



# Time to Antibiotics for Pediatric Open Fractures

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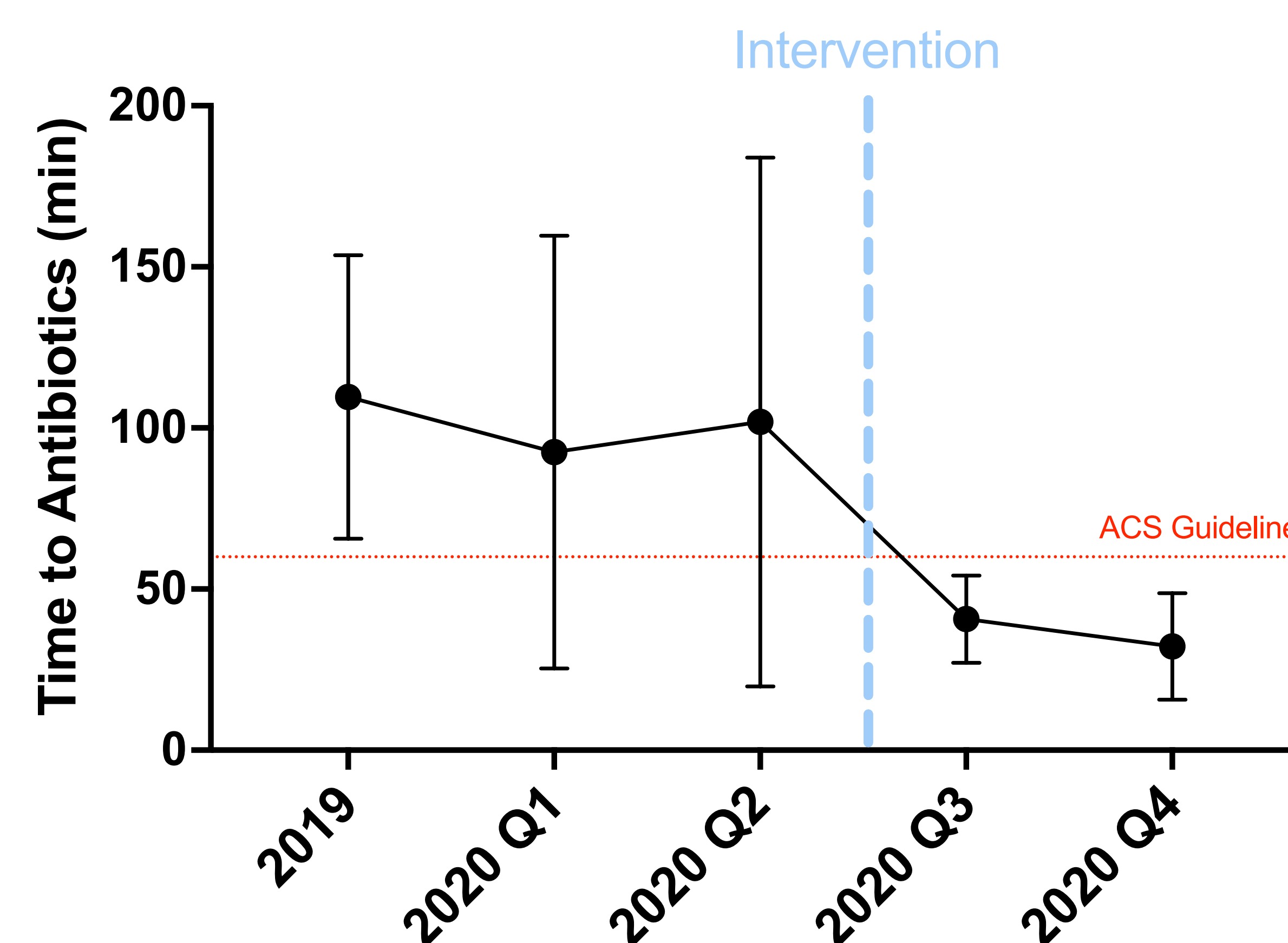
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## Background

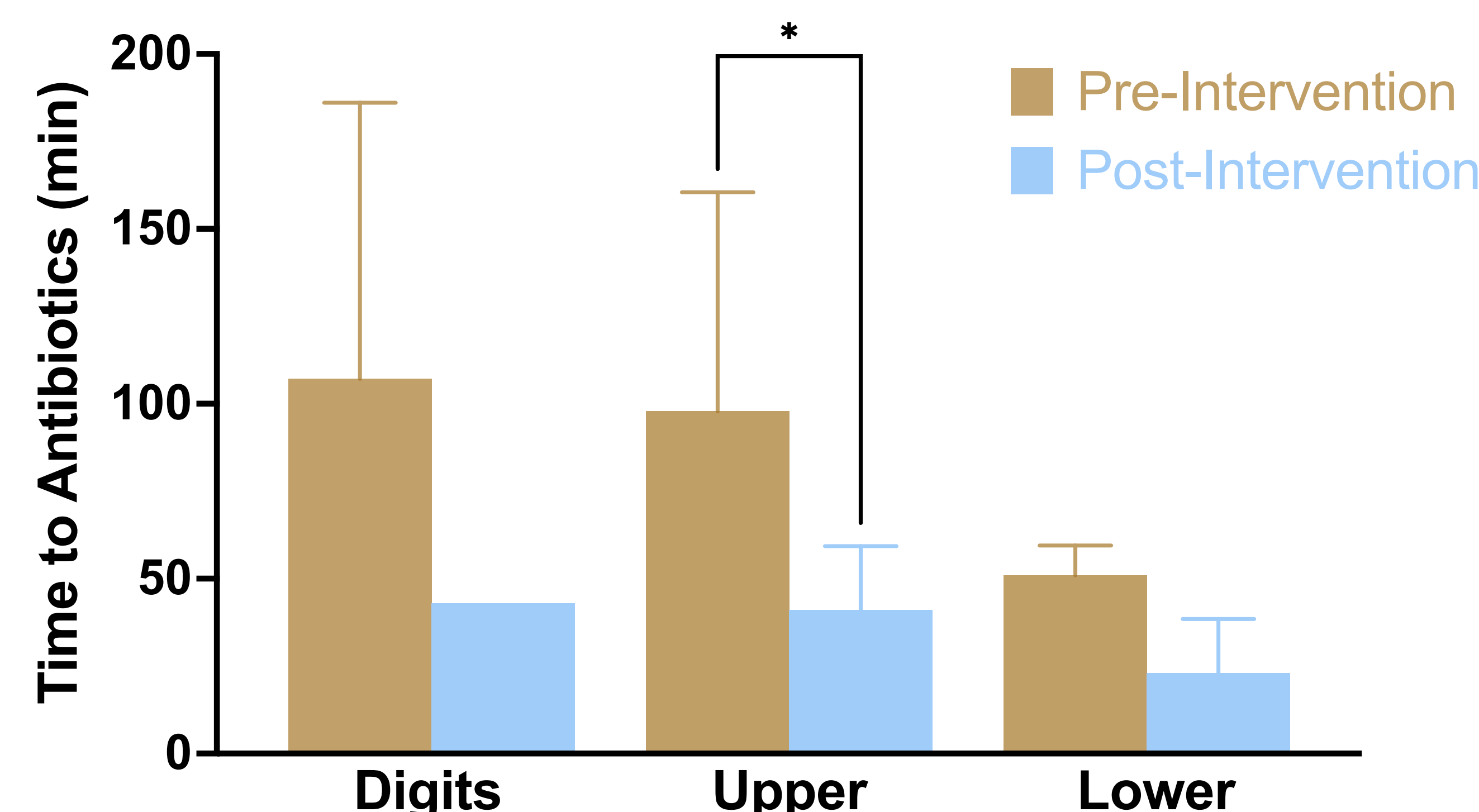
- Although open fractures are relatively uncommon in the pediatric population, these injuries carry serious potential for morbidity if infected.<sup>1</sup> Risks for developing a fracture-related infection include fracture location, severity, timing to antibiotic administration, and time to operative management.<sup>2</sup>
- Current guidelines from the American College of Surgeons<sup>3</sup> (ACS) recommend that open fractures should receive **IV antibiotics within one hour of presentation**.
- While many open fractures present with obvious deformity, some can be challenging to identify:
  - Case: A 14 year old male presented to the ED with L great toe pain that occurred after direct impact to a chair 2 days prior. X-rays showed a fracture of the distal phalanx (Fig 1). The patient was advised to seek outpatient orthopedic evaluation and was later found to have a Seymour open distal phalanx fracture with nailbed compromise.
- Prior to our intervention, our institution did not have a protocol or tracking system for time to antibiotics in pediatric open fractures.



**Figure 1:** Open Seymour fracture of the distal phalanx of the left great toe.



**Figure 2:** A total of 34 open fractures presented to the ED between June 2019 – Feb 2021. 26 fractures were included in the study, 8 fractures were excluded. Overall, the average time to antibiotics from decreased 71% from 110 to 32 minutes.



**Figure 3:** Ulnar fractures were most common (38%). Upper extremity fractures had an average time to antibiotics of 98 min pre-intervention and 41 min post-intervention. There was a significant reduction in time to antibiotics in upper extremity fractures ( $p = 0.015$ ). Fractures of the fingers and toes had the most time to antibiotics with an average of 107 minutes pre-intervention and 43 minutes post-intervention. Lower extremity open fractures had the shortest time to antibiotics with an average of 51 min pre-intervention and 15 post-intervention.

## Discussion

- Pediatric open fractures are considered orthopedic emergencies given their high risk of infection and associated morbidity.
- Prior to our intervention, the average time to antibiotics was well above ACS guidelines and showed large variance in time.
- Open fractures with obvious deformity are more common in the upper and lower extremities .
- Lower extremity fractures had average times to antibiotics below ACS guidelines throughout the study with minimal variance suggesting these injuries are more quickly identified by providers.
- Upper extremity fractures were the most common. The intervention resulted in a significant reduction in time to antibiotics ( $p = 0.015$ ).
- Fractures that are less obvious (i.e. fingers and toes) often require imaging for diagnosis, which delays antibiotic administration. Furthermore, some fractures may not be diagnosed as open until they are surgically debrided and reduced in the operating room. This is reflected in the pre-intervention data (mean = 107 min). While this data set is limited, the intervention appears to have decreased time to antibiotics in this subset of patients.
- Since the intervention, there have been zero cases in which antibiotics have been delayed greater than 60 minutes.
- In summary, ACS open fracture guidelines were met after briefing EM physicians, pharmacists, and nurses about the importance of early antibiotic administration.

## Intervention

- A multidisciplinary intervention was developed and implemented at an academically affiliated Children's hospital starting in Sep 2020 to ensure appropriate antibiotic administration within 60 minutes of patient arrival to the ED:
- EM physicians were briefed on current ACS guidelines during a monthly staff meeting.
  - Pharmacy educated staff to prepare antibiotics within 3 minutes of a potential open fracture arrival to the ED.
  - ACS guidelines were sent to all ED nurses in a monthly newsletter.

## Methods

- All patients with open fractures who presented to Children's ED between June 2019 – Feb 2021 were reviewed. Transfers from outside facilities and skull/face fractures were excluded.
- The following data was collected: hospital arrival date/time, body region and type of fracture, time between presentation to ED to antibiotic administration.
- *Primary outcome measure:* Time (minutes) elapsed between open fracture presentation to ED to antibiotic administration.

## Future Directions

- Recurrent provider CME on subject matter for physicians.
- Give physicians real-time feedback about their timing of antibiotic administration.
- EMR notification for physicians and pharmacy when there is a fracture in triage.
- Assess frequency of infection before and after intervention.

## References

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2. Puetzler, Jan, et al. Clinical practice in prevention of fracture-related infection. Injury. 2019; 50 (1208-1215). <https://doi.org/10.1016/j.injury.2019.04.013>.
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