OPEN

# Does the American College of Surgeons New Level I Children's Surgery Center Verification Affect Treatment Efficiency and Narcotic Administration in Treating Pediatric Trauma Patients with Femur Fracture?

Carter R White, MS, Holly B Leshikar, MD, Micaela R White, MS, Spencer R White, MS, Karen Semkiw, RNC, Diana L Farmer, MD, FACS, Brian M Haus, MD

**BACKGROUND:** In 2015, the American College of Surgeons (ACS) created a new hospital improvement program to enhance the performance of pediatric care in US hospitals. The Children's Surgery Verification (CSV) Quality Improvement Program is predicated on the idea that pediatric surgical patients have improved outcomes when treated at children's hospitals with optimal resources. Achieving ACS level I CSV designation at pediatric trauma centers may lead to greater benefits for pediatric trauma patients; however, the specific benefits have yet to be identified. We hypothesize that achieving the additional designation of ACS level I CSV is associated with decreased narcotic use perioperatively and improved efficiency when managing pediatric patients with femur fractures.

**STUDY DESIGN:** This study is a retrospective analysis of traumatic pediatric orthopaedic femur fractures treated at a verified level I pediatric trauma center before and after CSV designation (2010 to 2014 vs 2015 to 2019). Efficiency parameters, defined as time from admission to surgery, duration of surgery, and duration of hospital stay, and narcotic administration in oral morphine equivalents (OMEs) were compared.

**RESULTS:** Of 185 traumatic femur fractures analyzed, 80 occurred before meeting ACS level I CSV criteria, and 105 occurred after. Post-CSV, there was a significant decrease in mean wait time from admission to surgery (16.64 hours pre-CSV, 12.52 hours post-CSV [$p < 0.01$]) and duration of hospital stay (103.49 hours pre-CSV, 71.61 hours post-CSV [$p < 0.01$]). Narcotic usage was significantly decreased in both the preoperative period (40.61 OMEs pre-CSV, 23.77 OMEs post-CSV [$p < 0.01$]) and postoperative period (126.67 OMEs pre-CSV, 45.72 OMEs post-CSV [$p < 0.01$]).

**CONCLUSIONS:** Achieving ACS level I CSV designation is associated with increased efficiency and decreased preoperative and postoperative narcotic use when treating pediatric trauma patients. (J Am Coll Surg 2023;236:476–483. © 2022 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of the American College of Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.)

**Disclosure Information: Nothing to disclose.**

Received August 7, 2022; Revised November 12, 2022; Accepted November 15, 2022.

From the University of California, Davis, School of Medicine, Sacramento, CA (CR White, Leshikar, MR White, Farmer, Haus); the University of California, Davis, Children's Hospital Department of Orthopaedic Surgery, Sacramento, CA (Leshikar, Haus); Applied Technologies, Austin, TX (SR White); and the University of California, Davis, Children's Hospital Department of General Surgery, Sacramento, CA (Semkiw, Farmer).

Correspondence address: Brian M Haus, MD, Department of Pediatric Orthopaedic Surgery, University of California, Davis, 4860 Y St #3600, Sacramento, CA 95817. email: bhaus@ucdavis.edu





https://doi.org/10.1097/XCS.0000000000000496
ISSN 1879-1190/22

In 2015, the American College of Surgeons (ACS) created a new hospital designation to improve the efficiency and performance of care for children in American Children's hospitals. The level I Children's Surgery Verification (CSV) designation is achieved when a hospital system demonstrates excellence in its infrastructure and in its operations toward the pediatric-specific care of patients. Several important elements include 24-hour, 7 days a week availability of pediatric surgical subspecialties, pediatric anesthesiologists, and qualified pediatric nurses; access to pediatric intensive care beds; and children's surgical quality improvement programs.[1-3]

Tiered CSV is the result of the 2012 Task Force for Children's Surgical Care, which recognized that there are specific resources and facilities necessary for optimized delivery of surgical care for children.[1] Improved outcomes, decreased morbidity, and decreased mortality have been shown for pediatric patients when treated at pediatric centers for complex and routine conditions.[4-11] This includes pediatric trauma patients, when multiple subspecialists may be needed for the injured child, with designated pediatric trauma centers improving mortality and specific functional outcomes.[4-11]

Orthopaedics plays a significant role in the care of the injured child, with the majority of polytraumatized patients presenting with musculoskeletal injuries.[12-15] The ACS previously outlined the best practice guidelines for orthopaedic care.[2,3] Although not explicit in a best practice for definitive timing, other studies have shown that timely care of femoral shaft fractures decreases overall hospital stays.[16] The ACS best practice guidelines emphasize the need for appropriate pain management guidelines for those suffering from traumatic orthopaedic injury.[2,3,17] The appropriate preoperative and postoperative management of pain using a pediatric-focused approach is of the utmost importance.[4-11]

The purpose of this study is to determine the impact of the additional implementation of infrastructure and policies requisite for ACS level I CSV designation at an already well established pediatric trauma center. We hypothesized that achieving the additional designation of ACS level I CSV will be associated with (1) increased efficiency in treating pediatric patients with isolated femur fractures as defined by time to operating room (OR), duration of surgery, length of postoperative hospitalization, and total duration of hospitalization and (2) decreased preoperative and postoperative narcotic administration.

## METHODS

A retrospective analysis was performed on pediatric orthopaedic trauma patients with isolated femur fractures treated at a busy, suburban academic center for two 5-year intervals before (2010 to 2014) and after (2015 to 2019) the implementation of policies and enhanced infrastructure designed to meet the guidelines for ACS level I CSV designation. The hospital had continuous ACS level I Pediatric Trauma Center Verification throughout the course of this study (initially granted in 2005) and achieved additional CSV designation in 2015. The patient population was gathered from a relation database containing electronic medical record data using a Structured Query Language query of Current Procedural Terminology codes specific to closed femur fractures. Inclusion criteria included all patients 18 years or younger evaluated from January 1, 2010, to Decembe 31, 2019, with a traumatic isolated, closed femur fracture (Abbreviated Injury Scale = 0) who received operative treatment (Current Procedural Terminology codes 27267, 27500, 27501, 27506, 27507, 27509, 27513, 27514, 27516, and 27519). Exclusion criteria included patients greater than 18 years old, any patients with abnormal bone pathology (i.e., osteogenesis imperfecta, cerebral palsy, metabolic bone disease), and patients with bilateral injuries or additional injuries of the face, head or neck, chest, abdomen, or pelvic girdle. Additional exclusion criteria included patients with concurrent fractures of the femoral neck, Salter–Harris fractures, or knee involvement (i.e., accompanying anterior cruciate ligament reconstruction).

Patient demographics were compiled to compare pre-CSV and post-CSV populations. Each patient's age, weight, and sex at the time of surgery were noted, as well as the surgical intervention (flexible nail vs intramedullary nail vs submuscular plate) and mechanism of injury (fall injury vs gunshot wound injury vs motor vehicle injury vs recreational injury). Examples of motor vehicle injuries included ATV accidents, automobile vs bicycle, automobile vs skateboarder, automobile vs pedestrian, dirt bike accidents, motorcycle accidents, and tractor rollover accidents. Examples of recreational injuries included sports injuries (such as while playing baseball, basketball, football, rugby, soccer, softball, or wrestling), jet ski injuries, skateboarding injuries, skiing injuries, wakeboarding injuries, and farm injuries (such as crush injuries from a bull or horse kick). Complete data on race and ethnicity was not available for all patients and is outside the scope of this study.

For each patient, efficiency parameters defined as time from admission to surgery, duration of surgery, time elapsed from OR exit to discharge, and duration of hospital stay were compared between time periods. In addition, narcotics administered preoperatively (defined as the time between admission and surgery onset), intraoperatively (defined as between incision start and incision close), and postoperatively (defined as the time between exit from the OR and discharge). Custom software was implemented to process queries from the electronic medical record. The software used regular expression searches and the Pandas Python library to extract narcotic name, narcotic route (i.e., oral, intravenous, subcutaneous, or intramuscular), and narcotic dose. Basic arithmetic operations were used to calculate standard oral morphine equivalent (OME) conversions.[18] The total OMEs were calculated for narcotics administered preoperatively, intraoperatively, and postoperatively.

Prior to CSV designation, both adult and pediatric surgeons performed indicated surgeries on pediatric patients. However, after implementation of CSV guidelines, all skeletally immature patients received surgery exclusively from pediatric specialty surgeons. Finally, the listed discharge attending was used to differentiate patients treated by services managed by pediatric subspecialists, such as pediatric orthopaedic surgeons and pediatric general surgeons, from services managed by adult general surgeons. Next, the administered narcotics were analyzed based on the presence or absence of advanced pediatric training of the prescribing physician. OMEs prescribed by physicians with advanced pediatric training (i.e., pediatric surgeons, pediatric anesthesiologists, pediatric orthopaedists) were compared to OMEs prescribed by physicians without advanced pediatric training (i.e., general trauma surgeons). Welch's $t$ tests and chi-square analysis were used to compare data between the two 5-year time intervals (2010 to 2014 and 2015 to 2019) to account for the difference in patient volume between time periods.

## RESULTS

A total of 185 traumatic femur fractures met the inclusion and exclusion criteria; 80 (43.2%) occurred before the implementation of policies and infrastructure meeting ACS level I criteria, and 105 (56.8%) occurred after, representing a 31.3% increase in operative femur fractures. Between the pre-CSV and post-CSV time periods, there was no significant difference in average age (10.01 years vs 9.85 years), weight (38.77 kg vs 41.50 kg), sex (15 females vs 26 females; 65 males vs 79 males), or mechanism of injury (fall injuries: 19 vs 29; gunshot wound injuries: 1 vs 1; motor vehicle injuries: 35 vs 46; or recreational injuries: 25 vs 29). In both the pre-CSV and post-CSV time periods, motor vehicle injuries were the most likely mechanism of injury (43.8% of injuries pre-CSV and 43.8% of injuries post-CSV). There was a significant difference in the surgical intervention patients received after CSV designation. More patients were treated with flexible nails post-CSV (27.5% pre-CSV vs 42.9% post-CSV) and intramedullary nails (28.8% pre-CSV vs 37.1% post-CSV), and fewer patients were treated with submuscular plates (43.8% pre-CSV vs 21% post-CSV; Table 1).

In comparing the two 5-year time intervals, there was a decrease in mean wait time for surgery from admission (16.64 hours pre-CSV and 12.52 hours post-CSV [$p < 0.01$]), time elapsed from OR exit to discharge (84.60 hours pre-CSV and 56.64 hours post-CSV [$p < 0.01$]), and total length of hospital stay (103.49 hours pre-CSV and 71.61 hours post-CSV [$p < 0.01$]; Fig. 1). There was no significant change in duration of surgery (1.99 hours pre-CSV and 2.19 hours post-CSV [$p = 0.15$]; Fig. 1). The 30-day readmission rate was very low in both the pre-CSV and post-CSV periods. Only 2 patients were readmitted in the pre-CSV period, both from subsequent falls. Only 8 patients were readmitted in the post-CSV period, most commonly for knee pain after flexible nailing and subsequent falls, with one patient requiring readmission for intractable nausea and vomiting and one patient requiring readmission for changing a soiled cast due to not tolerating outpatient cast change.

Patients were administered significantly less narcotics in both the preoperative and postoperative settings after implementation of the ACS level I CSV criteria (Fig. 2). Preoperatively, patients received an average of 40.61 OMEs pre-CSV and only 23.77 OMEs post-CSV ($p < 0.01$). Postoperatively, patients received an average 126.67 OMEs pre-CSV and only 45.72 OMEs post-CSV

**Table 1.** Patient Demographics in the Pre-CSV (2010–2014) and Post-CSV (2015–2019) Time Periods

| Demographic | 2010–2014 (pre-CSV), n = 80 | 2015–2019 (post-CSV), n = 105 |
|---|---|---|
| Age, y, median | 10.01 | 9.85 |
| Weight, kg, median | 38.77 | 41.50 |
| Sex, n (%) | | |
| Female | 15 (18.8) | 26 (24.8) |
| Male | 65 (81.3) | 79 (75.2) |
| Treatment, n (%) | | |
| Flexible nail | 22 (27.5)* | 44 (42.9)* |
| Intramedullary nail | 23 (28.8)* | 39 (37.1)* |
| Submuscular plate | 35 (43.8)* | 22 (21)* |
| Mechanism of injury, n (%) | | |
| Fall | 19 (23.8) | 29 (27.6) |
| Gunshot wound | 1 (1.3) | 1 (1.0) |
| Motor vehicle | 35 (43.8) | 46 (43.8) |
| Recreational | 25 (31.3) | 29 (27.6) |

*The value represents the statistical significance between pre-CSV and post-CSV time periods based on chi-square analysis ($p < 0.05$).
CSV, Children's Surgery Verification.

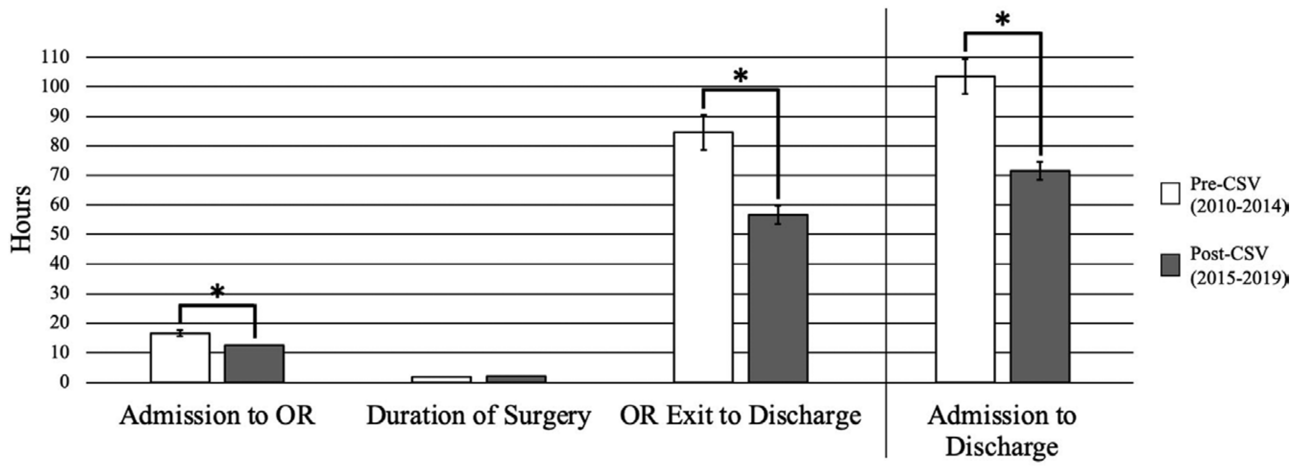


**Figure 1.** Time elapsed from hospital admission to key time points during hospital encounter. Key time points included time of admission, time of operating room (OR) entry, time of OR exit, and time of discharge. The average time elapsed between each key time point was calculated and compared between the pre-Children's Surgery Verification (CSV) and post-CSV periods. Standard error bars >1 are shown. *, statistical significance based on Welch's *t* test ($p < 0.05$).

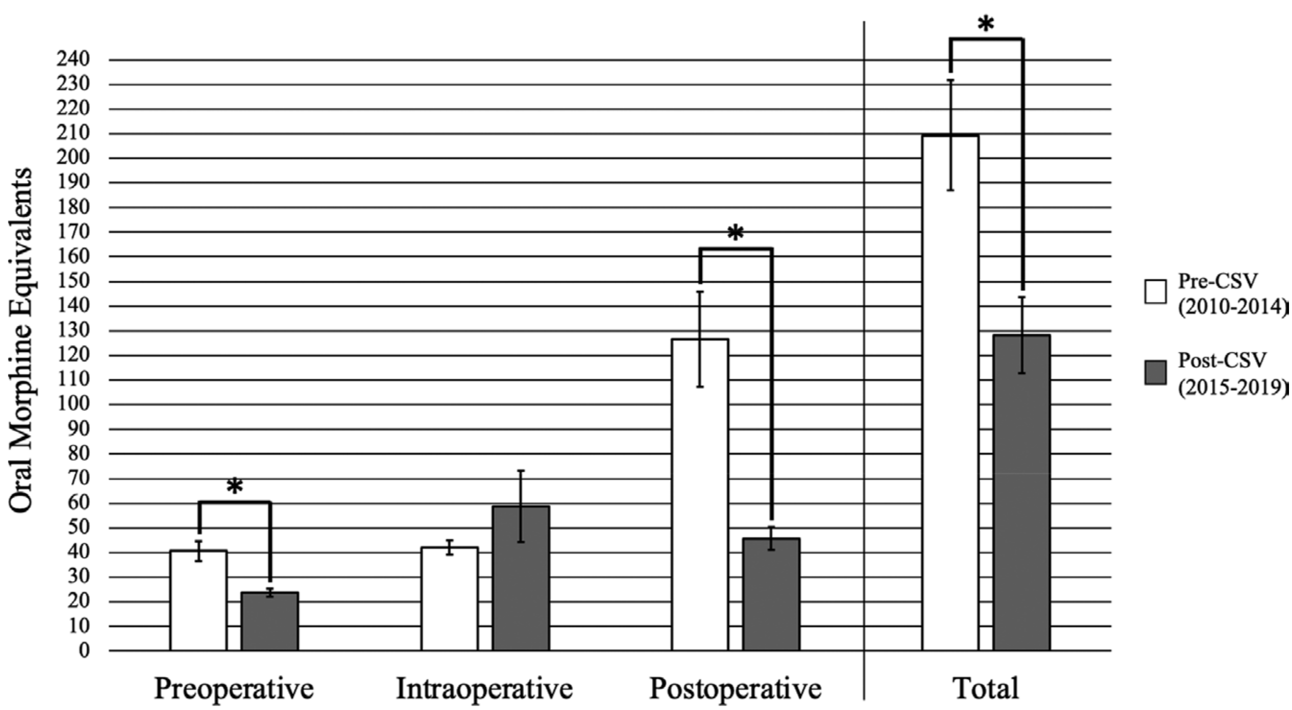


**Figure 2.** Oral morphine equivalents (OMEs) administered per time period throughout hospital stay. The preoperative time period represents OMEs administered between hospital admission and entry to operating room (OR). The intraoperative time period represents OMEs administered between incision start and incision close. The postoperative time period represents OMEs administered between exit from the OR and discharge. Standard error bars are shown. *, statistical significance based on Welch's *t*-test ($p < 0.05$); CSV, Children's Surgery Verification.

($p < 0.01$). Intraoperatively, there was no significant difference in OMEs administered pre-CSV compared to post-CSV (42.02 OMEs vs 58.65 OMEs [$p = 0.26$]). Throughout the entire hospital stay, there was a significant reduction in narcotic administration (209.30 OMEs pre-CSV vs 128.14 OMEs post-CSV [$p < 0.01$]; Fig. 2). Summaries of the measured efficiency parameters and administered narcotics are shown in Tables 2 and 3.

When analyzing narcotic administration based on pediatric or nonpediatric care providers, there was a

**Table 2.** Time Elapsed from Hospital Admission to Key Time Points during Hospital Encounter

| | Pre-CSV | | Post-CSV | | |
|---|---|---|---|---|---|
| Time period | Mean, h | Standard error | Mean, h | Standard error | p Value |
| Admission to OR | 16.64 | 1.08 | 12.52 | 0.54 | <0.01 |
| Duration of operation | 1.99 | 0.10 | 2.19 | 0.11 | 0.15 |
| OR exit to discharge | 84.60 | 5.91 | 56.64 | 3.05 | <0.01 |
| Admission to discharge | 103.49 | 5.97 | 71.61 | 3.15 | <0.01 |

Key time points include the time of admission, time of OR entry, time of OR exit, and time of discharge. Statistical significance was calculated using Welch's *t* test to compare the average hours elapsed in the pre-CSV period compared to the post-CSV period.
CSV, Children's Surgery Verification; OR, operating room.

**Table 3.** OMEs Administered in Key Time Periods during Hospital Encounter

| | Pre-CSV | | Post-CSV | | |
|---|---|---|---|---|---|
| Time period | Oral morphine equivalent | Standard error | Oral morphine equivalent | Standard error | p Value |
| Preoperative | 40.61 | 3.90 | 23.77 | 1.71 | <0.01 |
| Intraoperative | 42.02 | 2.84 | 58.65 | 14.41 | 0.26 |
| Postoperative | 126.67 | 19.25 | 45.72 | 4.57 | <0.01 |
| Total | 209.30 | 22.43 | 128.14 | 15.54 | <0.01 |

Key time points include the time of admission, time of OR entry, time of OR exit, and time of discharge. The preoperative time period represents OMEs administered between hospital admission and entry to OR. Intraoperative time period represents OMEs administered between incision start and incision close. Postoperative time period represents OMEs administered between exit from the OR and discharge. Statistical significance was calculated using Welch's *t* test to compare average OMEs administered in the pre-CSV period compared to the post-CSV period.
CSV, Children's Surgery Verification; OME, oral morphine equivalent; OR, operating room.

statistically significant increase in patients managed by pediatric services (14 of 80 [17.50%] pre-CSV and 44 of 105 [41.90%] post-CSV [p < 0.01]). Analysis of narcotics administration in these groups showed significant decreases in narcotic use for patients managed by pediatric services in the post-CSV period (Fig. 3). In the pre-CSV period, patients receiving pediatric specialty care experienced a significant 43.37% reduction in administered narcotics throughout the duration of hospital stay compared to patients receiving care from adult specialty teams (128.25 OMEs vs 226.49 OMEs [p < 0.01]). Similarly, in the post-CSV period, patients receiving pediatric care were given 56.63% less narcotics during their hospitalization than patients treated by adult specialty teams (72.87 OMEs vs 168.01 OMEs [p < 0.01]).

## DISCUSSION

The American College of Surgeons established the pilot program for the Children's Surgery Verification in 2014[1-3] in response to the concern that the care of high-risk pediatric patients was being delivered in nonspecialized environments.[4-11] The goal of the program was to optimize the delivery of children's surgical care and better align hospital resources with patient needs.[1-3] The ultimate vision of the program was the creation of "a system that allows for a prospective match of every child's individual surgical needs with a care environment that has optimal pediatric resources" for every infant and child in the US.[1-3]

Of surgical patients, pediatric trauma patients represent a unique high-risk population for whom improved outcomes have been repeatedly shown when cared for at pediatric trauma centers.[4-11] Verified trauma centers have stringent guidelines and require resources that are unique to the care of trauma patients. Our study confirms our hypothesis and identifies significant improvement in time to operation, overall length of stay, and decreased opioid administration with the addition of ACS level I CSV designation, suggesting that the policies and infrastructure required to achieve CSV leads to additional improvements in the care of pediatric trauma patients beyond trauma level verification.

We attribute these specific improvements to the commitment of human resources, the establishment of a formalized perioperative infrastructure as well as requiring a structured performance improvement process. Level I CSV requires 24-hour, 7-day a week availability of surgeons, anesthesiologists, and nurses with specialized pediatric training. In our institution, this allowed for the creation of a dedicated operating room for all urgent pediatric cases to allow for expeditious care of all conditions requiring acute surgical intervention. Prior studies show that the creation of an urgent operating room reduces delays in care for acute orthopaedic injuries.[19-23]

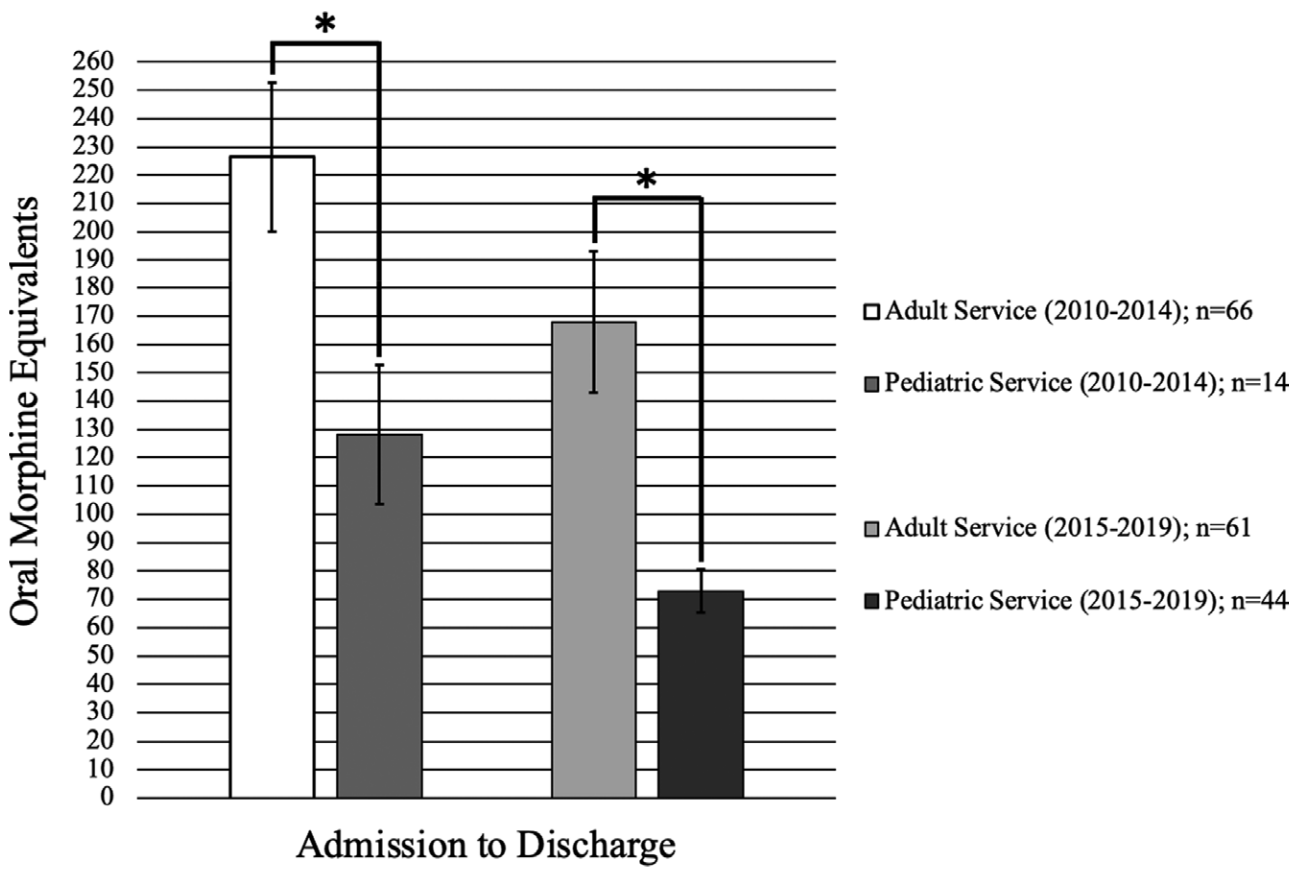


**Figure 3.** Oral morphine equivalents (OMEs) administered by adult care teams and pediatric care teams throughout the duration of hospital stay. OMEs administered by adult services were compared to OMEs administered by pediatric services before and after American College of Surgeons level I Children's Surgery Verification. Standard error bars are shown. *, statistical significance based on Welch's *t* test ($p < 0.05$).

To better exemplify what effect these changes had on pediatric trauma patients, we examined the outcomes of isolated pediatric femur fractures, which represents the highest level of care provided to pediatric trauma patients,[4-11] and further research may show similar improvements for other isolated orthopaedic, neurosurgical, urologic, or general surgical injuries. Compared to pre-CSV, there was a significant increase in the number of cases post-CSV, potentially reflecting an improved ability to accommodate a higher volume of cases with subsequent post-CSV changes in referral and transfer patterns and regionalization of specialty care.[4-11]

The results of our study show a significant improvement in the ability to get urgent patients to the operating room, demonstrating a 24.80% improvement in admission to OR time, with greater provider commitment and improved resources for access to care. The significant decrease in average length of stay from 4.3 days to 3.0 days is multifactorial. First, earlier time to operation allows for earlier recovery and discharge to home. Second, with the addition of more pediatric providers, there was a shift in surgical intervention, with more patients treated with flexible nails and intramedullary nails rather than submuscular plates post-CSV. This is possibly explained by pediatric providers having a better understanding of the indications for flexible nails, which include age, weight (the generally accepted threshold is <50 kg), and injury pattern[24,25] and the benefits of flexible nailing in this population.[26,27] In addition, it is also likely that pediatric-trained surgeons are more comfortable placing flexible nails and intramedullary nails in this population.

In addition, after CSV designation, there was a shift in postoperative care of patients to pediatric providers (17.50% increased to 41.90% between the time periods pre-CSV and post-CSV). It is our belief that pediatric providers may use more multimodal oral analgesics, which can be used more easily at home, further supported by the decreased opioid administration in the post-CSV period. Third, increasing resources such as the use of child life therapy for nonpharmacologic pain management and the increased allocation of pediatric occupational and physical therapists may allow for earlier discharge home.[28]

Opioid administration decreased not only in the postoperative period but also preoperatively in the postverification era. A larger decrease in the total OMEs compared to reduction of hospital stay, 38.78% compared to 30.80%, suggests that not all of this reduction can be attributed to length of stay. Potential explanations include (1) pediatric anesthesiologists effectively using multimodal pain programs including regional anesthesia even in very young children,[29] (2) pediatric orthopaedic providers being more likely to use NSAIDs than their adult colleagues,[30,31] and (3) nonpharmacologic management of pain through child life therapy. Also, changing national, state, and local laws and regulations about the use of narcotics may contribute to less opioid use during an acute hospitalization.[28,32] However, further investigation is needed to identify the specific cause of these changes in narcotic trends.

A limitation of this study is that some institutional changes implemented over the long course of the study period may not have been captured. For example, we excluded operative management with spica cast placement, because early in the study period (approximately 2010 to 2013), spica casts were being performed in the emergency department and not in the operating room, representing an institutional change independent from the verification process. Additionally, there were significant institutional changes in the use of pediatric anesthesia providers during the study period; however, these changes did not completely align with the timeline of the verification process. Therefore, clear associations between pediatric anesthesia providers and intraoperative medication use are difficult to make.

Regarding our findings on hospital narcotic use, the overall decrease in opioid use during the study period may in fact be largely due to an overall national trend to move away from opioid administration vs a true association with the verification process. Given the study design, we were unable to capture outcomes such as psychosocial well-being and prevention of stress for which a pediatric center may be better equipped due to the environment, specialty training, and use of child life therapists. These patient-reported outcomes represent a rich area for further research. Last, these findings represent a large-volume academic center where the pediatric hospital is located within the physical space of the adult hospital, making these results potentially generalizable only within this unique type of setting. Future studies should also investigate home narcotic prescription and usage following discharge, the use of perioperative regional anesthesia, and long-term outcomes in this unique trauma population.

## CONCLUSIONS

The findings of this study are novel and significant. They demonstrate that implementing hospital infrastructure and policies requisite for ACS level I Children's Surgery Verification is associated with significantly increased efficiency and decreased narcotic use in treating pediatric trauma patients. ACS level I CSV was associated with decreased overall hospitalization and duration of time from emergency department to operating room. Additionally, preoperative and postoperative narcotic use was reduced in the post-CSV period.

### Author Contributions

Conceptualization: CR White, Leshikar, Semkiw, Farmer, Haus
Data curation: CR White, Leshikar, MR White, Haus
Formal analysis: CR White, Leshikar, MR White, Haus
Methodology: CR White, Leshikar, MR White, Semkiw, Farmer, Haus
Project administration: CR White
Software: CR White, SR White
Supervision: CR White, Leshikar, Haus
Writing – original draft: CR White, Leshikar, MR White, SR White, Semkiw, Farmer, Haus
Writing – review & editing: CR White, Leshikar, MR White, SR White, Semkiw, Farmer, Haus

## REFERENCES

1. Wang KS, Cummings J, Stark A, et al. Optimizing resources in children's surgical care: an update on the American College of Surgeons' verification program. Pediatrics 2020;145:e20200708.
2. American College of Surgeons. Optimal resources for children's surgical care: Children's Surgery Verification quality improvement program v.1. Available at: https://www.facs.org/media/o4kmpkuy/acs-csv_standardsmanual.pdf. Accessed November 28, 2021.
3. American College of Surgeons. About Children's Surgery Verification. Available at: https://www.facs.org/quality-programs/accreditation-and-verification/childrens-surgery-verification/. Accessed November 28, 2021.
4. Potoka DA, Schall LC, Gardner MJ, et al. Impact of pediatric trauma centers on mortality in a statewide system. J Trauma 2000;49:237–245.
5. Potoka DA, Schall LC, Ford HR. Improved functional outcome for severely injured children treated at pediatric trauma centers. J Trauma 2001;51:824–832.
6. Oyetunji TA, Haider AH, Downing SR, et al. Treatment outcomes of injured children at adult level 1 trauma centers: are there benefits from added specialized care? Am J Surg 2011;201:445–449.
7. Hulka F, Mullins RJ, Mann NC, et al. Influence of a statewide trauma system on pediatric hospitalization and outcome. J Trauma 1997;42:514–519.
8. Acierno SP, Jurkovich GJ, Nathens AB. Is pediatric trauma still a surgical disease? Patterns of emergent operative intervention in the injured child. J Trauma 2004;56:960–965.
9. Tepas JJ 3rd, Frykberg ER, Schinco MA, et al. Pediatric trauma is very much a surgical disease. Ann Surg 2003;237:775–780.

10. Densmore JC, Lim HJ, Oldham KT, Guice KS. Outcomes and delivery of care in pediatric injury. J Pediatr Surg 2006;41:92–98.
11. Sathya C, Alali AS, Wales PW, et al. Mortality among injured children treated at different trauma center types. JAMA Surg 2015;150:874–881.
12. Li J, Monuteaux MC, Bachur RG. Interfacility transfers of noncritically ill children to academic pediatric emergency departments. Pediatrics 2012;130:83–92.
13. Peebles ER, Miller MR, Lynch TP, Tijssen JA. Factors associated with discharge home after transfer to a pediatric emergency department. Pediatr Emerg Care 2018;34:650–655.
14. Li J, Pryor S, Choi B, et al. Reasons for interfacility emergency department transfer and care at the receiving facility. Pediatr Emerg Care 2020;36:95–100.
15. Lyria Hoa MH, Ong YG, Pek JH. Trauma transfers to the pediatric emergency department—is it necessary? Turk J Emerg Med 2020;20:12–17.
16. Grauberger J, O'Byrne M, Stans AA, et al. Does shorter time to treatment of pediatric femur shaft fractures impact clinical outcomes? J Pediatr Orthop 2020;40:e435–e439.
17. American College of Surgeons. ACS trauma quality programs: best practice guidelines for acute pain management in trauma patients. Available at: https://www.facs.org/media/exob3dwk/acute_pain_guidelines.pdf. Accessed June 22, 2022.
18. Nielsen S, Degenhardt L, Hoban B, Gisev N. A synthesis of oral morphine equivalents (OME) for opioid utilisation studies. Pharmacoepidemiol Drug Saf 2016;25:733–737.
19. Brusalis CM, Shah AS, Luan X, et al. A dedicated orthopaedic trauma operating room improves efficiency at a pediatric center. J Bone Joint Surg Am 2017;99:42–47.
20. Redmann AJ, Robinette K, Myer CM 4th, et al. Association of reduced delay in care with a dedicated operating room in pediatric otolaryngology. JAMA Otolaryngol Head Neck Surg 2018;144:330–334.
21. Bhattacharyya T, Vrahas MS, Morrison SM, et al. The value of the dedicated orthopaedic trauma operating room. J Trauma 2006;60:1336–1340.
22. Wixted JJ, Reed M, Eskander MS, et al. The effect of an orthopedic trauma room on after-hours surgery at a level one trauma center. J Orthop Trauma 2008;22:234–236.
23. Chacko AT, Ramirez MA, Ramappa AJ, et al. Does late night hip surgery affect outcome? J Trauma 2011;71:447–453.
24. Ligier JN, Metaizeau JP, Prevot J, Lascombes P. Elastic stable intramedullary nailing of femoral shaft fractures in children. J Bone Joint Surg Br 1988;70-B:74–77.
25. Moroz LA, Launay F, Kocher MS, et al. Titanium elastic nailing of fractures of the femur in children: predictors of complications and poor outcome. J Bone Joint Surg Br 2006;88-B:1361–1366.
26. Sink EL, Gralla J, Repine M. Complications of pediatric femur fractures treated with titanium elastic nails: a comparison of fracture types. J Pediatr Orthop 2005;25:577–580.
27. Lascombes P, Haumont T, Journeau P. Use and abuse of flexible intramedullary nailing in children and adolescents. J Pediatr Orthop 2006;26:827–834.
28. Carter AJ, Greer ML, Gray SE, Ware RS. Mock MRI: reducing the need for anaesthesia in children. Pediatr Radiol 2010;40:1368–1374.
29. Tao B, Liu K, Wang D, et al. Perioperative effects of caudal block on pediatric patients in laparoscopic upper urinary tract surgery: a randomized controlled trial. BMC Pediatr 2019;19:427.
30. Nuelle JAV, Coe KM, Oliver HA, et al. Effect of NSAID use on bone healing in pediatric fractures: a preliminary, prospective, randomized, blinded study. J Pediatr Orthop 2020;40:e683–e689.
31. Stillwagon MR, Feinstein S, Nichols B, et al. Pain control and medication use in children following closed reduction and percutaneous pinning of supracondylar humerus fractures: are we still overprescribing opioids? J Pediatr Orthop 2020;40:543–548.
32. Hyland EJ, D'Cruz R, Harvey JG, et al. An assessment of early child life therapy pain and anxiety management: a prospective randomised controlled trial. Burns 2015;41:1642–1652.