Using audit-and-feedback to improve antimicrobial-prescribing in Emergency Departments: a quasi-experimental study across 4 sites in the Veterans Health Administration

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Daniel J. Livorsi, MD, MS[1,2]; Rajeshwari Nair, MBBS, PhD[1,2]; Andrew Dysangco, MD[3]; Andrea Aylward, PharmD[4]; Bruce Alexander, PharmD[1]; Matthew Smith, MD[2]; Sammantha Kouba, DO[2]; Eli N. Perencevich, MD, MS[1,2]

1. Center for Access & Delivery Research & Evaluation (CADRE), Iowa City Veterans Affairs Health Care System, Iowa City, IA, USA; 2. University of Iowa Carver College of Medicine, Iowa City, IA, USA
3. Indiana University School of Medicine and the Richard L Roudebush VA Medical Center, Indianapolis, IN; 4. Sioux Falls VA Health Care System, Sioux Falls, SD

Correspondence:
daniel-livorsi@uiowa.edu
319-688-3871

INTRODUCTION

- Audit-and-feedback is an effective strategy for improving antimicrobial-prescribing.
- The use of audit-and-feedback for outpatient antimicrobial stewardship has been largely studied in primary care clinics with limited data in Emergency Departments (EDs).
- In this quasi-experimental study, we evaluated whether the use of audit-and-feedback with peer-to-peer comparisons could reduce unnecessary antimicrobial use at 2 intervention EDs compared to 2 control EDs.

MATERIALS AND METHODS

Study Design: A quasi-experimental study with a non-equivalent control group
Site selection: All EDs were affiliated with Veterans Affairs Medical Centers (VAMCs) in the midwestern United States. Intervention (n=2) and control sites (n=2) were matched on their baseline antimicrobial-prescribing rate and their hospital complexity level, as defined by the VHA.
Intervention:

- The entire study period was 24-months in duration: baseline (12 months), implementation (1 month), and intervention (11 months).
- The intervention consisted of one-on-one education about antimicrobial-prescribing with each ED clinician and individualized antimicrobial-prescribing feedback with comparisons to local peers (baseline and quarterly for 1 year).
- In all, 27 of 31 (87.1%) eligible ED clinicians were enrolled, including 8 (88.9%) at intervention site 1 and 19 (86.4%) at intervention site 2.

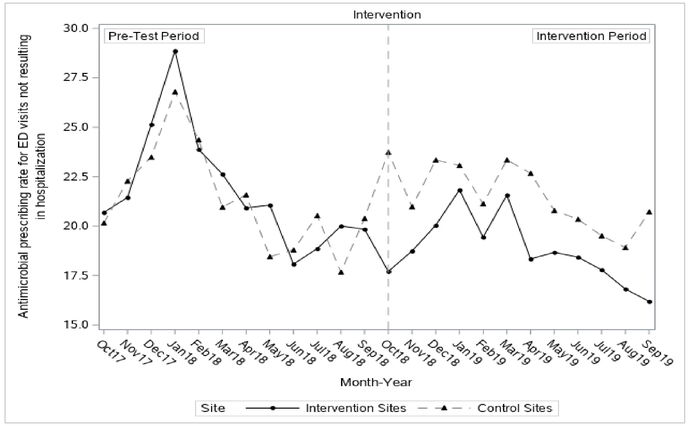
Outcome Measurement:

- **Primary:** antimicrobial-prescribing rate (i.e. frequency of prescribing an outpatient antimicrobial prescription within 24 hours of the ED visit; hospitalized patients were excluded)
- **Secondary outcomes**
  - Antibiotic-prescribing rate (limited to anti-bacterial agents)
  - ARI metric: rate of prescribing antibiotics for uncomplicated viral ARIs
  - Clinical outcomes within 30-days of ED visit
  - Guideline-concordant management, as defined by manual chart reviews for 6 conditions of interest (acute bronchitis, COPD exacerbations, cystitis, pharyngitis, acute sinusitis, URI)

Table 1. Characteristics of patient-visits at 2 intervention and 2 control EDs during the baseline and intervention periods

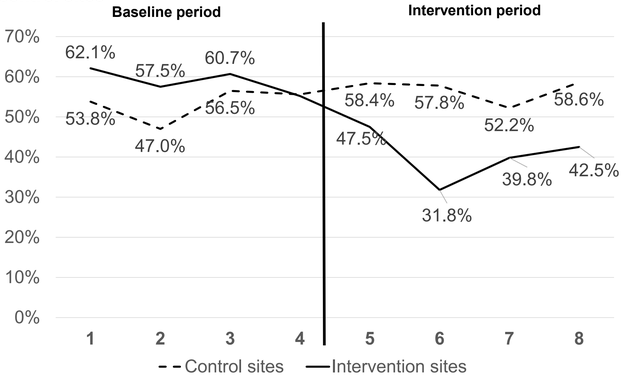
Characteristics	Intervention Sites		Control Sites	
	Baseline	Intervention	Baseline	Intervention
Number of visits	28,157	27,610	31,119	32,284
Median age (IQR), years	61 (49-70)	62 (49-71)	63 (50-71)	63 (50-72)
Male	90.1%	90.1%	91.2%	91.6%
White	71.4%	70.9%	82.9%	82.9%
Infections				
Bronchitis	2.7%	2.1%	2.8%	2.9%
UTI	2.4%	2.2%	2.4%	2.4%
Sinusitis	1.4%	1.4%	1.6%	1.8%
SSTI	3.6%	3.5%	4.1%	4.2%
URI	1.4%	1.6%	1.8%	1.6%

Figure 1. Comparison of antimicrobial-prescribing between the pre-test and intervention periods at 2 intervention EDs and 2 control EDs



As shown in Figure 1, between implementation of the intervention and the end of the study period, intervention sites had a 10.1% relative reduction in antimicrobial use while control sites had a relative increase of 7.1% in antimicrobial use. However, these changes were not statistically significant.

Figure 2. Antibiotic-prescribing in ED visits associated with a diagnostic code for an uncomplicated acute respiratory tract infection at intervention and control sites



As shown in Figure 2, antibiotic-prescribing for uncomplicated ARIs increased from 52.3% (915/1,750) to 56.7% (921/1,624) at control sites (p=0.01) while decreasing from 59.3% (1,402/2,365) to 39.7% (905/2,278) at intervention sites (p<0.01).

Table 2. Guideline-concordant management of 6 common infection types, based on findings from manual chart reviews
Charts were randomly selected for review and were independently evaluated by two adjudicators who were blinded to each site's assignment.

	Intervention sites		Control sites	
	Baseline period (n=240)	Intervention period (n=230)	Baseline period (n=240)	Intervention period (n=225)
Guideline-concordant decision-making	**125 (52.1%)**	**166 (72.2%)**	**123 (51.3%)**	**131(58.2%)**
Antibiotic-prescribed when indicated	55 (22.9%)	73 (31.7%)	54 (22.5%)	69 (30.7%)
Antibiotic not prescribed when not indicated	70 (29.2%)	93 (40.4%)	69 (28.8%)	62 (27.6%)
Guideline-concordant selection	51/55 (92.7%)	68/73 (93.2%)	50/54 (92.6%)	66/69 (95.7%)
Guideline-concordant duration	35/55 (63.6%)	51/73 (69.9%)	34/54 (63.0%)	44/69 (63.8%)

In comparing the baseline and intervention periods, guideline-concordant decision-making improved from 52.1% to 72.2% (p<0.01) at intervention sites compared to 51.3% to 58.2% (p=0.13) at control sites (Table 2).

Table 3. Clinical outcomes at 30-days for patient-visits to 2 intervention and 2 control EDs during the baseline and intervention periods

Secondary Outcomes	Intervention Sites				Control Sites			
	Baseline, %	Intervention, %	Crude RR (95% CI)	Adjusted RR (95% CI)	Baseline, %	Intervention, %	Crude RR (95% CI)	Adjusted RR (95% CI)
Repeat ED visit	17.6	18.7	1.06 (0.88-1.28)	0.88 (0.84-0.91)	17.4	18.7	1.07 (0.89-1.29)	0.89 (0.86-0.93)
Inpatient admission	5.9	6.3	1.06 (0.77-1.47)	0.99 (0.95-1.02)	5.6	5.9	1.04 (0.75-1.45)	0.97 (0.93-1.00)
Late antimicrobial use	21.8	18.8	0.86 (0.72-1.03)	1.03 (0.97-1.09)	21.3	21.5	1.01 (0.85-1.20)	1.23 (1.16-1.30)
***C. difficile* infection**	8.7	5.9	0.68 (0.50-0.92)	0.66 (0.63-0.69)	6.9	9.3	1.33 (1.00-1.77)	1.25 (1.21-1.30)

SUMMARY

- After the implementation of audit-and-feedback at 2 EDs, antimicrobial use did not significantly decrease at intervention sites (Figure 1).
- Antibiotic appropriateness improved at the intervention sites, based on both reductions in antibiotic-prescribing for visits coded as viral ARIs (Figure 1) and by antibiotic decision-making for a select set of common infection types (Table 2). Improvements were not seen at control sites.
- The intervention was safe. Repeat ED visits decreased at all sites. *C difficile* infection rates significantly declined at intervention sites while rates significantly increased in control sites.
- Future studies on audit-and-feedback should include more study sites to improve statistical power and to capture sites with different institutional norms on antimicrobial use.

LIMITATIONS

- We cannot exclude temporal confounding or selection bias.
- Intervention site 2 had assigned a dedicated ED pharmacist to its ED the month before our interventions started, and it is difficult to separate the effect of this new pharmacist from our intervention.
- Thirty percent of manual chart reviews were discordant and had to be re-reviewed by a third reviewer, who was not blinded. However, even after we excluded these charts, guideline-concordant decision-making was still significantly better at intervention sites during the intervention period compared to the baseline period.