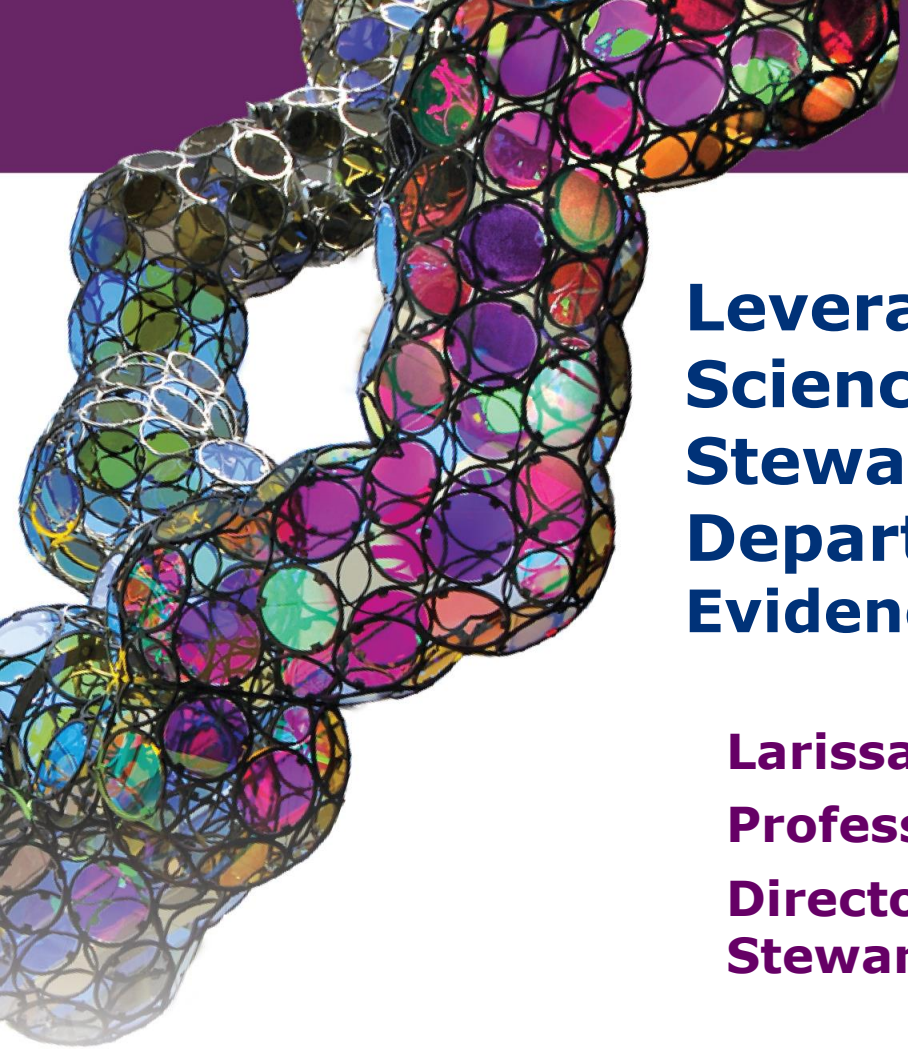
UC DAVIS HEALTH



Leveraging Implementation Science to Improve Antibiotic Stewardship in the Emergency Department:
Evidence and Future Directions

Larissa May, MD, MSPH

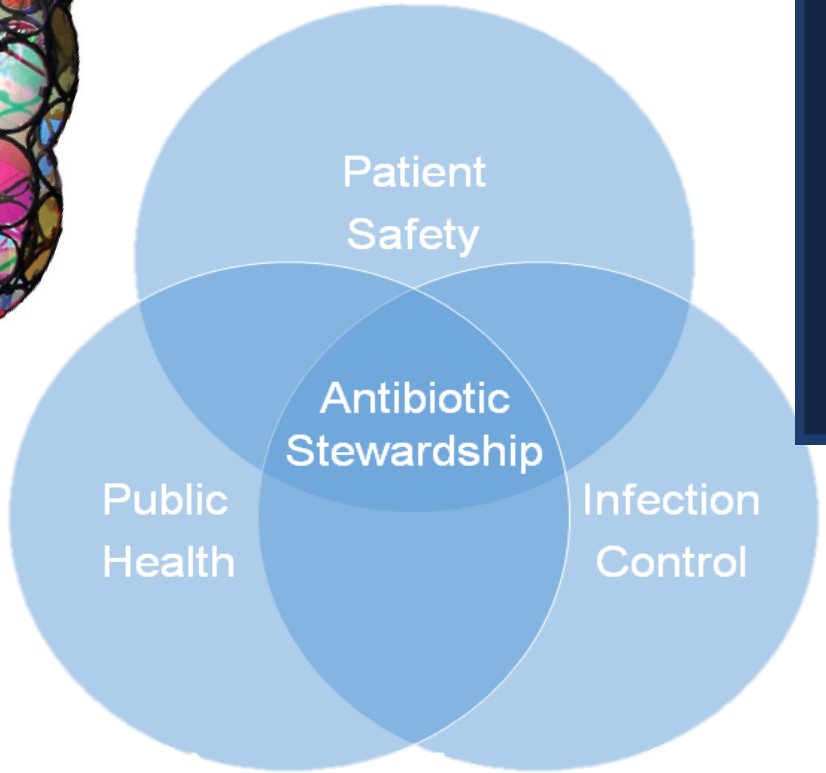
Professor of Emergency Medicine

Director of ED and Outpatient Antibiotic Stewardship

Disclosures

- No relevant financial disclosures or conflicts of interest
- Some of the work presented here was funded by the CDC and the Merck Investigator Studies Program

Why Antibiotic Stewardship?



New National Estimate*

Each year, antibiotic-resistant bacteria and fungi cause at least an estimated:

2,868,700 infections

35,900 deaths

Clostridioides difficile **is related to antibiotic use and antibiotic resistance:**

223,900 cases

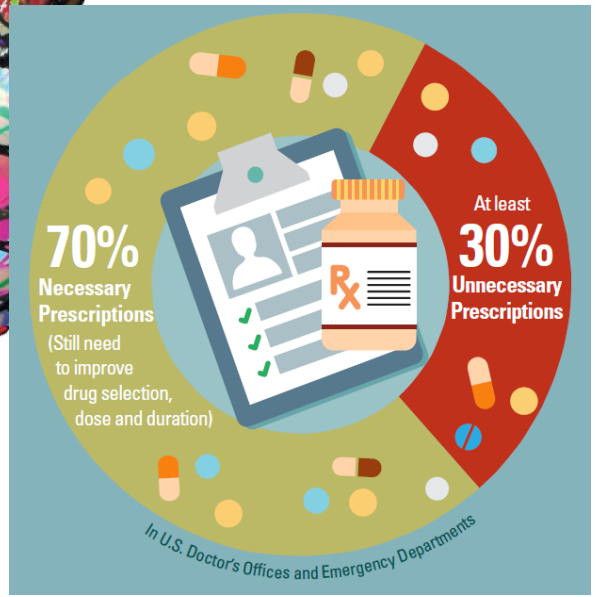
12,800 deaths

Stewardship in the ED

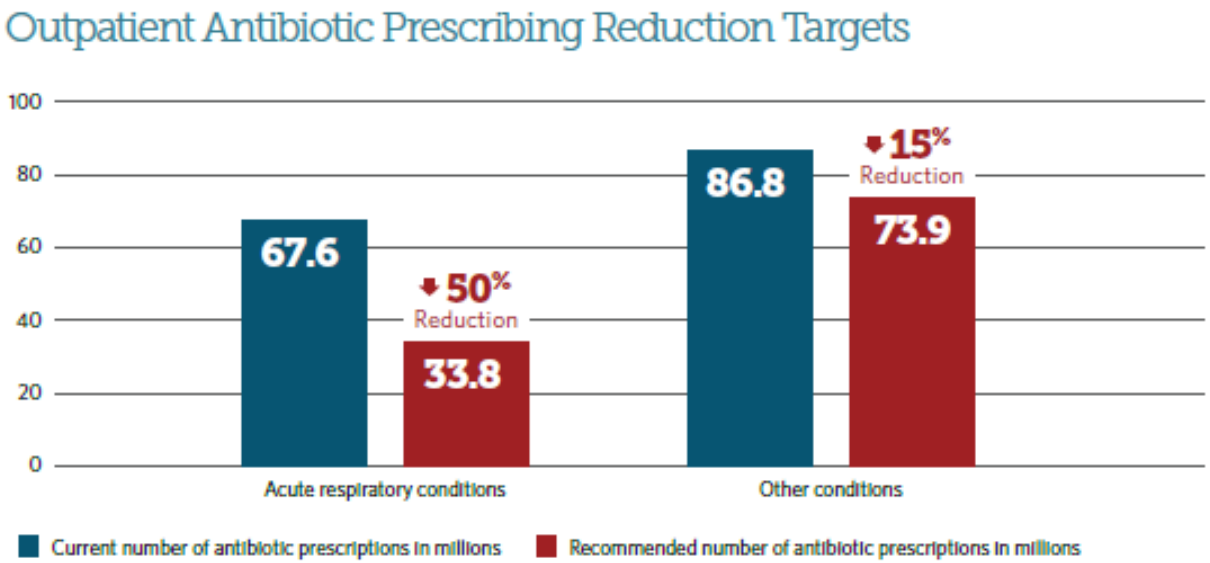
- Opportunity to focus on quality of care
- Nexus of inpatient and community
- Broad spectrum antibiotics often appropriate
  - Sepsis
  - Clinical pathways
- Antibiotic choice often continued in inpatient setting

Where Do We Want to Be?

Setting National Targets



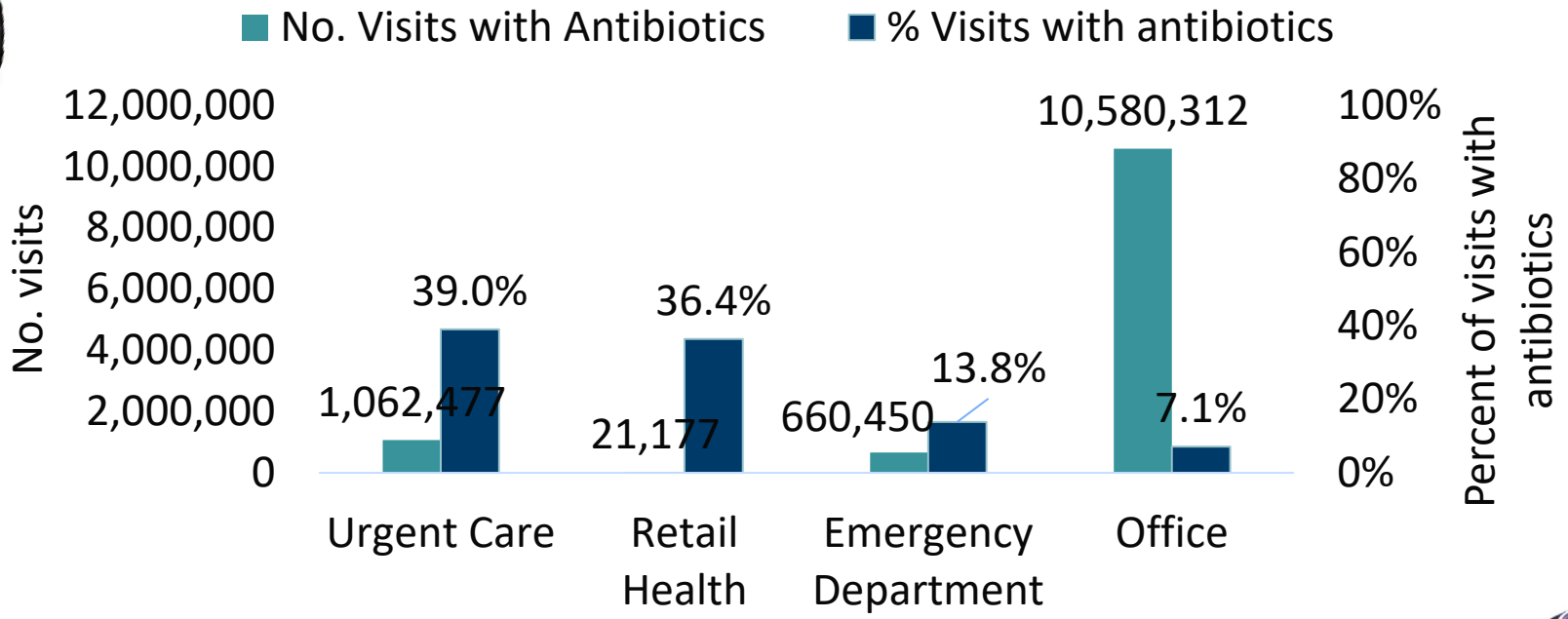
47 million unnecessary antibiotic prescriptions per year



Source: Analysis of NAMCS and NHAMCS data on U.S. antibiotic prescribing, 2010-2011

Fleming-Dutra et al. JAMA 2016;315(17): 1864-1873.
http://www.pewtrusts.org/~/media/assets/2016/05/antibioticuseinoutpatientsettings.pdf;

Antibiotic prescribing per visit by outpatient setting — MarketScan, 2014



Palms D, Hicks L, Hersh AL, et al. *JAMA Int Med.* E-Publish Ahead of print July 16, 2018.

Challenges in the ED

May et al. Multisite Exploration of Clinical Decision Making for Antibiotic Use by Emergency Medicine Providers Using Quantitative and Qualitative Methods

- 1. Survey of 150 ED providers on KAB
- 2. IDI with 21 providers across 8 sites

- **Themes:**
- Resource/environmental factors
- Access/quality of care received outside ED
- Patient-provider relationship
- Clinical inertia
- Local knowledge generation

How Do We Accomplish our Goals?

Core Elements of Outpatient Antibiotic Stewardship

Commitment
Demonstrate dedication to and accountability for optimizing antibiotic prescribing and patient safety.

Action for policy and practice
Implement at least one policy or practice to improve antibiotic prescribing, assess whether it is working, and modify as needed.

Tracking and reporting
Monitor antibiotic prescribing practices and offer regular feedback to clinicians, or have clinicians assess their own antibiotic prescribing practices themselves.

Education and expertise
Provide educational resources to clinicians and patients on antibiotic prescribing, and ensure access to needed expertise on optimizing antibiotic prescribing.

Sanchez GV, Fleming-I

Approaches to stewardship in the ED

- Engage clinicians in existing ASP
- Multidisciplinary collaboration
- Education
- Guidelines and Clinical Pathways
- Peer comparison and other nudges
- Clinical decision support
- Rapid Diagnostics
- Focus on outpatients/care transitions

Clinician Education in Outpatient Setting

- Active programs
- Tailored educational messaging
- Multidisciplinary grand rounds
- Engagement of thought leaders from the specialty/setting
- Unlikely to lead to enduring changes without ongoing oversight

Setting-Specific Guidelines

- Clinical practice guidelines
- Opportunity to tailor based on individual susceptibilities and formulary
- Outpatient antibiograms
- Empiric Antibiotic guidelines
- Education and feedback
- Clinical pathways

Site Pharmacist

- Recent literature suggests pharmacists can be key component of clinical care team
- Facilitate appropriate prescribing
- Define outcome measures for outpatient prescribing
- Culture callbacks

Post-prescription Review

- Inpatient strategy
- Telephone follow-up
- Care coordination
- “Wait and see” approach
- Shorten duration of therapy
- Streamlining
- Need additional funds for outpatient settings

Targets for stewardship in the ED

- Appropriate antibiotics
  - Pneumonia, UTI, miscellaneous bacterial infections
- No antibiotics
  - Bronchitis, bronchiolitis, viral URI, influenza, non-suppurative otitis media, viral pneumonia, asthma, allergy
- Test for bacterial infection
  - Pharyngitis (all-cause)
- Reduction in antibiotics to level of the lowest prescribing region
  - Sinusitis, suppurative otitis media
  - All other remaining conditions

Clinician Education

- **Percival et al, Am J Emerg Med, 2015**

- Pre-post study with educational intervention
  - 350 ED outpatients with uncomplicated UTI
- Primary outcome: guideline adherent empiric tx
- Appropriate empiric antibiotic tx increased from 44.8% to 83% ($P < .001$).
- Driven by increase in nitrofurantoin (cystitis) from 12% to 80% ($P < .001$).
- No change in 30-day repeat ED visits for UTI

Electronic Order Sets

- **Hecker et al, PLoS One 2014**
- Electronic UTI order set then 2 months of feedback
- Women 18-65 with UTI diagnosis
- Outcomes: adherence, antibiotic use, accuracy
- Adherence increased from 44% to 68% (period 1) to 82% (period 2) ($P \leq .015$).
- Rx of FQ for uncomplicated cystitis decreased from 44% to 14% (period 1) to 13% (period 2) ($P < .001$ and 0.7).

Antibiograms

Table 3: ED Antibiograms for *E. Coli* from Uncomplicated UTI Compared to All ED Antibiograms

Antibiogram		Emergency Department, Uncomplicated UTI		Emergency Department, All Urine Cultures		
Antibiotic(s)	Interpretation	Tested	% positive	Tested	% positive	P Value
Ampicillin/Sulbactam	Non-susceptible	51	39.2	869	42.9	0.603
	Susceptible		60.8		57.1	
Cefazolin	Non-susceptible	53	13.2	877	10.5	0.533
	Susceptible		86.8		89.5	
Ceftriaxone	Non-susceptible	52	3.8	869	2.4	0.377
	Susceptible		96.2		97.6	
Ciprofloxacin	Non-susceptible	53	9.4	869	25.2	**0.008**
	Susceptible		90.6		74.8	
Nitro	Non-susceptible	51	3.9	866	8.3	0.424
	Susceptible		96.1		91.7	
TMP-SMX	Non-susceptible	53	26.4	869	33.6	0.281
	Susceptible		73.6		66.4	

How can improve our antibiotic prescribing practices?

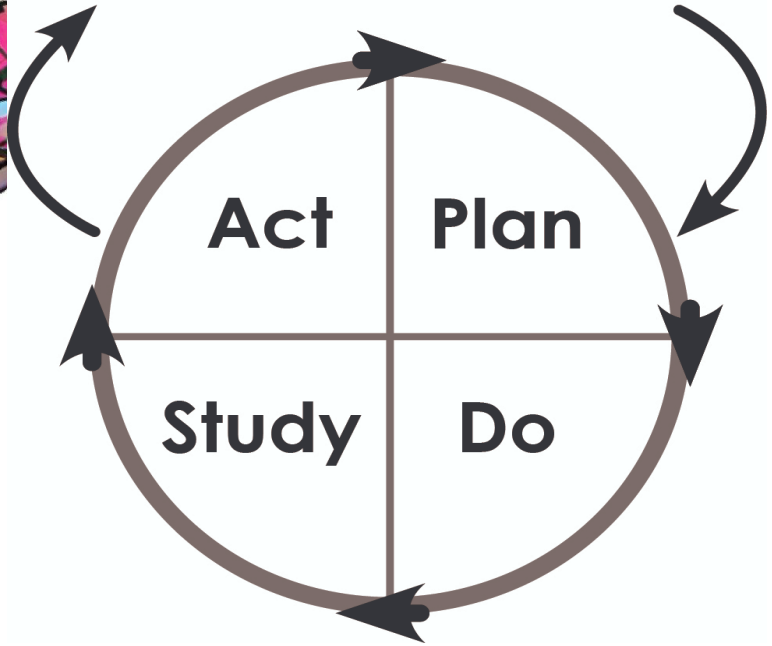
- Identify effective interventions to improve outpatient antibiotic prescribing
- Adapt them to the local context
- Use rigorous implementation science methods
- Disseminate for broader uptake (scale and spread)

Model for Improvement

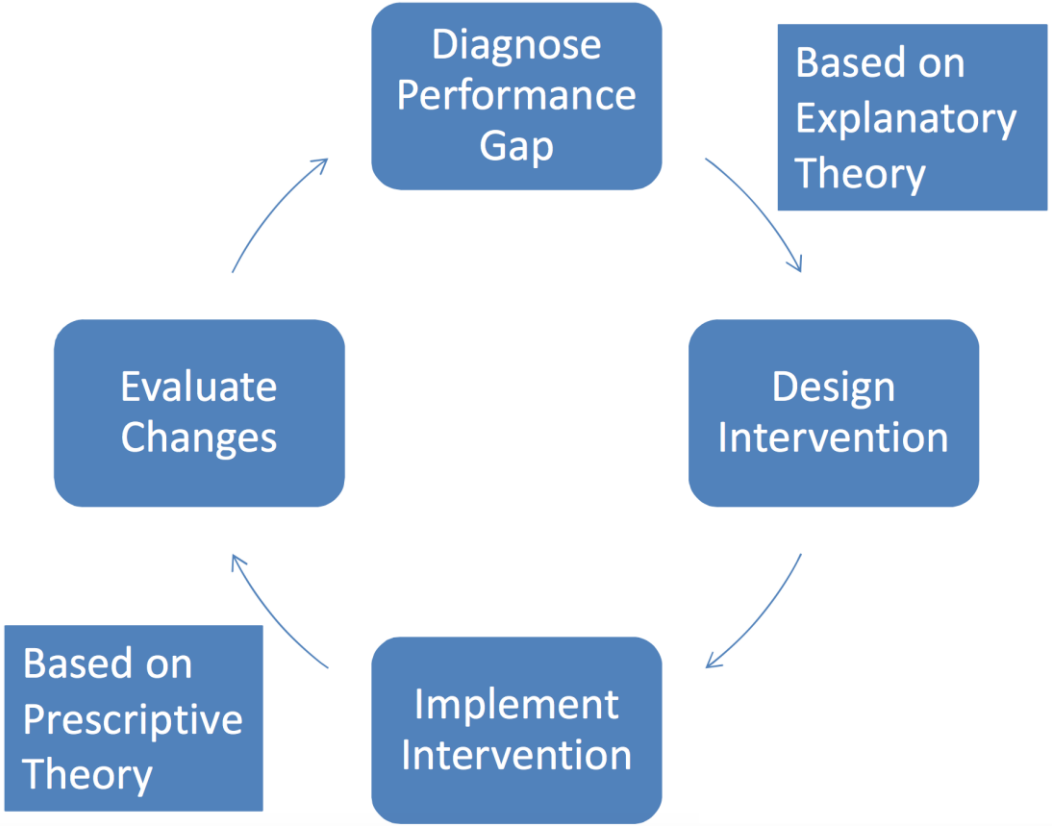
What are we trying to accomplish?

How will we know that a change is an improvement?

What change can we make that will result in improvement?



Implementation Science



Background

- Changing healthcare landscape
- Implementation strategies need to be tested in common healthcare delivery models
  - implementation science expertise is lacking
  - providers accustomed to an environment of quality improvement and emphasis on value-based care

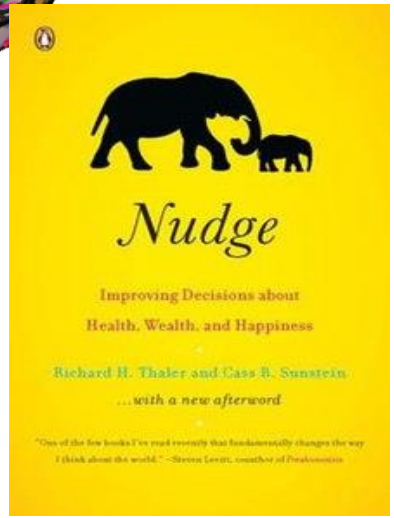
Changing Behavior

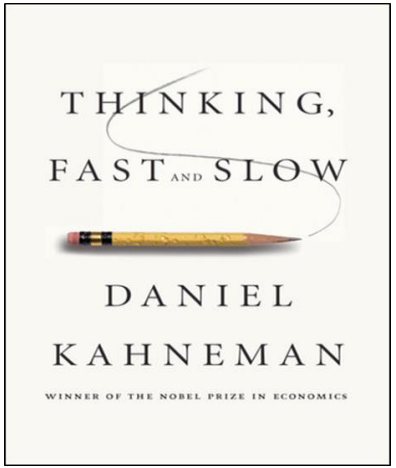
JAMA Internal Medicine

Original Investigation

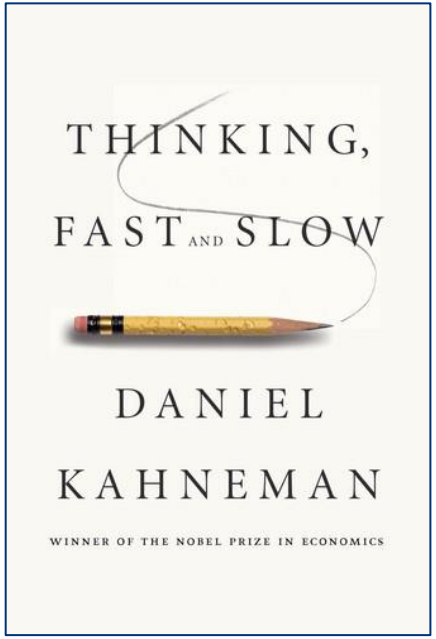
Nudging Guideline-Concordant Antibiotic Prescribing
A Randomized Clinical Trial

Daniella Meeker, PhD; Tara K. Knight, PhD; Mark W. Friedberg, MD, MPP; Jeffrey A. Linder, MD, MPH; Noah J. Goldstein, PhD; Craig R. Fox, PhD; Alan Rothfeld, MD; Guillermo Diaz, MD; Jason N. Doctor, PhD





Two Distinct Cognitive Systems



Automatic	Reflective
Uncontrolled	Controlled
Effortless	Effortful
Associative	Deductive
Fast	Slow
Unconscious	Self-aware
Experience-based	Rule-based

Evidence-Based Quality Improvement

- Educational methods — decisions based on knowledge
  - Guidelines
  - Clinical decision support
- Behavioral methods — decisions influenced by psychosocial factors
  - Communications training
  - Public commitments
- Mixed theoretical basis
  - Audit and feedback with comparisons to peers
  - Academic detailing (one-on-one education)

MITIGATE ANTIMICROBIAL STEWARDSHIP TOOLKIT

https://tinyurl.com/mitigatetoolkit

EMERGENT THEMES FROM SEMI-STRUCTURED INTERVIEWS

Barriers	Facilitators
Patient expectations for antibiotics	Provider education during resident didactics, nursing briefings, department meetings
Providers lack of knowledge of existing guidelines	Incorporation of patient education materials into the triage and discharge processes
Under-utilization of existing patient education materials	Routine display of bilingual patient education materials in triage areas and patient exam rooms
Maintaining awareness of the stewardship program over time	Systematic placement of stewardship material amongst provider spaces

TRIANGULATION WITH SURVEY RESPONSES

Antibiotics are most frequently overprescribed for:	Acute Bronchitis Sinusitis Pharyngitis
Barriers to stewardship:	Patient expectations (78%) Lack of clear guidelines (29%) Lack of access to guidelines (23%)
Preferred method of stewardship:	Provision of guidelines (71%) Electronic decision support (52%) Provider education (37%) Individual feedback (19%)

Evidence

JAMA The Journal of the American Medical Association

ORIGINAL CONTRIBUTION

Effect of Behavioral Interventions on Inappropriate Antibiotic Prescribing Among Primary Care Practices
A Randomized Clinical Trial

Daniella Meeker, PhD; Jeffrey A. Linder, MD, MPH; Craig R. Fox, PhD; Mark W. Friedberg, MD, MPP; Stephen D. Persell, MD, MPH; Noah J. Goldstein, PhD; Tara K. Knight, PhD; Joel W. Hay, PhD; Jason N. Doctor, PhD

JAMA Internal Medicine

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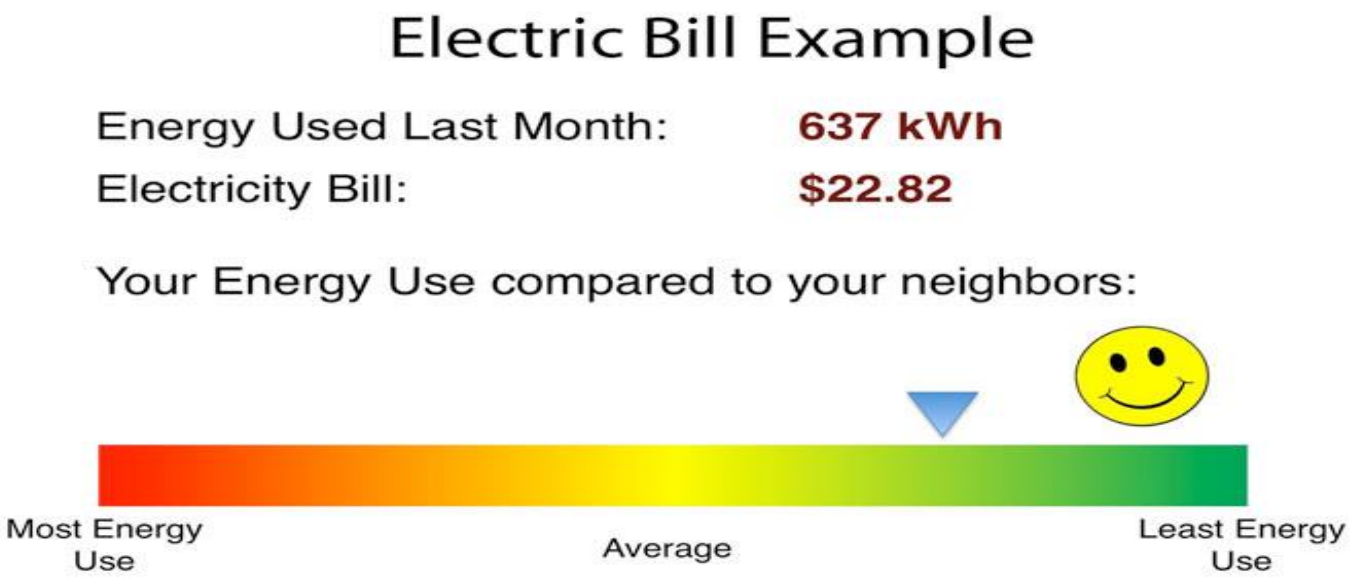
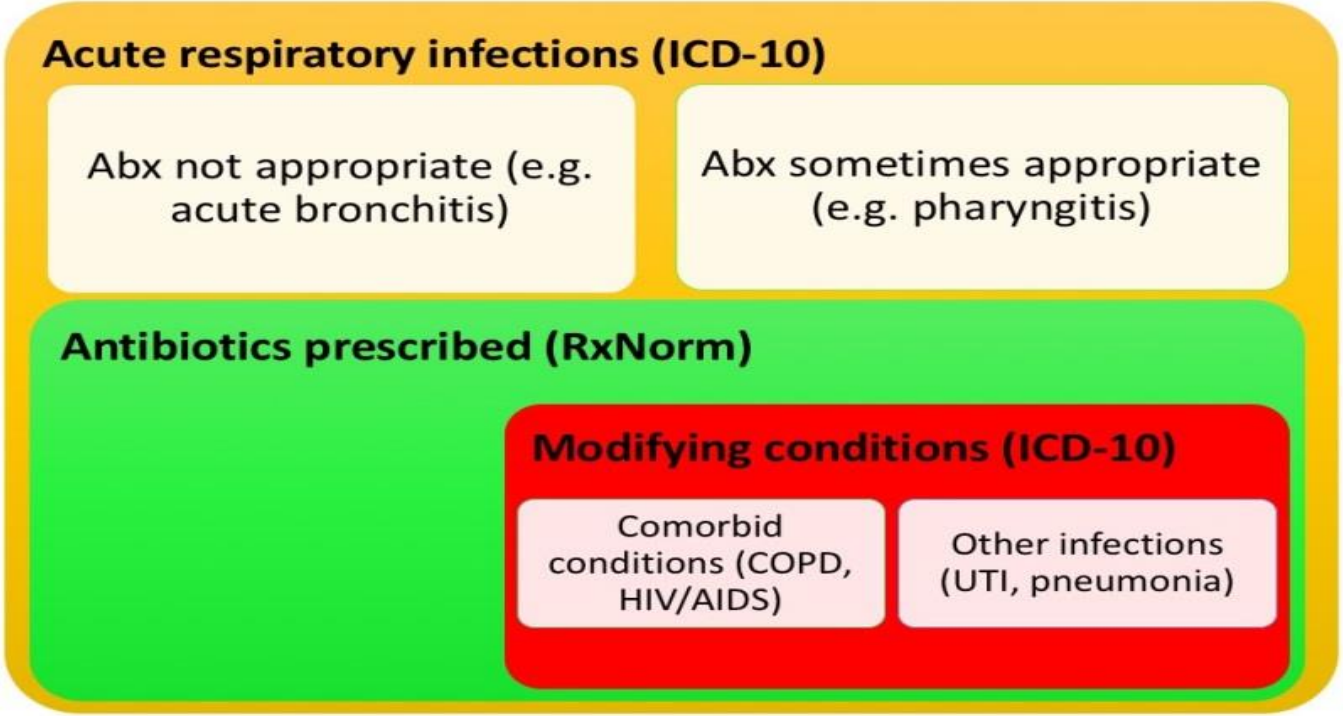
Nudge: Social Norms



Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annu. Rev. Psychol.*, *55*, 591-621.Kallgren, C. A., Reno, R. R., & Cialdini, R. B. (2000). A focus theory of normative conduct: When norms do and do not affect behavior. *Personality and social psychology bulletin*, *26*(8), 1002-1012.

Clinician Feedback



Social Norms: Underperformer

Dear Dr. X,

You were not a top performer in antibiotic stewardship for likely viral infections last week.

You wrote too may unnecessary prescriptions.

Based on your most recent activity, you wrote X prescriptions of Y acute respiratory infection cases that didn’t warrant antibiotics.

Sincerely,
The MITIGATE antibiotic stewardship team

Social Norms: Top Performer

Dear Dr. X,

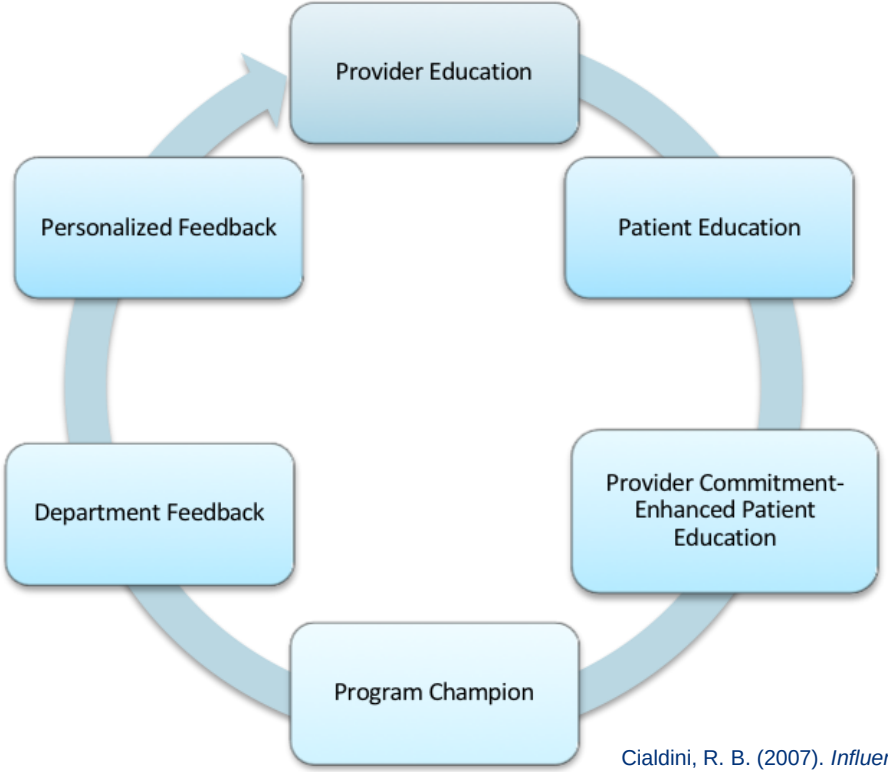
Congratulations! You were a top performer in antibiotic stewardship for likely viral infections last month.

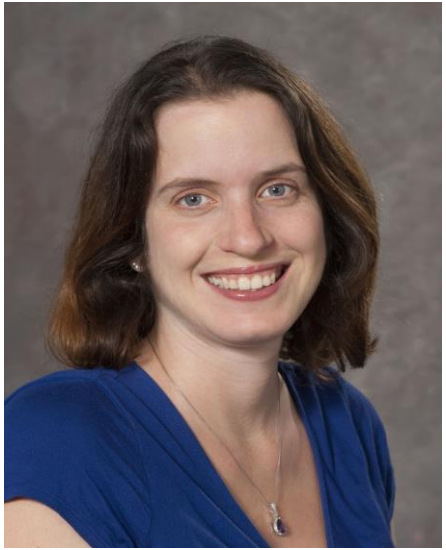
You were in the top 10% of providers.

Based on your most recent activity, you wrote X prescriptions of Y acute respiratory infection cases that didn’t warrant antibiotics.

Sincerely,
The MITIGATE antibiotic stewardship team

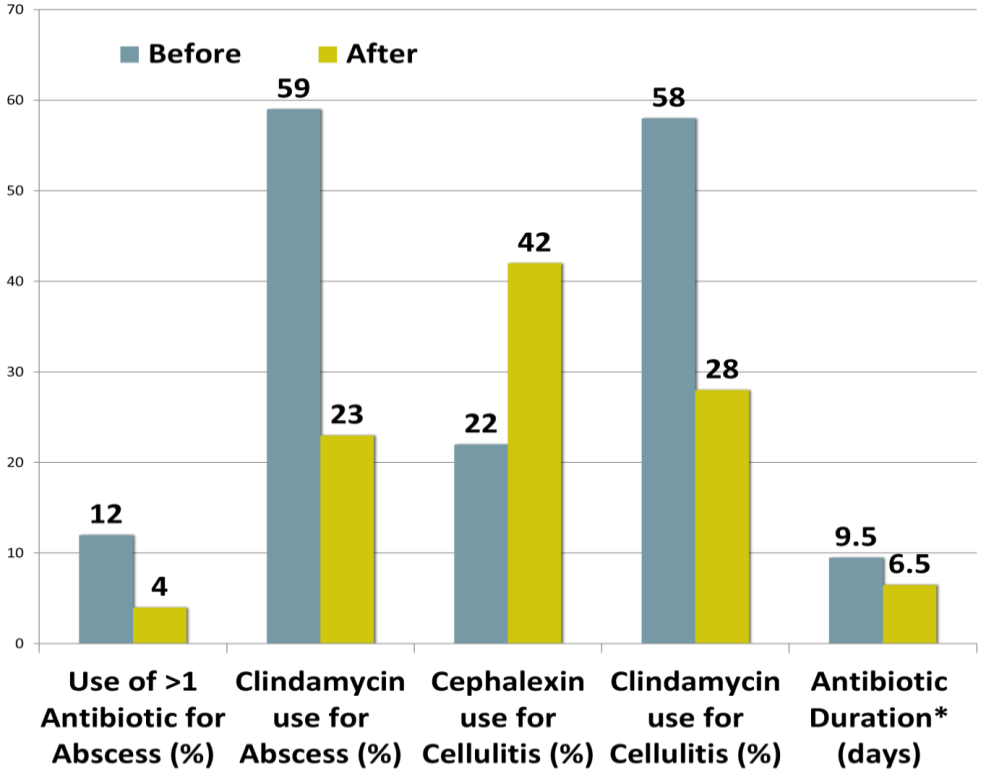
Nudge: Identifiability





Cialdini, R. B. (2007). *Influence: The psychology of persuasion*. New York: Collins.

Results: SSTI stewardship



*Difference of -3.0 (-0.6, -5.3) days (95% CI adjusted for provider cluster effects)

Nudge: Consistency

...We know that giving is important to you, as you have given in the past:

Last Donation	2017 Gift Amount	2018 Gift Amount
12/27/2017	$100	$0

Burger, J. M. (1999). The foot-in-the-door compliance procedure: A multiple-process analysis and review. *Personality and Social Psychology Review*, *3*(4), 303-325.
Sherman, D. K., & Cohen, G. L. (2006). The psychology of self-defense: Self-affirmation theory. *Advances in experimental social psychology*, *38*, 183-242.

A Commitment to Our Patients about Antibiotics

Antibiotics only fight infections caused by bacteria. Like all drugs, they can be harmful and should only be used when necessary. ***Taking antibiotics when you have a virus can do more harm than good: you will still feel sick and the antibiotic could give you a skin rash, diarrhea, a yeast infection, or worse.***

Your health is important to us. As your healthcare providers, we promise to provide the best possible treatment for your condition. If an antibiotic is not needed, we will explain this to you and will offer a treatment plan that will help. We are ***dedicated*** *to prescribing antibiotics* ***only*** *when they are needed, and we will avoid giving you antibiotics when they might do more harm than good.*

If you have any questions, please feel free to ask us.

Sincerely,

MITIGATE Study Commitment Log

By signing below you commitment to the department to prescribe antibiotics only when they are needed, and will avoid giving antibiotics when they might do more harm than good.

Please refer to the CDC letter/poster for additional reading.

Printed Name	Signature	Badge Reel	Pin	Commitment Poster Signature
John Doe	John Doe	☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

Public Commitment

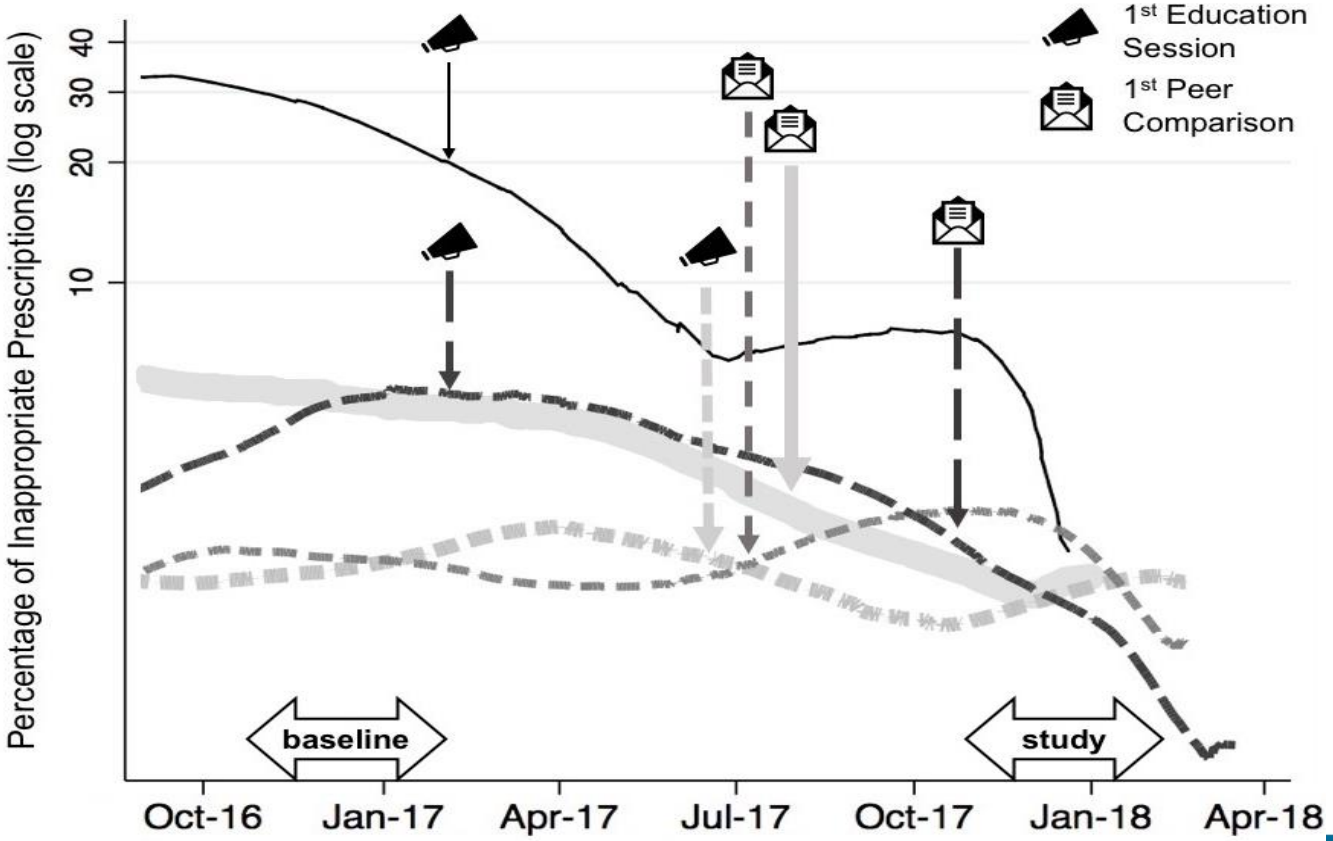
"We need to talk about your flair"

All-Setting Acute Care Modifications
Bilingual patient education posters, brochures and handouts from CDC Get Smart campaign materials
Provider public commitment flair (badges; pins) and signing of commitment logs
Monthly individualized provider feedback and peer comparison of antibiotic prescribing practices
Stewardship program education in monthly department meetings & daily nurse briefings
Viral prescription pads & discharge workstations supplied with educational handouts for patients to fit clinical workflow

Implementation Components

Component	Acute care examples	Behavioral Basis
Provider education	Staff meeting educational presentations on stewardship as patient safety, smartphone apps	Knowledge translation, injunctive social norm
Patient education	CDC GetSmart waiting room posters, Choosing Wisely brochures given at triage, viral prescriptions	Priming, managing expectations, injunctive social norm
Provider Commitment	Physician-worn “flair” (pens, pins, etc.) that is thematically consistent with the CDC GetSmart posters and brochures	Consistency w/ prior commitment professional self-image
Physician champion	Designated physician at each site who will lead provider education and be an advocate for antimicrobial stewardship	Accountability to peer leader
Departmental Feedback	Monthly aggregate of antibiotic prescribing practices for ARI from electronic health record data provided to departmental leadership	Hawthorne Effect; descriptive norm
Provider feedback and education	Case-based educational rounds with a stewardship consulting service, available by consultation for patient-related issues	Social learning, modeling behavior
Peer-comparison using personalized Audit and Feedback	Personalized monthly performance ranking receiving designation of being a “top performer” (top decile) or “not a top performer” for appropriate prescribing delivered by email* or provider dashboard	Descriptive social norms, professional self-image
Electronic clinical decision support	Provider dashboards, antibiotic justification during order entry, viral ARI order sets to facilitate supportive care measures	Descriptive social norms, injunctive norms, managing expectations

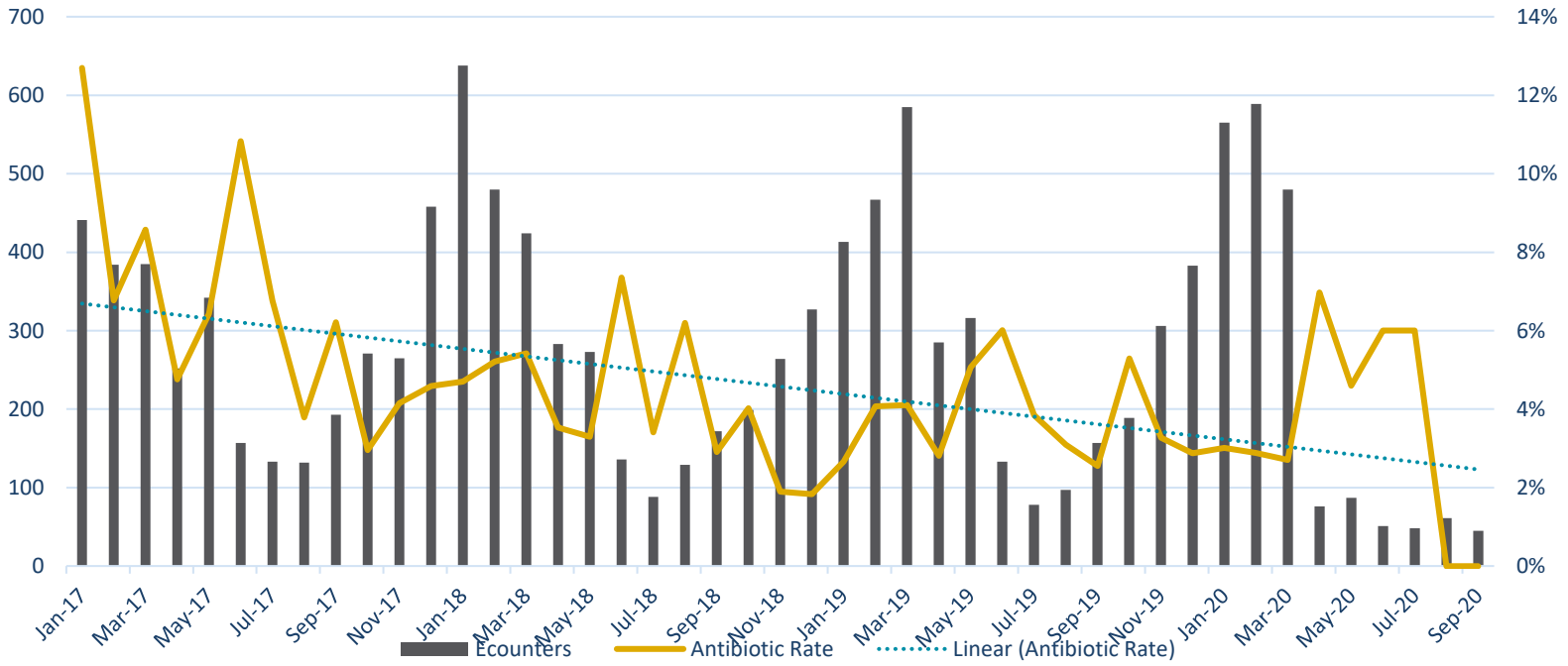
Reduction in Inappropriate Rx



Implementation outcomes

- **Acceptability**
  - 84% agree antibiotic stewardship is important
  - 10% believe stewardship interferes with usual practice
- **Fidelity**
  - 100% of interviews
  - 52.4% of pre-implementation surveys
- **Adoption**
  - 99% public commitment signatures
  - 92.6% display of public commitment flair

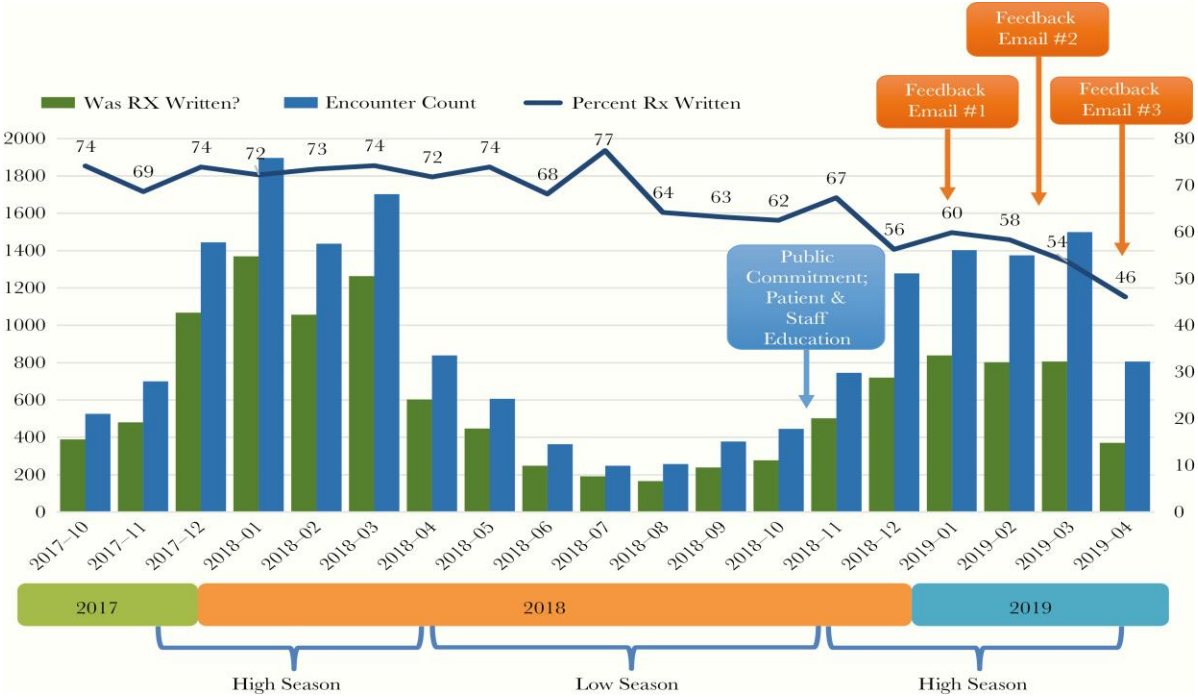
Emergency Department Encounters-Viral URI



Limitations

- Sites all academically-affiliated and located in 2 states
  - Local context and culture will differ elsewhere
- Did not look at sustainment or harms
  - Other implementation theories exist that emphasize other aspects of practice change
- Toolkit is publicly available
- Testing for scale and spread

Trends of acute respiratory tract infection prescribing in rural urgent care setting



Open Forum Infect Dis, Volume 7, Issue 7, July 2020, ofaa174, https://doi.org/10.1093/ofid/ofaa174

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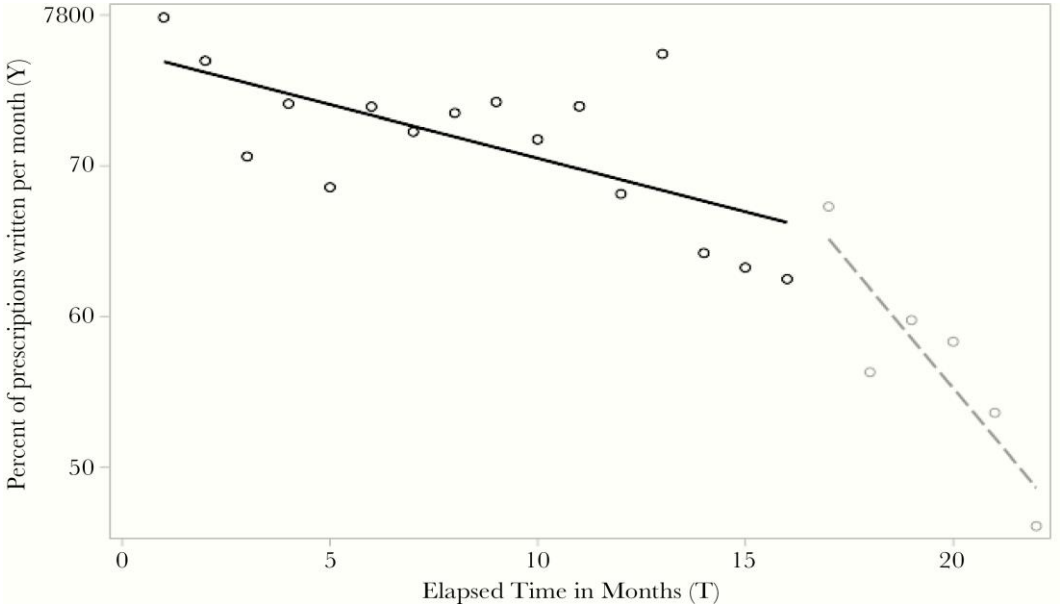

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LESSONS LEARNED

- Nudges
  - Formal commitment (consistency)
  - Local champion (identifiability)
  - Comparisons (social norms)
- Clinician buy-in
  - Low hanging fruit
- Operational support
- Implementation science and QI =framework for evidence-based program implementation

ED Collaborative Participants


ANY
QUESTIONS?