



Discharge narcotic prescribing and management practices at pediatric trauma centers in the United States



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ABSTRACT

Introduction: Trauma is the leading cause of mortality among children in the US. Injured children often receive narcotic pain medication throughout their hospital stays and upon discharge from pediatric trauma centers. While effective, narcotics carry significant risks. There is a dearth of knowledge regarding narcotic education, prescribing practices, and pain management training at pediatric trauma centers. We hypothesize that there is a lack of standardization in these practices among pediatric trauma centers nationally.

Methods: A national survey was sent to medical directors at ACS-verified and state designated level 1 and 2 pediatric trauma centers. Data were collected over 6 months on discharge narcotic education and prescribing practices.

Results: Of 97 surveys sent, 92 were returned (94.8% response). Responses show that narcotics are most commonly prescribed by residents (79.1%). Electronic Medical Record (EMR) prescribing is common (89.2%); however, only 1.75% of EMRs give recommendation to prescribe naloxone. Only 9.7% report a standardized format of narcotic education. Most healthcare staff providing narcotic education receive no training in nonpharmacological pain management (68.8%). Most centers report no formal process to reduce the quantity of discharge narcotics prescribed (71.0%). Respondents report many barriers to providing discharge narcotic education to patients and families, including staff training on how to provide discharge narcotic education, staff availability, patient/parent literacy, and format of available educational resources.

Conclusion: The study results show that there is lack of standardization in discharge narcotic education and prescription practices among pediatric trauma facilities nationally and highlight the need for a standardized narcotic prescribing and management protocol. Despite the growing national concern of opiate misuse, particularly among children, respondents report inability to deliver adequate narcotic education owing to various communication and systems barriers.

Type of study: Cross-sectional survey.

Level of evidence: Level IV.

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Trauma is common in the pediatric population in the United States with 7,315,676 nonfatal injuries in children less than 18 years old reported by the Centers for Disease Control and Prevention in 2016 [1]. Injured children often receive opioid pain medication for analgesia and may also receive benzodiazepines for muscle spasm or anxiety during their inpatient treatment and at discharge from the hospital. Acute treatment for injury may represent a child's first exposure to narcotic medication. Caregivers taking children home after injury often find themselves administering narcotics to a minor for the first time with

no prior medical education or experience. Caregivers are thus dependent on the education they receive prior to hospital discharge to accurately assess the child's pain, safely administer narcotics, recognize adverse effects of the narcotics, securely store, and properly dispose of unused medication.

A recent study at our ACS-verified Level 1 Pediatric Trauma Center evaluated the rate of narcotic prescribing at hospital discharge compared to the rate that those prescriptions were filled in the state's electronic prescription monitoring program. That study found that roughly $\frac{2}{3}$ of children were prescribed narcotics at discharge, and $\frac{2}{3}$ of those prescriptions were confirmed to have been filled after discharge (Wills, H.W. 2016, unpublished data). The rate of narcotic prescription filling varied by age, with prescriptions for those 0–5 years old filled less than half of the time and adolescents from 13 to 17 years old filling

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78% of the time. The discrepancy between prescribing and filling suggested either overprescribing of narcotics by providers or underutilization of narcotics by caretakers, particularly children between 0 and 5 years. The large number of doses and durations of therapy provided at discharge may indicate that overprescribing was occurring in some cases. Great variations in narcotic prescribing practices were noted even among providers in that single center study.

Our review of the literature identified no studies on narcotic prescribing practices for injured children at hospital discharge. While there has been extensive research on adult narcotic prescription and usage, there is a gap in the knowledge pertaining to pediatric narcotic usage and prescription practices, particularly at pediatric trauma centers. We hypothesize that, despite the publicly acknowledged opioid epidemic, there is a lack of standardization in prescribing practices and discharge narcotic education practices for injured children across the United States. Our research study aims to address this knowledge gap by surveying trauma medical directors at Level 1 and 2 Pediatric Trauma Centers verified by the American College of Surgeons, states, or other governing authorities in the United States regarding current discharge narcotic prescription practices and discharge narcotic education.

1. Materials & methods

A survey was created pertaining to discharge narcotics for injured children covering several domains: prescriber characteristics, prescribing practices, prescriber education in pain management, discharge education provided to caretakers, narcotic minimization practices, and perceived barriers to narcotic education (Table 1). The survey was piloted with the surgical staff at an American College of Surgeons verified Level 1 Pediatric Trauma Center.

The survey was built in SurveyMonkey Pro (SurveyMonkey, San Mateo, CA), a web-based survey platform which allows for survey distribution by e-mail, web-based data collection, and tabulation of survey responses with descriptive statistics. An e-mail describing the study and including a link to the survey was drafted and circulated by SurveyMonkey and repeat e-mail solicitations were sent to those who did not initially respond. Consent to participate was presented on the first page of the survey. Collected data were deidentified. Disposition of e-mail addresses was visible to the research team (e.g. e-mail bounced, respondent opened link to survey, respondent opted out, respondent entered survey, e-mail was on the SurveyMonkey opt out

Table 1
Survey questions and answer options.

Is your trauma center verified by the American College of Surgeons (ACS) or another regulatory body? (Check all that apply)	<ul style="list-style-type: none"> • ACS • State 	<ul style="list-style-type: none"> • Not verified • Other (please specify) 	
What is your trauma center verification? (Check all that apply)	<ul style="list-style-type: none"> • Pediatric Level 1 • Pediatric Level 2 	<ul style="list-style-type: none"> • Adult level 1 • Adult level 2 	<ul style="list-style-type: none"> • Adult level 3 • Adult level 4 • Other (please specify)
What is your region? (Dropdown)	ACS COT Region		
How many staffed pediatric beds does your facility have?	<ul style="list-style-type: none"> • Less than 50 • 50–100 	<ul style="list-style-type: none"> • 101–200 • 201–300 	<ul style="list-style-type: none"> • 301–400 • >400
Approximately how many patients were admitted to your pediatric trauma center in 2016?	Free text		
Who provides narcotic prescriptions at your facility? (Check all that apply)	<ul style="list-style-type: none"> • Resident physicians • Attending physicians • Advanced practice provider (NP, PA, APN) 		
At discharge, which residents at your pediatric trauma center prescribe narcotics? (Check all that apply)	<ul style="list-style-type: none"> • General Surgery • Orthopedic Surgery • Neurosurgery • ENT • EMR • Prescription Pad 	<ul style="list-style-type: none"> • Plastic Surgery • Ophthalmology • Emergency Medicine • Pediatrics or Med/Peds • None • Other (Please specify) 	<ul style="list-style-type: none"> • Internal Medicine • Family Medicine • Other
How are narcotics prescribed at your facility? (Check all that apply)	<ul style="list-style-type: none"> • Patient's recent pain scores • Patient's inpatient NARCOTIC pain medication use 	<ul style="list-style-type: none"> • Morphine equivalent dosing of discharge NARCOTICS • Recommendations for pain medication dosing 	<ul style="list-style-type: none"> • Recommendations for duration of treatment • Recommendation for naloxone prescription • None of these • There is no specific narcotic education • Other (please specify)
When prescribing narcotics at discharge, does your EMR alert or guide you on any of the following? (Check all that apply)	<ul style="list-style-type: none"> • Attending surgeon • Fellow/Resident • Advanced practice provider (NP, PA, APN) 	<ul style="list-style-type: none"> • Outpatient pharmacist • RN • Hospital pharmacist 	<ul style="list-style-type: none"> • Other (please specify)
At your facility, who provides narcotic discharge education to patients and parents? (Check all that apply)	<ul style="list-style-type: none"> • Yes • Print document • Staff education 	<ul style="list-style-type: none"> • No • Video education • Not sure 	<ul style="list-style-type: none"> • Unknown • Other (please specify)
Does your facility employ a standardized format for narcotic discharge education? What type of standardized discharge narcotic education does your facility employ? (Check all that apply)	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • Other
Do those providing discharge narcotic education receive training in nonpharmacological methods of dealing with pain? (e.g. distraction, deep breathing, etc.)	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • No 	
Does your facility have a formal process to reduce the amount of narcotics prescribed at discharge? (e.g. minimization plan, protocol, policy, "champion", or working group)	<ul style="list-style-type: none"> • Yes • If yes or other, please specify 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • Other
At your facility, what communication barriers are there to providing discharge narcotic education? (Check all that apply)	<ul style="list-style-type: none"> • Patient/parent literacy • Patient/parent language • Medical jargon • Staff availability to provide education 	<ul style="list-style-type: none"> • Assurance of patient/parent understanding Positive feedback to education 	<ul style="list-style-type: none"> • Format of available education (print, video, verbal, etc.) • Other (please specify)
At your facility, what systems barriers are there to providing discharge narcotic education? (Check all that apply)	<ul style="list-style-type: none"> • Staff training on how to provide education 	<ul style="list-style-type: none"> • Staff training on how to provide education 	<ul style="list-style-type: none"> • Availability of educational resources • Other (please specify)
Please select the format that you think would provide the most effective narcotic education at discharge:	<ul style="list-style-type: none"> • Verbal instruction • Educational video 	<ul style="list-style-type: none"> • Educational pamphlet • Other (please specify) 	
Please use the space below for any additional comments.	Free text		

list). As an incentive to participate, respondents were given the option of entering a raffle for a \$100 gift card. If respondents chose to enter the raffle, they were directed to a separate survey to provide contact information.

Pediatric trauma medical directors (TMDs) in the United States were identified from publicly available websites of the American College of Surgeons (ACS), American Trauma Society, and Pediatric Trauma Society, as well as a general internet browser search [2–5]. A total of 126 trauma medical directors at ACS and State-verified level 1 and 2 Pediatric Trauma Centers in the US were identified along with corresponding e-mail addresses. Following 70 bounced emails, phone calls were made to each pediatric trauma center to confirm that the center was a verified pediatric trauma center and to confirm the e-mail address of the TMD, resulting in a final count of 97 email addresses verified via phone call with an administrative assistant or trauma medical director.

Survey responses were analyzed using descriptive statistics and confidence statistics. This study was approved by the Human Subject Research IRB at Lifespan Corporation, Providence, RI [1072384-1 and 1072384-2].

2. Results

Of 126 potential Pediatric Trauma Centers, 29 email addresses for trauma medical directors could not be verified by telephone, leaving 97 telephone-confirmed email addresses of pediatric trauma medical directors. Of those, 76 gave consent while 16 opted out of the survey. Sixty-seven respondents went on to fill out the first survey question for a 69.1% completion rate.

2.1. Pediatric trauma center characteristics

Verification of trauma centers was by the American College of Surgeons (77.6%), state-verified (20.9%), and “other” indicating both ACS and state verified, or county-verified (1.5%). All ACS Committee on Trauma regions in the United States were represented. Pediatric trauma centers of varying sizes were represented, with most centers having 101–200 or 201–300 beds (Fig. 1).

2.2. Prescriber characteristics

When asked to select all types of providers who gave narcotic prescriptions at discharge, the most common was residents (79.1%), followed by advanced practice providers (APP, 77.6%), then attending physicians (71.6%). The specialties of residents prescribing narcotics at discharge were primarily general surgery (98.0%) with varying rates for surgical subspecialists (range 9.8% to 64.7%), emergency medicine (45.1%), and pediatric residents (49.0%, Fig. 2). The specialties of ophthalmology, internal medicine, and family medicine were each reported as prescribers at fewer than 20% of pediatric trauma centers.

EMR prescribing was reported by most centers (89.2%), with 63.1% reporting their EMR's providing recommendations for narcotic

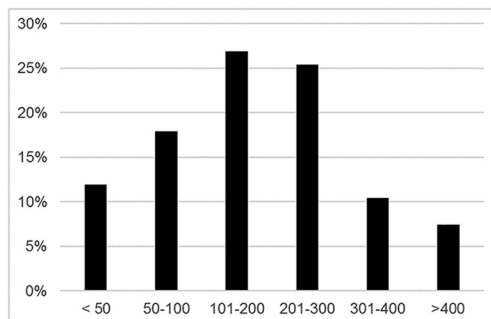


Fig. 1. Distribution of pediatric trauma centers by the number of staffed beds.

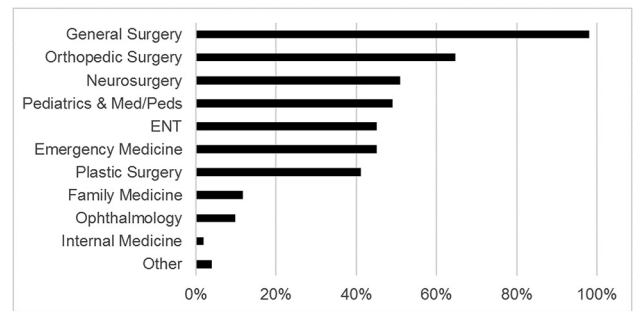


Fig. 2. Specialties of residents who prescribe narcotics at hospital discharge from U.S. pediatric trauma centers as a percentage of responding centers.

prescribing: patient's recent pain score (10.5%), patient's inpatient narcotic use (24.6%), morphine equivalent dosing (8.8%), discharge narcotic dose recommendation (45.6%), or discharge narcotic duration recommendation (8.8%). EMR recommendation for naloxone was reported by 1.75% of centers.

2.3. Discharge narcotic education for caretakers

When questioned about which members of the healthcare team provide narcotic education at discharge, centers most commonly reported that this was provided by nurses (75.0%), then APPs (56.3%), residents (32.8%), and attending surgeons (32.8%), while few reported education being provided by inpatient (12.5%) or outpatient pharmacists (10.9%, Fig. 3). When questioned about a standardized format for narcotic discharge education, 9.7% of centers reported a formal process, 71.0% reported no standardized process, and 19.3% reported “unknown”. Among trauma centers with a standardized format of discharge narcotic education, 65% reported utilizing a print document, 35% reported verbal education by the staff, 35% reported “not sure”, while none reported using video education (Fig. 4). When asked about the perceived most effective and ideal format of discharge education, 38.3% favored verbal instruction, 35.0% favored video education, and 28.3% favored an educational pamphlet. When asked if those providing discharge education had received training in nonpharmacological methods of addressing pain (e.g. distraction, deep breathing, ice-packs, etc.), 68.8% reported no such formal provider training. When asked about a formal process to reduce the quantity of narcotics prescribed at discharge (e.g. minimization plan, protocol, policy, narcotic reduction “champion” or similar working group), most reported no formal process (56.3%).

2.4. Barriers to narcotic discharge education

When asked to select all types of communication barriers to providing narcotic discharge education to caretakers, TMDs indicated patient / parent literacy (64%), patient / parent language (57%), assurance of patient / parent understanding (51%), format of available education (43%).

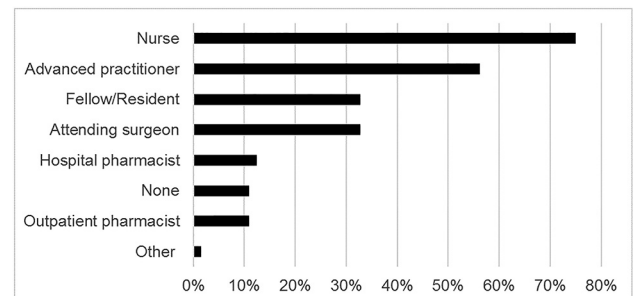


Fig. 3. Healthcare providers providing narcotic education to the caregivers of children at hospital discharge from U.S. Pediatric Trauma Centers.

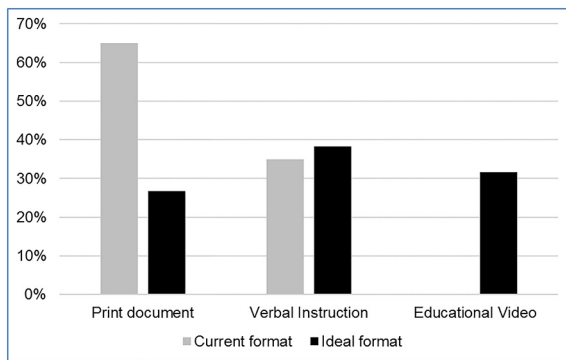


Fig. 4. Format of narcotic education provided at discharge available (gray) versus that considered 'ideal' (black) by Trauma Medical Directors at U.S. Pediatric Trauma Centers.

Medical jargon and concerns about positive feedback to education were not indicated as barriers. When asked to select all types of systems barriers, staff training on how to provide narcotic education (77%), staff availability (54%), and availability of educational resources (65%) were indicated (Table 2).

3. Discussion

Our study focused on the narcotic prescribing practices and pain management education provided to caregivers of injured children at the time of discharge from the hospital after acute injury care. Our results support our hypothesis that there is a lack of standardization in discharge narcotic prescribing and narcotic education practices among level 1 and 2 pediatric trauma centers in the United States. We identified several potential areas to address the quantity of narcotics prescribed and the quality of education provided to those caring for children after hospital discharge.

We found that more than half of US pediatric trauma centers have no narcotic reduction measures in place. We identified that the healthcare providers who prescribe narcotics at discharge (e.g. residents, APPs, and attendings) are often not the same providers providing discharge narcotic education (e.g. primarily nurses). Few PTCs report currently training healthcare workers in nonpharmacologic pain management strategies, including both for prescribers and for those who provide education to patients and caretakers. While 89% of PTCs report utilizing electronic medical records for prescribing, the majority of those EMRs do not give assistance or advice for narcotic prescribing to align discharge pain therapy to the patient's reported inpatient pain or recent narcotic use. A very small fraction report EMR guidance on prescribing naloxone.

We found that narcotic prescriptions are provided almost equally by residents, APPs, and attending physicians. A wide array of both surgical and nonsurgical specialty residents provide narcotic prescriptions. Of note, many centers report that pediatric or medicine / pediatrics (49%) and emergency medicine residents (45%) provide prescriptions at

discharge for injured children, so these groups must be considered for prescriber education. Ophthalmology, internal medicine, and family medicine residents are infrequent prescribers, so targeting these groups could be considered on a center-by-center basis according to the local prescribers' cross-section.

Regarding the education provided to caregivers, we identified a discrepancy between what is currently done and what trauma directors consider the ideal format. Most centers (71%) report that they do not have a standardized format of discharge narcotic education; many (19%) are uncertain whether they do or not. Of the 10% that do report such a process, none use video education. This stood out since approximately 1/3 of TMDs thought that video education would be the best method of education. While 38% considered verbal instruction best and 27% selected educational pamphlet, the reported barriers of patient / parent literacy (64%), patient / parent language (57%), assurance of patient / parent understanding (51%), and format of available education (43%) should be considered when designing standardized educational materials and processes.

The exact role that the opioids and benzodiazepines prescribed for childhood injury has on the national opioid epidemic in the United States is not fully quantified but does warrant consideration by all facilities that treat injured children. Pediatric trauma centers are uniquely qualified to explore and intervene in this aspect of narcotic prescribing owing to their volume of trauma patients and their quality improvement infrastructure. The American College of Surgeons requires screening, brief intervention, and referral for treatment (SBIRT) for alcohol for trauma center verification and recommends the same for drug use [6]. However, there is no current recommendation or requirement for narcotic reduction.

Examples of narcotic reduction could include a "narcotic reduction champion" or narcotic reduction plan. An emphasis could be placed on formal training of providers in standardized discharge education and in nonpharmacologic pain management strategies, such as exercise, cognitive therapy, relaxation and meditation, massage, heat or cold therapies, and other pain medications that are less likely to be habit-forming. Medical goals of pain therapy should be emphasized, such as pulmonary toilet, independent ambulation, return to normal eating and self-care, as appropriate for the patients' injuries rather than on abating the pain itself. Setting realistic expectations about postinjury and postoperative pain is important, such as typical duration of pain and expected time to return to normal activities, school, and sports. Adverse drug events related to opioids should be discussed preemptively.

Strong consideration should be given at each facility to the continuity of the pain management message provided to patients and families. Since there is a disconnect between the narcotic prescriber and the education provider, standardized education in a format that addresses local barriers makes sense. In our preparation for this study and follow-up review of the literature, we have not identified any video-based education for narcotic education at hospital discharge for children and their caretakers.

In order to create the most effective form of video-assisted patient education, research demonstrates that the presentation format is of paramount importance. A systematic review published by Abed et al. found that the most effective way to modify complex behavior of viewers, such as safe discharge narcotic storage and disposal, is to include a narrative or storyline. To target pediatric patients and their families, the video could tell a narrative of a pediatric patient with their family members or caretakers leaving the hospital and engaging in best practices for narcotic storage and disposal. To improve a specific skill, such as teaching a patient to use distraction or deep breathing exercises to manage pain, Abed et al. found that the most effective video method is to show real people filmed while engaged in the practice [7]. To target the pediatric population, the video could focus on a pediatric patient practicing deep breathing exercises to manage his or her pain.

When considering that TMDs report barriers to education including language and provider availability, video education could address these

Table 2
Perceived barriers to providing narcotic discharge education reported by Trauma Medical Directors at U.S. Pediatric Trauma Centers.

Barriers	Responses (%)
Communication Barriers	
• Patient / parent literacy	64
• Patient / parent language	57
• Assurance of patient/parent understanding	51
• Format of available education	43
Systems Barriers	
• Staff training on how to provide narcotic education	77
• Staff availability	54
• Availability of educational resources	65

barriers well. The audio instruction in a video could be produced in multiple languages, all aspects of safe home narcotic safety could get balanced attention, and information in the video could stimulate discussion with the care team to allow tailored messaging with the patient and their home caretaker.

Misuse of prescription narcotic medication is an area of growing national concern, particularly as the opioid epidemic is emerging as one of the worst drug crises in American history. The opioid epidemic is often thought of as a major issue for adults in the United States; however, data show that the prescription opioid epidemic permeates the pediatric population as well. Allen, et al. reported that poison control centers received reports of 188,468 prescription opioid exposures among children aged <20 years old from 2000 through 2015 [8]. Kane, et al. examined billing records from 49 children's hospitals in 27 states and District of Columbia using the Pediatric Health Information System (PHIS) database and showed that pediatric hospitalizations owing to opioid overdoses have nearly doubled between 2004 and 2015 [9]. They found that despite several strategies to prevent opioid overdose among children, morbidity and mortality owing to opioid-related poisonings continue to be a problem. The study found prescription opioid medications to be the leading cause of opioid poisonings in young children. Among the pediatric population, marijuana and alcohol abuse is declining while prescription opioid abuse is on the rise, nearly doubling from 1995 to 2005 [10]. In 2014, there were more than 460,000 adolescents who were current nonmedical users of pain relievers, and 168,000 had an addiction to prescription pain relievers [11].

Monitto, et al. describe that pediatric providers often prescribe more opiates than needed to treat pain and report the need for further research to develop evidence-based opioid prescribing guidelines for physicians treating acute pain in children [12]. This is of great concern since these patients and their family members are at risk of both accidentally and purposefully using or abusing these prescription opioids.

Recently, the Colorado Opioid Safety Collaborative consisting of 10 Colorado hospital emergency rooms (ERs), reported a six-month pilot project conducted to help reduce opioid use by cutting prescription opioids. In place of opioids, they aimed to use less addictive alternative medications for pain such as lidocaine. In six months, the 10 ERs cut their use of opioids by 36% on average and decreased prescribed opioid doses by 35,000 doses compared to the same amount of time in 2016 [13].

While the CDC offers guidelines for opioid prescription in the setting of chronic pain, it does not offer guidelines for postsurgical patients or for children [14]. Some states have begun to create their own best practice guidelines for opioid prescription in the pediatric population, such as Washington State's Agency Medical Director's Group (AMDG) [15]. However, their recommendations target chronic pain in children rather than acute or perioperative pain. Examples of their recommendations include: avoiding opioids in the vast majority of chronic noncancer pain in children as evidence of safety and efficacy is lacking, limiting total dispensed and educating parents about dosing, administration, storage and disposal to minimize risks of diversion or accidental ingestion, and having adolescents undergo screening for risk of substance use disorder as adults would.

Our study has several inherent limitations typical to survey studies. We may have missed important input from potential respondents owing to the lack of a centralized database of all pediatric trauma centers that are verified by their state and not by the ACS. Among identified contact e-mails, some respondents had already opted out of receiving surveys, limiting access to their opinions. Our questions could have been misinterpreted by respondents or offered no options to which the respondent agreed leading to nonresponse to that item. Finally, lack of response to individual items causes "hidden data" such as the respondent's motivation to answer or not, personal perspective, and individual bias.

A specific limitation of this study is the selection of pediatric trauma medical directors as subjects. They may have variable levels of personal engagement in the fine points of discharge narcotic prescribing at their centers or on an individual basis, leading to bias. Therefore, our findings

are limited by the lack of perspectives from other physicians and midlevel providers or from nurses providing discharge narcotic education, and this may have affected our results. As the majority of injured children are treated outside of pediatric trauma centers and there is an inherent selection bias for higher acuity injury at pediatric trauma centers, the results of this study may be difficult to generalize to all hospitals that treat injured children. Furthermore, the resources available to address the findings of this study may vary greatly across hospitals that treat injured children.

4. Conclusion

In our national survey of pediatric trauma medical directors, we found several areas to improve care toward the goal of reducing the quantities of opioid and benzodiazepine doses, improving safe administration by non-medical caretakers, addressing secure drug storage, and educating on proper disposal. There was a desire by respondents to have video education for discharge narcotic education. There was also a recognition of several communication and practical barriers to education that could be addressed with standardized education, perhaps by a video education program. The population that seems best to target for reduction in prescribing includes all types of licensed individual practitioners, including attendings, residents, and advanced practice providers. The specialties of residents to target vary by center, but consist of most surgical specialties, emergency medicine, and pediatric residents.

Further investigation is needed to better define and validate pain management education for prescribers that care for injured children. Likewise, development and validation of education their caretakers of injured children are also needed. Improved utilization of existing electronic medical records could aid prescribers in their selection of narcotic dosing based on patients' in-hospital pain and medication utilization and identify those children who may benefit from a naloxone prescription as hospital discharge.

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