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Evaluation of an emergency department to outpatient parenteral antibiotic therapy program for cellulitis ☆

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ABSTRACT

Objective: Emergency department (ED) patients with non-purulent skin and soft tissue infections (SSTIs) requiring intravenous antibiotics may be managed via outpatient parenteral antibiotic therapy (OPAT). Prospective studies describing the performance of an ED-to-OPAT clinic program are lacking. The primary objective was to determine the OPAT treatment failure rate for ED patients with non-purulent SSTIs.
Methods: We conducted a prospective observational cohort study of adults with non-purulent SSTIs managed via an ED-to-OPAT clinic program. OPAT treatment failure was defined as hospitalization after a minimum of 48 h of OPAT for: worsening infection; intravenous line complications; or adverse antibiotic effects. Secondary outcomes were to describe OPAT clinic processes, patient satisfaction, and physician rationale for selecting intravenous antibiotics.
Results: We enrolled a consecutive sample of 153 patients [mean age 60.5 years, 82 male (53.6%)]; 137 patients (89.5%) attended their clinic appointment. OPAT treatment failure was 4.4%. None of the adverse intravenous line (10.9%) and adverse antibiotic (8.0%) events required hospitalization. Patients reported high satisfaction with timeliness of referral (median score 9 out of 10) and overall care received (median score of 10). The top five reasons given by physicians for selecting intravenous therapy were: clinical impression (52.9%); failed oral therapy (41.8%); diabetes (17.6%); severe pain (7.8%); and peripheral vascular disease (7.8%).
Conclusions: This prospective study demonstrates that an ED-to-OPAT clinic program for non-purulent SSTIs is safe, has a low rate of treatment failures and results in high patient satisfaction. The rationale for selecting intravenous antibiotics showed significant variability among ED physicians.

1. Introduction

1.1. Background

First described in 1974 in the United States, outpatient parenteral antibiotic therapy (OPAT) is defined as the administration of at least two doses of parenteral antimicrobials on different days without interim observation [1]. Many countries have since adopted OPAT for a variety of infections [2-5]. A recent prospective cohort study found that the need for intravenous antibiotics was the most common reason for hospital admission in patients with skin and soft tissue infections (SSTIs) [6]. OPAT is thus an attractive option for adults with non-purulent SSTIs who require intravenous antibiotics without the need for hospitalization. Patients discharged from the emergency department (ED) can receive OPAT follow up in a number of settings: return to the ED, a family physician clinic, a homecare clinic run by nurses, or a dedicated OPAT clinic. Due to difficulties with primary care access [7] and associations between ED overcrowding and increased adverse events [8], an ED-to-OPAT clinic program may be a preferred option due to important advantages: 1) decreased hospital admissions; 2) increased patient convenience; and 3) decreased ED visits.

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1.2. Importance

ED-based studies have shown that intravenous antibiotics are frequently administered [9,10]. Surprisingly, there is scant literature regarding ED antibiotic prescribing for SSTIs [11]. Furthermore, there are no published studies describing ED physician rationale for selecting intravenous over oral antibiotics, despite this being a critical first step in the development of an OPAT program [1,12]. Administration of OPAT is not without risk. Potential adverse events for any infection treated with OPAT include infection progression, peripheral line-related complications or adverse antibiotic events that may warrant subsequent hospitalization [4,13]. Prior studies report the hospital admission rate following OPAT ranging from 2.6 to 8% [13-15]. However, these studies included a number of infections, making it difficult to determine the true clinical failure rate for SSTIs in particular. A recent retrospective study reported a hospital admission rate of 5.5% for a cellulitis OPAT cohort, although the reasons for hospitalization were not described [16].

1.3. Goals of this investigation

The primary objective of this study was to determine the OPAT treatment failure rate for adults with non-purulent SSTIs who are initially managed in the ED. Secondary objectives were to describe OPAT clinic processes (time to first appointment, total number of clinic visits and duration of therapy), determine adverse events, assess patient satisfaction, and identify emergency physician rationale for selecting intravenous antibiotics.

2. Methods

2.1. Study design and setting

We conducted a prospective observational cohort study of adult patients with non-purulent SSTIs initially managed in the ED with intravenous antibiotics and referred to the OPAT clinic. The study population was enrolled from the Ottawa Hospital Civic and General EDs (two tertiary care adult EDs with a combined 170,000 patient visits annually). All enrolled patients were referred to the OPAT clinic, located at the Ottawa Hospital Civic Campus. The OPAT clinic was established in 2014 and operates on three half days per week. The study design was in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology statement [17]. The Ottawa Health Science Network Research Ethics Board approved this study.

2.2. Selection of participants

We enrolled a consecutive sample of patients meeting eligibility criteria from January 15 to June 20, 2017. Eligible patients were adults (age $\geq$ 18 years) presenting to the ED and diagnosed with an uncomplicated non-purulent SSTI and meeting all of the following criteria: (i) felt to require intravenous antibiotic by the treating emergency physician; (ii) logistically feasible to receive care at home or in the community; (iii) patients were aware of and agreeable to a plan for OPAT. The decision to use intravenous antibiotics was left to the discretion of the emergency physician, which was done in a prior ED-based study [18]. Furthermore, it would be impractical to obtain infectious disease consultation for all potentially eligible patients in the ED setting. Patients were excluded for the following reasons: (i) age < 18 years; (ii) diagnosis of a purulent SSTI where an incision and drainage procedure was performed; (iii) significant cognitive or verbal impairment such that informed consent was not feasible; and (iv) patients who were not local residents (and thus could not attend an OPAT clinic appointment) or who did not have a telephone.

2.3. Interventions

The emergency physician selected the agent, dose, frequency and duration of parenteral antibiotic at their own discretion. All patients received intravenous antibiotics through a peripheral intravenous line in the community via the local homecare program. Patients returned to the ED for subsequent intravenous doses if there was a delay in establishing homecare as an outpatient. Patients then followed up with an infectious disease consultant at the OPAT clinic, at the next available clinic date (ranging from two to ten days). The infectious disease consultant was responsible for determining if further intravenous therapy was warranted or if the patient could be stepped down to oral therapy.

2.4. Data collection

All patients were assessed by emergency physicians or residents supervised by attending emergency physicians. Study details were distributed by electronic mail to familiarize physicians with the study. The emergency physician was responsible for completing the OPAT referral form (see the Supplementary appendix), which also required the physician to indicate rationale for selecting intravenous therapy. Physicians were asked to use a ruler on the right-margin of the referral form to obtain accurate infection dimensions. Patients were provided with an information sheet outlining the study details and verbal consent was obtained for a 14-day telephone follow-up call. As this study was observational, the research ethics board approved the protocol with the requirement of only verbal consent.

All patients received a 14-day telephone follow up using a standardized form (see the Supplementary appendix) to assess patient satisfaction and outcomes. Participants were considered lost to follow up if they could not be reached after a maximum of 3 phone calls. The principal investigator abstracted all relevant clinical data from the electronic health record (ED physician and nursing notes, OPAT clinic records) onto a standardized case record form (see the Supplementary appendix). Eligible patients were enrolled regardless of whether the OPAT referral form was fully completed.

2.5. Outcomes

The primary outcome was OPAT treatment failure. There is no established definition of OPAT treatment failure for SSTIs in the literature. The United States Food and Drug Administration recommends that clinical response to treatment should be assessed at 48 to 72 h from initiating therapy [19]. When surveyed, a majority of Canadian emergency physicians selected 48 h as the optimal timeframe for determining if treatment failure had occurred following initiation of antibiotic therapy [20]. After review of the literature [9,10,21-25] and discussion with local experts in emergency medicine and infectious disease, we reached a consensus definition of OPAT treatment failure. Patients were considered to have a treatment failure if they were subsequently admitted to hospital after a minimum of 48 h of OPAT for any of the following reasons: (i) worsening infection; (ii) line-related complications (e.g. bacteraemia, venous thromboembolism); or (iii) drug-related complications (e.g. *Clostridium difficile* colitis).

Secondary outcomes included ED physician rationale for selecting the intravenous route, OPAT clinic data and patient satisfaction. The treating physician was allowed to select more than one reason for selecting intravenous therapy. For clinic data, we recorded time to first visit, total number of visits, and the number of patients lost to follow-up. At a 14-day telephone follow up, we asked patients to

give a numerical rating from one (least satisfied) to ten (most satisfied) with respect to timeliness of referral from the ED and overall patient satisfaction. Adverse outcomes included antibiotic events and device events.

2.6. Analysis

We used descriptive statistics to describe the proportion of patients who had an OPAT treatment failure, adverse antibiotic or device events, OPAT clinic data and patient satisfaction. Continuous data are presented as means with standard deviations or medians with an interquartile range (IQR, Q1–Q3) for normally and non-normally distributed data, respectively. Categorical data are presented as proportions with 95% confidence intervals (CI).

3. Results

3.1. Characteristics of study subjects

We screened a consecutive sample of patients (n = 214) referred to the OPAT clinic over the five-month study period and identified 153 eligible cases (Fig. 1). A total of 137 patients (89.5%) attended their clinic appointment. Of the 16 patients (10.5%) who did not attend their appointment, five patients (3.3%) were admitted to hospital prior to their clinic appointment and 11 patients (7.2%) were lost to follow up. For patients who attended their appointment, we were able to contact 118 patients (86.0%) for a 14-day telephone follow up.

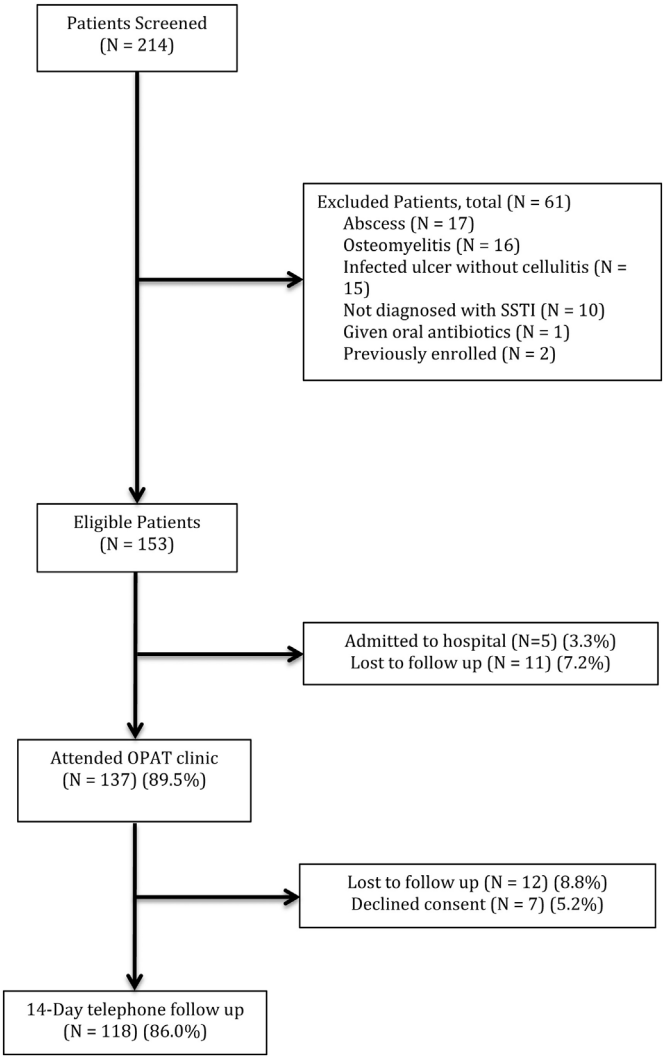

Fig. 1. Flow diagram.

Table 1 highlights the baseline patient and infection characteristics. The mean age of enrolled patients was 60.5 years, and almost a quarter of patients had diabetes (24.8%) or lymphedema (23.5%). Almost half of patients (48.4%) were taking oral antibiotics at the time of their presentation to the ED. The most common location of infection was the leg (45.1%) and the median area of erythema was 150 cm^2 (IQR 40–300). Emergency physicians ordered blood tests in the majority of these patients (68.0%) and the median white blood cell count was 9.0×10^9/L (IQR 6.8–11.6). The treating physician ordered blood cultures for 22 patients (14.4%); there were no positive blood cultures and one blood culture was contaminated.

3.2. Main results

Table 2 shows the variation in antimicrobial therapy administered in the ED. Most patients received a single intravenous antibi-

Table 1
Baseline characteristics of adults with non-purulent skin and soft tissue infections (SSTIs) seen in the ED (N = 153).

Variable	N = 153
Age (years), mean ± SD	60 ± 19
Range	21–100
Male (%)	82 (53.6)
Hospital site (%)	
The Ottawa Hospital Civic Campus	80 (52.3)
The Ottawa Hospital General Campus	73 (47.7)
Comorbidities	
Diabetes mellitus	38 (24.8)
Lymphedema	36 (23.5)
Prior cellulitis in past 12 months	26 (17.0)
Obesity	19 (12.4)
Peripheral vascular disease	12 (7.8)
Coronary artery disease	10 (6.5)
Active cancer	8 (5.2)
Chronic kidney disease	8 (5.2)
Congestive heart failure	7 (4.6)
Liver disease	7 (4.6)
Injection drug use	7 (4.6)
History of MRSA colonization or infection	5 (3.3)
Organ transplant recipient	1 (0.6)
Medications	
Currently taking oral antibiotics	74 (48.4)
Triage vital signs	
Temperature, °C (mean ± SD)	36.5 ± 0.7
Heart rate, beats/min (mean ± SD)	86 ± 17
Systolic blood pressure, mmHg (mean ± SD)	138 ± 21
Respiratory rate, breaths/min (mean ± SD)	17 ± 2
Oxygen saturation, % (median, IQR)	97, 96–98
Infection location (%)	
Leg	69 (45.1)
Foot	21 (13.7)
Arm	23 (15.0)
Hand	19 (12.4)
Face	16 (10.5)
Torso	5 (3.3)
Infection characteristics (%)	
Chronic leg ulcers	20 (13.1)
Bite	11 (7.2)
Surgical site infection	4 (2.6)
Infection dimensions recorded (%)	124 (81.0)
Area of erythema, cm^2 (median, IQR)	150, 40–300
Laboratory tests	
White blood cell count ordered (%)	104 (68.0)
White blood cell count, $\times 10^9$/L (median, IQR)	9.0, 6.8–11.6
Blood culture sent	22 (14.4)
Negative blood culture	21 (13.7)
Contaminant	1 (0.6)
Positive blood culture	0 (0)

SD = standard deviation; IQR = interquartile range; MRSA = methicillin resistant *Staphylococcus aureus*; IV = intravenous.

otic (93.5%). Cefazolin was the most commonly administered antibiotic and was administered in 99 patients (64.7%). Of those that received cefazolin, 33 patients (33.3%) and 66 patients (66.7%) received 1000 mg and 2000 mg, respectively.

In Table 3, the variation in antibiotic prescribing practices for patients sent home from the ED is presented. Cefazolin was the most commonly prescribed antibiotic (66.0%). The chosen dose of cefazolin for 101 patients was as follows: 1000 mg (n = 51, 50.5%); 1500 mg (n = 1, 1.0%); and 2000 mg (n = 49, 48.5%). After cefazolin, the most commonly prescribed antibiotics were ceftriaxone (19.6%) and clindamycin (10.5%).

Emergency physician rationale for selecting intravenous antibiotics is shown in Table 4. Treating physicians provided a total of 22 different rationales. The top five reasons for selecting intravenous therapy were: clinical impression (52.9%); failed oral antibiotic therapy (41.8%); diabetes (17.6%); severe pain (7.8%); and peripheral vascular disease (7.8%).

Of the total 153 patients referred to the OPAT clinic, 137 patients (89.5%) attended their scheduled appointment. The OPAT clinic data is shown in Table 5. The emergency physician and infectious disease consultant diagnosis of a non-purulent SSTI were concordant in 93.4% of cases. The median time to the first clinic visit was 5 days (IQR 4–7). The median duration of intravenous therapy was 9 days (IQR 7–14). Patients reported a high degree of satisfaction with timeliness of clinic referral (median score 9 out of 10) and overall care received (median score of 10 out of 10). Of the 118 patients who could be reached for telephone follow up, 110 patients (93.2%) indicated they would prefer follow-up with the OPAT clinic if they required intravenous antibiotics in the future.

Table 6 shows 14-day outcomes for the 137 patients who attended their initial OPAT clinic appointment. The majority of patients (63.5%) returned to the ED within 14 days. The most common reason was a return for scheduled intravenous doses if the homecare program could not be initiated in time for the next required dose. Only six patients suffered an OPAT treatment failure (4.4%; 95%CI 2.0 to 9.2); all were due to worsening infection. Fifteen patients (10.9%) had an adverse device event (blocked or dislodged peripheral intravenous line) and there were no cases of line infection or bacteraemia. Eleven patients (8.0%) had an adverse

Table 2
Intravenous antibiotic treatment administered while in the ED (N = 153).

Antibiotic selection	Number of patients, N = 153 N (%)
IV antibiotics only	148 (96.7)
Oral and IV antibiotics	5 (3.3)
Number of IV antibiotics	
One	143 (93.5)
Two	10 (6.5)
IV antibiotic agent and single dose	
Cefazolin	99 (64.7)
Dose = 1000 mg	33 (21.6)
Dose = 2000 mg	66 (43.1)
Ceftriaxone	37 (24.2)
Dose = 1000 mg	31 (20.3)
Dose = 2000 mg	6 (3.9)
Clindamycin	17 (11.1)
Dose = 300 mg	1 (0.6)
Dose = 600 mg	12 (7.8)
Dose = 900 mg	4 (2.6)
Vancomycin	5 (3.3)
Dose = 1000 mg	3 (2.0)
Dose = 1500 mg	1 (0.6)
Dose = 2000 mg	1 (0.6)
Piperacillin-Tazobactam (3375 mg)	2 (1.3)
Meropenem (1000 mg)	2 (1.3)
Ciprofloxacin (400 mg)	1 (0.6)
Oral antibiotics[a]	
Clindamycin	2 (1.3)
Ciprofloxacin	2 (1.3)
Trimethoprim-sulfamethoxazole	1 (0.6)

IV = intravenous.
[a] Given in addition to intravenous antibiotics.

Table 3
Intravenous antibiotic prescriptions for patients discharged from the ED (N = 153).

ED IV antibiotic prescription	Number of patients, N = 153 N (%)
Cefazolin	101 (66.0)
Single dose	
1000 mg	51 (33.3)
1500 mg	1 (0.6)
2000 mg	49 (32.0)
Frequency	
Twice daily	5 (3.3)
Three times daily	94 (61.4)
Four times daily	2 (1.3)
Duration, days (median, IQR)	7, 7–7
Range	3–14
Ceftriaxone	30 (19.6)
Single dose	
1000 mg	25 (16.3)
2000 mg	5 (3.3)
Frequency	
Once daily	1 (0.6)
Twice daily	29 (19.0)
Duration, days (median, IQR)	7, 7–9
Range	3–10
Clindamycin	16 (10.5)
Single dose	
300 mg	1 (0.6)
450 mg	1 (0.6)
600 mg	11 (7.2)
900 mg	3 (2.0)
Frequency	
Twice daily	1 (0.6)
Three times daily	15 (9.8)
Duration, days (median, IQR)	7, 7–7
Range	5–14
Vancomycin	3 (2.0)
Piperacillin-Tazobactam	2 (1.3)
Meropenem	2 (1.3)
Ciprofloxacin	1 (0.6)

IQR = interquartile range (Q1–Q3); range = min–max; IV = intravenous, ED = emergency department.

Table 4
Emergency physician rationale for IV antibiotics for all 153 patients.

Rationale for IV antibiotics[a]	Number of patients, N (%) N = 153
Clinical impression	81 (52.9)
Failed oral antibiotic therapy	64 (41.8)
Diabetes	27 (17.6)
Severe pain (>8/10)	12 (7.8)
Peripheral vascular disease	12 (7.8)
Bite	7 (4.6)
Prior SSTI that required IV antibiotics	5 (3.3)
Social/compliance issues	5 (3.3)
Abnormal skin at infection site[b]	3 (2.0)
Prior oral antibiotic failure	2 (1.3)
Prior SSTI in same area	2 (1.3)
Hypotension or fever and tachycardia	2 (1.3)
Rapidly spreading erythema or lymphangitis	2 (1.3)
Indwelling IV catheter	1 (0.6)
Blunt trauma	1 (0.6)
Ear involvement	1 (0.6)
Injection drug use	1 (0.6)
Immunocompromised	1 (0.6)

IV = intravenous; SSTI = skin and soft tissue infection.
[a] Emergency physicians indicated >1 rationale for some patients.
[b] Surgical site infection, underlying burn, underlying melanoma.

Table 5
Outpatient parenteral antibiotic therapy (OPAT) clinic data (N = 137).

OPAT clinic metric	Number of patients, N (%) N = 137
Cellulitis confirmed as diagnosis[a]	128 (93.4)
Alternate diagnoses	
Abscess	3 (2.2)
Osteomyelitis	3 (2.2)
Drug rash	2 (1.4)
Stasis dermatitis	1 (0.7)
Time to follow-up (days), median, IQR	5, 4–7
Range	1–18
Total clinic visits, median, IQR	2, 1–3
Total duration of IV antibiotics (days), median, IQR	9, 7–14
Total duration of IV and oral antibiotics (days), median, IQR	17, 12–28
Patient follow up at 14 days	118 (86.1)
Patient satisfaction (scale of 1 to 10[b]), median, IQR	
Timeliness of referral to OPAT clinic	9, 8–10
Overall satisfaction with care received	10, 9–10
Patient preference for follow up in future	
OPAT clinic	110 (80.3)
Family doctor	5 (3.6)
ED	3 (2.2)
Unknown (lost to follow up)	19 (13.9)

OPAT = outpatient parenteral antibiotic therapy; IV = intravenous; IQR = interquartile range, Q1–Q3.
[a] The infectious disease specialist agreed with the emergency physician diagnosis of a non-purulent SSTI.
[b] 1 is least satisfied and 10 is most satisfied.

Table 6
Outcomes at 14 days after the index ED visit[a].

Adverse events	Number of patients, N = 137, N (%)
Reason for return ED visit within 14 days	87 (63.5)
Repeat IV antibiotic doses	55 (40.1)
Number of repeat visits, median, IQR	1, 1–2
Range	1–5
For SSTI and discharged home	18 (13.1)
For SSTI and hospital admission (OPAT treatment failure)	6 (4.4)
Diagnosed with abscess requiring I&D	4 (2.9)
Unrelated medical problem	4 (2.9)
Adverse device events	15 (10.9)
Blocked peripheral IV line	9 (6.6)
Dislodged peripheral IV line	6 (4.4)
Thrombophlebitis, line infection or bacteraemia	0 (0)
Adverse antibiotic events	11 (8.0)
Diarrhea	8 (5.8)
Rash	2 (1.4)
Oral thrush	1 (0.7)
Nausea and/or vomiting	0 (0)

IQR = interquartile range (Q1–Q3); range = min–max.
ED = emergency department; IV = intravenous; SSTI = skin and soft tissue infection; I&D = incision and drainage.
[a] Excluding those lost to follow-up.

antibiotic event with the majority experiencing diarrhea. None of the adverse device or antibiotic events resulted in hospitalization.

4. Discussion

4.1. Interpretation of results

This prospective observational cohort study describes ED-to-OPAT clinic performance in the management of adults with non-purulent SSTIs. There was a very low rate of both OPAT treatment failures and adverse antibiotic or peripheral line events. To our knowledge, this is the first study to prospectively evaluate emergency physician rationale for intravenous antibiotics in the management of non-purulent SSTIs. The top five reasons for selecting intravenous therapy were: clinical impression; failed oral antibiotic therapy; diabetes; severe pain; and peripheral vascular disease. There was significant practice variation among emergency physicians regarding antibiotic agent, dose and duration. Cefazolin was the most commonly prescribed parenteral antibiotic and emergency physicians were split regarding the dose. Patients reported a very high degree of satisfaction with their care. Our findings strengthen the argument that an ED-to-OPAT clinic model is effective, safe, and results in a high degree of patient satisfaction.

4.2. Previous studies

Our study found a low OPAT treatment failure rate (4.4%) that is similar to previously published studies [13-15]. However, this is the first prospective study to assess OPAT for non-purulent SSTIs in the ED patient population. Appropriate patient selection for outpatient intravenous therapy is a critical first step to the success of an OPAT program [1,12]. However, there are no published studies to date that have examined emergency physician rationale for selecting parenteral therapy. Current guidelines [1,5,26] list patient satisfaction as a key element to an OPAT program. We found a high degree of patient satisfaction that is similar to prior studies [15,18].

4.3. Strengths

A consecutive sample of patients (n = 214) were screened for enrolment from all OPAT clinic referrals so as not miss any potential cases over the study period and to minimize selection bias. The data were collected prospectively and we were thus able to accurately identify physician rationale for selecting parenteral therapy. To our knowledge, this is the first prospective study that provides important insight into physician decision-making regarding patient selection for intravenous as opposed to oral antimicrobial therapy.

4.4. Limitations

There are study limitations that warrant mention. First, this study was conducted at two tertiary care EDs but had a small sample size due to feasibility. Second, patients were referred to the OPAT clinic if the treating physician felt that intravenous therapy was required, which is a subjective criterion. As this study was observational, this process was not changed. However, this study sought to determine physician rational for intravenous therapy. Furthermore, some oral agents have a high bioavailability, which suggests that intravenous therapy may not be required for some infections. However, there is currently a lack of high-quality evidence to guide clinicians regarding selecting the appropriate route of therapy, and current guidelines regarding route of therapy are based on expert opinion [27].

In addition, some healthcare systems may not have an OPAT program that can be accessed for ED patients. Thus, the study results may not be generalizable to other settings. However, our results have demonstrated that establishing OPAT for SSTIs should be considered as a safe and effective option in communities currently lacking this option. The high proportion of ED return visits was likely due to the limited days and times during which the OPAT clinic operates. Some patients did not attend their clinic appointment and were lost to follow-up (7.2%). It is possible that some of these patients lost to follow up may have experienced a treatment failure. We feel it is unlikely, however, that patients who received treatment at our centre would present to another

hospital for further care. Another limitation was that 14.0% of patients who attended the clinic visit could not be reached by telephone or declined consent. It is possible that their patient satisfaction scores may have differed significantly from the group that had a complete follow up.

A further limitation is that we could not record patient weight or categorize the degree of obesity due to feasibility in obtaining this data. It is possible that at least some of the variation observed in antimicrobial dosing, duration and frequency might be related to patient body habitus. However, we feel this is unlikely because the small proportion of patients with obesity (12.4%) would not fully explain the high degree of observed dosing variability. In addition, the choice of antibiotic agent may be different in communities with a high prevalence of methicillin resistant *Staphylococcus aureus*.

Lastly, there is no validated definition of OPAT treatment failure. Petrak et al. recommended that future studies examining OPAT efficacy should include robust definitions for treatment failure [14]. We attempted to develop a robust definition by reviewing the literature [9,10,21-25] and reaching consensus among local experts in emergency medicine and infectious disease.

4.5. Clinical implications

There are important clinical implications that deserve mention. Our study demonstrated a high degree of variation in antimicrobial prescribing practices, which reflects a significant lack of consensus among emergency physicians regarding optimal management of this common clinical condition. Additionally, a large proportion of patients returned to the ED. This is likely because the local homecare program only operates on weekdays between 0900 and 1600. This would require patients seen in the evening or on weekends to return to the ED for repeat antibiotic doses.

The rates of adverse events and OPAT treatment failure were very low, suggesting that the ED-to-OPAT clinic model is safe, effective and results in high patient satisfaction. This model can be introduced in other communities currently lacking OPAT to potentially decrease hospital admissions and associated healthcare costs.

4.6. Research implications

Our study identified reasons emergency physicians institute intravenous antibiotic therapy for non-purulent SSTIs. Future studies should seek to assess whether patients with these identified rationales genuinely require intravenous therapy, or whether they can be treated with less invasive and cheaper oral antibiotics. Novel intravenous antimicrobials with prolonged half-lives (e.g. dalbavancin, oritavancin) allow for once-weekly dosing to treat SSTIs. Future studies should examine the impact of these newer agents on ED-to-OPAT programs with respect to OPAT failure, return ED visits and number of OPAT clinic visits required. We also identified a large degree of variation with antibiotic prescription practices. Randomized clinical trials comparing various doses and durations of intravenous therapy will aid in making more robust guidelines to aid emergency physicians when selecting the appropriate antibiotic regime.

5. Conclusion

This prospective study demonstrates that an ED-to-OPAT clinic program for non-purulent SSTIs is safe, has a low rate of treatment failures and results in high patient satisfaction. The rationale for selecting intravenous antibiotics showed significant variability among ED physicians. Future directions should involve the development and testing of objective OPAT criteria to better determine which outpatients may be treated with oral versus intravenous therapy.

Conflicts of interest

The authors have no conflicts of interest to report.

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Author contributions

KY, KNS, GW and IGS conceived and designed the study. KY and IGS obtained research funding. KY undertook data abstraction, and managed the data. GW, DE and VT provided statistical advice on the study design and analysis. KY drafted the manuscript, and all authors contributed substantially to its revision. KY takes responsibility for the paper as a whole.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2019.02.023.

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