KANSAS JOURNAL of MEDICINE

Original Research

Post-Operative Pain After Orthopedic Surgery: A Comparative Study Between the United States and Ethiopia

Laura E. Jackson, Ph.D., Meghan Lemons, MS-3., Haley Albers, MS-3, Kameron King, MS-3, Joey Maksoud, MS-3, Michael Braman, MS-3, Collin Freking, MS-3, Johnathan Dallman, M.D., Damon Mar, Ph.D., Abiy Haile, M.D., Solomon Mengistu, M.D., Archie Heddings, M.D.

ABSTRACT

Introduction. Post-operative pain management varies across healthcare systems and cultural contexts. While opioids are central in the United States, many countries rely on non-opioid strategies due to limited access or cultural norms. Authors of this study compared pain management strategies and outcomes among orthopedic trauma patients at academic centers in the United States and Ethiopia.

Methods. A retrospective cohort study was conducted of patients undergoing orthopedic trauma surgery at Tikur Anbessa Specialized Hospital (Ethiopia) and the University of Kansas Health System (United States) between May and October 2022. Visual Analog Scale (VAS) pain scores at 24 and 48 hours post-operatively, analgesic use, and demographics were analyzed.

Results. Ethiopian patients often were more male, younger, and had lower body mass indexes and fewer comorbidities (e.g., obesity, diabetes, smoking) than United States patients. Despite receiving fewer analgesics and no post-operative nerve blocks, Ethiopian patients reported lower VAS pain scores at both 24 and 48 hours. In the United States cohort, patients with nerve blocks had lower pain scores than those without; however, both groups reported higher scores than Ethiopian patients. In the United States, pain scores correlated positively with the number of analgesics administered.

Conclusions. Ethiopian patients reported better pain control despite fewer interventions, suggesting that systemic, demographic, and cultural factors may strongly influence post-operative pain experiences. These findings underscore the importance of context-sensitive approaches to pain management and highlight the need for further research to inform equitable, effective strategies across diverse settings.

INTRODUCTION

Post-operative pain management remains a global challenge. In the United States, opioids have traditionally served as the cornerstone of post-surgical analgesia. However, growing concerns about adverse effects and dependency risks have driven a shift toward multimodal, opioid-sparing strategies.[1-6]

Opioid prescribing practices vary widely across countries, shaped by healthcare infrastructure, regulations, and cultural norms.[6] For example, Young et al.[7] found that American patients were prescribed significantly higher morphine milligram equivalents than patients in the Netherlands and Haiti. Similarly, Ayres et al.[8] reported that Romanian patients, who received no opioids, experienced more pain in the first 24 hours post-operatively but less pain in the second 24 hours compared to American patients receiving opioids.

In many low- and middle-income countries (LMICs), limited access to medications and interventions such as regional nerve blocks or intravenous opioids necessitates reliance on lower-intensity strategies. These disparities create opportunities for natural comparisons between high-resource and resource-limited settings. Cultural coping mechanisms and patient expectations may further shape how pain is perceived and reported.[8]

Such global differences highlight the importance of understanding how systemic and cultural factors influence pain experiences. As high-use countries move toward alternatives to opioid-centric models, examples from LMICs demonstrate that effective pain control is possible without opioids. Religious beliefs, patient expectations, clinician-patient relationships, and health literacy are among the factors that can shape pain perception, expression, and management.

In this study, we compared post-operative pain management strategies and outcomes among orthopedic trauma patients at two academic medical centers: one in Ethiopia and one in the United States. This collaboration between the University of Kansas Health System and Tikur Anbessa Specialized Hospital sought to explore cross-national practices, enhance understanding of global pain management, and identify context-specific strategies for resource-limited settings. We hypothesized that American patients would receive more opioids but report worse pain control, given prior evidence linking higher opioid use with increased pain sensitivity, cultural expectations, and opioid-induced hyperalgesia.[8]

METHODS

Study Design. This retrospective cohort study compared post-operative pain management among orthopedic trauma patients treated at two academic medical centers: The University of Kansas Health System (Kansas City, KS, USA) and Tikur Anbessa Specialized Hospital (TASH; Addis Ababa, Ethiopia). TASH, Ethiopia's primary referral hospital, has limited opioid availability (e.g., tramadol, morphine), and use in orthopedic patients is minimal due to supply constraints and restrictive prescribing practices. Post-operative nerve blocks are not routinely administered.[6] Surgeries were performed between May 1 and October 31, 2022. Institutional review board (IRB) approval was obtained from both institutions, and informed consent was waived due to use of de-identified data. The institutions were chosen based on an established academic partnership, providing a unique opportunity to compare orthopedic trauma care and post-operative pain management across distinct resource and cultural contexts.

American data were extracted from the Healthcare Enterprise Repository for Ontological Narration (HERON), a de-identified electronic health record platform using Current Procedural Terminology (CPT) and International Classification of Diseases (ICD-10) codes.[9] Ethiopian data were prospectively collected during patient care and entered into Research Electronic Data Capture® (REDCap®), hosted at the University of Kansas Medical Center.[10,11]

Inclusion Criteria. Eligible participants were ≥18 years anunderwent surgical fixation for traumatic fractures, including acetabulum, bimalleolar, trimalleolar, clavicle, distal radius, femoral head/neck/shaft, pelvis, pelvic ring, pilon, proximal humerus, tibia with fibula, or tibial plateau. Patients with multiple qualifying injuries were categorized as polytrauma. Exclusion criteria included non-operative management, pregnancy, or incomplete post-operative pain score documentation.

Data Collection. Variables included demographics (age, sex, body mass index [BMI]), injury characteristics (fracture type, mechanism of injury, time from injury to admission), and comorbidities (obesity, diabetes, smoking, alcohol use). Pain management variables included opioid and non-opioid medications, route of administration, opioid doses (converted to morphine milligram equivalents [MMEs]), and use/timing of peripheral nerve blocks.

Pain Score Measurement. Pain was measured using the Visual Analog Scale (VAS; 0 = no pain, 10 = worst imaginable pain).[12] When multiple scores were recorded within a 24-hour window, the mean was used for 0-24- and 24-48-hour intervals.

Statistical Analysis. Categorical variables were summarized as frequencies and percentages; continuous variables as means and standard deviations. Normality was assessed with the Shapiro-Wilk test. Group comparisons used Chi-square or Fisher's exact tests for categorical variables and independent *t*-tests or Wilcoxon rank-sum tests for continuous variables, depending on distribution. Analyses were conducted in R version 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria), with significance set at $\alpha = 0.05$. To evaluate whether analgesic intensity was associated with pain, Pearson correlations were computed between the total number of analgesics administered (opioid and non-opioid, unweighted by dose) in the first 24 and 48 hours and corresponding VAS pain scores. Linearity was checked with scatterplots, and both variables were tested for normality. Correlations were stratified by cohort (Ethiopia vs. United States).

RESULTS

Patient Demographics. Of 357 patients, 122 were Ethiopian and 235 American. Ethiopian patients were younger, more often male, and had lower mean weight and BMI compared with Americans (all $p < 0.001$; Table 1).

Comorbidities and Pain Scores. Obesity (37.9% vs. 1.6%) and diabetes (17.0% vs. <1%) were more prevalent in Americans. Smoking rates differed significantly, but alcohol abuse did not. In the American cohort, neither obesity nor diabetes was associated with higher post-operative pain scores at 24 or 48 hours.

Mechanisms of Injury. Falls were the most common mechanism in Americans (54%), followed by motor vehicle accidents (26%). Among Ethiopians, motor vehicle accidents were most common (44%), followed by falls (26%). Less frequent causes included gunshot wounds (19 vs. 11), assaults (11 vs. 6), crush injuries (6 vs. 4), pathologic fractures (0 vs. 4), recreational injuries (0 vs. 21), and other/unknown causes.

Time to Admission. Ethiopian patients had longer average delays from injury to hospital admission (16.8 ± 56.0 days vs. 6.0 ± 8.8 days), though this was not statistically significant ($p = 0.23$). The wide variability in Ethiopia likely reflects delayed presentation and limited access to care.

Injury Types. Distal radius and trimalleolar fractures were more common in Americans, while tibia/fibula and femoral shaft fractures predominated in Ethiopians.

Post-Operative Pain and Analgesia. Pain management differed markedly. No Ethiopian patient received a peripheral nerve block, compared with 48.9% of Americans. Among Americans who did, pain scores were unexpectedly higher (24h: 5.2 ± 2.9; 48h: 6.4 ± 2.6) than Ethiopians. To standardize comparisons, analyses excluded patients with blocks. Without blocks, American patients reported significantly higher pain scores than Ethiopians at both 24h (5.5 ± 2.7 vs. 4.8 ± 1.7, $p = 0.004$) and 48h (6.6 ± 2.5 vs. 2.8 ± 1.6, $p < 0.001$; Table 2). Notably, Ethiopian pain scores declined from 24 to 48h, while American scores increased.

Analgesic Use. Analgesic profiles differed (Table 3). Ethiopians received primarily tramadol (99%), with diclofenac (37%) and paracetamol (2%). Americans received fentanyl (69%), paracetamol (47%), oxycodone (41%), hydromorphone (28%), and ketorolac (2%). Mean doses (±SD) were Ethiopians: tramadol 50 mg (0.0), diclofenac 72 mg (8.6), paracetamol 1000 mg (0.0); Americans: paracetamol 833 mg (182.6), fentanyl 47 mcg (74.3), oxycodone 9 mg (3.2), hydromorphone 1.2 mg (2.1), ketorolac 23 mg (10.3).

Dosing Patterns. Ethiopian tramadol was almost always scheduled TID (96-98% across 48h). Diclofenac was BID (51%) or PRN (49%). American paracetamol schedules varied (BID 23%, TID 32%, QID 4% in first 24h; mostly QID in second 24h, 72%). Fentanyl use was inconsistent initially but escalated, with most patients requiring ≥3 doses in the second 24h (93%). Oxycodone and hydromorphone were usually scheduled 2-4 times daily. Ketorolac was given BID in the first 24h and TID-QID thereafter.

Correlations Between Analgesia and Pain. In Ethiopia, the number of analgesics did not correlate with pain scores. In contrast, Americans receiving more analgesics reported higher pain, with significant positive correlations at 24h ($r = 0.502$, $p < 0.001$) and 48h ($r = 0.203$, $p = 0.039$).

Table 1. Summary of Ethiopian and American orthopedic fracture patient demographics.

Demographics	Ethiopian Participants, n = 122	American Participants, n = 235	*P* value
Female/Male	21/101	122/113	p <0.001
Age (Years)	34.9 ± 15.3	47.7 ± 17.6	p <0.001
Body Mass Index (kg/m2)	22.2 ± 2.7	29.3 ± 8.0	p <0.001

Note: Gender is represented as counts and compared between groups using a Chi-square test. Means and standard deviations are reported for age and body mass index (BMI). Age and BMI were compared using *t*-test or Wilcoxon rank sum tests as appropriate.

Table 2. Comparison of post-operative visual analog scale (VAS) pain scores between Ethiopian and American orthopedic fracture patients who did not receive a peripheral nerve block.

Pain Score	Ethiopian Participants, n = 122	American Participants, n = 235	*P* value
24 hours	4.8 ± 1.7	5.5 ± 2.7	p = 0.004
48 hours	2.8 ± 1.6	6.6 ± 2.5	p <0.001

Note: Means and standard deviations are reported, and comparisons between groups were made using independent *t*-tests.

Table 3. Post-operative analgesics administered to Ethiopian and American orthopedic patients in the first 24 and 48 hours after surgery. Means and standard deviations are reported for doses. Frequencies and percentages are presented for medication use.

Ethiopian Participants			
Analgesic (dose)	**1st 24h, n (%)**	**2nd 24h, n (%)**	**n (%)**
Tramadol (mg)	BID: 5 (4) TID: 116 (96)	BID: 2 (2) TID: 118 (98)	121 (99)
Diclofenac (mg)	PRN: 22 (49) BID: 23 (51)	PRN: 9 (20) BID: 36 (80)	45 (37)
Paracetamol (mg)	PRN: 2 (100)	-	2 (2)
American Participants			
Analgesic (dose)	**1st 24h, n (%)**	**2nd 24h, n (%)**	**n (%)**
Paracetamol (mg)	BID: 56 (23) TID: 78 (32) QID:107 (4) >QID: 6 (3)	BID: 15 (6) TID: 52 (21) QID: 180 (72)	118 (47)
Fentanyl (mcg)	BID: 53 (21) TID: 67 (27) QID: 59 (24) >QID: 69 (28)	BID: 41 (17) TID: 83 (33) QID: 41 (17) >QID: 83 (33)	172 (69)
Hydromorphone (mg)	BID: 110 (44) TID: 46 (19) QID: 57 (23) >QID: 34 (14)	BID: 58 (24) TID: 87 (35) QID: 58 (24) >QID: 43 (18)	69 (28)
Oxycodone (mg)	BID: 94 (38) TID: 74 (30) QID: 59 (24) >QID: 19 (8)	BID: 64 (26) TID: 53 (21) QID: 71 (29) >QID: 60 (24)	102 (41)
Ketorolac (mg)	BID: 249 (100)	TID: 124 (50) QID: 124 (50)	6 (2)

Abbreviations: PRN, as needed; BID, two times daily; TID, three times daily; QID, four times daily; >QID, more than four times daily.

DISCUSSION

This cross-national analysis highlights that post-operative pain outcomes are influenced by more than pharmacologic intensity. Demographics, mechanisms of injury, systemic factors, and cultural expectations all shaped how pain was perceived, reported, and treated. These findings underscore why universal pain management strategies may not translate equally across settings.

Ethiopian patients were significantly younger, more male, and leaner than American patients. These differences align with trauma patterns in LMICs, where occupational exposure, reliance on public transport, and weaker safety enforcement disproportionately affect younger men.[13-15] Such demographic factors may shape both pain thresholds and reporting behaviors, reflecting broader social and economic influences. Mechanisms of injury also diverged: Americans more often sustained falls, recreational, and pathologic fractures, while Ethiopians experienced motor vehicle accidents, gunshot wounds, and crush injuries; patterns consistent with occupational and societal risks.

BMI differences further highlight physiologic contributors to pain. Obesity-related inflammation can exacerbate chronic pain and impair recovery,[16,17] whereas low BMI may signal malnutrition and poor bone healing. Both extremes alter bone density and fracture risk, potentially shaping pain outcomes.[18] Time to surgery also differed; Ethiopians had longer delays, possibly reducing acute nociceptive pain before surgery, while Americans underwent earlier fixation during peak inflammatory response.[19]

Analgesic strategies varied markedly. Nerve blocks, used only in the United States, provided modest benefit but did not equalize pain outcomes. This challenges assumptions about their universal efficacy and suggests cultural expectations, prior opioid exposure, and care environments modulate their effect.[20,21] Similarly, the positive correlation between number of analgesics and pain in Americans, but not Ethiopians, likely reflects reactive prescribing rather than true efficacy. These findings highlight that escalating medications does not necessarily improve outcomes without addressing underlying pathology or patient expectations.[22]

Limitations. This study has limitations. We did not account for preoperative analgesic use or psychological factors such as preoperative anxiety, both of which may affect post-operative pain. Cohorts also differed in demographics and comorbidities, including age, sex, BMI, obesity, and diabetes. The retrospective design precludes causal inference, and variability in care protocols (e.g., nerve blocks, medication regimens) introduces confounding. Cultural influences on pain reporting are difficult to quantify; however, psychological factors, such as preoperative anxiety, likely contributed, as prior studies have documented differences in anxiety prevalence across settings.[23,24] Finally, reliance on 24-hour mean VAS scores limited temporal granularity. Despite these limitations, the trends align with prior research on opioid-induced hyperalgesia, cultural influences, and demographic effects on recovery.[16,19,22,23,25]

CONCLUSIONS

Despite not receiving post-operative nerve blocks, Ethiopian patients reported consistently lower pain scores than American patients, even when the latter received blocks. While fracture types also differed; distal radius and trimalleolar more common in Americans, tibia/fibula and femoral shaft more common in Ethiopians; these contrasts cannot fully explain the differences observed. Instead, system-level, cultural, and physiologic factors likely play a central role.

Future research should examine how multimodal, non-opioid strategies perform across diverse environments, particularly in resource-limited settings. Attention to surgical timing, patient expectations, and the contextual effectiveness of nerve blocks will be key to developing equitable, culturally attuned approaches to post-operative pain management.

ARTICLE INFORMATION

Received Apr. 18, 2025; Accepted for publication Sept. 25, 2025; Published online Dec. 16, 2025 Kans J Med 2025 Nov-Dec; 18:124-128. https://doi.org/10.17161/kjm.vol18.23860.

Corresponding Author: Laura Jackson, Ph.D., ljackson18@kumc.edu, (785) 331-8899.

Author Affiliations: The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas, USA (Jackson, Lemons, Mar); Department of Orthopedic Surgery, The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas, USA (Dallman Mar, Heddings); Department of Orthopedic Surgery, Saint Paul's Millennium Medical College- Gulele Sub-City, Addis Ababa, Ethiopia (Haile, Mengistu)

REFERENCES

1. Sabatino MJ, Kunkel ST, Ramkumar DB, Keeney BJ, Jevsevar DS. Excess Opioid Medication and Variation in Prescribing Patterns Following Common Orthopaedic Procedures. J Bone Joint Surg Am. 2018 7;100(3):180-188. PMID: 29406338.
2. Abed V, Khalily CD, Landy DC, Lemaster NG, Stone AV. Risk Factors Associated with Prolonged Opioid Use After Revision Total Shoulder Arthroplasty. J Am Acad Orthop Surg Glob Res Rev. 2023 17;7(11):e23.00118. PMID: 37976449.
3. Kim KY, Anoushiravani AA, Chen KK, Roof M, Long WJ, Schwarzkopf R. Preoperative Chronic Opioid Users in Total Knee Arthroplasty-Which Patients Persistently Abuse Opiates Following Surgery? J Arthroplasty. 2018;33(1):107-112. PMID: 28844770.
4. Tong Y, Fernandez L, Bendo JA, Spivak JM. Enhanced Recovery After Surgery Trends in Adult Spine Surgery: A Systematic Review. Int J Spine Surg. 2020;14(4):623-640. PMID: 32986587.
5. Devin CJ, Lee DS, Armaghani SJ, et al. Approach to pain management in chronic opioid users undergoing orthopaedic surgery. J Am Acad Orthop Surg. 2014;22(10):614-22. PMID: 25281256.
6. Lovecchio F, Premkumar A, Stepan JG, Albert TJ. Fighting Back: Institutional Strategies to Combat the Opioid Epidemic: A Systematic Review. HSS J. 2019;15(1):66-71. PMID: 30863235.
7. Zywiel MG, Stroh DA, Lee SY, Bonutti PM, Mont MA. Chronic opioid use prior to total knee arthroplasty. J Bone Joint Surg Am. 2011 2;93(21):1988-93. PMID: 22048093.
8. Onwuchekwa Uba R, Ankoma-Darko K, Park SK. International comparison of mitigation strategies for addressing opioid misuse: A systematic review. J Am Pharm Assoc (2003). 2020 -;60(1):195-204. PMID: 31677934.
9. Young JD, Bhashyam AR, Qudsi RA, et al. Cross-Cultural Comparison of Postoperative Discharge Opioid Prescribing After Orthopaedic Trauma Surgery. J Bone Joint Surg Am. 2019 17;101(14):1286-1293. PMID: 31318808.
10. Ayres JM, Dallman J, Nolte JA, et al. Managing Post-Operative Pain in Orthopedic Patients: An International Comparison. Kans J Med. 2023 21;16(1):56-60. PMID: 36845259.
11. Liu M, Melton BL, Ator G, Waitman LR. Integrating Medication Alert Data into a Clinical Data Repository to Enable Retrospective Study of Drug Interaction Alerts in Clinical Practice. AMIA Jt Summits Transl Sci Proc. 2017 26;2017:213-220. PMID: 28815131.
12. Harris PA, Taylor R, Minor BL, et al; REDCap Consortium. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform. 2019;95:103208. Epub 2019 May 9. PMID: 31078660.
13. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-381. PMID: 18929686.
14. Nugent SM, Lovejoy TI, Shull S, Dobscha SK, Morasco BJ. Associations of Pain Numeric Rating Scale Scores Collected during Usual Care with Research Administered Patient Reported Pain Outcomes. Pain Med. 2021 8;22(10):2235-2241. PMID: 33749760.
15. Bezabih Y, Tesfaye B, Melaku B, Asmare H. Pattern of Orthopedic Injuries Related to Road Traffic Accidents Among Patients Managed at the Emergency Department in Black Lion Hospital, Addis Ababa, Ethiopia, 2021. Open Access Emerg Med. 2022 21;14:347-354. PMID: 35903799.
16. Mengistu Z, Ali A, Abegaz T. The pattern of orthopedic fractures and visceral injury in road traffic crash victims, Addis Ababa, Ethiopia. PLoS One. 2021 24;16(9):e0253690. PMID: 34559808.
17. Mock C, Quansah R, Krishnan R, Arreola-Risa C, Rivara F. Strengthening the prevention and care of injuries worldwide. Lancet. 2004 26;363(9427):2172-9. PMID: 15220042.
18. Mihalko WM, Bergin PF, Kelly FB, Canale ST. Obesity, orthopaedics, and outcomes. J Am Acad Orthop Surg. 2014;22(11):683-90. PMID: 25344593.
19. Chunduri A, Aggarwal AK. Multimodal Pain Management in Orthopedic Surgery. J Clin Med. 2022 28;11(21):6386. PMID: 36362617.
20. De Laet C, Kanis JA, Odén A, et al. Body mass index as a predictor of fracture risk: a meta-analysis. Osteoporos Int. 2005;16(11):1330-8. PMID: 15928804.
21. Chou R, Gordon DB, de Leon-Casasola OA, et al. Management of Postoperative Pain: A Clinical Practice Guideline From the American Pain Society, the American Society of Regional Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. J Pain. 2016;17(2):131-57. Erratum in: J Pain. 2016;17(4):508-10. Dosage error in article text. PMID: 26827847.

22. Lee M, Silverman SM, Hansen H, Patel VB, Manchikanti L. A comprehensive review of opioid-induced hyperalgesia. Pain Physician. 2011;14(2):145-61. PMID: 21412369.
23. Egbert RC, Bouck TT, Gupte NN, et al. Hypoalbuminemia and Obesity in Orthopaedic Trauma Patients: Body Mass Index a Significant Predictor of Surgical Site Complications. Sci Rep. 2020 6;10(1):1953. PMID: 32029855.
24. Mulugeta H, Zewdie A, Getachew T, Deressa W. Injury epidemiology and emergency department length of stay in trauma hospital in Addis Ababa, Ethiopia. PLoS One. 2024 11;19(11):e0309962. PMID: 39527528.
25. Dada O, Gonzalez Zacarias A, Ongaigui C, et al. Does Rebound Pain after Peripheral Nerve Block for Orthopedic Surgery Impact Postoperative Analgesia and Opioid Consumption? A Narrative Review. Int J Environ Res Public Health. 2019 5;16(18):3257. PMID: 31491863.

Keywords: *analgesics, opioid; orthopedics; pain management; pain; post-operative pain*