

Original Contributions

Injury Severity and Time to Documented Analgesia in Emergency Department Trauma Patients

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Abstract—Background: Delays in analgesia remain common after traumatic injury, but whether greater injury severity is associated with faster analgesia is not well defined. **Objectives:** We evaluated the association between Injury Severity Score (ISS) and time to first documented emergency department analgesia. **Methods:** We conducted a retrospective cohort study of adult trauma registry encounters at a Level I trauma center from May 1, 2022, through April 30, 2025. The primary outcome was time from emergency department arrival to first documented qualifying analgesic administration. Patients without documented analgesia were censored at emergency department departure. Cox models evaluated ISS continuously and by categories: 1 to 8, 9 to 15, 16 to 24, and 25 or greater. Secondary outcomes were analgesia within 30 and 60 minutes. **Results:** Among 6,095 included encounters, the primary ISS analytic cohort included 5,093. Overall, 3,072 patients received documented analgesia (60.3%). Median time to documented analgesia was 104.5 minutes (IQR 56.0–206.1). Analgesia was documented within 30 minutes in 220 patients (4.3%) and within 60 minutes in 836 patients (16.4%). Higher ISS was associated with shorter time to documented analgesia (hazard ratio 1.028 per ISS point; 95% CI 1.023 to 1.034). Categorical and sensitivity analyses showed a nonlinear association: ISS 9–15 and ISS 16–24 were associated with faster documented analgesia, whereas ISS 25 or greater had the lowest rates of early documented analgesia. **Conclusion:** Injury severity was associated with documented analgesic timing

in a nonlinear pattern, with the lowest rates of early documented analgesia among the most severely injured patients. © 2026 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

Keywords—emergency service; hospital; wounds and injuries; injury severity score; analgesia; pain management

Introduction

Pain is a common reason for emergency care, yet timely analgesia remains inconsistent across emergency department populations. Early work described oligoanalgesia, with patients frequently receiving delayed or inadequate pain treatment.¹ Subsequent multicenter data demonstrated persistent high pain intensity with suboptimal management in routine practice.² Despite greater attention to emergency department (ED) pain management, delayed and incomplete analgesia remain common. These gaps have been described across emergency department populations and remain relevant to trauma care.^{3,4}

In trauma care, early analgesia competes with resuscitation, imaging, procedures, consultant evaluation, neurologic assessment, and disposition decisions, all of which may delay medication administration.^{5,6,7} In severely in-

jured patients, analgesic timing may also be influenced by acuity, airway management, hemodynamic instability, and the need to distinguish undertreatment from appropriate deferral during trauma resuscitation.⁸ At the same time, evidence supports the use of opioids, non-opioid agents, and sub-dissociative ketamine for acute traumatic pain in appropriate patients.⁹⁻¹²

The Injury Severity Score (ISS) is a standard measure used to quantify overall injury burden and compare trauma populations. Greater injury severity may increase analgesic need while also creating competing priorities that delay medication administration. Prior studies of emergency department analgesia have often evaluated trauma patients as a single group or adjusted for injury severity without examining whether analgesic timing differs across levels of injury severity. We evaluated the association between ISS and time to first emergency department analgesic administration among adult trauma encounters. We also examined whether this association differed across prespecified ISS categories.

Methods

Study Design and Setting

We conducted a retrospective cohort study of adult trauma patient visits to the emergency department of Staten Island University Hospital, an urban tertiary academic hospital and Level I trauma center within the Northwell Health system in New York City. The emergency department evaluates approximately 100,000 visits annually and serves as a regional trauma referral center for Staten Island University Hospital. We identified consecutive adult trauma registry encounters among patients aged 18 years or older from May 1, 2022, through April 30, 2025. The study was approved with a waiver of informed consent due to minimal risk and use of existing data (#26-0021).

Study Population

The cohort was derived from the institutional trauma registry and therefore represents a selected trauma population rather than all emergency department patients with traumatic injury. Trauma registry inclusion required patients to meet institutional trauma criteria with notification of the trauma surgery service, and was not based on all ED trauma diagnoses. The first eligible encounter per patient was included. Encounters were excluded for predefined criteria, including arrival in cardiac arrest, death on arrival, immediate transfer to the operating room within 10 minutes of arrival, and absence of a qualifying injury diagnosis. Encounters with missing or invalid time variables

required to define the primary outcome were excluded from time-to-event analyses. ISS was not available for all encounters. Patients with missing ISS were retained in descriptive analyses but excluded from ISS-adjusted analyses.

Data Sources and Variables

Data were obtained through an electronic query of the institutional trauma registry and linked electronic health record data. Demographic variables, injury characteristics, ISS, Glasgow Coma Scale (GCS), disposition, and registry injury type were obtained from the institutional trauma registry. Medication administration and timing variables were obtained from the electronic medication administration record via Quantitative Intelligence, using documented administration time rather than medication order time. The primary outcome was derived from structured medication administration timestamps, not manual chart abstraction. Intubation and early procedures were identified from emergency department treatment fields and associated treatment text using prespecified definitions. Pain severity was assessed using documented numeric pain scores. When both activity and rest pain scores were available, the higher score was used. Altered mental status was defined as GCS <15. Early procedures included airway intervention, chest tube placement, thoracotomy, invasive line placement, and transfusion-related procedures. Emergency department length of stay was used to define the observation window for outcome assessment. Implausible emergency department length of stay values, including negative values and extreme outliers, were treated as missing.

Data Quality and Abstraction

Data extraction was performed electronically using predefined registry and electronic health record fields. Because the primary outcome was derived from structured medication administration timestamps, no manual adjudication was required, and interrater reliability was not calculated. Variables requiring clinical interpretation from treatment fields, including intubation and early procedures, were defined before analysis using prespecified criteria. Missing data were quantified for key variables, and adjusted models were performed using complete-case analysis.

Outcome Definition

The primary outcome was time (minutes) from emergency department arrival to first documented qualifying analgesic administration during the emergency department encounter. A qualifying analgesic was defined using

structured electronic medication administration record data extracted from the electronic medical record (EMR) via Quantitative Intelligence. Medications were classified as analgesics based on the electronic medication category and medication name, using a prespecified definition of qualifying analgesics. Qualifying analgesics included medications categorized as analgesics in the electronic health record, including opioid and non-opioid analgesics. Ketamine was included when documented as an analgesic medication. Prehospital analgesic administration was not available in the structured emergency department medication administration record and was not included in the primary outcome. Therefore, the outcome should be interpreted as documented analgesic administration rather than all analgesia or all pain treatment delivered at the bedside. Sedative, induction, or procedural medications used for intubation or procedural sedation were not counted as analgesia unless a qualifying analgesic medication was separately documented. The earliest documented administration time was used. When multiple medications were administered simultaneously, the shared timestamp was treated as the first qualifying analgesic. Analgesic administrations occurring after emergency department departure were not considered outcome events.

Censoring and Follow-up

Follow-up time was defined as the time from emergency department arrival to the earliest of first qualifying analgesic administration or emergency department departure. Patients without documented qualifying analgesia during the encounter were followed until emergency department departure.

Secondary Outcomes

Secondary outcomes included receipt of qualifying analgesia within 30 minutes and within 60 minutes of emergency department arrival.

Statistical Analysis

Continuous variables were summarized using medians and interquartile ranges. Categorical variables were summarized using counts and proportions. Time-to-event analyses were performed using Cox proportional hazards models. Follow-up began at emergency department arrival and ended at the first qualifying analgesic administration or emergency department departure. Patients without documented qualifying analgesia during the emergency department encounter were censored at emergency department departure. The primary model evaluated ISS as a continuous variable and adjusted for age, shock index, and blunt versus penetrating injury type. Sex was handled

through model stratification because the proportional hazards assumption was not met for that variable. ISS was also modeled using prespecified clinical categories: 1–8, 9–15, 16–24, and ≥ 25 , with ISS 1–8 as the reference group. Hazard ratios greater than 1 indicate shorter time to documented analgesia.

Sensitivity models adjusting for pain score and altered mental status were restricted to encounters with available pain score and GCS data. Additional sensitivity analyses within this restricted cohort excluded patients with GCS <15, intubated patients, and patients undergoing early procedures. Sensitivity analyses also repeated the primary models after restricting outcome events to analgesic administrations occurring within 6 hours of emergency department arrival. To address differential opportunity for emergency department analgesia, additional sensitivity analyses were performed after restricting the cohort to encounters with emergency department length of stay of at least 60 minutes and after excluding patients who underwent emergency department intubation or early procedures. Secondary analyses used logistic regression to evaluate receipt of qualifying analgesia within 30 and 60 minutes. Multivariable models were performed using complete-case analysis for the covariates included in each model. The complete-case model cohort included encounters with available ISS, valid positive follow-up time, non-missing shock index, registry sex coded as male or female, and injury type coded as blunt or penetrating. Analyses were performed using StataNow SE, version 19.5 (StataCorp LLC, College Station, TX).

Results

Study Population

A total of 6,221 adult trauma encounters were identified. After exclusion of 126 encounters based on predefined criteria, 6,095 adult trauma patient visits were included. ISS was available for 5,188 patient visits (85.1%) and missing for 907 (14.9%). The primary ISS analytic cohort included 5,093 patient visits after excluding encounters with missing ISS or invalid follow-up time. Baseline characteristics stratified by ISS category are shown in [Table 1](#). Adjusted multivariable models included 4,785 encounters with complete data for age, sex, shock index, and blunt or penetrating injury type. Pain scores were available for 4,355 of 5,093 encounters in the primary ISS analytic cohort (85.5%). The median documented pain score was 5 (IQR, 1–7). Altered mental status, defined as GCS <15, was present in 381 of 4,835 encounters with available GCS data (7.9%), and GCS was missing in 258 of 5,093 encounters (5.1%). Intubation was documented in 91 encounters (1.8%), and early

Table 1. Baseline Characteristics and Emergency Department Analgesia By Injury Severity Score Category

Characteristic	All patients	ISS 1–8	ISS 9–15	ISS 16–24	ISS ≥ 25
N	5,093	3,046	1,717	212	118
Age, y, median (IQR)	74.2 (57.9–84.2)	71.3 (51.5–82.8)	77.8 (66.7–86.0)	73.3 (60.7–83.3)	73.7 (60.4–81.1)
Male sex, No. (%)	2,459 (48.3)	1,546 (50.8)	726 (42.3)	120 (56.6)	67 (56.8)
Pain score, median (IQR) [n]	5 (1–7) [4,355]	4 (0–6) [2,513]	5 (3–8) [1,551]	5 (0–7) [192]	4 (0–6) [99]
GCS, median (IQR)	15 (15–15)	15 (15–15)	15 (15–15)	15 (15–15)	15 (14–15)
GCS <15, No./avail. (%)	381/4,835 (7.9)	217/2,882 (7.5)	94/1,639 (5.7)	29/200 (14.5)	41/114 (36.0)
ISS, median (IQR)	5.0 (2.0–9.0)	4.0 (1.0–4.0)	9.0 (9.0–10.0)	17.0 (17.0–19.0)	26.0 (25.0–29.0)
Shock index, median (IQR)	0.6 (0.5–0.7)	0.6 (0.5–0.7)	0.6 (0.5–0.7)	0.6 (0.5–0.7)	0.6 (0.5–0.7)
Penetrating injury, No. (%)	112 (2.2)	95 (3.1)	10 (0.6)	6 (2.8)	1 (0.8)
ED disposition, No. (%)					
Admitted/obs	3,254 (63.9)	1,627 (53.4)	1,342 (78.2)	193 (91.0)	92 (78.0)
Discharged	1,374 (27.0)	1,238 (40.6)	130 (7.6)	6 (2.8)	0 (0.0)
Other/transfer/left/death	465 (9.1)	181 (5.9)	245 (14.3)	13 (6.1)	26 (22.0)
ED analgesia, No. (%)	3,072 (60.3)	1,629 (53.5)	1,261 (73.4)	133 (62.7)	49 (41.5)
Time to analgesia, min, median (IQR)	104.5 (56.0–206.1)	110.3 (58.5–217.3)	99.3 (53.1–186.5)	90.0 (53.8–215.7)	108.0 (73.5–201.8)
Analgesia ≤ 30 min, No. (%)	220 (4.3)	115 (3.8)	91 (5.3)	12 (5.7)	2 (1.7)
Analgesia ≤ 60 min, No. (%)	836 (16.4)	423 (13.9)	368 (21.4)	40 (18.9)	5 (4.2)
ED LOS, min, median (IQR)	511.0 (323.0–996.0)	469.0 (298.0–998.8)	587.0 (379.0–1054.0)	516.5 (342.8–763.3)	361.5 (254.5–599.8)

Note: Values are shown as median (interquartile range) or No. (%). Percentages are calculated within ISS category unless a row-specific denominator is shown. Pain score used the higher documented activity or rest numeric pain score when both were available. Other/transfer/left/death includes transfer, death, OR/IR disposition after 10 minutes, left before completion/against medical advice/elopement, home services, other, and unknown disposition. Direct transfer to the operating room within 10 minutes was a predefined exclusion. ED = emergency department; GCS = Glasgow Coma Scale; IR = interventional radiology; ISS = Injury Severity Score; LOS = length of stay; obs = observation; OR = operating room.

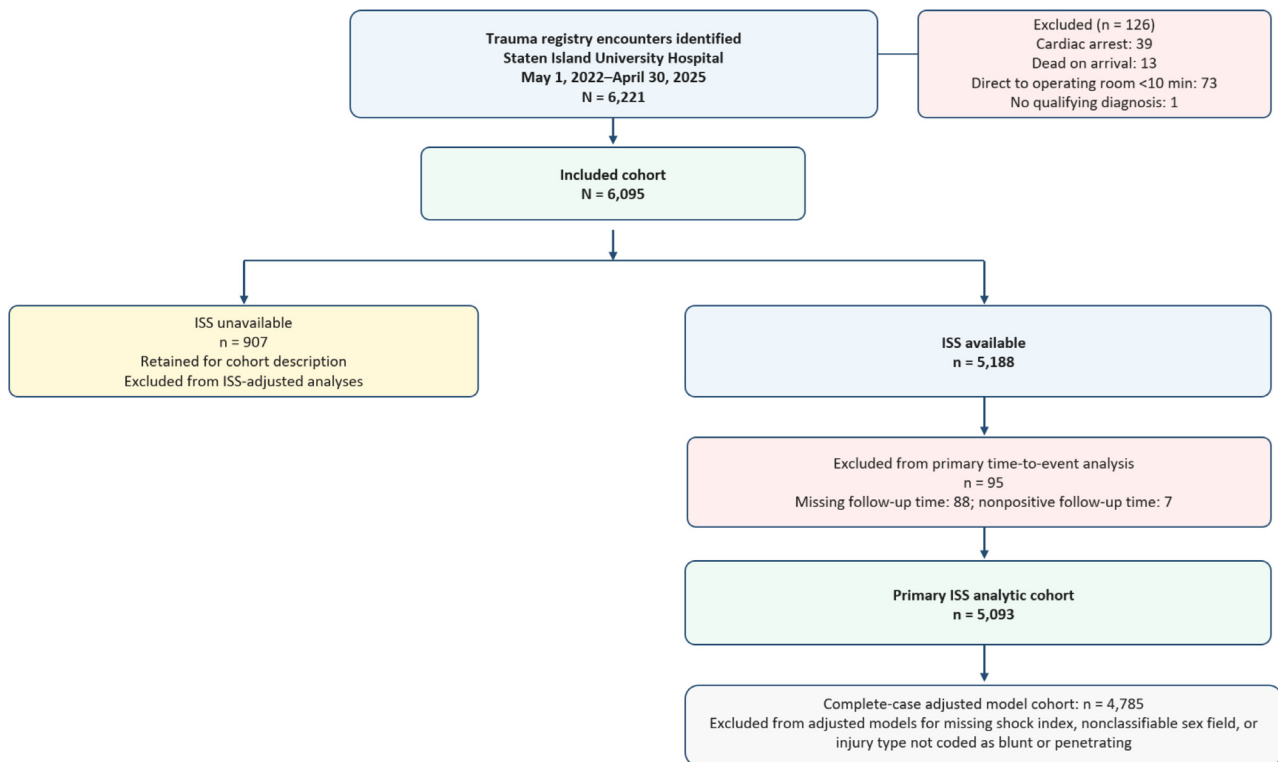


Figure 1. STROBE flow diagram of cohort derivation and analytic exclusions. ISS = Injury Severity Score.

procedures were documented in 366 encounters (7.2%). The cohort derivation and analytic exclusions are shown in [Figure 1](#). Descriptive comparisons of encounters with available versus missing ISS used the full included cohort and are shown in Supplemental Table 1.

Emergency Department Analgesia

Among patients in the analytic cohort, 3,072 of 5,093 (60.3%) received analgesia in the emergency department, while 2,021 (39.7%) did not receive analgesia before leaving the emergency department. Among treated patients, the median time to analgesia was 104.5 minutes (interquartile range [IQR] 56.0–206.1). The difference was clinically meaningful across ISS categories, with the highest cumulative probability of earlier documented analgesia in the ISS 9–15 and ISS 16–24 groups and the lowest early documented analgesia rates in the ISS ≥ 25 group. Analgesia was administered within 30 minutes in 220 patients (4.3%) and within 60 minutes in 836 patients (16.4%) ([Table 1](#)).

Time-to-Analgesia Analysis

In the primary time-to-event model, 3,072 patients received documented emergency department analgesia, and 2,021 were censored at emergency department departure

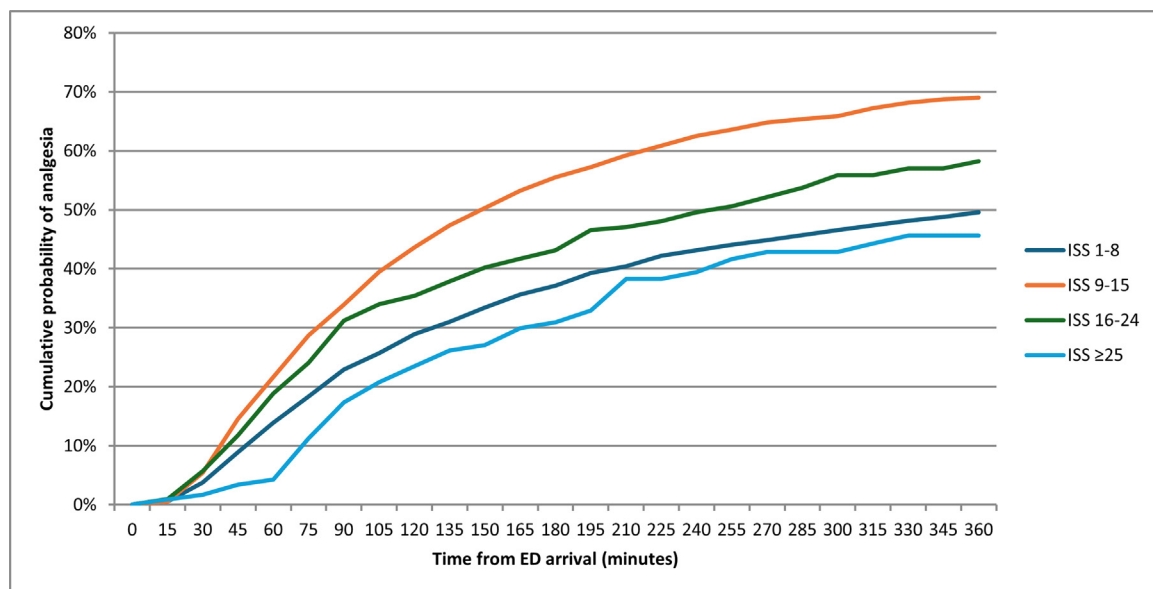
without documented analgesia. Continuously measured ISS was associated with shorter time to documented emergency department analgesia. Each 1-point increase in ISS was associated with a 3% higher hazard of analgesic administration (hazard ratio [HR] 1.028; 95% confidence interval [CI] 1.023–1.034). Categorical modeling showed that this association was not uniform across ISS groups. Compared with patients with ISS 1–8, patients with ISS 9–15 received analgesia faster (HR 1.76; 95% CI 1.63–1.90), as did patients with ISS 16–24 (HR 1.35; 95% CI 1.13–1.62). Patients with ISS ≥ 25 did not receive analgesia more quickly than those with ISS 1–8 (HR 0.82; 95% CI 0.61–1.11). Full model results are shown in [Table 2](#). The cumulative probability curves in [Figure 2](#) show the same pattern.

In a sensitivity analysis restricted to encounters with available pain score and GCS data, adjustment for pain score and altered mental status did not materially change the nonlinear association between ISS category and time to documented analgesia. Compared with ISS 1–8, ISS 9–15 remained associated with faster documented analgesia (HR 1.60; 95% CI, 1.48–1.73), as did ISS 16–24 (HR 1.31; 95% CI, 1.08–1.58), whereas ISS ≥ 25 was not associated with faster documented analgesia (HR 0.91; 95% CI, 0.66–1.26). Findings were similar after excluding patients with GCS < 15 , intubated patients, and patients undergoing early procedures.

Table 2. Cox Proportional Hazards Models for Time to First Documented Emergency Department Analgesic Administration

Primary Continuous ISS model	Hazard Ratio (95% CI)	p value
ISS, per point	1.028 (1.023-1.034)	<.001
Age, per year	0.992 (0.990-0.994)	<.001
Shock index	0.69 (0.56-0.85)	<.001
Penetrating injury	1.007 (0.765-1.327)	.958
Categorical ISS model	Hazard ratio (95% CI)	p value
ISS 9-15	1.76 (1.63-1.90)	<.001
ISS 16-24	1.35 (1.13-1.62)	.001
ISS ≥ 25	0.82 (0.61-1.11)	.199
Age, per year	0.990 (0.988-0.992)	<.001
Shock index	0.68 (0.56-0.84)	<.001
Penetrating injury	1.006 (0.764-1.325)	.966

Note: Cox proportional hazards models evaluated time from emergency department arrival to first qualifying emergency department analgesic administration. Patients without documented analgesia during the emergency department encounter were censored at emergency department departure. Hazard ratios greater than 1 indicate shorter time to documented analgesia. Both models were stratified by sex and adjusted for age, shock index, and injury type. Reference groups were ISS 1–8 for the categorical ISS model and blunt injury for injury type. ISS denotes Injury Severity Score; CI, confidence interval.

**Figure 2. Cumulative probability of first documented emergency department (ED) analgesic administration by Injury Severity Score category.**

Findings were similar in additional sensitivity analyses restricted to encounters with emergency department length of stay of at least 60 minutes and after excluding patients who underwent emergency department intubation or early procedures. In both analyses, patients with ISS 9–15 and ISS 16–24 received analgesia faster than patients with ISS 1–8, whereas patients with ISS ≥ 25 did not.

Early Analgesia

Findings were similar in secondary analyses evaluating documented analgesia within 30 and 60 minutes. When ISS was modeled continuously, higher ISS was associated with greater odds of early analgesia. In categorical models, patients with ISS 9–15 had higher adjusted odds

of analgesia within both 30 and 60 minutes, whereas patients with ISS ≥ 25 had the lowest observed rates of early analgesia and lower adjusted odds of analgesia within 60 minutes compared with patients with ISS 1–8 (Supplemental Table 3).

Missing ISS

Among encounters with valid follow-up time, patients with missing ISS were less likely to receive analgesia than those with available ISS (324/775 [41.8%] vs 3,072/5,093 [60.3%]). Patients with missing ISS also differed in age, sex, injury characteristics, and disposition, with more home discharges and fewer early procedures (Supplemental Table 1).

Discussion

In this cohort of adult emergency department trauma patients, the association between injury severity and analgesic timing was nonlinear. Patients with moderate injury severity received analgesia more quickly than those with minor injury, but patients with ISS ≥ 25 did not. This highest-severity group also had the lowest rates of analgesia within 30 and 60 minutes. Time to analgesia varied by injury severity rather than improving steadily as ISS increased. In patients with ISS ≥ 25 , documented analgesic timing may reflect resuscitation priorities, sedation or airway medications, impaired pain assessment, and documentation gaps as much as analgesic need.

This study extends prior ED oligoanalgesia research by examining analgesic timing separately across ISS-defined injury severity groups.^{1–4} Prior studies have often adjusted for injury severity or evaluated trauma patients as a single group, limiting the assessment of whether analgesic timing differs across severity groups. The most severely injured patients did not show the faster analgesic administration seen in the ISS 9–15 and ISS 16–24 groups. Analgesic delivery was delayed overall, with a median time to analgesia exceeding 100 minutes and a minority of patients receiving analgesia within 60 minutes. These findings are consistent with prior trauma and emergency pain literature showing that delayed or incomplete analgesia remains common despite available opioid, non-opioid, and ketamine-based options for acute traumatic pain. Our study adds to this literature by showing that analgesic timing differs by injury severity, rather than occurring uniformly across trauma patients.^{2,6,7}

The pattern is unlikely to be explained by one missed step. Patients with severe injury frequently require airway management, hemodynamic stabilization, transfusion, rapid imaging, consultant involvement, and preparation for operative or critical care disposition. These demands can delay analgesia, move it until after initial

stabilization, or make pain difficult to assess. Clinicians may also postpone or modify analgesic administration when there is concern that medications could affect hemodynamics, mental status, or serial examination. Some high-acuity patients may undergo intubation, procedural sedation, or other early interventions that are not fully captured by a medication-timing outcome focused on documented analgesic administration. Although the observed pattern persisted after adjustment for pain score and altered mental status, and after excluding patients with GCS < 15 , intubated patients, and patients undergoing early procedures, these variables remain crude markers of early resuscitation.

These findings do not establish that severely injured patients were undertreated. Lower early documented analgesia in the ISS ≥ 25 group may reflect resuscitation priorities, sedation, difficulty assessing pain, urgent procedures, documentation limitations, or limited opportunity for medication administration rather than inadequate pain treatment. Time-to-analgesia measures should therefore be interpreted differently in high-acuity trauma patients, where resuscitation, sedation, pain assessment, documentation, and opportunity for medication administration differ from lower-acuity encounters. These findings support review of analgesia assessment, documentation, and reassessment after stabilization, but they do not establish a specific practice change or universal time-to-analgesia target. Review may be most useful when stratified by injury severity, especially for patients undergoing early resuscitation. Practical targets include assigning analgesia reassessment during resuscitation, adding post-stabilization pain checks to trauma protocols, and reviewing high-ISS cases in which no analgesic administration is documented.

Future studies should determine when delayed documented analgesia represents undertreatment and when it reflects sedation, inability to assess pain, or appropriate deferral during resuscitation. Data on injury mechanism, injury pattern, neurologic status, trauma activation level, pain scores, imaging sequence, and medication class would help identify patients who need earlier reassessment. Prospective testing of trauma-specific analgesia prompts would be needed before treating a shorter time to analgesia as a safe quality target in this population.

Limitations

This study has several limitations. It was conducted at a single center, which may limit generalizability. ISS was missing in approximately 15% of encounters. Encounters without documented ISS differed from those with available ISS, with lower rates of analgesia administra-

tion, fewer early procedures, more home discharges, and more absent treatment or disposition data. These differences suggest that ISS missingness was not random and may reflect lower treatment intensity, incomplete registry abstraction, or incomplete linkage between registry and EHR data. Selection bias may therefore affect ISS-adjusted analyses.

The definition of analgesia was based on medication administration records and does not account for sedation or analgesia delivered as part of procedural or airway management. This could misclassify analgesia exposure in high-acuity patients and partly explain the pattern seen in the $\text{ISS} \geq 25$ group. Pain scores were available for most encounters in the primary ISS analytic cohort but were still missing in 14.5%. Missing pain scores may not be random and may reflect altered mental status, intubation, sedation, language barriers, urgent procedures, competing resuscitation priorities, or documentation workflow. GCS < 15 was used as an operational proxy for altered mental status, but GCS may reflect neurologic injury, intoxication, sedation, intubation, or documentation limitations. Prehospital analgesic administration was not captured in the structured emergency department medication administration record. As a result, we could not determine whether delayed or absent documented emergency department analgesia reflected undertreatment, inability to assess pain, reduced consciousness, competing resuscitation priorities, prehospital treatment, or analgesia embedded within sedation or procedural care. We did not evaluate analgesic class, dose, route, or multimodal analgesic strategies, as this analysis focused on the timing of the first documented analgesic administration rather than medication selection.

Electronic health record timestamps may not fully capture clinical decision-making. Medication administration timestamps were pulled directly from the electronic medication administration record. Still, as with any retrospective EHR-based medication-timing study, documented administration times may not perfectly reflect the exact bedside moment of medication delivery, particularly during urgent resuscitation or override workflows. Residual confounding is likely, particularly from injury pattern, neurologic status, trauma activation level, airway management, sedation, and resuscitation intervention. Comorbidity burden and frailty were not included in the adjusted models because available comorbidity fields were not sufficiently complete or standardized for reliable analysis. These factors may influence both analgesic decision-making and disposition, particularly in older adults and fall-related trauma patients. Trauma activation level was not included in the adjusted models because the registry field contained missing and nonstandard entries that could not be reliably distinguished from the absence of activation. We adjusted for injury type as blunt or pen-

etrating injury, but mechanism-specific categories such as falls, motor vehicle collisions, pedestrian injuries, or assaults were not available in the analytic dataset. We therefore could not determine whether the association between ISS and analgesic timing differed by mechanism of injury or among older adults with fall-related trauma.

Patients who left the emergency department without receiving analgesia may have differed from those who remained under observation, because disposition, admission, operative care, transfer, or death may be related to both injury severity and analgesic administration. We therefore interpret the Cox models as describing documented emergency department analgesic timing rather than underlying analgesic need. Sensitivity analyses restricted to encounters with emergency department length of stay of at least 60 minutes and excluding patients with emergency department intubation or early procedures showed similar findings, but residual bias related to differences in opportunity for analgesia remains possible.

Conclusions

In this cohort of emergency department trauma patients, injury severity was associated with time to documented analgesia in a nonlinear pattern. Patients with moderate injury severity received analgesia more promptly, whereas those with $\text{ISS} \geq 25$ had the lowest rates of early documented analgesia. Overall analgesic delivery was delayed, with few patients receiving treatment within the first hour. Quality review of trauma analgesia should account for injury severity and should pay particular attention to post-stabilization reassessment in high-acuity patients.

Ethics Approval and Consent to Participate

This study was approved by the institutional review board with a waiver of informed consent due to minimal risk and use of existing data (#26-0021).

Consent for Publication

Not applicable.

Availability of Data and Materials

The data are not publicly available because they contain patient-level clinical information derived from the trauma registry and electronic health record.

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Use of Artificial Intelligence

During preparation of this manuscript, ChatGPT (OpenAI) was used only for limited language editing and readability review. The authors reviewed, revised, and verified the manuscript and take full responsibility for the final content.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Barry Hahn: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Najiha Farooqi:** Writing – review & editing, Data curation, Conceptualization. **Esther Cohen:** Writing – review & editing, Resources, Project administration, Data curation, Conceptualization. **Anna Van Tuyl:** Writing – review & editing, Resources, Project administration, Data curation. **Josh Greenstein:** Writing – review & editing, Methodology, Investigation, Data curation, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jemermed.2026.08.021](https://doi.org/10.1016/j.jemermed.2026.08.021).

References

1. Wilson JE, Pendleton JM. Oligoanalgesia in the emergency department. *Am J Emerg Med* 1989;7:620–3.
2. Todd KH, Ducharme J, Choiniere M, et al. PEMI Study Group. Pain in the emergency department: results of the pain and emergency medicine initiative (PEMI) multicenter study. *J Pain* 2007;8:460–6.
3. Rupp T, Delaney KA. Inadequate analgesia in emergency medicine. *Ann Emerg Med* 2004;43:494–503.
4. Motov SM, Khan AN. Problems and barriers of pain management in the emergency department: are we ever going to get better? *J Pain Res* 2008;9:5–11.
5. Galvagno Jr SM, Nahmias JT, Young DA. Advanced Trauma Life Support® Update 2019: management and applications for adults and special populations. *Anesthesiol Clin* 2019;37:13–32.
6. Dißmann PD, Maignan M, Cloves PD, et al. A review of the burden of trauma pain in emergency settings in Europe. *Pain Ther* 2018(7):179–92.
7. Fabbri A, Voza A, Riccardi A, et al. The pain management of trauma patients in the emergency department. *J Clin Med* 2023;12:3289.
8. Spilman SK, Lechtenberg GT, Hahn KD, et al. Is pain really undertreated? Challenges of addressing pain in trauma patients during prehospital transport and trauma resuscitation. *Injury* 2016;47(9):2018–24.
9. Motov S, Rockoff B, Cohen V, et al. Intravenous subdissociative-dose ketamine versus morphine for analgesia in the Emergency department: a randomized controlled trial. *Ann Emerg Med* 2015;66:222–9 e1.
10. Le Cornec C, Le Pottier M, Broch H, et al. Ketamine compared with morphine for out-of-hospital analgesia for patients with traumatic pain: a randomized clinical trial. *JAMA Netw Open* 2024;2(7), e2352844.
11. Häske D, Böttiger BW, Bouillon B, et al. Analgesia in patients with trauma in emergency medicine. *Dtsch Arztebl Int* 2017;114:785–92.
12. Motov SM, Vlasica K, Middlebrook I, et al. Pain management in the emergency department: a clinical review. *Clin Exp Emerg Med* 2021;8:268–78.

Article Summary

1. Why is this topic important?

Timely analgesia is a core part of emergency trauma care, but trauma patients may experience delayed treatment when early care prioritizes resuscitation, imaging, procedures, and disposition decisions.

2. What does this study attempt to show?

This study evaluates whether injury severity, measured by Injury Severity Score, is associated with time to first documented emergency department analgesic administration among adult trauma patients.

3. What are the key findings?

Injury severity was associated with analgesic timing, with patients in the ISS 9 to 15 and 16 to 24 groups receiving analgesia sooner, while patients with ISS 25 or greater had the lowest rates of early documented analgesia.

4. How is patient care impacted?

The findings support closer review of pain treatment, documentation, and reassessment after stabilization, particularly for high-acuity trauma patients.