Postdischarge nonmedical use of prescription opioids in at-risk drinkers admitted to urban Level I trauma centers

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BACKGROUND: Nonmedical use of prescription opioids (NM-POs) has reached epidemic proportions in the United States. Unintentional overdose deaths involving prescription opioids have quadrupled since 1999. Herein, we examine NM-POs and their associated risk factors among two cohorts of trauma patients with at-risk drinking.

METHODS: This secondary analysis examines NM-PO from two separate randomized trials that delivered brief alcohol interventions to patients in urban Level I trauma centers. In the first study, data were collected from 1,493 injured patients at a single trauma center, and in the second study, data were collected from 596 injured patients at two trauma centers. All participants were considered at-risk drinkers because they were admitted for an alcohol related injury as indicated by a positive blood alcohol concentration and/or self-reported heavy drinking.

RESULTS: In Study 1, NM-PO nearly doubled from 5.2% before admission to 9.8% at 6 months after discharge. At 12 months after discharge, those who reported NM-PO (odds ratio [OR], 2.31; 95% confidence interval [CI], 1.28–4.15) and drug use (OR, 2.62, 95% CI, 1.70–4.04) before admission had the highest odds for postdischarge NM-PO. In Study 2, NM-PO increased from 5.2% before admission to 6.8% at 12 months after discharge. At 12 months after discharge, those who reported NM-PO (OR, 2.71; 95% CI, 1.10–6.66) or drug use (OR, 4.05; 95% CI, 2.00–8.21) before admission had the highest odds for postdischarge NM-PO.

CONCLUSION: The results suggest that there is an increased risk of postdischarge NM-PO among injured patients with at-risk drinking, particularly among those with a recent history of drug use or NM-PO. Cautious, evidence-based opioid prescribing may reduce exposure to prescription opioids in high-risk patients, risk of subsequent misuse, and possible diversion. (*J Trauma Acute Care Surg*. 2014;76: 833–839. Copyright © 2014 by Lippincott Williams & Wilkins)

LEVEL OF EVIDENCE: Prognostic/epidemiologic study, level II.

KEY WORDS: Prescription opioid abuse; pain management; traumatic injury care.

Appropriate treatment of pain in the trauma care setting not only helps alleviate physical suffering but also reduces psychological distress.[1] Adequate analgesia has been shown to facilitate a more rapid recovery, shorter hospital stays, and restoration of physiologic functionality.[2–4] In contrast, untreated pain can lead to respiratory depression, hemodynamic compromise, rhythmic disorders, cardiac ischemia, poor recovery as well as depression and anxiety.[3–5] It is well recognized that pain is best treated aggressively and on a time-contingent basis.[6,7]

The nonmedical use of prescription analgesics, that is, the use of painkillers without a prescription or use outside the prescribed parameters, is the fastest growing drug problem in the United States. The number of prescriptions filled for opioid pain relievers, some of the most powerful and potentially addictive medications available, has increased dramatically in the past decade.[8,9] In 2010, the quantity of prescription painkillers dispensed by health care facilities was four times the amount dispensed in 1999.[10,11] By 2010, enough prescription analgesics were prescribed to medicate every American adult around-the-clock for 1 month.[11,12] Correspondingly, unintentional deaths involving prescription opioids have quadrupled in the past 5 years.[13] Overdoses involving prescription opioids now account for more overdose deaths than heroin and cocaine combined.[14] Given the high rates of substance abuse among injured patients, the unintended consequences of prescription opioids are particularly disconcerting.[15–18]

The purposes of the current study were to (1) examine the rates of the nonmedical use of prescription opioids (NM-PO) and (2) assess the risk factors associated with postdischarge NM-PO among trauma patients with at-risk drinking. This secondary data analysis comes from two randomized clinical trials that evaluate the effectiveness of brief motivational intervention to reduce at-risk drinking among injured patients with alcohol problems in three urban Level I trauma centers. This secondary data analysis constitutes the first multisite examination of rates and predictors of NM-PO among trauma patients with at-risk drinking.

PATIENTS AND METHODS

Screening and Patient Recruitment

Study 1 was a randomized control trial of screening and brief motivational intervention conducted in an urban Level I trauma center in Dallas, Texas. Study 1 was conducted between

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May 2003 and May 2005. The follow-up rates in Study 1 were 75% at 6 months and 62% at 12 months. Methods for screening, recruitment, assessment, intervention, and postdischarge assessment have been described previously.[19] In Study 1, admitted injured patients were approached by study staff if they had a clinical indication of intoxication or a positive blood alcohol concentration, reported drinking alcohol 6 hours before their injury, reported alcohol use exceeding National Institute on Alcohol Abuse and Alcoholism recommended levels for at-risk drinking or indicated one or more positive items on the CAGE questionnaire.[20,21] Those who were medically stable and oriented to person, place, and time were approached and screened. Patients were excluded from participation in Study 1 if they were younger than 18 years, did not speak English or Spanish, did not have a permanent residence, were in police custody, were suicidal or psychotic, had experienced a sexual assault, or had a medical condition that did not allow for informed consent, self-report assessment, or intervention.

Study 2 was a multisite randomized clinical trial of screening and brief motivational intervention conducted in two urban Level I trauma centers in Dallas and Austin, Texas. Study 2 was conducted between October 2007 and December 2010. The follow-up rates in Study 2 were 85% at 3 months, 79% at 6 months, and 75% at 12 months. Study methods for screening, recruitment, assessment, intervention, and postdischarge assessment have been described previously.[22] In Study 2, admitted injured patients were approached by study staff if they had a positive score on consumption questions of the Alcohol Use Disorders Identification Test (AUDIT)-C,[23] reported drinking within 6 hours of the injury for which they were admitted, or had a positive blood alcohol concentration. The exclusion criteria for Study 2 were identical to Study 1.

Following the initial informed consent process, study participants provided information regarding demographic characteristics and substance abuse, including NM-PO. Postdischarge assessments in Study 1 were conducted at 6 months and 12 month after discharge. In Study 2, postdischarge assessments were conducted at 3, 6, and 12 months after discharge. The primary outcome of both of the studies were alcohol use and alcohol problems, which were measured using self-report quantity and frequency measures of alcohol use in Study 1 and the timeline follow method back in Study 2.[24,25] Both studies were reviewed and approved by the institutional review boards of the University of Texas of Texas Health Science Center at Houston, The University of Texas at Austin, and the medical centers where the studies were conducted.

Assessment and Measures

The focus of the current study was on drug use, with specific emphasis on NM-PO and nonprescription drug use. In Study 1, drug use was assessed using the Composite International Diagnostic Interview Short-Form (CIDI-SF) developed by the World Health Organization.[26] The CIDI-SF asks respondents if they have used any of nine categories of drugs in the past 12 months "on your own," including (1) prescription painkillers; (2) marijuana or hashish; (3) cocaine, crack, or free base; (4) heroin; (5) amphetamines or other stimulants; (6) LSD (lysergic acid diethylamide) or other hallucinogens (e.g., PCP [phencyclidine], angel dust, peyote, mescaline ecstasy, or MDMA [methylenedioxymethamphetamine]); or (7) inhalants that they sniff or breath to get high or to feel good (e.g., amylriutrate, Freon, nitrous oxide or whippets, gasoline, spray paint). NM-PO was captured using reports of prescription painkillers use "on your own." Within the CIDI-SF, "on your own" is defined as using prescription opioids (1) without a doctor's prescription (i.e., illegal drugs or medicine obtained without a prescription), (2) in larger amounts than prescribed, (3) or for a longer period than prescribed.

In Study 2, drug use was assessed using the Alcohol, Smoking, and Substance Involvement Screening Test or ASSIST.[27] The ASSIST asks respondents if they have used any of the following categories of drugs in the past 90 days: (1) prescription painkillers or opiates; (2) marijuana, hashish, blunts, or other forms of THC [tetrahydrocannabinol]; (3) crack, smoked rock, free base cocaine, or other forms of cocaine; (4) heroin or heroin mixed with other drugs; (5) speed, uppers, amphetamines, methamphetamine, ecstasy, MDMA, or other stimulant; (6) acid, LSD, ketamine, special K, mushrooms, or other hallucinogens (such as mescaline, peyote, psilocybin or "shrooms"); (7) inhalants or huffed (such as correction fluids, gasoline, glue, lighters, spray paints, or other paint thinner; (8) nonprescription or street methadone; and (9) PCP or angel dust. NM-PO was captured using reports of painkiller or opioid use "for reasons other than prescribed or taken them more frequently or at higher doses than prescribed."

Randomization and Intervention

After completing the assessment at admission to the trauma center, participants were randomized to control or experimental conditions in both studies. In Study 1, patients received treatment as usual or a brief motivational intervention (BMI).[19] In Study 2, participants received brief advice, a BMI, or a BMI plus booster.[22]

Analyses for the Current Study

t tests and χ^2 analyses were conducted to detect differences between the two studies among those reported NM-PO and drug use before admission. χ^2 tests were also conducted to assess differences between NM-PO and drug use before admission and after discharge. General estimating equations were used to estimate time effects for changes in the likelihood of NM-PO and drug use across time. Treatment assignment was included as a control variable within the general estimating equation models. Finally, a binary logistic regression was used to predict the effects of NM-PO and drug use before admission on postdischarge NM-PO. In Study 1, we examined the changes in NM-PO and drug use over time in three periods: (1) before admission and 6 months after discharge, (2) 6 months after discharge to 12 months after discharge, and (3) the entire postdischarge period. In Study 2, we examined change in NM-PO and drug use over time in four periods: (1) before admission and 3 months after discharge, (2) three months after discharge to 6 months after discharge, (3) 6 months after discharge to 12 months after discharge, and (4) the entire postdischarge period. The binary logistic regressions controlled for treatment condition (Study 1, BMI; Study 2, BMI or BMI plus booster), sex, age, race/ethnicity (Hispanic or Black), intentional injury, and employment status. Since Study 2 was a multisite

TABLE 1. Differences in Demographic Characteristics by Study

Group	Category in Group	Study 1, n (%)	Study 2, n (%)	χ^2	*df*	*p*
Sex				9.3	1	0.002
	Male	1,231 (82.5)	423 (76.5)			
Age*		33.2 (11.4)	34.9 (12.5)	−2.91	912.8	0.004
Race/ethnicity	Non-Hispanic	956 (64)	396 (71.6)	10.3	1	0.001
	Hispanic	537 (36)	157 (28.4)			
	Non-black	1,205 (80.7)	414 (74.9)	8.4	1	0.004
	Black	288 (19.3)	139 (25.1)			
Work status				19.1	1	<0.001
	Unemployed	457 (30.6)	226 (40.9)			
Injury type				4.6	1	0.032
	Intentional	317 (21.2)	142 (25.7)			

*Mean, SD, and *t*.

randomized clinical trial, binary logistic regressions for Study 2 also controlled for site.

RESULTS

Differences in Demographic Characteristics and Drug Use Across Studies

A total of 1,493 patients were recruited to participate in Study 1, and 553 were recruited to participate in Study 2. Table 1 shows the demographic characteristics of participants in Study 1 compared with those in Study 2. Participants in Study 2 were slightly older, were more likely to be unemployed, were admitted for intentional injuries, and were less likely to be male. There was a greater proportion of Hispanics in Study 1, and there was a greater proportion of blacks in Study 2.

Table 2 reports the differences between study groups for NM-PO and drug use before admission and after discharge. The only significant difference between Study 1 and 2 was that a greater portion of Study 1 participants reported NM-PO at 6 months.

NM-POs and Drug Use Before Admission and After Discharge

Table 3 reports the proportions of study participants reporting NM-PO and drug use before admission and after discharge. The most commonly used drugs were marijuana (35% overall, results not shown) and cocaine (17% overall, results not shown). Table 3 also reports the changes NM-PO and drug use across time before admission to after discharge. There were significant decreases in drug use across time in Study 1 at 6 months and 12 months. Similar significant decreases in drug use were observed in Study 2 at 3, 6, and 12 months. Significant decreases in overall drug use were similarly observed in the use of marijuana and cocaine, the most commonly used drugs. In contrast, a significant increase in NM-PO was observed in Study 1 at 6 months. No significant changes

TABLE 2. Changes in Prescription Opioid and Drug Use Over Time by Study

Group	Category	Study 1, n (%)	Study 2, n (%)	χ^2	*df*	*p*
NM-PO before admission	No	1,389 (93.2)	524 (94.8)	1.6	1	0.207
	Yes	101 (6.8)	29 (5.2)			
NM-PO 3 mo	No	NA	440 (93.2)	NA	NA	NA
	Yes	NA	32 (6.8)			
NM-PO 6 mo	No	933 (90.6)	407 (94.0)	4.6	1	0.032
	Yes	97 (9.4)	24 (6.0)			
NM-PO 12 mo	No	802 (92.2)	382 (93.2)	0.4	1	0.532
	Yes	68 (7.8)	28 (6.8)			
Drug use before admission	No	822 (55.1)	303 (54.8)	0.0	1	0.891
	Yes	669 (44.9)	250 (45.2)			
Drug use 3 mo	No	NA	327 (69.3	NA	NA	NA
	Yes	NA	145 (30.7)			
Drug use 6 mo	No	740 (72.0)	321 (74.1)	0.7	1	0.400
	Yes	288 (28.0)	112 (25.9)			
Drug use 12 mo	No	631 (72.5)	288 (70.4)			
	Yes	239 (27.5)	121 (29.6)	0.6	1	0.433

TABLE 3. Proportions of Study Participants Reporting Drug Use Before Admission and Changes in Postdischarge Drug Use*

	Base	3 mo	6 mo	12 mo	Base 3 mo	Base 6 mo	Base 12 mo
Study 1	% (n)		OR (95% CI)				
Prescription opioids	6.8 (101)	NA	9.4 (97)	7.8 (68)	NA	1.41 (1.07–1.85)	1.18 (0.88–1.59)
Marijuana	36.6 (546)	NA	24.5 (252)	24 (209)	NA	0.55 (0.48–0.63)	0.55 (0.47–0.63)
Cocaine	19.3 (287)	NA	8.4 (86)	6.8 (59)	NA	0.42 (0.34–0.51)	0.32 (0.25–0.41)
Drug use	44.9 (669)	NA	28.0 (288)	27.5 (239)	NA	0.49 (0.44–0.56)	0.48 (0.42–0.55)
Study 2							
Prescription opioids	5.2 (29)	6.8 (32)	6.0 (26)	6.8 (28)	1.32 (0.82–2.13)	1.14 (0.70–1.87)	1.31 (0.80–2.15)
Marijuana	39.4 (218)	27.2 (128)	22.6 (98)	25.9 (106)	0.56 (0.46–0.66)	0.44 (0.38–0.53)	0.52 (0.43–0.64)
Cocaine/crack	15.2 (84)	7.0 (33)	5.5 (24)	8.1 (33)	0.40 (0.32–0.61)	0.32 (0.21–0.48)	0.45 (0.31–0.65)
Drug use	45.2 (250)	30.7 (145)	25.9 (112)	29.6 (121)	0.53 (0.44–0.64)	0.41 (0.34–0.50)	0.49 (0.40–0.60)

*Time effect models adjusted for intervention condition.
NA, not applicable.

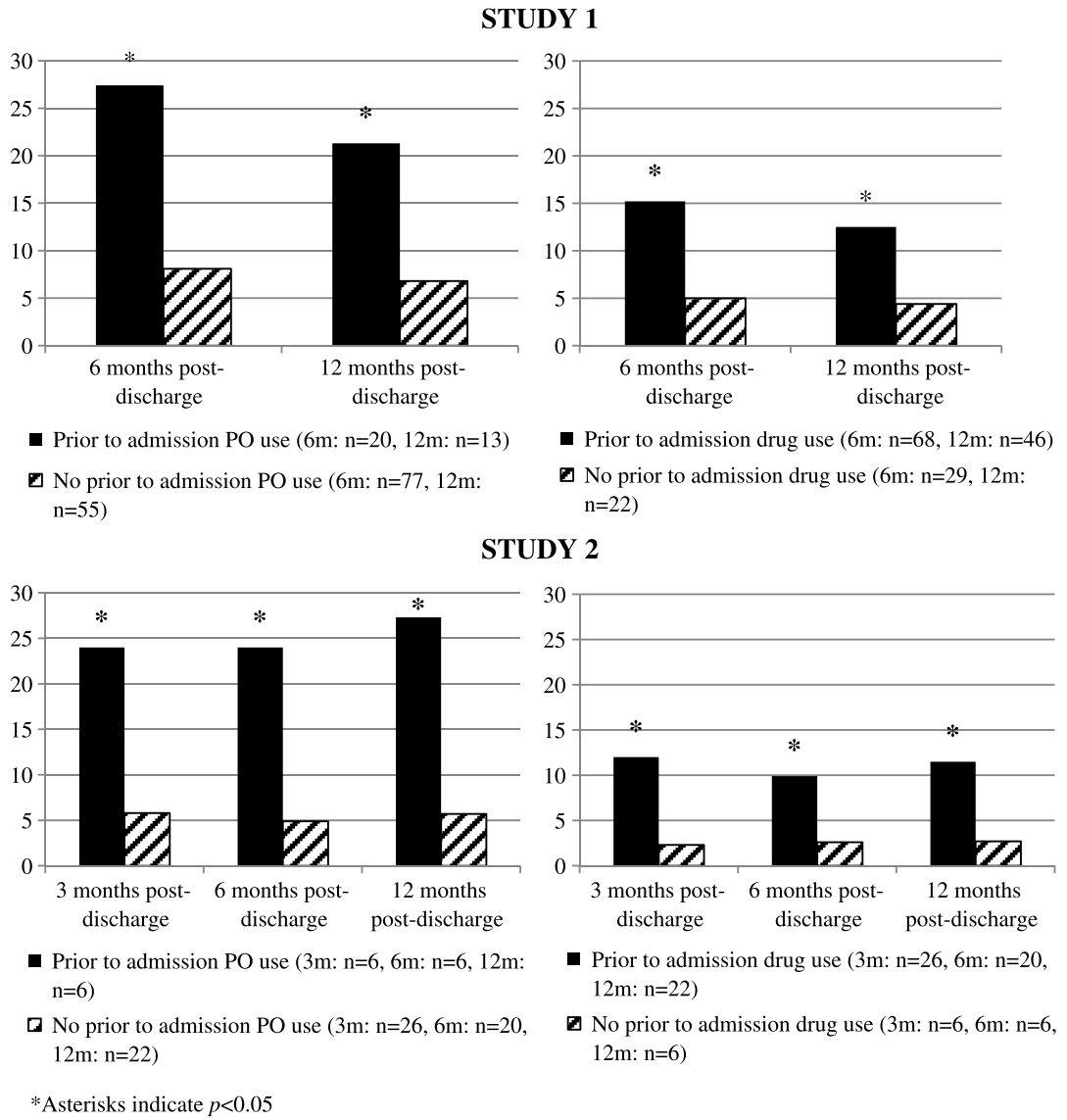

FIGURE 1. The proportions of patients who reported the nonmedical use of prescription opioids or street drugs before admission and then subsequently reported the nonmedical use of prescription opioids after discharge for Studies 1 and 2.

TABLE 4. Logistic Regression Models Predicting Postdischarge NM-PO in Study 1*

Time Point	Covariate	B	SE	Wald χ^2	*df*	*p*	aOR	95% CI
6 mo								
	Prescription opioid	0.93	0.31	9.25	1	0.002	2.54	1.39–4.64
	Drug use	0.95	0.25	14.72	1	0.000	2.59	1.59–4.22
12 mo								
	Prescription opioid	0.83	0.37	5.08	1	0.024	2.29	1.11–4.70
	Drug use	0.91	0.29	9.90	1	0.002	2.49	1.41–4.39

*Adjusted for sex, age, race/ethnicity, intentional injury, employment status, and treatment assignment.

in NM-PO were observed in Study 2 or at 12-month follow-up in Study 1.

Association Between NM-POs and Drug Use Before Admission and After Discharge

Figure 1 graphs the proportions of study participants who reported NM-PO after discharge among those reporting NM-PO or drug use before admission. Study 1 participants who reported NM-PO at admission were more than four times as likely at 6 months (odds ratio [OR], 4.3; 95% confidence interval [CI], 2.45–7.57) and more than three times as likely at 12 months (OR, 3.7; 95% CI, 1.89–7.25) to report NM-PO after discharge. Study 1 participants who reported drug use before admission were more than three times as likely at 6 months (OR, 3.4; 95% CI, 2.17–5.38) and more than three times as likely at 12 months (OR, 3.1; 95% CI, 1.82–5.23) to report NM-PO after discharge.

Similarly, Study 2 participants who reported NM-PO before admission were more than five times as likely at 3 months (OR, 5.1; 95% CI, 1.88–13.90), more than six times as likely at 6 months (OR, 6.1; 95% CI, 2.21–17.02), and more than six times as likely at 12 months (OR, 6.2; 95% CI, 2.22–17.51) to report NM-PO after discharge. In addition, Study 2 participants who reported drug use before admission were more than five times as likely at 3 months (OR, 5.7; 95% CI, 2.30–14.13), more than four times as likely at 6 months (OR, 4.1; 95% CI, 1.61–10.37), and more than four times as likely at 12 months (OR, 4.6; 95% CI, 1.83–11.65) to report NM-PO after discharge.

Predictors of Postdischarge NM-POs

Table 4 shows the results from the logistic regressions predicting postdischarge NM-PO based on NM-PO and drug use before admission in Study 1. Study 1 participants who reported NM-PO and drug use before admission were significantly more likely to report NM-PO 6 months after discharge. Furthermore, Study 1 participants who reported NM-PO and drug use before admission had greater odds of NM-PO from 6 months to 12 months. Finally, those with NM-PO (OR, 2.31; 95% CI, 1.28–4.15) and drug use (OR, 2.62; 95% CI, 1.70–4.04) before admission in Study 1 were more likely to report NM-PO after discharge over the entire postdischarge period (results not shown).

Table 5 shows the results of the logistic regression predicting postdischarge NM-PO based on NM-PO and drug use before admission in Study 2. Study 2 participants who reported NM-PO before admission were more likely to report NM-PO 3 months after discharge. Furthermore, Study 2 participants who reported NM-PO and drug use before admission were more significantly more likely to report NM-PO from 3 months to 6 months after discharge. In addition, Study 2 participants who reported NM-PO and drug use before admission were more likely to report NM-PO from 6 months to 12 months after discharge. Finally, Study 2 participants who reported NM-PO (OR, 4.12; 95% CI, 2.02–8.39) and drug use (OR, 2.89; 95% CI, 1.10–7.60) before admission were more likely to report NM-PO after discharge over the entire postdischarge period (results not shown). Interestingly, for 6 months to 12 months following admission, participants who received

TABLE 5. Logistic Regression Models Predicting Postdischarge NM-PO in Study 2*

Time Point	Covariate	B	SE	Wald χ^2	*df*	*p*	OR	95% CI
3 mo								
	Prescription opioid	1.67	0.49	11.44	1	0.001	5.32	2.02–14.00
	Drug use	0.90	0.55	2.69	1	0.101	2.46	0.84–7.22
6 mo								
	Prescription opioid	1.20	0.52	5.47	1	0.019	3.34	1.22–9.16
	Drug use	1.17	0.56	4.28	1	0.039	3.22	1.06–9.73
12 mo								
	Prescription opioid	1.27	0.52	6.04	1	0.014	3.55	1.29–9.74
	Drug use	1.22	0.58	4.41	1	0.036	3.38	1.08–10.55

*Adjusted for sex, age, race/ethnicity, intentional injury, employment status, and treatment assignment.

the BIB intervention were 69% less likely to report NM-PO (OR, 0.31; 95% CI, 0.10–0.95) from 6 months to 12 months after discharge (results not shown).

DISCUSSION

In contrast to the use of other drugs, postdischarge NM-PO among injured patients with at-risk drinking did not significantly decrease. This is notable because significant reductions in substance abuse subsequent to injury have been observed independent of intervention.[28] In some treatment studies, changes in drinking following brief alcohol interventions have been attributed to the impact of the injury event itself.[29] Thus, the significant increase in NM-PO in one study and sustained rates of NM-PO in the other study are probably distinct patterns of NM-PO use among this high-risk group of injured patients. This conclusion is bolstered by the fact that they were observed in two studies and across three urban Level 1 trauma centers with significantly different patient populations.

Participants in this study are considered at risk because they were drinking at the time of their injury and/or reported heavy drinking. As with injury, alcohol and drug use is involved in many prescription overdose deaths.[30] In these analyses, injured patients with at-risk drinking who used drugs before admission were two to five times more likely to report NM-PO after discharge. Taken together, these findings suggest that subsequent NM-PO may be a significant issue in the trauma care setting and is more likely among, but not limited to, a high-risk group of at-risk drinkers who also report drug use or NM-PO before admission. As has been previously demonstrated for alcohol use, admission for treatment of a traumatic injury may constitute a teachable moment or window of opportunity to address drug use and nonmedical use of prescription opiates.

Given the high rates of substance abuse among injured patients, trauma centers may be one avenue through which exposure and access to prescription opioids may lead to unintended, long-term medical consequences. While not examined in this study, the effects of NM-PO among trauma patients may directly result in the subsequent overuse of the emergency department. Pain is one of the most common chief complaints among emergency department patients.[31] NM-PO was responsible for more than 475,000 emergency department visits in 2009, a number that nearly doubled in just 5 years.[32] While these medications are crucial for pain management among trauma patients, once they are dispensed, prescription drugs are frequently diverted to people using them without prescriptions. More than three of four people who misuse prescription painkillers use medications prescribed to someone else. Diversion of these medications to illicit channels is a significant public health and law enforcement problem.[33]

This study is not without its limitation. The parent studies were not designed to assess NM-PO, and two different standardized assessments were used in the two studies. While a statistically significant increase in opioid misuse was observed in the first study and there were sustained rates of misuse in the second study, the rates of misuse, both before admission and after discharge, may not be clinically significant. In addition, increased rates of postdischarge NM-PO may be limited to a particularly high-risk group of admitted, trauma patients. We are unable to determine whether similar patterns of opioid misuse would be observed across all admitted trauma patients. We are also unable to differentiate between NM-PO use as a function of seeking the euphoric effects of prescription opioids, predictable neuroadaptive tolerance, or physiologic dependence. Finally, the finding that brief motivational intervention with telephone booster was significantly associated with decreased misuse of opioids at 12 months after discharge should be interpreted with caution. While this finding was unexpected and should be further examined to establish its validity, a behavioral intervention based on motivational interviewing that specifically targets drug use may effectively reduce subsequent NM-PO among high-risk trauma patients.

Cautious, evidence-based prescription of opioids among admitted trauma patients may reduce the risk of unintended consequences such as NM-PO, overuse of the emergency department visits, possible prescription drug diversion, and unintentional overdoses. The experience of pain differs from individual to individual depending on factors such as sex, age, race/ethnicity, and even cultural background.[34–37] Psychological factors such as depression, coping strategies, and anxiety disorders and secondary gain issues such as active litigation and insurance claims also influence the perception of pain.[38,39] Concerns about adverse effects, medication interactions, and addiction all contribute to a patient's decision to accept or reject pain medication. Fearful of the addictive potential of opioids, many at-risk trauma patients may prefer a nonopioid or a less potent opioid medication. Thus, the use of opioids among trauma patients to reduce pain should account for individual preferences and differences in the response pain in addition to injury severity. While medications are important in pain management, reassurance, empathy, and explanations—about the condition and its likely course—are no less important.[40] Exposure to opioids can be effectively reduced among trauma patients as part of an effort to address the overall public health impact of opioid misuse.

AUTHORSHIP

C.A.F. was a coinvestigator in Study 1 and the principal investigator in Study 2, led the conceptualization of this project, provided critical feedback on the Patients and Methods as well as the Results sections, and wrote the Introduction and Conclusion sections. G.C. helped to conceptualize this project, served as the statistician, wrote the Patients and Methods as well as the Results sections, and provided critical feedback on the introduction and conclusion. R.C. was the principal investigator in Study 1 and provided critical feedback on this article. M.F. and C.V.R.B. were coinvestigators in Study 2 and provided critical feedback on this article.

DISCLOSURE

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