

Clinical Decision Support Tool for Antibiotic Prescribing

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Introduction

Microbiological cultures are the gold standard by which infectious diseases are diagnosed and treated. These results take days to finalize thus antibiotic treatment often must be started empirically, informed by prior culture results reported in the Electronic Health Record (EHR). However, these results can be cumbersome to access and integrate into clinical decision-making, resulting in delays to effective treatment

Visualization techniques can be employed to make complex data more easily understood. We hope to show that a visualization tool for viewing prior culture results will better inform ED physician prescribing and decrease administration of antibiotics to the resistant infections.

➤ BIDMC preliminary data:

- 19% of initial antibiotics prescribed for ICU patients in septic shock were later determined to be ineffective by culture results
- Approximately 10% of BIDMC emergency department (ED) patients with past positive culture results received medications for which they had documented resistance

➤ IOM Dimensions of Quality of Care: By enhancing the selection of antibiotics prescribed, both Safety and Effectiveness should improve. Making complex data more easily interpretable will result in increases in Efficiency and Timeliness.

Goal

- Primary objective: to improve physician knowledge of patients' past culture results using a visualization tool, as assessed via a questionnaire
- Secondary outcomes: rate of resistance to the antibiotics ordered, changes in the antibiotic orders made after clinicians view the tool, usability of the tool and decision-making of providers

Team

Emergency Medicine:

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Simmons Usability Lab:

Alyson Gamble, LCIS

Intervention

Date drawn ↑↓	Source ↑↓	Organism ↑↓	PENICILLIN G	AMPICILLIN	OXACILLIN	CEFAZOLIN	CEFTAZIDIME	CEFTRIAXONE	CEFEPIME	AMPICILLIN/SULBACTAM	PIPERACILLIN/TAZOBACTAM	MEROPENEM	LINEZOLID	VANCOMYCIN	CLINDAMYCIN	TRIMETHOPRIMSULFA	NITROFURANTOIN	CIPROFLOXACIN	LEVOFLOXACIN	GENTAMICIN	TOBRAMYCIN	ERYTHROMYCIN	TETRACYCLINE	DAPTOMYCIN
03/22/19	URINE	ESCHERICHIA COLI		I		S	S	S	S	I	S	S				S	S	R		S	S			
01/08/19	URINE	ESCHERICHIA COLI				S	S	S	S	S	S	S				S	S	R		S	S			
01/08/19	URINE	ENTEROCOCCUS SP.		S										S									R	
10/23/18	URINE	ESCHERICHIA COLI		R		R	R	R	R	R	S	S				S	S	R		S	S			
10/23/18	URINE	KLEBSIELLA OXYTOCA				R	S	S	S	R	S	S				S	S	S		S	S			
08/14/18	URINE	KLEBSIELLA PNEUMONIAE				S	S	S	S	S	S	S				S	I	S		S	S			
08/11/18	URINE	KLEBSIELLA PNEUMONIAE				S	S	S	S	S	S	S				S	I	S		S	S			
07/28/18	URINE	ENTEROCOCCUS SP.																						
07/25/18	URINE	ESCHERICHIA COLI		R		R	R	R	R	R	S	S				S	S	R		S	R			
07/25/18	URINE	ENTEROCOCCUS SP.		S									S	R			S						R	
07/22/18	URINE	ESCHERICHIA COLI		R		R	R	R	R	R	S	S				S	S	R		S	R			
07/21/18	URINE	KLEBSIELLA PNEUMONIAE				S	S	S	S	S	S	S				S	S	S		S	S			
07/21/18	URINE	STENTROPHOMONAS MALTOPHILIA														S								
07/04/18	URINE	ENTEROCOCCUS SP.		S									S	R			S						S	
07/04/18	URINE	ENTEROCOCCUS SP.		R										S			S						R	
07/04/18	BLOOD CULTURE	BACILLUS SPECIES; NOT ANTHRACIS																						
07/03/18	URINE	KLEBSIELLA PNEUMONIAE				S	S	S	S	S	S	S				S	I	S		S	S			
06/09/18	URINE	ESCHERICHIA COLI		R		S	S	S	S	I	S	S				S	S	R		S	S			

- A tool to visualize past culture data was iteratively developed with multidisciplinary input (ED, medicine, pharmacy, informatics, surgery)
- After ordering antibiotics on patients, ED physicians will be asked to complete a questionnaire asking whether the patient has known prior resistance to four antibiotics. Providers will be randomized to include use of the visualization tool vs the hospital EHR as a control.
- Encounters are excluded if the research assistant (RA) cannot reach the provider before antibiotics have been administered or cancelled, before the visit is completed, or participation would impede care.
- Surveys will also be administered to participants regarding self-assessment of their decision-making process and the usability of the tool.
- At the end of the study, the rates of ineffective antibiotic ordering and changes to antibiotic orders will be assessed

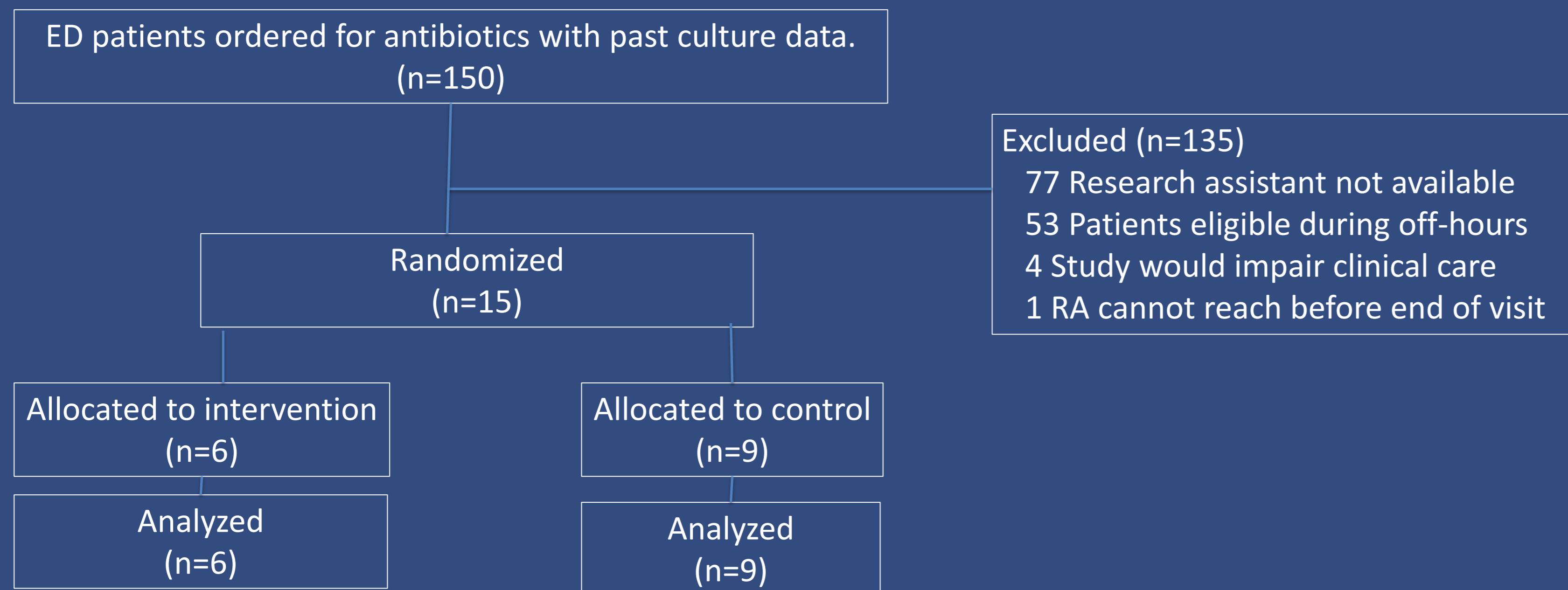
For more information, contact:

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Progress to Date



Evaluation of the tool is currently underway in the ED. Enrollment into the study began on March 1st 2018.

	With tool	Without tool
Understand the previous culture data for this patient	5 [3.5-5]	2 [1-4.5]
Feel like made an informed antibiotic choice	5 [4.5-5]	5 [4-5]
The tool provided new information that you were not previously aware of	5 [4.5-5]	
The tool enabled you to more quickly understand this patient's microbiological	4 [4-5]	
The tool was easy to use	5 [4.5-5]	

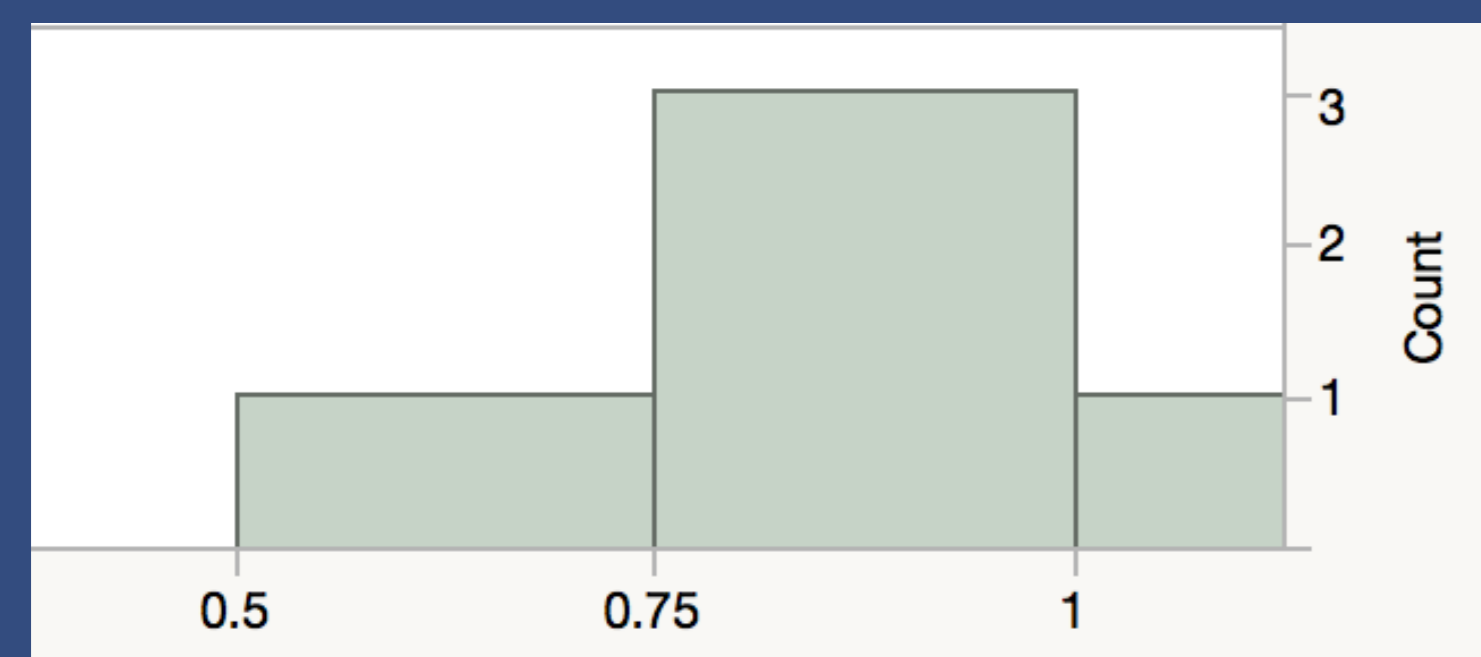
Median and IQR for survey responses regarding usability of the tool (administered to intervention group only) and comfort with the antibiotic decision-making process. Likert scales were used (1 strongly disagree, 5 strongly agree).

Lessons Learned

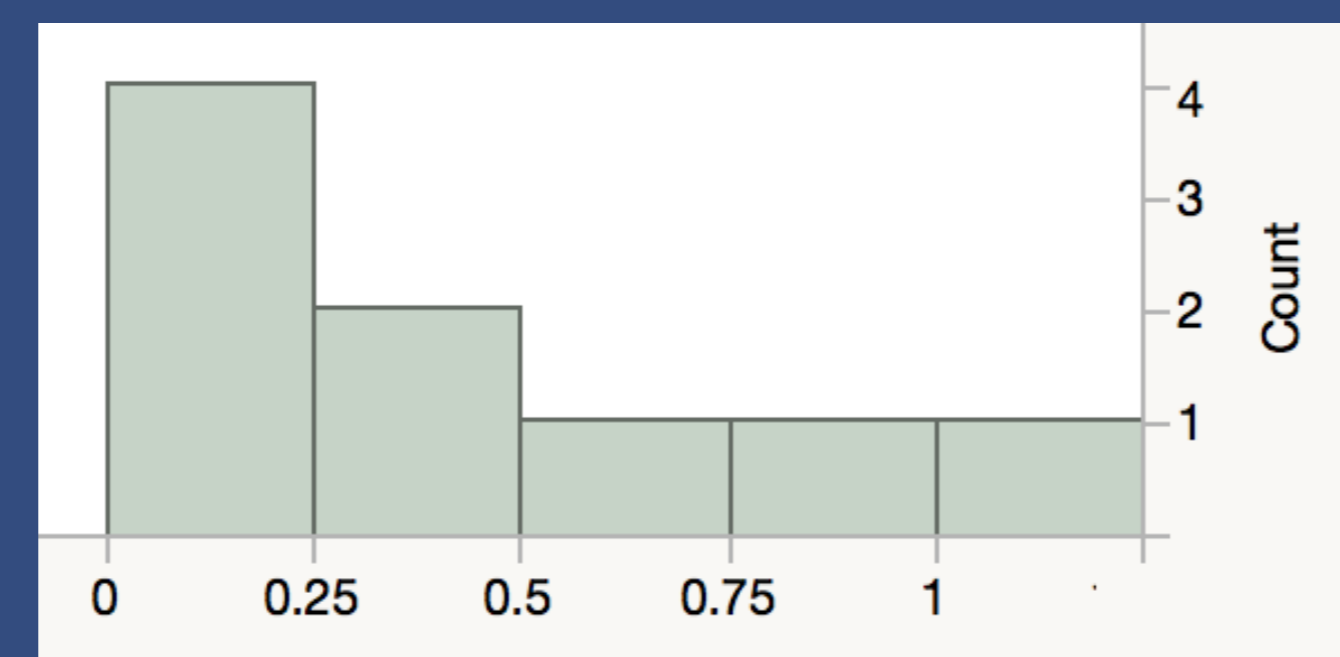
- Both inpatient and outpatient Internal Medicine services have unique challenges for our evaluation as originally planned
- Unobtrusive and efficient methods to reach providers and administer the intervention are difficult
- As “superusers” of the tool, the Antimicrobial Stewardship Team (AST) provides an opportunity to understand in detail how to improve the tool through a usability study in conjunction with the Usability Lab at Simmons College

Next Steps

- Deploy the tool across BIDMC and possibly incorporate into WebOMR
- Usability study with AST to further understand opportunities for improvement
- Continue enhancement of the tool and development of new features
- Further evaluation in different clinical settings



Score using visualization tool
Median 0.75, IQR [0.63-0.88]



Score using standard EHR
Median 0.25, IQR [0-0.63]

Percent of correct responses regarding patients' past antibiotic resistance for the intervention and control groups. Providers were asked if patients were sensitive to four antibiotics according to past records. P=0.063 using a Wilcoxon Singed Rank test with a significance level of 0.05.

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