

# Decreasing the Duration of Discharge Antibiotic Treatment Following Inpatient Skin and Soft Tissue Abscess Drainage

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## Abstract

**Introduction:** Skin and soft tissue abscesses do not require prolonged systemic antimicrobial treatment following drainage. We aimed to decrease the duration of discharge antibiotic treatment to less than 5 days following inpatient incision and drainage of uncomplicated abscesses. **Methods:** A new treatment protocol that defined uncomplicated abscesses, as well as inclusion and exclusion criteria, was created to monitor the accurate duration of prescribed therapy at discharge. We implemented a treatment algorithm that takes into account the epidemiologic changes in microbial etiologies and the presence of systemic findings for patients after surgical incision and drainage. We used control charts to assess the impact of the interventions. **Results:** Four hundred and eighteen patients were discharged following abscess drainage from our inpatient infectious diseases unit in 2016. The patients were 3 months to 21 years of age. Only 72 (17%) patients had prescribed discharge antibiotic treatment courses that were less than 5 days [range 0–31 days, median 8 days (IQR 6, 9)], and the average prescribed course at discharge was 8.6 days. During the study period, we significantly decreased the average duration of discharge antibiotics to 7.3 days in all patients ( $P = 0.0016$ , 95% CI:  $-2.1036$  to  $-0.4964$ , difference of means  $-1.3$ ). The discharge treatment duration of patients with uncomplicated abscess was shorter at 4.7 days [range 0–9 days, median 5 days, (IQR 3, 5)]. Prescription compliance to less than 5 days treatment course at discharge increased from the baseline of 17% to 42% overall. **Conclusions:** Standardizing definitions of uncomplicated skin and soft tissue abscesses was critical to the success of this project. In addition to possible improved treatment adherence and decreased side effects, our protocol led to decreased patient care costs with no documented changes in readmission rates. (*Pediatr Qual Saf* 2020;2:e257; doi: 10.1097/pq9.000000000000257; Published online February 15, 2020.)

## INTRODUCTION

### Problem Description and Available Knowledge

Skin and soft tissue infection (SSTI) is one of the most frequent indications for

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antibiotic use in infectious diseases and results in more than 2 million emergency department visits annually.<sup>1</sup> SSTIs have been on the rise, paralleling the observed increase in infections due to methicillin-resistant *Staphylococcus aureus*.<sup>2,3</sup> SSTIs generally present with cellulitis and/or abscesses. Skin and soft tissue abscesses are distinct as they require incision and drainage (I&D) for optimal management. The appropriate strategy for the antimicrobial treatment following I&D of abscesses has not been well established.<sup>4</sup> Studies have demonstrated that antibiotics may not be required for the care of an abscess after an appropriate I&D but indicated for other non-abscess SSTIs.<sup>2,5-7</sup> The Infectious Disease Society of America (IDSA) guidelines also recommend a shorter course or no antibiotic treatment following drainage of abscesses.<sup>8</sup> However, recently, cure rates for simple abscesses due to *S. aureus* treated with I&D plus clindamycin or trimethoprim-sulfamethoxazole (TMP-SMX) were found to be significantly higher than in patients who were treated with I&D plus placebo.<sup>3,9</sup> Published SSTI treatment studies also demonstrated that shorter durations of 5 or 6 days were as effective as 10 days of treatment.<sup>10,11</sup> The treatment of abscesses presents an additional complexity as there is usually a residual area of cellulitis following

abscess drainage that may require further antibiotic treatment.

### ***Rationale and Specific Aims***

We defined a short course of therapy as 5 days or less, which is in line with the IDSA recommendations.<sup>8</sup> Additional rationales for shorter courses of therapy include limiting the development of bacterial resistance, decreasing the total cost burden of care, and reducing adverse effects associated with antibiotic therapy. We observed that prolonged antibiotic use following drainage of skin and soft tissue abscesses was frequent in our institution. Our primary aim was to decrease the duration of prescribed antibiotics for patients discharged from our inpatient infectious diseases unit following I&D of simple skin and soft tissue abscesses to 5 days or less. Our balancing measure was to monitor the readmission rates due to skin and soft tissue abscess within 1 month of discharge for patients receiving a shorter course of treatment and compare it to the 2016 readmission rates.

## **METHODS**

### ***Context***

The Section of Pediatric Infectious Disease at Nationwide Children's Hospital (NCH) launched this quality improvement project. The NCH Institutional Review Board determined that this project was quality improvement work and not human subjects research. Therefore, the IRB did not require review and approval or written informed consent.

NCH is one of the largest free-standing children's hospitals in the nation, serving a population of over 2 million people in central Ohio. The Pediatric Infectious Diseases Section is unique, with a dedicated inpatient infectious disease unit. The inpatient infectious disease unit has ~3,400 discharges annually.<sup>12</sup> A significant number of these inpatients have admission diagnoses of SSTIs. Patients evaluated at local urgent care clinics or emergency rooms with skin and soft tissue abscesses are frequently referred to NCH for admission to the inpatient infectious disease unit for antibiotic therapy and I&D of the abscess. These patients are then discharged shortly after the procedure on an oral antibiotic treatment course. The emergency room physicians and/or the consulting pediatric surgeons consider admission to the inpatient unit for patients who failed to respond to initial outpatient antibiotic treatment, and/or had an abscess that required drainage requiring appropriate in-patient-administered sedation.

### ***Interventions/Measures***

We assembled a multidisciplinary team, which included infectious disease physicians, pediatric surgeons, nurses, clinical pharmacists, and quality improvement specialists. The team brainstormed rationales for prolonged course of antibiotic treatment and organized these into an affinity diagram revealing 4 key drivers: accurate baseline

duration of prescribed outpatient therapy, physician prescribing culture, physician and staff awareness and understanding, and effective monitoring of compliance with the suggested standard treatment protocol by all faculty members (Fig. 1). We considered individual physician management and treatment styles and identified concerns for a shorter course of treatment, such as the risk of infection progression and recrudescence of infection. We discussed the study protocol with aims during multiple infectious disease section meetings that initiated a positive change even before the implementation of the official protocol. During this period, we identified the need for a treatment algorithm addressing individual and group concerns. These concerns included the possibility of a more severe infection in young patients, patients with systemic signs including persistent fevers, and those with severe cellulitis. We discussed the definition of an uncomplicated abscess and the approach to treatment in patients with cellulitis despite a drained abscess. Additional concerns included the possibility of inadequate treatment, access to care for families living in remote areas, and the possibility of readmissions. We then developed inclusion and exclusion criteria for our treatment protocol to which all infectious disease physicians agreed (Table 1). Our project included patients between 3 months to 21 years of age who were admitted with skin and soft tissue abscesses and discharged from the infectious diseases inpatient unit following I&D performed during the hospitalization with no or minimal residual cellulitis at the time of discharge (uncomplicated abscess). We defined minimal residual cellulitis as 5 cm or less at the time of discharge. We decided that these patients could be discharged with 5 days or less of antibiotic therapy.

Beginning January 2017, we serially introduced interventions including Plan, Do, Study, Act cycles. We finalized the education of faculty, fellows, and staff for shortened antibiotic treatment by February 2017. The treatment algorithm following abscess I&D that takes into account the epidemiologic changes in microbial etiologies and the presence of systemic findings was implemented in March 2017 (Fig. 2). During the study period, any inpatient antibiotic administered after I&D but before discharge was included in calculating the total discharge antibiotic duration.

### ***Analyses***

The primary goal was to decrease the duration of discharge antibiotic treatment following inpatient I&D of skin and soft tissue abscesses by discharging patients with uncomplicated abscesses after 5 or fewer days of antibiotics. We reviewed patient discharge orders and, when available, reviewed NCH pharmacy prescription dosing to assess the duration of treatment. The NCH information services department queried the electronic medical record (EMR) for defined inclusion and exclusion criteria, and one of the physician team members reviewed charts monthly to ascertain the number of patients identified.

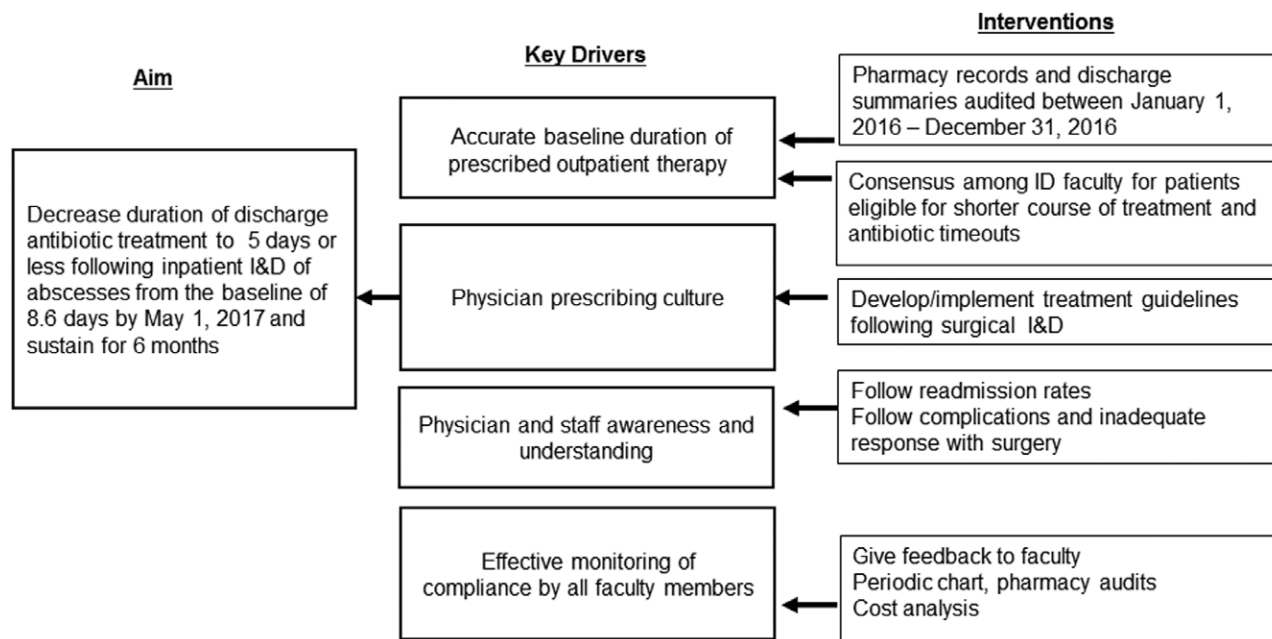


Fig. 1. Aim and key driver diagram developed by QI.

Table 1. Inclusion and Exclusion Criteria

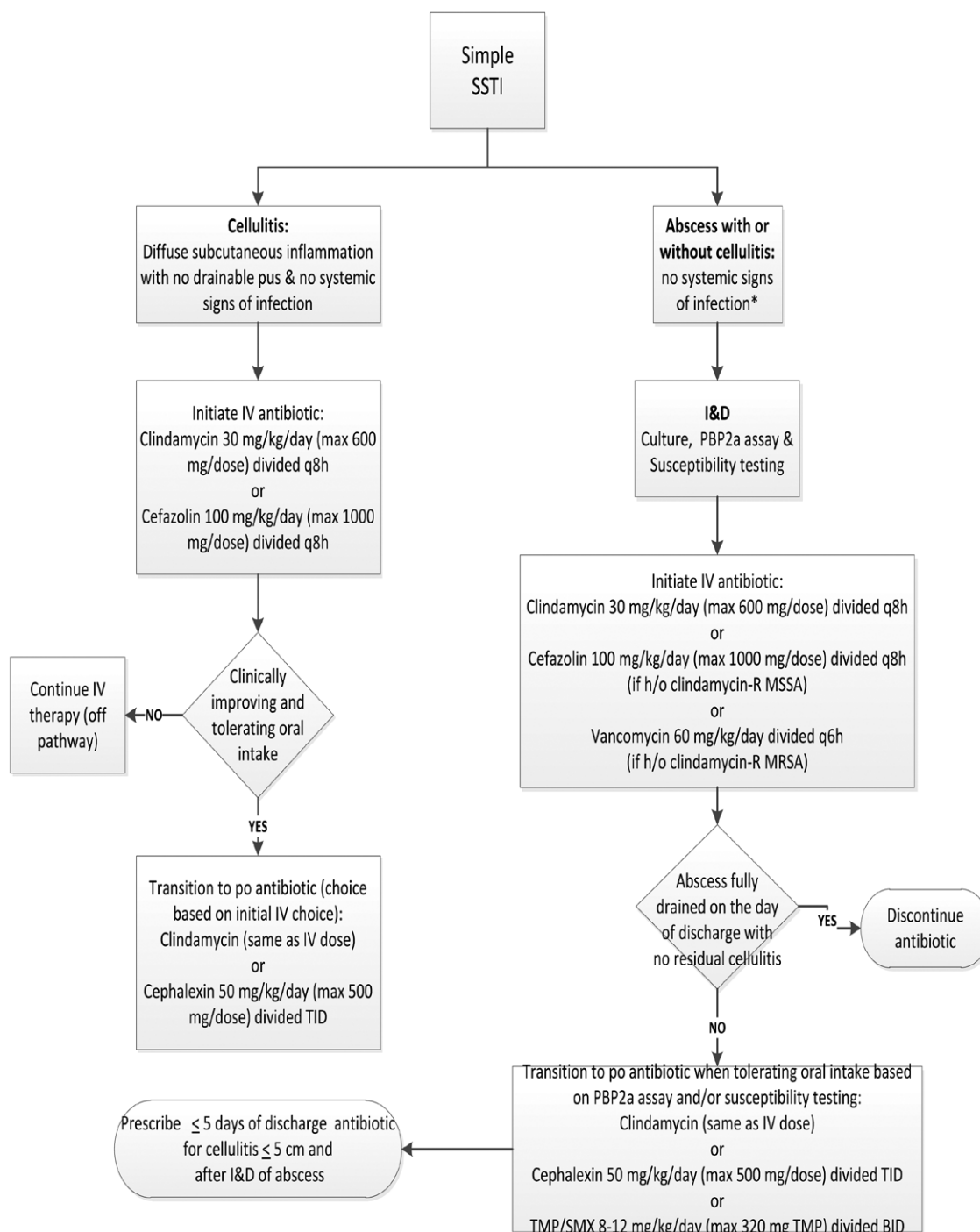
Inclusions	Exclusions
3 months to 21 years of age Admission and discharge from infectious diseases service following I&D performed during hospitalization with no or minimal residual cellulitis at the time of discharge Residual cellulitis defined as 5 cm or less at time of discharge	Complicated SSTI with signs or symptoms indicating systemic involvement and/or uncontrolled comorbidities such as diabetes that may complicate treatment Systemic involvement indicators: fever > 101°F with tachycardia >2 SD for age >8 hours of hospitalization, diaphoresis, fatigue, anorexia, and vomiting that is not due to medication taste Face and neck infections and lymphadenitis Cat scratch disease Hidradenitis suppurativa Pilonidal cyst Perianal abscesses (not buttock abscesses) Burns Wounds requiring a wound vac Patients with immunodeficiency Decubitus ulcers Animal/human bites, foreign body infections Surgical site infections Underlying skin disorders at the site of infection such as severe eczema Residual cellulitis reported as >5 cm at time of discharge

We generated control charts to track the performance of individual physicians, to analyze shifts, to measure the impact of the interventions on the prescribed duration of antibiotic treatment following I&D, and the readmission rate to NCH due to the persistence or recurrence of SSTI within 1 month of discharge. We used a 2-sample *t* test for analysis of baseline data (see Supplemental Digital Content at <http://links.lww.com/PQ9/A158> for Tables). Minitab 18.1 software was used to compare data before and after project implementation (Supplemental Digital Content at <http://links.lww.com/PQ9/A158> for Table 1). During monthly QI meetings, we discussed the process, and addressed unforeseen barriers such as the inaccurate identification of patients with uncomplicated skin and soft tissue abscess. Individual providers received specific feedback.

## RESULTS

During the 2016 pre-intervention period, 418 patients were admitted and discharged following abscess drainage from our inpatient infectious disease unit. The patients were between 3 months to 21 years of age. Only 72 (17%) patients had a discharge antibiotic treatment course that was less than 5 days (range 0–31 days, median 8 days), and the average prescribed treatment course at discharge was 8.6 days.

During the study period, May 1, 2017, through December 31, 2017, 211 patients were admitted with the diagnosis of SSTI and abscess. The average duration of prescribed discharge antibiotics in these patients was 7.35 days (range 0–30 days, median 6 days, IQR 5, 7). Physician prescription compliance to less than 5 days prescribed treatment course at discharge increased to 42%.

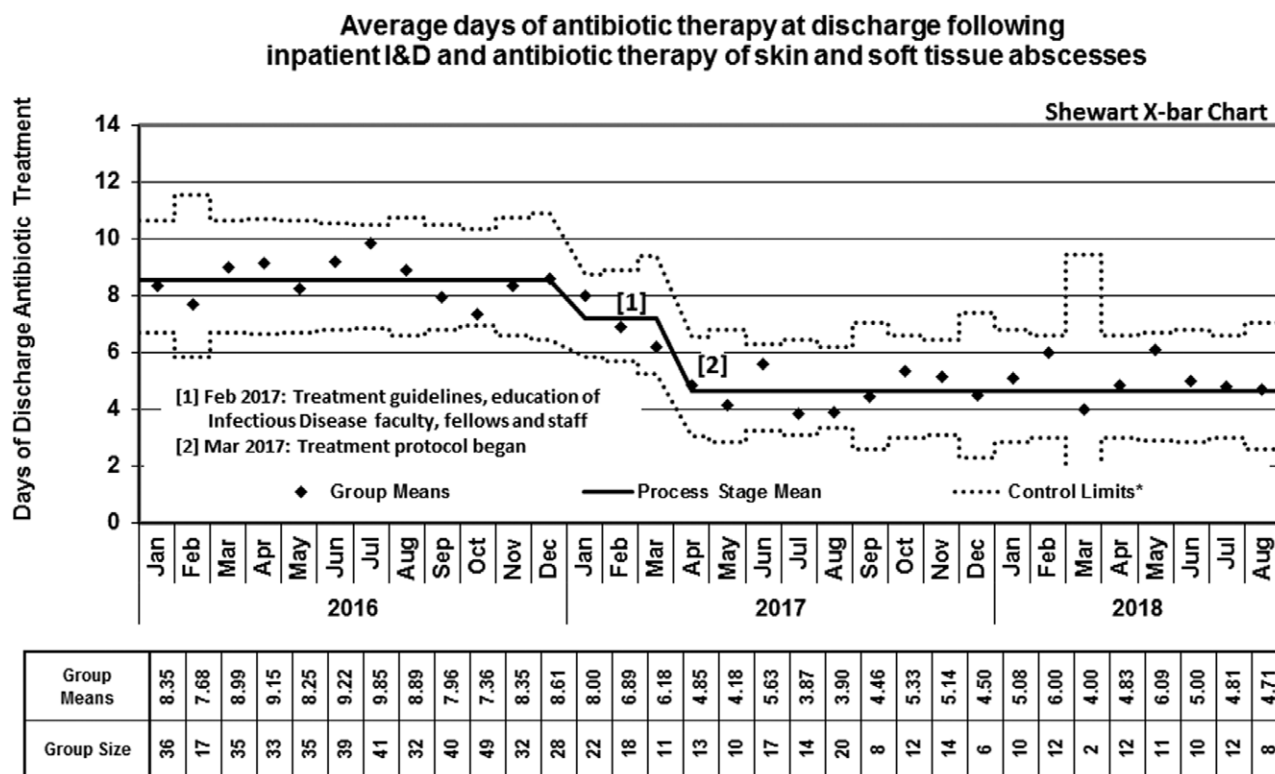


**Fig. 2.** Treatment algorithm developed by infectious disease faculty. \*Fever  $>101^{\circ}\text{F}$  with tachycardia  $>2$  SD for age over 8 hours of hospitalization, diaphoresis, fatigue, anorexia, and vomiting that is not due to medication taste. R, resistant.

Of these 211 patients, 102 patients fulfilled the protocol inclusion and exclusion criteria. The discharge treatment duration of these patients (uncomplicated abscess) was shorter at 4.7 days [range 0–9 days, median 5 days, (IQR 3, 5)], and the prescription compliance of 5 or fewer days of antibiotic at discharge increased to 85% (Fig. 3). We excluded 109 patients as they had more serious infections with diagnoses such as tenosynovitis and osteomyelitis or residual cellulitis following I&D larger than 5 cm.

We did not observe any prolongation of the length of stay after we started our project in comparison to baseline. Patients with prolonged hospital stays had either complicated infections that required exclusion from the study or had oral intolerance or social problems requiring an extension of their stay for continued parenteral therapy.

Decreasing the duration of antibiotic treatment led to no significant change in readmission rates. During 2016



**Fig. 3.** Average days of prescribed antibiotic therapy at discharge following I&D. Continuous/variable data (average days) measured using Shewart Xbar chart calculating upper and lower control limits to signal special cause variation.

and the first 4 months of 2017, the readmission rate due to SSTI with abscess following I&D within 1 month of discharge was 6.2%. During the first 8 months of the study, the readmission rate was 7.8% ( $P = 0.6292$ , 95% CI  $-0.05$  to  $0.08$  for before and after intervention periods, the difference between means,  $0.016$ ); however, the overall readmission rate to our unit was higher. A shorter treatment duration possibly increased treatment adherence and tolerance to oral medications preventing potential readmissions. During the study, a 10-day treatment course of oral clindamycin based on a bodyweight of 15kg would cost \$222. (The oral suspension would cost \$134.) The decrease in treatment duration from baseline of 8.6 days to 5 days saved an estimated 48–62 USD per patient. Based on the decreased treatment duration and patient numbers since May 2017, the protocol saved families and payors 4,896–6,324 USD estimated annually.

## DISCUSSION

Outpatient treatment duration after hospitalization for SSTIs among pediatric patients is not well studied. Available evidence suggests that shorter courses of treatment could be used after appropriate abscess drainage.<sup>4,13,14</sup> In a few studies, TMP-SMX or clindamycin, compared with no antibiotics, reduced the absolute risk of treatment failure by 5% at 1 month.<sup>15</sup> In patients who were cured, these antibiotics reduced the absolute risk of recurrence at 3 months by ~8%.<sup>15</sup> However, in another recent study

performed in adults, no significant reduction was found in treatment failure with the addition of antibiotics following drainage of abscesses in the emergency room.<sup>16</sup>

Most studies and the IDSA guidelines do not adequately address the outpatient treatment of abscesses in children in whom there is an area of cellulitis surrounding the abscess site.<sup>8,17–20</sup> A recent meta-analysis including both children and adults found moderate-to-high quality evidence that in patients with “uncomplicated” skin abscesses treated with I&D, adjuvant antibiotic therapy lowers the risks of treatment failure, abscess recurrence, hospitalization, additional surgical procedures, and pain during treatment; but increases the risk of overall antibiotic (TMP-SMX and clindamycin) gastrointestinal side effects.<sup>21</sup> However, the authors did not define “uncomplicated” infection.<sup>21</sup>

Standardizing the treatment of SSTI and the uncomplicated abscess was the most challenging intervention but was critical in achieving physician consensus and the success of our project. After we reached a consensus on the definition, we created the treatment algorithm. Following these crucial steps, the implementation was smooth, and we achieved our goal even before our official start date. In addition to possibly increasing treatment adherence and decreasing side effects, decreasing the duration of antibiotic treatment will lead to decreased patient care costs.

SSTI and abscesses are an important application of inpatient and outpatient antibiotic stewardship.<sup>22</sup> The definitions of simple SSTI and abscess in children,

however, are quite variable between physicians. Highly variable provider prescription habits, as seen in our baseline data and concern for risk avoidance, especially with the public scares associated with methicillin-resistant *Staphylococcus aureus*, continue to drive unnecessary use of antibiotics.<sup>5,22,23</sup> Our study was unique with the creation of stringent definitions and exclusion criteria. Although our results may be limited as a single-center study, the specific definition of uncomplicated abscesses in children after application of exclusion criteria and ease of its adaptability will potentially guide other institutions to implement similar measures. We are implementing a similar process in other areas of our healthcare system (inpatient units, emergency and urgent care, outpatient clinics). Presentation of this QI project at local meetings brought further involvement from community physicians, emergency room physicians, and pediatric surgeons. The study team started collaborations with community physicians to create a diagnosis and management framework that will utilize preventive efforts to decrease recurrent SSTIs such as patient and family education regarding appropriate hygiene, use of chlorhexidine baths, and treatment of uncomplicated SSTI. Revised staffing and scheduling permitted our emergency room to have additional I&Ds done in the emergency room, preventing the need for inpatient admission. Collaboration is in place toward the establishment of an outpatient multidisciplinary clinic that will be equipped to perform I&Ds of uncomplicated skin and soft tissue abscesses within our hospital system.

### Limitations and Strengths

We did not review the EMR in all of the patients identified during the pre-intervention period. The EMR queries were done with the defined exclusion and inclusion criteria, but we did not know the actual number of patients during the baseline period with the diagnosis of uncomplicated abscess who were treated with 5 days or less of antibiotics at discharge. We also did not know the patient's severity of illness. The median treatment duration of 8 days during the pre-study period was consistent with clinical observations of prolonged antibiotic treatment courses. Also, during this baseline period, documentation of drainage procedures may not have been accurate as some patients might have had surgical drainage at an outside facility, although this is very unlikely. There were no changes in hospital admission practices before and during our study period. Although we did not observe significant changes in the study population in terms of payors and demographics during the study period, these factors were not fully analyzed during the baseline period. NCH follows all readmissions to our facilities within 1 month of discharge, and patients routinely seek follow-up care within our system if any concerns arise following their discharge. Although this passive collection of data may not capture out-of-network admissions, these are very rare, considering that the majority of our patient population reside in regions served by NCH.

We strongly believe that this work can be expanded to other healthcare organizations, although it is difficult to determine how well our conclusions will generalize to other settings.

### DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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