	2.67 (2.36–3.01)	1.74 (1.67–1.81)

*Adjusted for preexisting mental health disorders, socioeconomic disadvantage, and rural residence



No. at risk	5 years	15 years	25 years
Burn	14,901	9,069	4,027
No burn	175,426	108,757	47,403

FIGURE 1. Cumulative incidence of mental health hospitalization per 1000 patients with burns (solid line) and no burns (dotted line).

Yet, little is known about the long-term mental health impact of burns. Most studies have focused on the immediate period after a burn.^{4-6,12} Depression, anxiety, and post-traumatic stress disorders appear to be common in the short term.¹² In an analysis of 1530 patients with major burns, mental health visit rates were 3.7 times greater up to 3 years after a burn compared with beforehand.⁴ In a matched cohort study of 942 adults, patients were more likely than controls to report depression, anxiety, and substance use disorders up to 2 years after a burn.⁵ A study of 18,198 patients without preexisting mental health conditions found that burns were associated with the risk of depression

and stress disorders up to 5 years later.⁶ A survey of 421 adults with burns, the only study with more than 5 years of follow-up, suggested that self-reported mental health deteriorated up to 20 years later.³ We found a significant impact in the long term, with burns associated with the risk of mental health hospitalization up to 3 decades later. Severe burns with greater degree and surface area or that required grafts were associated with the greatest risk.

Studies of the long-term psychosocial outcomes of patients with burns have mainly assessed function, work, and relationships, not mental health directly.^{13,14} An analysis of 221 patients with burns surveyed with the Burn Specific Health Scale–Brief (BSHS-B) found that quality of life and recovery were impacted up to 10 years after a burn.¹³ The BSHS-B measures outcomes in 9 domains: (1) simple abilities (bathing and dressing), (2) heat sensitivity, (3) hand function, (4) treatment regimens, (5) work, (6) body image, (7) affect, (8) interpersonal relationships, and (9) sexuality.¹³ While the BSHS-B does not evaluate psychiatric outcomes, components such as body image, affect, and interpersonal relations are linked with mental health. A review of 19 studies found that burn survivors tend to have a lower health-related quality of life, suggesting that burns affect physical, mental, and social well-being.¹⁴

Our findings suggest that patients with burns are at risk of all types of mental disorders, including depression, anxiety, and eating disorders that are related to body image.¹⁵ Body dissatisfaction due to scarring, disfigurement, and amputation may be prevalent in patients with burns.^{3,16} Patients with visible burns may feel stigmatized and have lower self-esteem.¹⁷ In an analysis of 697 burn survivors, patients with head and neck burns reported being more dissatisfied with their appearance than patients with less visible burns.¹⁶ Facial disfigurement can negatively impact self-image.¹⁸ In our data, head and neck burns were associated with around two times the risk of mental health admission over time, resembling the short-term risks seen by others.⁶ Burns were even more

TABLE 4. Association Between Burns and Timing of Subsequent Mental Health Hospitalization

HR (95% CI),* Time of Mental Health Hospitalization for Patients With Burns vs Matched Controls				
	<5 yr	5–9 yr	10–14 yr	≥15 yr
Any mental health admission	2.45 (2.37–2.53)	1.30 (1.22–1.38)	1.14 (1.05–1.24)	1.17 (1.09–1.25)
Psychiatric disorder	2.42 (2.33–2.52)	1.34 (1.24–1.45)	1.22 (1.11–1.35)	1.13 (1.03–1.23)
Depression	2.15 (2.01–2.31)	1.35 (1.20–1.51)	1.07 (0.93–1.24)	1.08 (0.95–1.23)
Bipolar disorder	2.26 (2.05–2.48)	1.74 (1.48–2.04)	1.53 (1.23–1.90)	1.36 (1.08–1.70)
Stress or anxiety disorder	2.11 (2.01–2.23)	1.18 (1.08–1.30)	1.11 (0.99–1.25)	1.09 (0.98–1.21)
Eating disorder	4.13 (3.03–5.64)	2.02 (1.17–3.48)	2.94 (1.40–6.18)	3.15 (1.55–6.40)
Psychotic disorder	3.02 (2.80–3.26)	1.77 (1.53–2.05)	1.91 (1.56–2.34)	1.77 (1.43–2.20)
Personality disorder	3.16 (2.94–3.40)	1.94 (1.69–2.22)	1.95 (1.65–2.31)	1.47 (1.23–1.75)
Substance use disorder	2.50 (2.40–2.60)	1.37 (1.28–1.47)	1.22 (1.12–1.33)	1.21 (1.12–1.30)
Psychoactive drug, any	3.26 (3.04–3.50)	1.82 (1.62–2.05)	1.49 (1.28–1.73)	1.54 (1.35–1.76)
Opioids	3.37 (2.83–4.00)	2.12 (1.66–2.70)	1.64 (1.17–2.28)	1.45 (1.07–1.96)
Cannabis	3.45 (2.99–3.98)	2.07 (1.64–2.60)	1.77 (1.36–2.30)	1.83 (1.45–2.31)
Cocaine	3.24 (2.73–3.84)	2.10 (1.64–2.69)	1.80 (1.34–2.42)	1.43 (1.06–1.94)
Stimulants	5.22 (4.20–6.48)	2.40 (1.75–3.27)	1.89 (1.35–2.66)	1.94 (1.51–2.49)
Hallucinogens	2.90 (1.55–5.43)	4.29 (1.89–9.70)	1.85 (0.75–4.57)	1.64 (0.49–5.54)
Sedatives and hypnotics	3.37 (2.94–3.86)	1.63 (1.31–2.03)	1.50 (1.15–1.95)	1.40 (1.11–1.77)
Other drug	1.69 (1.19–2.41)	0.55 (0.26–1.16)	1.52 (0.67–3.44)	3.88 (1.21–12.37)
Alcohol	2.97 (2.80–3.16)	1.81 (1.62–2.01)	1.55 (1.36–1.77)	1.51 (1.36–1.69)
Tobacco	2.22 (2.11–2.33)	1.26 (1.16–1.37)	1.24 (1.12–1.36)	1.17 (1.08–1.27)
Suicide attempt	3.90 (3.48–4.37)	1.72 (1.40–2.11)	1.70 (1.32–2.18)	1.52 (1.22–1.90)

*Adjusted for preexisting mental health disorders, socioeconomic disadvantage, and rural residence.

strongly associated with eating disorders. Body image is an important component of eating disorders,¹⁹ with scars and disfigurement potentially exacerbating negative body perception. Data suggest that body dissatisfaction and visual appearance are correlated with eating disorders.²⁰ Burn scars may impact both body satisfaction and appearance.

Pain may be another complication of burns.²¹ Burns are among the most painful injuries,²² with patients at risk of neuropathic pain, as well as pain from surgical procedures, dressing changes, and physiotherapy.^{21,22} Control of burn-related pain may require opioids, sedatives, or other substances.^{21,23} Because pain may persist several years in up to 55% of patients,²⁴ prolonged substance use may lead to abuse and dependence.^{25,26} Our findings suggest that patients with burns had a considerably elevated risk of admission for substance use disorders up to 33 years later. Alcohol and psychoactive substance use disorders were both common, although we could not determine whether substance use disorders were iatrogenic or adopted as a coping mechanism after the burn. Suboptimal pain management can cause sleep disturbances, anxiety, or posttraumatic stress symptoms that may lead to the use of other addictive substances.²¹ Patients with burns were at risk of stress and anxiety disorders, as well as sedative and hypnotic use disorders in our population.

Functional impairment may be an added stress, especially when a hand or limb that is necessary for daily tasks is burned. A review of 50 studies reported that 18.5% of patients have limited range of motion 5 years after a burn.²⁷ Up to 14% of patients have problems with activities of daily living.²⁷ Patients may need up to 6 months to return to work or school, with 50% having persisting difficulty in the workplace.²⁷ Some data indicate that 28% of patients with burns never return to work.²⁸ Unemployment is associated with psychiatric disorders, substance use disorders, and suicidal behavior.^{29,30} In our population, patients aged 20 to 64 years who are most likely to be in the labor force had the greatest risk of mental health hospitalization over time. There was no difference between men and women, suggesting that both sexes are equally at risk.

Our study had limitations. As we used hospital data, coding errors may have resulted in misclassification of exposures or outcomes, potentially attenuating the associations. We could only examine burns severe enough to require hospital admission. Although we were able to identify patients who required skin grafts, we did not have data on other surgical procedures or medications used for burns. We could not restrict the total body surface area to second and third-degree burns. We analyzed mental health admissions, but could not include ambulatory care for mild mental health problems. Similarly, we could not account for mild preexisting mental disorders that were undocumented. We did not have information on ethnicity, personal income, or other factors that may be potential confounders. We could not assess causality as the data were observational. The findings are generalizable to a multicultural population with publicly funded health care, but may not apply to other settings.

CONCLUSIONS

In this study of nearly 250,000 patients followed over 33 years, burns were associated with a considerable long-term risk of mental health hospitalization. Associations were more pronounced for patients with burns of higher degree, covering a larger surface area, and requiring skin

grafts. Risks were elevated for all types of psychiatric and substance use disorders, as well as suicide attempts, especially in the first 5 years after a burn. The data suggest that mental health care teams should be involved early after a burn, especially for patients with severe burns. Future research on the severity and number of mental health admissions after a burn may be helpful in developing targeted interventions. The association between burns and subsequent substance use disorders suggests that pain management should be optimized to avoid abuse and dependence. It may be beneficial to compare outcomes of centers with dedicated psychologists on the burn team to other centers. More data are needed on the long-term outcomes of patients with burns, including strategies to improve mental health over time.

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