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Opioid creep in burn center discharge regimens: Doubled amounts and complexity of narcotic prescriptions over seven years

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ABSTRACT

Prescription opioid misuse is an epidemic international health crisis. Although burn providers are increasingly mindful of balancing pain relief with risk of opioid dependence, several burn centers have noticed their patients are still receiving an increased amount of opioids, termed "opioid creep." We examined discharge narcotic prescriptions at a single burn center in the Midwest United States and found that patients discharged in 2015 received nearly twice the amount of narcotics (mean=600 morphine equivalents [ME]) than those discharged in 2008 (mean=350 ME), with a significantly increased likelihood of a more complex narcotic discharge regimen. The increase in ME remained significant even after controlling for age, burn size, intensive care unit stay, discharge day, substance abuse, comorbidity status, insurance, language, race, and ethnicity. The data do not clearly explain such a significant increase. Although such increase in opioid prescription is undesirable, so too is regression to historical under-treatment of burn pain. Protocoled pain-management order sets on admission and discharge, as well as incorporation of alternatives adjuncts to lessen pain, may allow for better pain control with less opioid misuse.

1. Introduction

The epidemic of prescription opioid overdose and death in the United States persists at high levels [1]. From 2000 to 2014 in the United States, nearly half a million people died from drug overdoses, with prescription opioids involved in more overdoses than any other substance [1]. Since 2000 the rate of opiate overdose has tripled, and between 2013 and 2014 prescription opiate overdose rose 80%. The year 2014 saw 47,055 overdose related deaths—more than 1.5 times as many people who died in motor vehicle accidents in the same year. And the problem is more widespread than the fatalities. The National Survey on Drug Use and Health in 2014 reported 4.3 million people age 12 and older are currently nonmedical users of prescription pain relievers [2]. However, during roughly the same period of 1999–2014, health care providers' prescription of opioid pain relievers more than quadrupled [1].

Nor is the problem confined to the United States. A recent international review shows most countries witnessing increase in lethal drug overdose, except in Australia [2], where it should still be noted more people died from unintentional drug overdose than motor vehicle accidents in 2011 [3]. Young people worldwide may be particularly susceptible, with some studies showing high prevalence of

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misuse 10–20% in unexpected countries such as Saudi Arabia and China, comparable to the United States [4].

As all provider groups evaluate their response to the opioid crisis, the burn injury community has an especially important stake in this discussion. Pain after burn injury is unique in many respects and has historically been undertreated with serious consequences [6–8]. Undertreatment of pain from burn injury increases depression, post-traumatic stress disorder, and suicide risk, as well as decreases patient compliance with rehabilitation and wound healing [9,10]. Thus, establishing the importance of opioid analgesia after burn injury has been an important victory for the burn community. However, during the opioid epidemic, some in the burn community have noticed an upward trend in narcotic therapy. In 2004 the University of Washington Burn Center found that compared to the 1970s, hospitalized burn patients in the 2000s were receiving increased amounts of opioids, a phenomenon they called "opioid creep," [11,12]. The University of Iowa Burn Center also recently examined factors correlating with increased opioid analgesia in their inpatient and outpatient settings [13,14]. It should be noted that not all burn centers have noticed the same trend. A multicenter Shriner's study of hospitalized pediatric burn patients from 2001 to 2009 failed to show significant difference in opioid prescription with only a mild increase in antipsychotic prescription [15].

At our center, a 22 bed 10 ICU bed American Burn Association verified burn center in the Midwestern United States, our team has noticed an increase in both dose and complexity of outpatient opioid regimens. This retrospective cohort study aimed to compare opioid prescribing practice at discharge between the years 2008 and 2015, and to identify potential causes of an observed "opioid creep."

2. Methods

A retrospective cohort analysis was performed comparing all patients admitted to the burn center during the calendar year 2008 versus calendar year 2015. Patients were excluded if they were under 18 years of age, expired before discharge, previously injured and admitted for elective surgery, or had other diagnoses in the scope of burn center practice but not strictly related to burn pathophysiology or pain.

Patient charts were reviewed for demographic data, insurance status, burn mechanism of injury, percent total body surface area (%TBSA) burn, length of stay (LOS), length of ICU stay, number of surgeries, and whether discharge occurred over the weekend. When available, charts were reviewed for psychosocial comorbid conditions and preadmission substance use including prescription medications.

The primary study outcome was oral morphine equivalents (ME) prescribed upon discharge. The total amount of opioid available to be filled from the initial discharge prescription was converted to oral morphine equivalents (ME) from established equi-analgesic enteral conversion guides (morphine 30 mg, hydrocodone 30 mg, oxycodone 20 mg, hydromorphone 7.5 mg, and a conservative methadone conversion of 10 mg) [13,16]. The secondary study outcome was the complexity of the opioid regimen. Complexity was recorded as one, two, or three or greater (up to six) opioid products prescribed simultaneously at discharge. Discharge opioids were prescribed by licensed nurse practitioners and surgical residents, all under the supervision of the attending burn surgeon on service. Patients were discharged on the pain regimen they were currently on at that point in time in their hospitalization, with enough medication to last until clinic follow up in one to two weeks.

In further analyses, patient charts were classified for substance use, psychiatric comorbidities, and comorbid conditions. Substance use was noted with any documented preadmission use of alcohol, marijuana, cocaine, opioids, benzodiazepines, antidepressants, antipsychotics, or stimulants. Psychiatric comorbidities were noted with any documentation of bipolar disorder, schizophrenia, anxiety, depression, suicidality, substance abuse, abuse victim, or abuse perpetrator. Comorbid conditions were noted with any documentation of current pregnancy, history of homelessness, prior trauma, attention deficit disorder, seizures, dementia, stroke, migraine, neurofibromatosis, paraplegia, fibromyalgia, or chronic pain not including neuropathy. Patient characteristics such as race and preferred language were taken from patient-reported intake data.

2.1. *Statistical analysis*

An independent samples t-test was used to compare age between patients seen in 2008 versus 2015, while a non-parametric Wilcoxon rank-sum test was used to compare TBSA, number of surgeries, and length of stay between these two cohorts. Pearson chi-square tests were used for all other demographic comparisons between patients seen in 2008 versus 2015. In these comparisons, Fisher's exact tests were used when expected frequencies were sparse.

Morphine equivalent doses were assessed for normality using QQ plots and for outliers using box plots. Due to some non-normality, univariable non-parametric Wilcoxon rank sum tests were used to determine whether total morphine equivalents (ME) varied by study year, ICU status, patient sex, weekend discharge status, patients' use of substances, and language. A non-parametric Kruskal Wallis test was used to determine whether total ME varied among burn mechanism, patients' comorbidities, insurance, and race. When the overall Kruskal–Wallis test was significant, all possible post-hoc pairwise comparisons were assessed using the Dwass [17], Steel [18], and Critchlow–Fligner method [19]. A multivariable general linear model was also used to estimate the mean difference in morphine equivalents between 2008 and 2015 after controlling for patients' day of discharge, language, and insurance status. These covariates were selected because of their significance on univariable analysis and improvement in multivariable model fit statistics including Akaike's information criterion (AIC).

Regarding opioid complexity, the number of opioids prescribed comprised three levels (i.e., one, two, or three or more opioid products), and univariable ordinal logistic regression models were used to estimate the odds of being prescribed a higher number of opioids as a function of patient characteristics. In these models, the proportional odds assumption was assessed using a score statistic as described by Agresti [20]. A multivariable model was also used to

estimate the adjusted odds of being prescribed a higher number of opioids between 2008 and 2015 after controlling for ICU status, age, burn size, discharge day, substance use, and comorbidity status. As before, these covariates were selected because of their significance on univariable analysis and improvement in multivariable model fit statistics including AIC. All statistical analyses were performed using SAS version 9.4 (Cary, NC).

3. Results

Having applied exclusion criteria to focus on a population of adult burn injured patients who survived to discharge, there were 272 eligible patients in 2008 and 335 eligible patients in 2015, for a study population of 607 unique patients, reported in Table 1. Patient demographics, injury, and treatment characteristics are reported in Table 2. Both populations were predominantly white male English speakers with a variety of insurance statuses suffering flame burn between two and three percent. Approximately one third required surgery and intensive care each year, with a slightly larger percentage needing intensive care in 2008. Further details regarding patient substance use, psychiatric and other comorbidities and narcotic regimen characteristics are also reported in Supplemental Tables 1 and 2.

On univariable analysis, total morphine equivalents were higher in 2015 (Mdn=600, IQR=300–900) than in 2008 (Mdn=350, IQR=145–605; $p<.001$). See Table 3. Further, compared to patients with Medicare, total ME were higher for those with Medicaid (Mdn=558, IQR=225–840; $p=.03$), private insurance (Mdn=450, IQR=225–855, $p=.04$), and worker's compensation (Mdn=450, IQR=280–919; $p=.03$). On univariable analysis, total ME were nominally higher for patients discharged on a weekday rather than weekend ($p=.07$) as well as for patients whose primary language was English rather than non-English ($p=.08$).

In a multivariable analysis that controls for weekend discharge status, primary language, and insurance, patients seen in 2015 still had a higher amount of ME prescribed when compared to those seen in 2008 (Mdiff=171.43, 95% CI: 32.32–310.55; $p=.02$). See Table 4. In this model, while the overall significance for insurance was not statistically significant ($p=.06$), patients with Medicare continued to use fewer opioids than those with private insurance (Mdiff=−345.53, 95% CI: −653.12 to −37.94).

Regarding the complexity of patients' opioid prescriptions, patients seen in 2015 were 1.93 (95% CI: 1.18–3.14) times more likely to be prescribed a more complex opioid regimen than those seen in 2008 even after controlling for patients' ICU status, age, burn size, weekend discharge status, use of substances, comorbidity status, insurance, and race. See Table 5. In this model, patients seen in the ICU also received more complex opioid regimens ($p<.001$) as did those discharged on a weekday ($p=.02$). Further, after controlling for all other variables in the model, use of Medicaid insurance was associated with more complex opioid regimens ($p=.01$) as was increasing burn size ($p<.001$).

Table 1 – Eligible patients and exclusions by year.

	2008	2015
Admissions	556	714
Children under 18	207	201
Expired before discharge	18	12
Admit for OR	5	44
Pure inhalation injury	5	9
SJS/TENS	10	17
Soft tissue infection	28	58
Other dermal diagnosis	7	21
Road rash	3	n/a
Degloving injury	n/a	1
Other (dvt, condyloma, inhalation rule out)	n/a	14
Pt chart unable to be located	n/a	2
Study populations	272	335

4. Discussion

Paradoxically, during an epidemic of opiate misuse despite an increasing awareness among practitioners of the dangers of narcotic prescriptions, during the seven years between 2008 and 2015, this study has uncovered a significant increase in narcotic prescription. Both the amount of narcotics increased and the odds of being prescribed a greater variety of narcotics doubled. These increases remain significant even after controlling for other meaningful predictors of narcotic use, including ICU status, age, burn size, weekend discharge status, use of substances, comorbidity status, insurance, language, and race/ethnicity. Patients were also twice as likely to receive a more complex opioid regimen.

The amounts of discharge narcotics reported here are significantly greater than that reported previously by the University of Iowa Burn Center [13], where the cohort had median ME 114 (IQR, 90–180), with a recommendation to prescribe less than 100 ME for discharge. By comparison our 2007 cohort had a median ME 350 (IQR, 145–605) and our 2015 cohort had a median ME 600 (IQR 300–900).

Doubling of opioid prescription over seven years begs both further investigation and action. The burn community is increasingly pressured to monitor opioid therapy while safeguarding and advocating for burn-appropriate analgesia. At present, apart from the single center studies cited here, there are no clearly established guidelines for safe burn opioid discharge regimens. A multi-centered investigation could establish burn-specific safe standards for discharge ME before any regimen is judged to be excessive.

Action may be taken at an institutional level to review and standardize discharge regimens. In the years following the 2015 study cohort, our burn center developed discharge order sets, the results of which are still being observed. In a recent American Burn Association survey of dressing change analgesia, only 24% of centers were using a standardized protocol for their anesthetic regimen [21]. By protocolling, centers can become better attuned to their own benchmarks and be able to defend patient specific deviation where necessary.

It remains unclear why our center saw such an opioid increase. Several hypotheses were not supported. First, these data do not suggest that narcotics increased because the patients have gotten sicker or need more analgesia because

Table 2 – Patient characteristics.

	Total (N=607)	2008 (n=272)	2015 (n=335)	p
Mean age (SD)	43.54 (17.21)	42.70 (17.98)	44.23 (16.54)	.28
Male sex	459 (76%)	215 (79%)	244 (73%)	.08
Race				.09
White	355 (58%)	163 (60%)	192 (57%)	
Hispanic	117 (19%)	51 (19%)	66 (20%)	
Black	85 (14%)	45 (17%)	40 (12%)	
Asian	12 (2.0%)	3 (1.1%)	9 (2.7%)	
Other	32 (5.3%)	9 (3.3%)	23 (6.9%)	
Unknown[a]	6 (1.0%)	1 (0.4%)	5 (1.5%)	
Primary language				.20
English	525 (86%)	227 (83%)	298 (89%)	
Spanish	61 (10%)	32 (12%)	29 (8.7%)	
Polish	10 (1.7%)	6 (2.2%)	4 (1.2%)	
Other	11 (1.8%)	7 (2.6%)	4 (1.2%)	
Primary lnsurance				<.001
Private	199 (33%)	95 (35%)	104 (31%)	
Medicare	61 (10%)	23 (8.5%)	38 (11%)	
Medicaid	138 (23%)	37 (14%)	101 (30%)	
Charity	14 (2.3%)	7 (2.6%)	7 (2.1%)	
Workman's compensation	116 (19%)	63 (23%)	53 (16%)	
Other insurance	79 (13%)	47 (17%)	32 (9.6%)	
Median % TBSA (IQR)	2.3 (1.0-6.0)	2.5 (1.0-7.2)	2.2 (0.9-5.2)	.11
Inhalation injury	17 (2.8%)	10 (3.7%)	7 (2.1%)	.24
Burn mechanism				–
Flame	278 (46%)	136 (50%)	142 (42%)	
Scald	107 (18%)	47 (17%)	60 (18%)	
Chemical	52 (8.9%)	22 (8.1%)	30 (9.0%)	
Grease	49 (8.1%)	19 (7.0%)	30 (9.0%)	
Electrical	33 (5.4%)	19 (7.0%)	14 (4.2%)	
Frostbite	28 (4.6%)	12 (4.4%)	16 (4.8%)	
Contact	26 (4.3%)	9 (3.3%)	17 (5.1%)	
Flash	13 (2.1%)	3 (1.1%)	10 (1.7%)	
Fireworks	10 (1.7%)	1 (0.4%)	9 (2.7%)	
Tar/wax	7 (1.2%)	4 (1.5%)	3 (0.9%)	
Friction	2 (0.3%)	0	2 (0.6%)	
Unknown	2 (0.3%)	0	2 (0.6%)	
Surgery during admission	172 (28%)	75 (28%)	97 (29%)	.71
Median number of surgeries (IQR)	0 (0-1)	0 (0-1)	0 (0-1)	.93
ICU stay	178 (29%)	101 (37%)	77 (23%)	<.001
Median ICU days (IQR)	0 (0-1)	0 (0-2)	0 (0-0)	.001
Median LOS (IQR)	3 (1-9)	2 (1-9)	3 (1-10)	.18
Weekend discharge	132 (22%)	49 (18%)	83 (25%)	.045

Note: SD=Standard deviation. IQR=Interquartile range. ICU=Intensive Care Unit. LOS=Length of stay.
[a] Not included in the test statistic.

their disease process is different; on the contrary, number of surgeries, burn size, and burn etiologies were stable across study eras. Comorbidities and documented substance use prior to injury were not significantly different. Nor was the increase due to differences in race/ethnicity or language. While it is possible that a particular cohort of residents could influence prescription patterns from year to year, given that our residency program, attendings, and nurse practitioner staff have all remained stable over the course of the study, our institution serves as its own control, and the opioid increase is not likely due to an altered prescriber culture. Some hypotheses posit that perhaps the population is shifting its threshold for pain, i.e. a "good old day hypothesis" [22,23] or that increasing nursing clinical documentation on pain as "the fifth vital sign" may elicit more pain and pain prescriptions. Our data cannot comment on this, but future papers may examine these hypotheses by comparing nursing documentation of pain across study eras.

We were surprised by the persistent effects of day of discharge and Medicaid/Medicare insurance status on discharge narcotics. At this time we can only conjecture that as payors and hospital management groups demand decreased lengths of stay, some of the acute pain control formerly done on the inpatient ward may be moving impatiently to outpatient care. However this conjecture is not robust; as remarked earlier, length of stay did not change.

In a multicultural society such as the United States, mindfulness of potential bias is increasingly important. Although patients with a preferred language other than English received nominally less total morphine equivalents,

Table 3 – Univariate analysis of total morphine equivalents.

	Valid N	Median	Interquartile range		p
			Lower	Upper	
Year					<.001
2008	272	350	145	605	
2015	335	600	300	900	
ICU					.44
No	429	450	225	760	
Yes	178	500	125	1140	
Burn type					.46
Flame	278	500	210	880	
Chemical	52	375	280	600	
Electrical	33	315	180	500	
Frostbite	28	550	210	600	
Contact	26	435	200	750	
Fireworks	10	600	300	840	
Grease	49	600	375	912	
Scald	107	450	210	800	
Sex					.52
Male	459	480	210	875	
Female	148	450	175	750	
Discharge					.07
Weekday	475	500	210	900	
Weekend	132	400	165	710	
Substance use					.49
No	448	450	210	845	
Yes	158	500	210	840	
Comorbidities					.58
None	506	455	210	875	
Psychiatric	60	450	210	800	
Other	40	475	0	605	
Language					.08
Other language	82	345	150	700	
English	525	500	225	850	
Insurance					.04
Private	199	450	225	855	
Medicare	61	300	0	600	
Medicaid	138	558	225	840	
Worker's compensation	116	450	280	919	
Uninsured or other	93	450	210	750	
Race					.60
White	355	450	200	825	
Black	85	600	280	870	
Hispanic	117	500	225	900	
Other	44	450	210	803	
Total cohort	607	450	210	840	–

Table 4 – Total morphine equivalents as a function of year while controlling for discharge day, language, and insurance status.

	Mean difference	95% Confidence interval		p
		Lower	Upper	
2015 vs 2008	171.43	32.32	310.55	.02
Weekend vs weekday	−102.76	−268.09	62.56	.22
English vs other language	26.16	−174.32	226.65	.80
Insurance (vs private)				.06
Medicaid	−73.57	−309.13	161.99	.88
Medicare	−345.53	−653.12	−37.94	.02
Uninsured	7.10	−257.05	271.25	.99
Worker's compensation	7.80	−240.75	256.35	.99

Note: Valid N=607.

Table 5 – Odds of more complex opioid regimen as a function of year while controlling for patient characteristics.

	Adjusted odds ratio	95% Confidence interval		p
		Lower	Upper	
Year (2015 vs 2008)	1.929	1.184	3.144	.01
ICU (yes vs no)	3.380	2.066	5.529	<.001
Age (per 1-year increase)	1.009	0.995	1.023	.21
Burn size (per 1% increase)	1.148	1.109	1.188	<.001
Discharge (weekend vs weekday)	0.456	0.249	0.834	.02
Substance use (yes vs no)	1.274	0.791	2.053	.32
Comorbidity (vs none)				.03
Other	3.004	1.355	6.661	.01
Psychiatric	1.198	0.622	2.307	.59
Insurance (vs private)				.02
Medicaid	2.220	1.268	3.888	.01
Medicare	0.831	0.386	1.793	.64
Uninsured or other	0.871	0.432	1.754	.70
Worker's compensation	1.062	0.535	2.108	.86
Race (vs white)				.17
Black	0.980	0.541	1.778	.95
Hispanic	0.540	0.276	1.055	.07
Other	1.502	0.700	3.223	.30

Note: Valid N=595.

the trend did not meet statistical significance. Hispanic patients were statistically less likely to receive a more complex regimen than white patients; however, the total morphine equivalents did not differ. Although bias was not a focus of this study, it appears that analgesia care at our institution appears equitable from these data.

Our study has several limitations. This is a single center retrospective study. Prescribing patterns may vary significantly from institution to institution, and there may be underappreciated factors which could be more apparent if performed in prospective fashion. Because our center is a tertiary and quaternary transfer center, our median %TBSA appears low and many of our patients do not follow up directly in clinic, returning instead to their local providers. Thus, our data sets cannot fully comment on how many of these prescriptions were filled, narcotic supply diversion, long term pain control, and the short and long term adverse effects of narcotics for many of our patients. Perhaps most importantly, this study lacks the patients' perspectives. To better understand increasing narcotic needs, it will be crucial to survey those who experience the pain.

Whatever the reason behind this persistent opioid creep, becoming attuned to its existence in our practice patterns is the first step to a carefully considered burn community response to the opioid epidemic. Reporting of discharge narcotics from other burn centers may bridge the discrepancy between this and other studies and assist in establishing safe standards which both protect burn patients from undertreatment of pain and overexposure to the risk of narcotics. We must be vigilant that for every appropriate indication for increased opioid regimens such as burn size and ICU stay, there may be potentially inappropriate indications driving our practices. As much as ever, the burn community must continue to advocate for burn appropriate analgesia.

Conflicts of interest

None.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.burns.2018.08.004.

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