Duke Center for Antimicrobial Stewardship and Infection Prevention: Research Update

11/17/2023

Duke University School of Medicine

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Duke Center for Antimicrobial Stewardship and Infection Prevention

Goals

- Highlight research contributions from DICON and DASON Hospitals
- Highlight research results you can use

- Several speakers highlighting work by topic area
- High-level overview: 1) recent publications, 2) ongoing projects, and 3) upcoming research opportunities

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Antimicrobial Stewardship Research

Rebekah Moehring, MD, MPH

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How can we use NHSN Antimicrobial Use (AU) Option Reports for ASP evaluations?

- Translating output from NHSN to Action
- Visualizations of AU data that are helpful for program assessments
- Clinical scenarios or questions where NHSN reports are helpful

Funding: CDC SHEPHeRD

Leveraging National Healthcare Safety Network Antibiotic Use Option to Inform, Implement and Assess Antibiotic Stewardship Activities

CLINICAL SCENARIOS

Category 1: Using AU Data to Identify and Inform Stewardship Opportunities for High Antimicrobial Use

+ 1. Individual SAAR category
+ 2. Targeted antimicrobial within a SAAR category
+ 3. SAAR category on a targeted unit type
+ 4. Specific antimicrobial in a select population

METRIC GUIDES

- **Manipulations of NHSN Extracts**
  - Specific Antimicrobial use bar chart
  - Antimicrobial use by route of delivery
  - Antimicrobial specific DOT/1000 days present
- **Combining NHSN Data with Additional Data from Local Sources**
  - Antimicrobial-specific Average Length of Therapy
  - NHSN Infection Rate Extracted to Combine with Antibiotic Data
- **Metrics Using Local Data Sources**
  - Antimicrobial use by Indication
  - Durations based on date of event
  - Percent of Patient Admissions receiving a Specific Antimicrobial
  - Targeted admissions denominator (diagnosis code or antibiotic use)
  - Provider Specific Prescribing (DOT)
  - Provider Specific Prescribing- Stratified by Route or Indication
  - Laboratory Test Utilization Rate
  - Culture Rates

Work Funded by Centers for Disease Control & Prevention SHEPheRD

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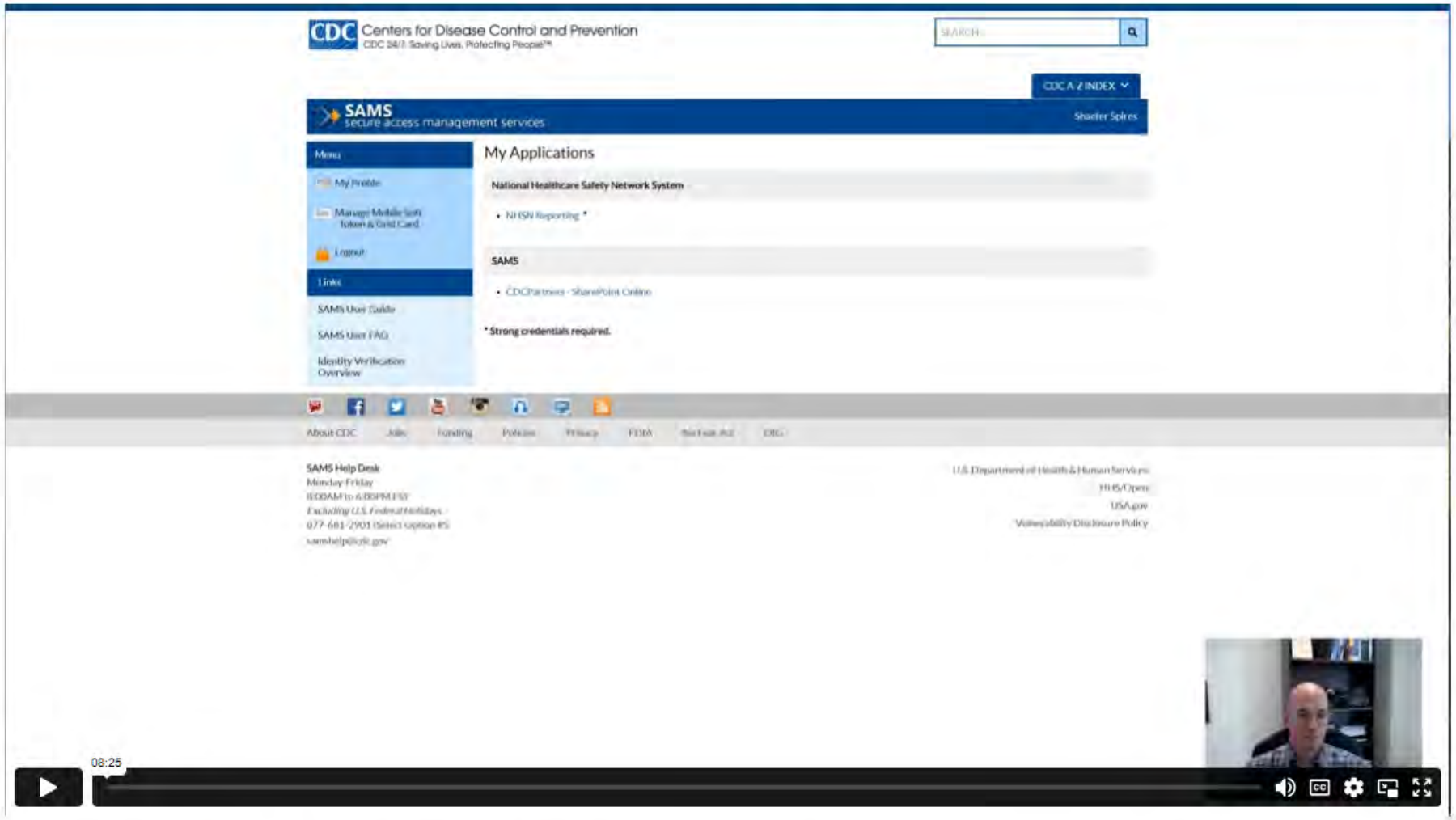
Percent of Patient Admissions receiving a Specific Antimicrobial



Click the full screen icon to view the video on the full screen, press the Esc key to return to previous video window.

Reference article: Percent of Patient Admissions receiving a Specific Antimicrobial PDF

Determine feasibility of three antimicrobial stewardship interventions targeting post-discharge antibiotics among community hospitals

- **Rationale:**
  - 40-60% of the total antibiotic course is prescribed post-discharge
  - Proposed interventions feasible? Scalable?
- **Study Design:** Quasi-experimental feasibility study
- **Setting:** 10-15 DASON network hospitals reporting discharge prescriptions to track total duration (inpatient and outpatient LOT).
- **Action:** Hospitals will pilot implementation of 3 stewardship interventions at the time of discharge prescribing.
- **Expected Result:** Measure and track total antibiotic duration and implement a discharge stewardship intervention to decrease overall duration of antibiotic therapy.

On-site retail pharmacy	• *Steward:* Discharge pharmacy (meds to beds) staff • *Intervention*: 1:1 prescriber feedback
Hot-line for off-site community pharmacies	• *Steward:* Community retail RPh • *Intervention*: Direct contact line between pharmacist and prescriber
Case management rounds	• *Steward:* Inpatient RPh • *Intervention*: Pre-discharge prescription planning

Funding: CDC Prevention Epicenter

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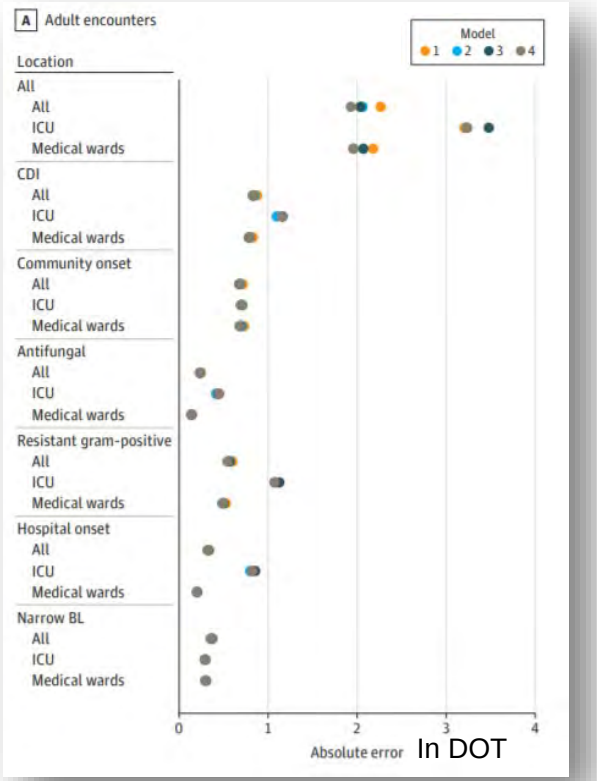
Feasibility and Utility of Robust Antibiotic Use Risk-adjustment (R-SAARs) in Antimicrobial Stewardship Program Assessments

- Rationale:
  - Benchmarking antibiotic use among hospitals is limited by differences in case mix.
  - Standardized Antimicrobial Administration Ratio (SAARs) only use a few (7) risk adjustment factors on facility/location level.
  - Prelim data: Encounter-level data from EHR can improve model accuracy – especially diagnosis information.
- Aim 1: Feasibility of Data collection + application of risk-adjustment models using encounter-level datasets
  - 4 Strategies: Yu, Goodman, Agnostic, (New) PEP Adjudicated
- Aim 2: Qualitative response from end-users (Usability, Value)



Funding: CDC Prevention Epicenter

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Yu et al. CID 2018;67(11):1677–85
Goodman et al. CID 2021;73(11): e4484-e4492
Moehring et al. JAMA Netw Open. 2021;4(3):e213460. doi:10.1001/jamanetworkopen.2021.3460

R-SAARs Collaborators (N=50 Hospitals)

- Academic and Community hospitals
  - Chicago, Hopkins, Utah, Intermountain Healthcare
  - DASON sites with full data
  - UNC and Duke University Hospitals
- Expert/PI panel: Select modeling strategy
- Comparative data feedback to end users:
  - Report #1: Raw Rates and Existing SAARs
  - Report #2: R-SAARs Report
- Hospital ASPs' Survey response: Are R-SAARs useful in assessing your ASP?

Accuracy/Fit	Absolute error (Mean)
Interpretability, Transparency	Acceptance from users Face validity of input variables Direction/degree of effects
Feasibility (Transportability, Durability)	Difficulty in measurement and reporting Missingness among input variables IT resources and maintenance
Equity	Age Sex Race/ethnicity Hospital Size Insurance Status

New Opportunity for DASON Participating Hospitals!

- **What:** New Reports based on Risk-adjusted Antibiotic Use Data for your hospital, using patient encounter level data that we already have for your facility
- **When:** September 2023- June 2024
- **Why:** Current CDC NHSN risk adjustment models for antibiotic use include only facility-level risk factors. Perhaps you, like many stewards have wondered if patient level factors would allow more robust risk adjustment. This is not currently possible in NHSN because the antibiotic use dataset does not include such granular data. At DASON, we are working with the CDC to determine if encounter level data would allow better risk adjusted comparisons of antibiotic use and assess if such data capture is feasible for NHSN.
- **How:**
- 1. We will create two new reports for you/your ASP team using data already captured in the DASON data extracts.
- 2. You will review these reports with your DASON liaison and be asked to provide feedback via an easy to complete RedCap™ Survey
- 3. A few sites will be asked to participate in a virtual interview to give more detailed feedback about the reports- this is optional.

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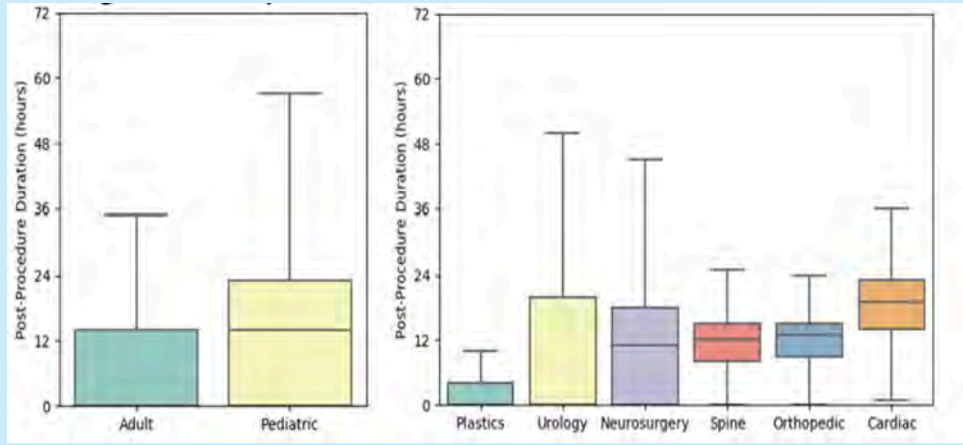
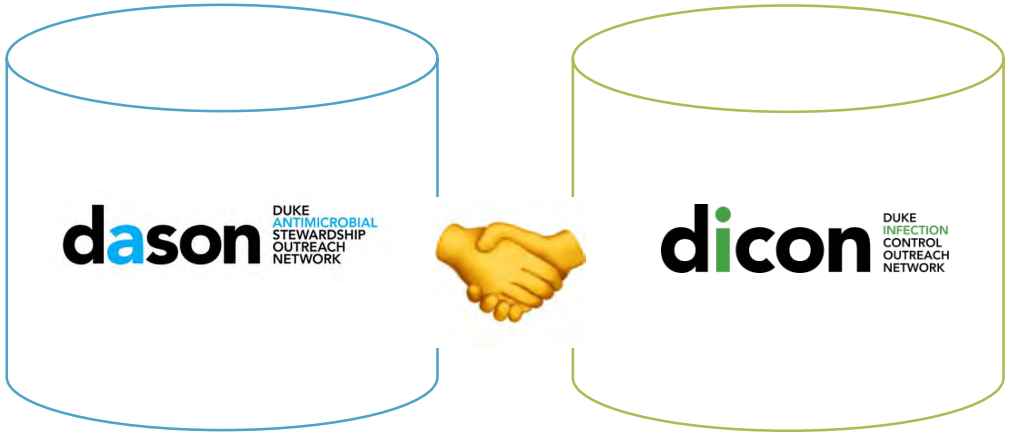
For questions contact your DASON pharmacist liaison or Dr. Rebekah Moehring,
rebekah.moehring@duke.edu

UPCOMING: Quantify the occurrence of extended durations of post-procedural antibiotics and associated adverse events to identify targets for hospital ASP intervention.

- **Rationale:** Large Variation in post-operative prophylaxis durations. VA Data: Extended prophylaxis linked to adverse events without benefit of SSI prevention
- **Setting:**
  - **Large Cohort (DICON/DASON)**
  - **Limited Cohort (UNC/Duke system) with clinical outcomes of interest**
- **Methods**:
  - Design: Retrospective cohort study
  - Outcome(s): Post-procedure duration of antibiotics, surgical site infections
  - Analysis 1: Descriptive; evaluate outcome distributions for post-procedure duration of antibiotics among procedure types and hospitals.
  - Analysis 2: Regression modeling; estimate the association between post-procedure duration of antibiotics with surgical site infection (primary), CDI (secondary) and AKI (secondary)

Figure. Post-procedure antibiotic durations in DUHS





Funding: CDC Prevention Epicenter; Project PIs: Michael Yarrington, Nick Turner

Biggest Benefit = Shared Experience


REVIEW

THE AMERICAN JOURNAL of MEDICINE

Top Myths of Diagnosis and Management of Infectious Diseases in Hospital Medicine

Melissa D. Johnson, PharmD, MHS, Angelina P. Davis, PharmD, MS, April P. Dyer, PharmD, MBA, MSCR, Travis M. Jones, PharmD, S. Shaefer Spires, MD, Elizabeth Dodds Ashley, PharmD, MHS
Duke Antimicrobial Stewardship Outreach Network (DASON), Duke University Medical Center, Durham, NC.

Johnson et al. Am J Med 2022; 135(7):828-835.

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- *"Clinicians are often presented with medical statements that are either more opinion than robust evidence, or wherein the evidence has evolved yet perception remains unchanged."*
- *"Today's teaching point may end up as tomorrow's myth."*

	DEBUNKED **Top Myths**
1	Antibiotics Do No Harm.
2	Antibiotic durations of 7, 14, 21 days are typically necessary.
3	If 1 drug is good 2 (or more) must be better.
4	Oral antibiotics are not as good as IV antibiotics for hospitalized patients.
5	Bacteria in the urine signifies a UTI and should be treated. Cloudy or smelly urine indicates your patient has a UTI.
6	A history of a penicillin allergy means the patient can never receive a beta-lactam antibiotic.
7	Antibiotics for surgical prophylaxis should typically be continued for at least 24 hours.
8	Antibiotics are necessary if drains are in place.
9	Nitrofurantoin can be used for UTIs only if CrCl exceeds 60 mL/min.
10	Fluoroquinolones remain an excellent first-line option for most common infections.

Urinary Tract Infection

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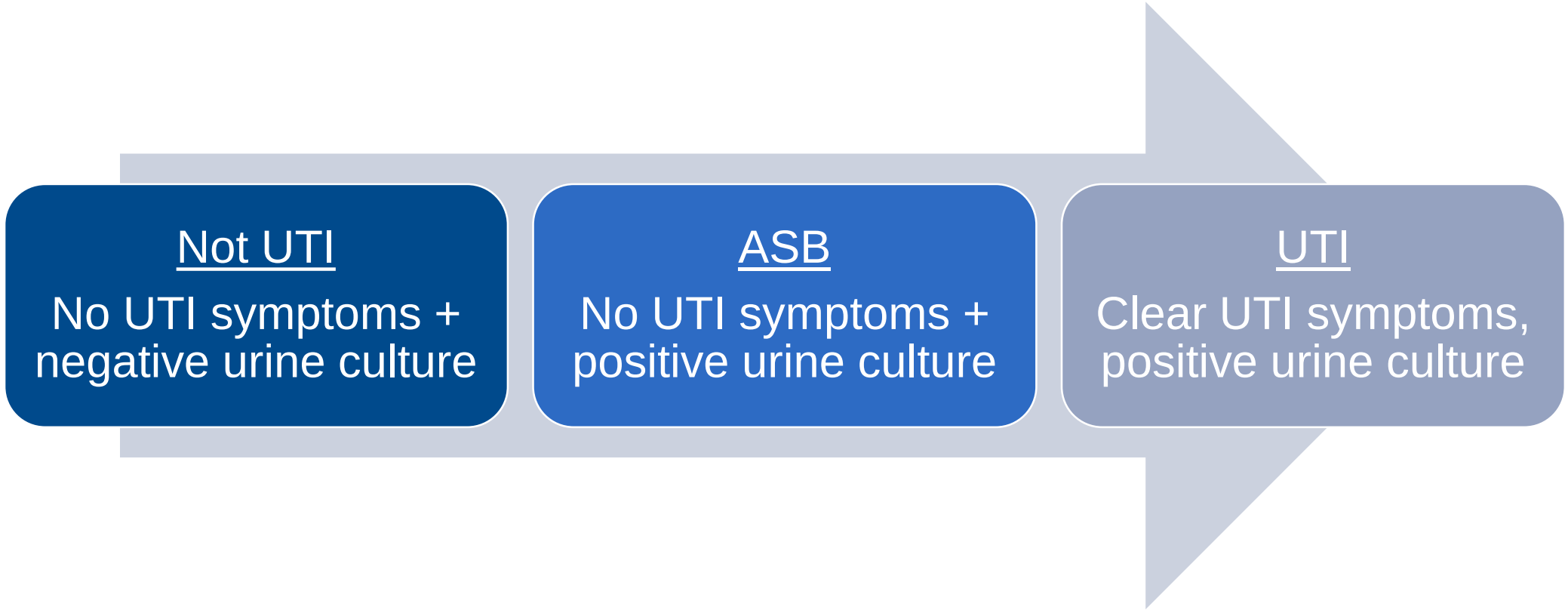
Background: Existing UTI categorization



UTI – Urinary tract Infection, ASB- Asymptomatic Bacteriruia

Nicolle LE, Gupta K, Bradley SF, et al. Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2019;68(10):1611-1615. doi:10.1093/cid/ciz021

Objectives

Our objectives were

- To understand the clinical presentation of patients who receive urine tests in a cohort of diverse hospitals
- To define new categories for patients that do not meet the classical UTI definition
- To compare the performance of different UA parameters in predicting UTI

Methods

Inclusion criteria: All adult inpatients 18 years of age or older without an indwelling urinary catheter in place at the time of urine culture, but with paired UA and urine cultures

Retrospective chart reviews of 3000-4000 eligible patients from 5-10 study hospitals from 2017-2019

Trained abstractors (Duke, SOVAH and WellStar trainees) collected clinical and demographic data into a 60-question Redcap survey

Focus Group discussion of multidisciplinary experts (ID, geriatrics, urology) to define the “continuum of UTI”

Newly defined categories were compared to current UTI categories defined by IDSA guidelines

Evaluate relevant UA parameters (alone and in combination) in predicting UTI by assessing sensitivity, specificity, NPV and PPV

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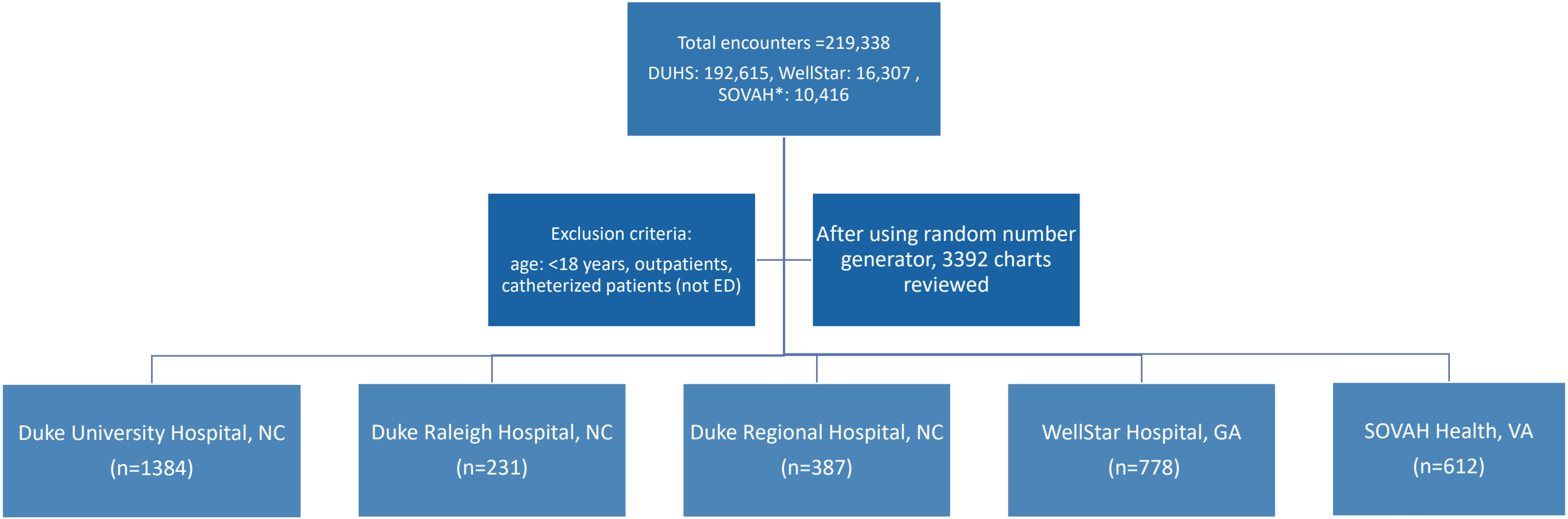
Advani et al, “Proposing the ‘Continuum of Urinary Tract Infection (UTI)’ for a Nuanced Approach to Diagnosis and Management of UTIs”, under revision, *Journal of Urology*

Strobe diagram



Advani et al, "Proposing the 'Continuum of Urinary Tract Infection (UTI)' for a Nuanced Approach to Diagnosis and Management of UTIs", under revision, *Journal of Urology*

UTI Categorization comparison (NIDDK K12 award Advani)

Chart review team

- **WellStar:** Rachel Johnson MD, Yassmin Rosshandler DO, Adero Francis MD, Sahra Ahmadi MD
- **SOVAH:** Faryal Mirza MD, Sarah Pardue MD, Anum Hasan MD
- **Duke Medical Students:** Meghana Rao MD, Julia Denniss, Helen Yang MD

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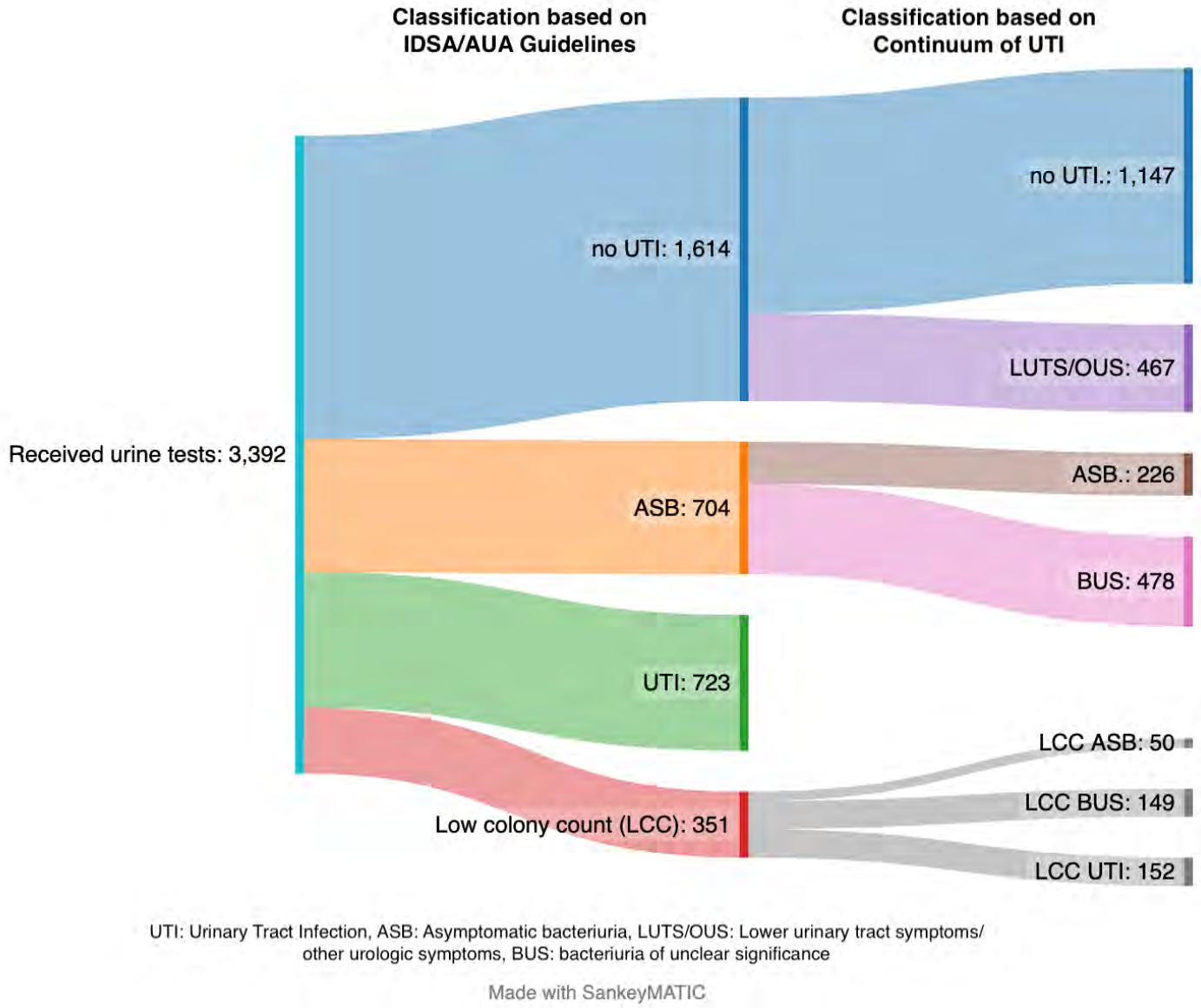

Advani et al, "Proposing the 'Continuum of Urinary Tract Infection (UTI)' for a Nuanced Approach to Diagnosis and Management of UTIs", under revision, *Journal of Urology*

Performance of Urinalysis (Epicenters Aim 3)

Table 2: Performance of Individual Urinalysis (UA) Parameters in Predicting UTI (all patients, 3392)				
UA Parameter	**Sensitivity**	**Specificity**	**PPV**	**NPV**
Leukocyte esterase				
≥ Trace	0.90	0.49	0.33	0.95
≥ 1+	0.88	0.50	0.33	0.94
≥ 2+	0.21	0.80	0.23	0.79
WBC count/hpf				
≥ 5	0.92	0.43	0.32	0.95
≥ 10	0.84	0.55	0.35	0.92
≥ 20	0.70	0.66	0.37	0.89
Nitrite				
Positive	0.48	0.83	0.43	0.86
Bacteria count/hpf,				
5-50	0.20	0.77	0.20	0.77
> 50	0.72	0.71	0.41	0.90
Yeast count/hpf				
Positive	0.07	0.94	0.23	0.80

Table 3 Complete Performance Estimates for the 5 Models with the Best Area Under the Receiver Operating Characteristic Curve (AUROC) Performance				
Model	**Test Rule**	**AUROC**	**Sensitivity**	**NPV**
Model 6, N=3230	>=20 WBCs or Nitrite	0.7093	0.83	0.92
Model 1, N=3347	>Trace LE or Nitrite	**0.7069**	0.94	**0.97**
Model 5, N=3231	>=10 WBCs or Nitrite	**0.7061**	0.91	**0.95**
Model 2, N=3347	>=1+ LE or Nitrite	**0.7039**	0.93	**0.96**
Model 9, N=3206	>=2+ LE or >=20 WBCs or Nitrite	0.6865	0.91	0.95

Table 4: Performance of Pyuria (>10WBCs/hpf) on urinalysis in Predicting UTI based on age, sex, and urine culture thresholds				
	Sensitivity	**Specificity**	**PPV**	**NPV**
Females <65yrs	0.80	0.57	0.38	0.90
Females ≥ 65yrs	0.81	0.45	0.34	0.87
Males <65yrs	0.82	0.67	0.25	0.97
Males ≥ 65yrs	0.95	0.59	0.38	0.98
<100,000cfu/ml	0.80	0.57	0.40	0.89

Advani et al, Investigating Urinalysis Criteria that Predict UTI: Impact of age, sex, and urine culture thresholds, IDWeek 2023

Conclusion

- Rigorous review of laboratory and symptom data from a diverse population dataset
- Diagnostic uncertainty exists when assessing patients with suspicion for UTI
- Combined UA parameters were better at predicting UTI, but performance of UA parameters differs based on age, sex, and urine culture thresholds
- Proposal:
  - Move away from dichotomous approach of ASB vs UTI
  - Use the “Continuum of UTI” for stewardship or deprescribing conversations.
  - Develop targeted interventions for patients with LUTS or BUS (e.g., leverage the urinalysis for its NPV)

Advani et al, “Proposing the ‘Continuum of Urinary Tract Infection (UTI)’ for a Nuanced Approach to Diagnosis and Management of UTIs”, under revision, *Journal of Urology*
Advani et al, Investigating Urinalysis Criteria that Predict UTI: Impact of age, sex, and urine culture thresholds, IDWeek 2023

Acknowledgements:

Network hospitals

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Dr. Dev Anderson

Duke ID:
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Rebecca North PhD

Duke Stewardship
Dr. Rebekah Moehring

Utah Hospital Medicine
Dr. Valerie Vaughn

Duke Urogynecology
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Evaluating the *C. difficile* Prevention Framework

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Overview

- CDC has a *C. difficile* prevention framework but it's never before been tested in the real world as a package…
- Five core strategies:
  - Isolation and contact precautions
  - CDI confirmation
  - Environmental Cleaning
  - CDI prevention infrastructure
  - Antibiotic Stewardship

Funding: CDC SHEPHeRD Program

DICON Hospitals (n=20)

- Augusta Health
- Carteret Health
- Central Carolina
- Chesapeake Regional Med Center
- Duke Raleigh
- Duke Regional
- Duke University Hospital
- Frye Regional Medical Center
- Iredell Memorial Hospital
- Johnston Memorial Hospital
- Maria Parham Medical Center
- Nash Health Care System
- Princeton Community
- Rex Healthcare
- Sarasota Memorial Health System
- Scotland Health Care System
- Southeastern Regional Medical Center
- SOVAH-Danville Regional
- Wayne Memorial Hospital
- Wilson Medical Center

Learnings: 2-step Testing

Part 1: CDI Epidemiology

- Fewer HO-CDI cases

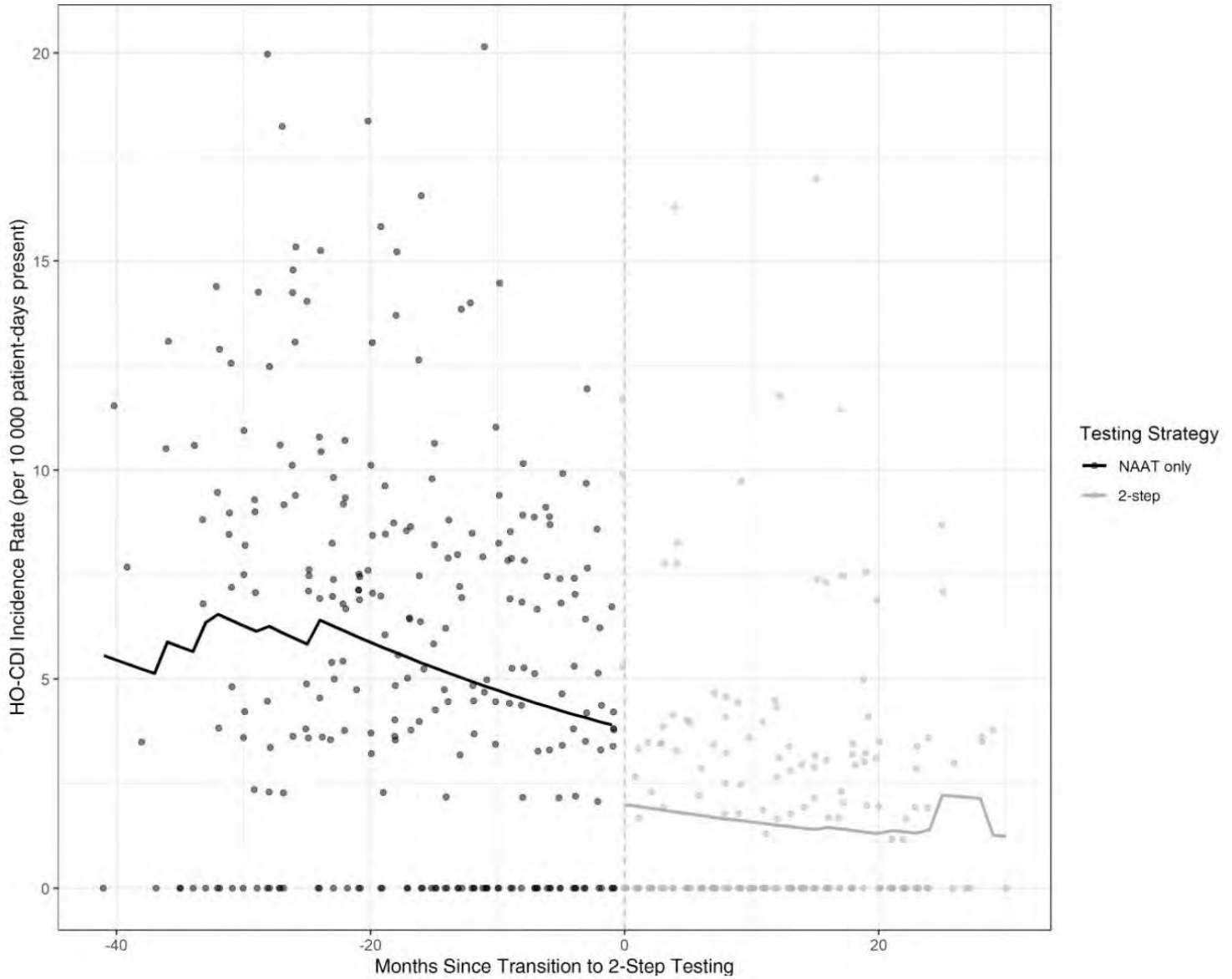

Figure 1. Hospital-onset *Clostridioides difficile* infection incidence rate by testing strategy. Abbreviations: HO-CDI, hospital-onset *Clostridioides difficile* infection; NAAT, nucleic acid amplification testing.

Turner et al *CID* 2023

Learnings: 2-step Testing

Part 2: CDI Antibiotic Use

- Fewer anti-CDI antibiotics

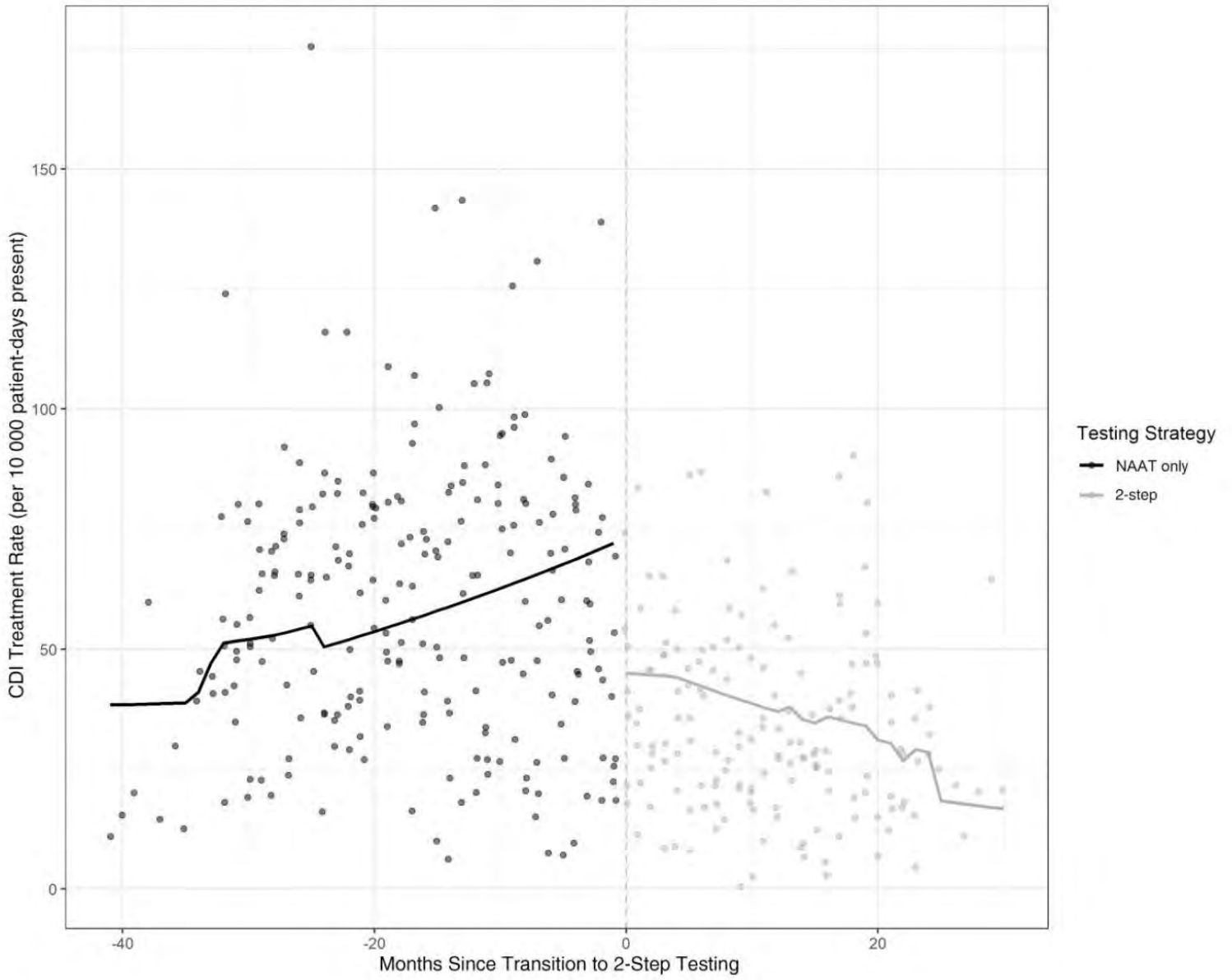

Figure 2. *Clostridioides difficile* infection treatment rate by testing strategy. Abbreviations: CDI, *Clostridioides difficile* infection; NAAT, nucleic acid amplification testing.

Turner et al *CID* 2023

Learnings: 2-step Testing

Part 3: Safety check

- No change in colectomies

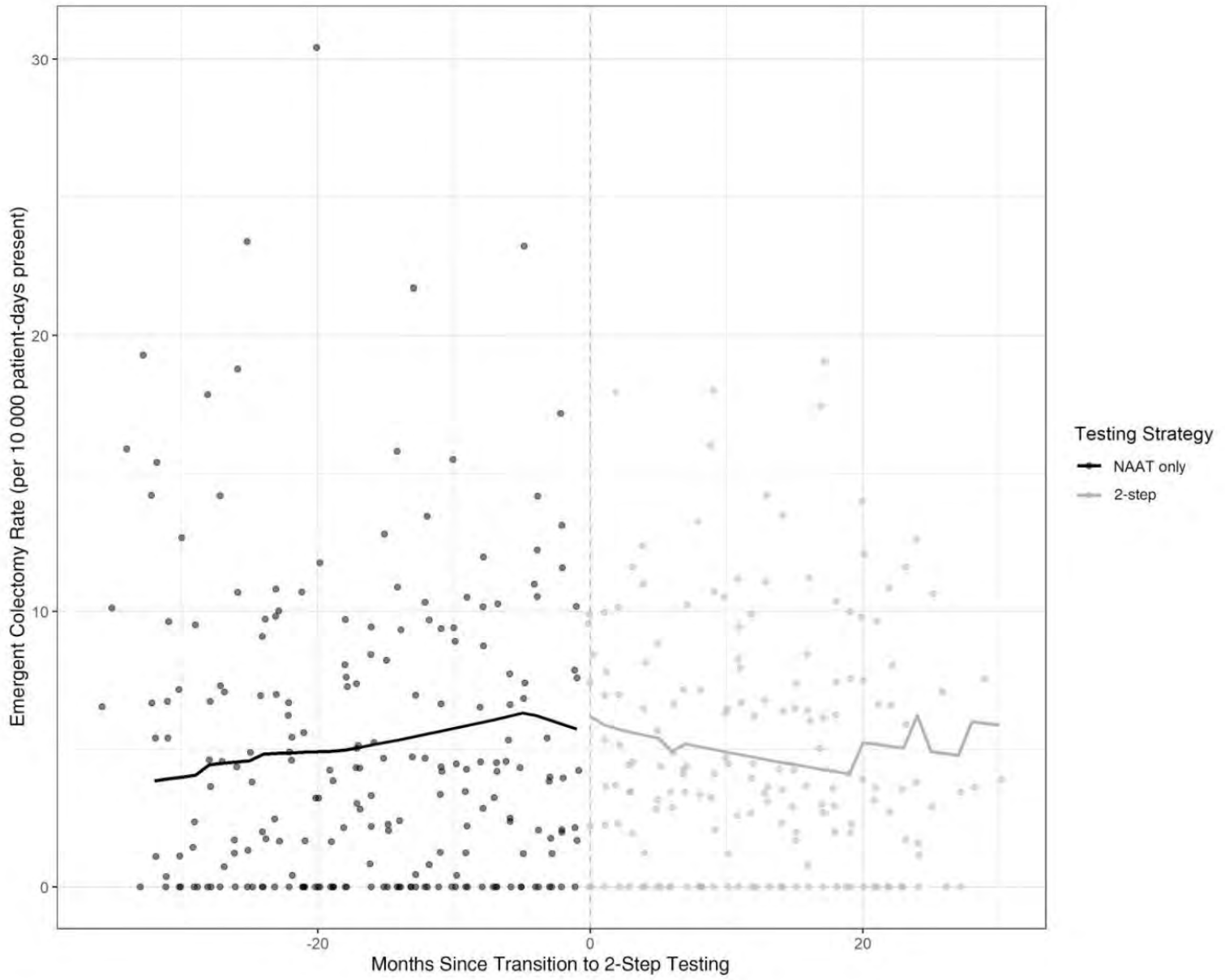

Figure 3. Emergent colectomy rate by testing strategy. Abbreviation: NAAT, nucleic acid amplification testing.

Turner et al *CID* 2023

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Learnings: Effectiveness

Many interventions to track…

(don't read that list)

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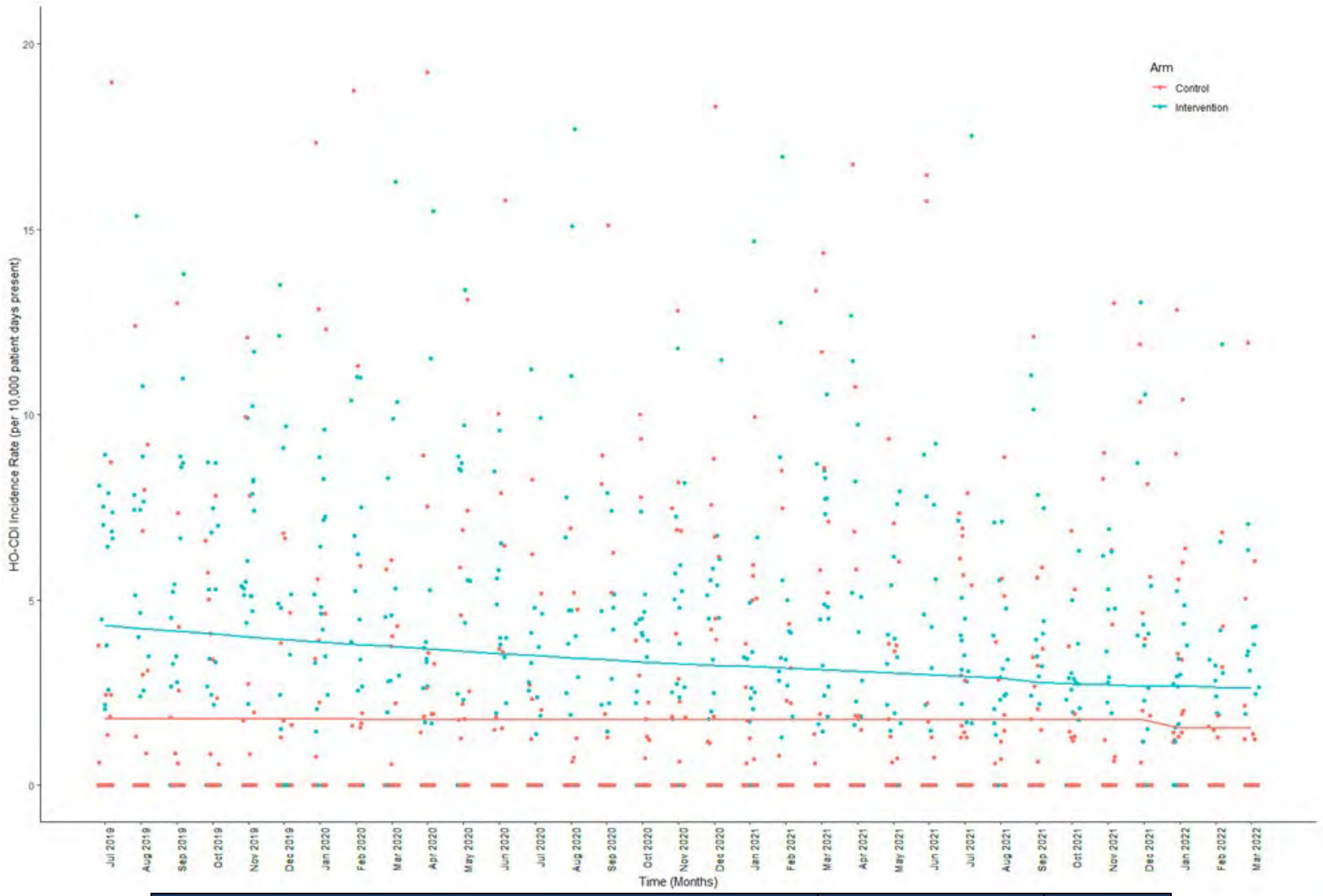
Framework Area	Framework Subcategory	Present at Baseline N (%)	Present at Close N (%)	Percent Increase[a] N (%)
Isolation	Nurse-driven rapid isolation	19/20 (95)	19/20 (95)	0
	Isolation until 48h after resolution	20/20 (100)	20/20 (100)	--
	Isolation for duration of hospitalization	18/20 (90)	18/20 (90)	0
	Improving isolation during unit transfer	1/20 (5)	1/20 (5)	0
	Single use equipment	13/20 (65)	13/20 (65)	0
	Isolation auditing	0/20 (0)	7/20 (35)	7/20 (35)
	Other	1/20 (5)	5/20 (25)	4/19 (21)
Infrastructure	Hand hygiene education	0/20 (0)	1/20 (5)	1/20 (5)
	Hand hygiene audit improvement	0/20 (0)	3/20 (15)	3/20 (15)
	Hand hygiene auditing frequency	0/20 (0)	2/20 (10)	2/20 (10)
	Hand hygiene protocol	20/20 (100)	20/20 (100)	--
	Hand hygiene audit initiation	20/20 (100)	20/20 (100)	--
	Infrastructure workgroup	0/20 (0)	1/20 (5)	1/20 (5)
	Infrastructure education	0/20 (0)	0/20 (0)	0/20 (0)
	Case reviews	2/20 (10)	6/20 (30)	4/18 (22)
	Other, infrastructure related	0/20 (0)	5/20 (25)	5/20 (25)
	Other, hand hygiene related	0/20 (0)	4/20 (20)	4/20 (20)
***Clostridioides difficile* Infection Confirmation**	Avoiding repeat *C. difficile* testing	14/20 (70)	15/20 (75)	1/6 (17)
	Avoiding test of cure	0/20 (0)	0/20 (0)	0
	Considering alternative diagnoses	13/20 (65)	13/20 (65)	0
	Avoiding testing while on laxatives	15/20 (75)	15/20 (75)	0
	Laboratory rejection of unformed stool	20/20 (100)	20/20 (100)	--
	Change in laboratory reporting	0/20 (0)	1/20 (5)	1/20 (5)
	2-step testing	2/20 (10)	10/20 (50)	8/18 (44)
	Other clinical intervention	0/20 (0)	11/20 (55)	11/20 (55)
	Other laboratory intervention	0/20 (0)	4/20 (20)	4/20 (20)
Environmental	Ultraviolet light	12/20 (60)	13/20 (65)	1/8 (13)
	Cleaning audits	10/20 (50)	13/20 (65)	3/10 (30)
	Cleaning additional patient care areas	11/20 (55)	11/20 (55)	0
	Use of sporicidal cleaning agents	20/20 (100)	20/20 (100)	--
	Daily cleaning protocols	18/20 (90)	19/20 (95)	1/2 (50)
	Terminal cleaning protocols	7/20 (35)	10/20 (50)	3/13 (23)
	Other	2/20 (10)	7/20 (35)	5/18 (28)
Stewardship	Institution-specific treatment guidelines	5/20 (25)	5/20 (25)	0
	Targeting improved durations	1/20 (5)	3/20 (15)	2/19 (11)
	Targeting high risk antibiotics	0/20 (0)	4/20 (20)	4/20 (20)
	Fluoroquinolone restriction	0/20 (0)	2/20 (10)	2/20 (10)
	Focus on duration at discharge	1/20 (5)	1/20 (5)	0
	Other	0/20 (0)	13/20 (65)	13/20 (65)

Learnings: Effectiveness

Rates improved vs external controls



Parameter	IRR (95% CI)	p-value
Overall time trend	0.95 (0.89-1.03)	0.22
Arm, intervention vs control	2.79 (1.10-7.05)	0.03
Time x arm (test of slope change, intervention vs control)	0.79 (0.67-0.94)	0.01

*Slope/trend changes expressed per 12-month period

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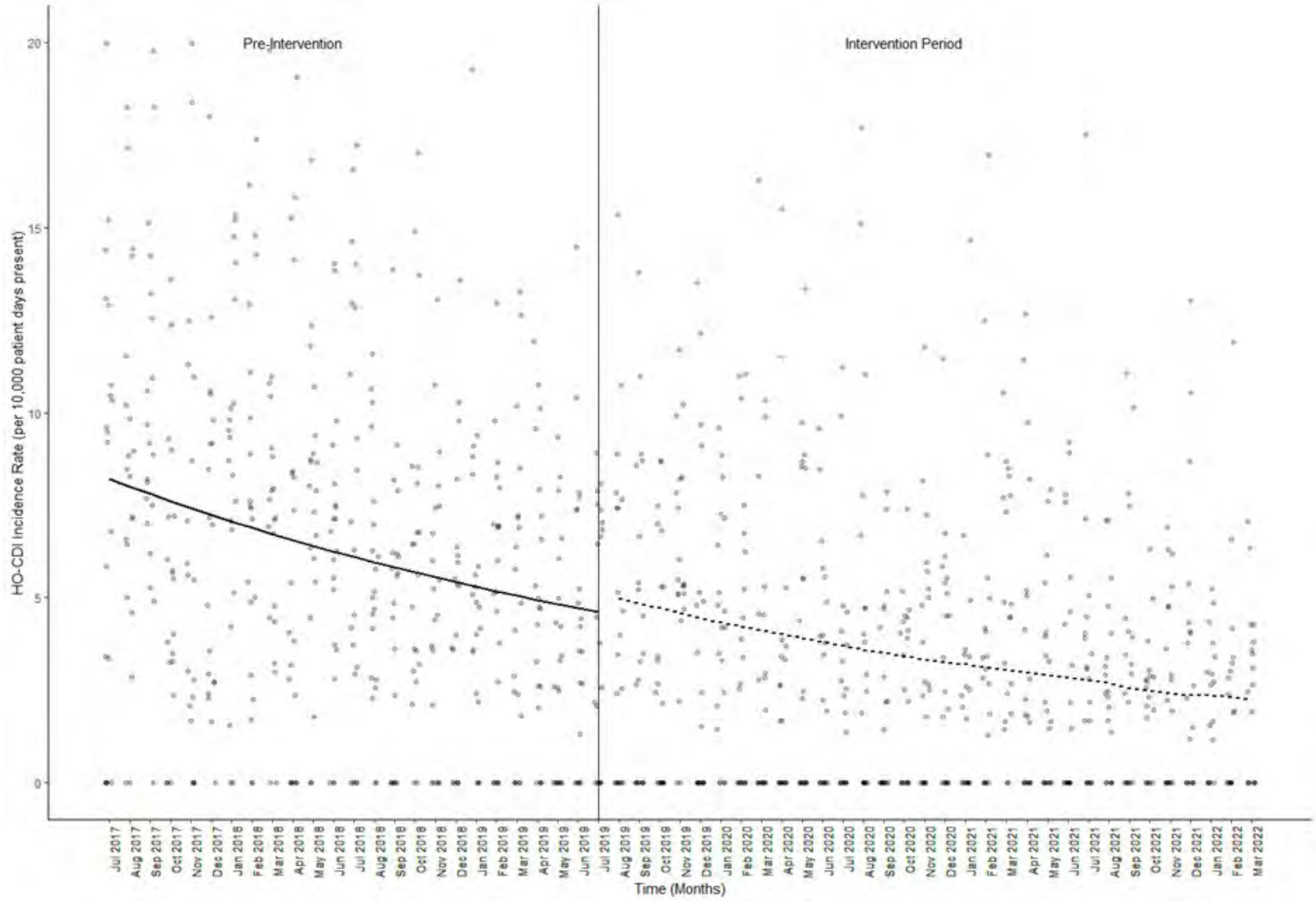
Learnings: Effectiveness

Less effect with internal controls



Parameter	IRR (95% CI)	p-value
Pre-intervention time trend	0.76 (0.68-0.85)	<0.01
Level change with intervention	1.12 (0.89-1.42)	0.34
Slope change with intervention	0.98 (0.77-1.24)	0.85

*Slope/trend changes expressed per 12-month period

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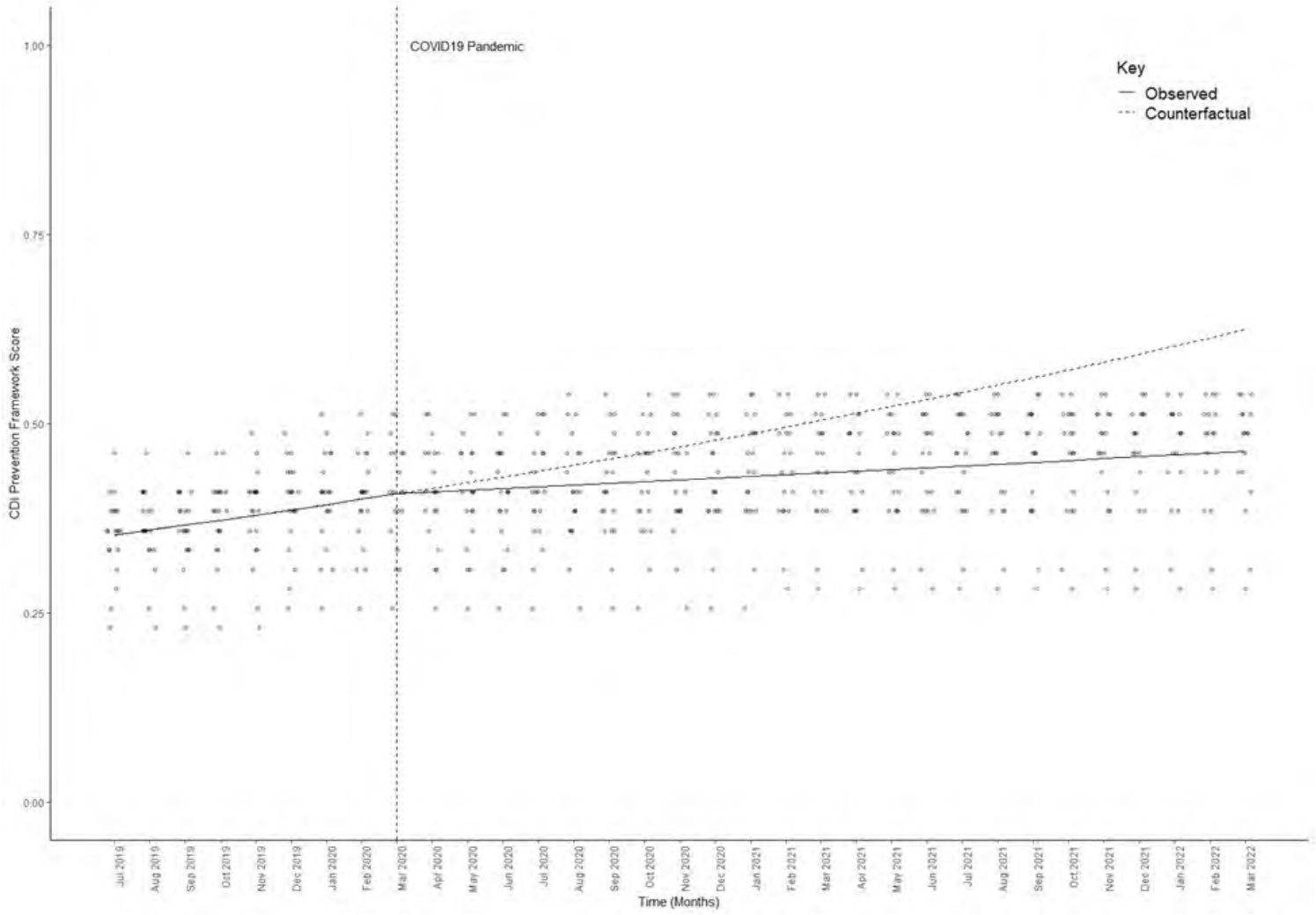
Learnings: Effectiveness

But COVID happened…



Parameter	IRR (95% CI)	p-value
Baseline trend	1.27 (1.15-1.40)	<0.001
Level change	1.00 (0.97-1.03)	0.99
Slope change	0.84 (0.75-0.94)	0.003

*Slope/trend changes expressed per 12-month period

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Learnings: Effectiveness

Post hoc analysis #1:

Checking “dose” effect

Modeling Approach	Parameter	IRR (95% CI)
Intervention Score	Time (baseline trend)	0.81 (0.68-0.97)
	Total intervention score	0.95 (0.90-0.99)
Intervention Quintiles	Time x quintile (slope change test by quintile)	0.89 (0.83-0.95)

*Slope/trend changes expressed per 12-month period

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Learnings: Effectiveness

Post hoc analysis #2:

Checking individual interventions

Model	Parameter	IRR (95% CI)
Full model[a]	Baseline trend	1.03 (0.89-1.19)
	Isolation auditing, level	0.94 (0.74-1.19)
	Isolation auditing, slope	1.07 (0.91-1.26)
	Case reviews, level	1.25 (0.97-1.61)
	Case reviews, slope	0.90 (0.79-1.03)
	Two-step testing, level	0.54 (0.48-0.61)*
	EVS audits, level	1.33 (0.99-1.78)
	EVS audits, slope	1.06 (0.92-1.21)
	Terminal clean, level	1.68 (1.23-2.29)*
	Terminal clean, slope	0.82 (0.72-0.93)*
	Stewardship durations, level	1.01 (0.63-1.61)
	Stewardship durations, slope	0.89 (0.72-1.09)
	Stewardship, high yield, level	0.59 (0.47-0.76)*
	Stewardship, high yield, slope	0.87 (0.71-1.07)
	Stewardship, fluoroquinolone, level	0.48 (0.25-0.93)*
	Stewardship, fluoroquinolone, slope	1.04 (0.66-1.64)
Limited model[b]	Baseline trend	0.90 (0.79-1.02)
	Isolation auditing, slope	1.13 (0.94-1.34)
	Case reviews, slope	0.81 (0.68-0.96)*
	Two-step testing, level	0.50 (0.42-0.59)*
	EVS audits	1.12 (0.95-1.32)
	Stewardship, high yield	0.77 (0.60-0.99)*

[a]Full model included all prevention measures undertaken by at least 2 hospitals

[b]Limited model included only prevention measures undertaken by at least 2 hospitals with at least 6 months of time accrued before and after each intervention

*Delineates effect estimates with a 95% CI that does not cross 1.0

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So what?

Updates to CDC Framework

1. Isolate and initiate contact precautions for suspected or confirmed CDI

- Create nurse-driven protocols[a] to facilitate rapid isolation of patients with suspected or confirmed CDI
  - Patients with diarrhea should be isolated while evaluation for the cause is ongoing (e.g., patient remains isolated during a trial off laxatives)
- For suspected patients, ensure rapid evaluation by healthcare personnel and infection prevention
- Place symptomatic patients[b] on contact precautions, in a single-patient room with a dedicated toilet
  - If single-patient rooms are not available, room patients with confirmed CDI together
- For patients with confirmed CDI, maintain contact precautions for at least 48 hours after diarrhea has resolved, or longer, up to the duration of hospitalization[c]
- Adhere to recommended hand hygiene practices
- Use dedicated patient-care equipment (e.g., blood pressure cuffs, stethoscopes)
- Implement daily patient bathing or showering with soap and water
- When transferring patients, notify receiving wards or facilities about the patient's CDI status so contact precautions are maintained at the patient's new location

So what?

Updates to CDC Framework

2. Confirm CDI in patients

- Clinical personnel
  - Assess for appropriateness of testing: Consider other infectious or non-infectious[d] causes of diarrhea before testing for CDI
  - Discontinue laxatives and wait for at least 48 hours before testing if still symptomatic
  - Once a patient has a positive CDI test do not repeat testing to detect cure; tests may remain positive for ≥6 weeks
- Laboratory personnel
  - Implement laboratory procedures to ensure testing of only appropriate specimens (e.g., unformed stool) for *C. difficile* or its toxins
    - For sites where appropriateness of testing is an issue, consider implementing two-step testing (e.g., high sensitivity NAAT or GDH test followed by high-specificity toxin test, rather than NAAT alone) to improve diagnostic accuracy
  - Report test results immediately to clinical care providers and infection control personnel through reliable means (e.g., a laboratory alert system)

So what?

Updates to CDC Framework

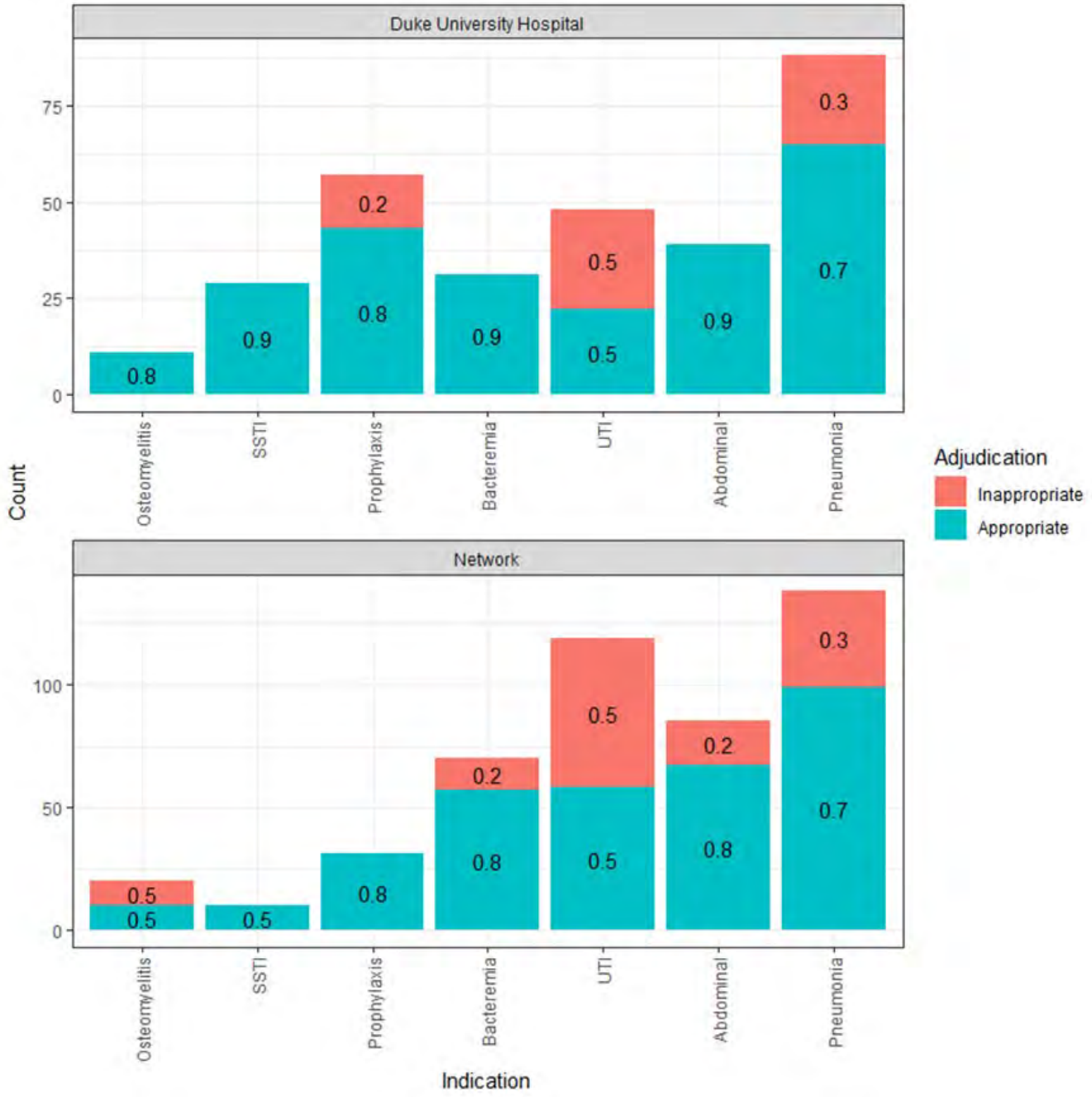
4. Develop infrastructure to support CDI prevention

- Incorporate reduction of CDI into the facility healthcare-associated infection prevention program, including but not limited to the design, implementation, evaluation, and feedback of intervention results
  - Include a multidisciplinary workgroup, including physicians, nursing, environmental services, and antibiotic stewardship to identify and implement the below strategies and to use data for action
- Monitor facility CDI rates, and target units with highest incidence of CDI for evaluation and intervention
- Review hospital-onset CDI cases to help identify potential gaps and opportunities for improvement
  - Review should focus on opportunities for improvement across each strategy (e.g., test indications, antibiotic appropriateness)
  - Utilize findings to engage relevant care teams and staff in gap remediation and performance improvement as soon after the CDI case as possible
- Educate and train healthcare personnel on prevention practices for CDI
- Routinely audit
  - Adherence to hand hygiene and contact precautions
  - Adequacy of room cleaning using methods described in "Options for Evaluating Environments Cleaning"
- Provide CDI rates and other performance improvement measures to senior leadership, clinical providers, laboratory personnel, environmental services, and other stakeholders
  - Notify appropriate individuals and facility departments about changes in the incidence (or frequency), complications (including recurrences), or severity of CDI

RCA Tool

Identifying high-impact targets

- UTI
- Pneumonia



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DiRTE

DISINFECTION,
RESISTANCE AND
TRANSMISSION
EPIDEMIOLOGY LAB

Bobby Warren

Duke University
School of Medicine

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Comparative Analysis of Fungal Sampling Methods in Healthcare Environments – Phase 1

- **Background**: Limited standard practices for environmental fungal surveillance in healthcare.
- **Objective**: Evaluate efficacy of different sampling & detection methods for fungal contamination.
- **Methods**:
  - Surfaces: Aluminum, formica, linen, HEPA.
  - Contaminants: Aspergillus fumigatus, Candida parapsilosis (~10^4 CFU).
  - Sampling: Foam sponges, flocked swabs, RODAC plates.
  - Detection: Culture-based, qPCR (FungiQuant primers for 18S rRNA).
- **Results**:
  - Total Samples: 960 (2 species, 4 surfaces, 3 methods, 2 detections).
  - qPCR superior to culture-based (Median recovery: 26.7% vs. 6.4%).
  - Sponges outperform swabs in recovery (Culture: 17.9% vs. 3.8%; qPCR: 36.2% vs. 10.5%).
  - Highest recovery on aluminum (qPCR: 43.4%).
- **Conclusion**:
  - qPCR with sponge sampling more effective for detecting fungal contaminants.
  - Further validation needed in real-world healthcare settings.

Comparative Analysis of Fungal Sampling Methods in Healthcare Environments – Phase 2

- **Background**: Limited standard practices for environmental fungal surveillance in healthcare.
- **Objective**: Apply optimized method to evaluate fungal contamination over 12-months in real-world conditions
- **Methods**:
  - Where: 3 units (Neuro ICU, Respiratory/MICU, BMT/Oncology), 1 in each of Duke's bed towers of varying age
  - Fomites: Patient rooms + Unit sampling
    - HVAC exports, bathroom floors, patient bed rails and room air
  - Sampling: Foam sponges + active air sampling
  - Detection: Culture-based, qPCR (FungiQuant primers for 18S rRNA) + culture
  - Total Samples: 2,016 (3 units, 28 samples, 12 months, 2 detections).
- **Progress**:
  - 3rd of 12 sampling months in progress

Unit Sample Maps

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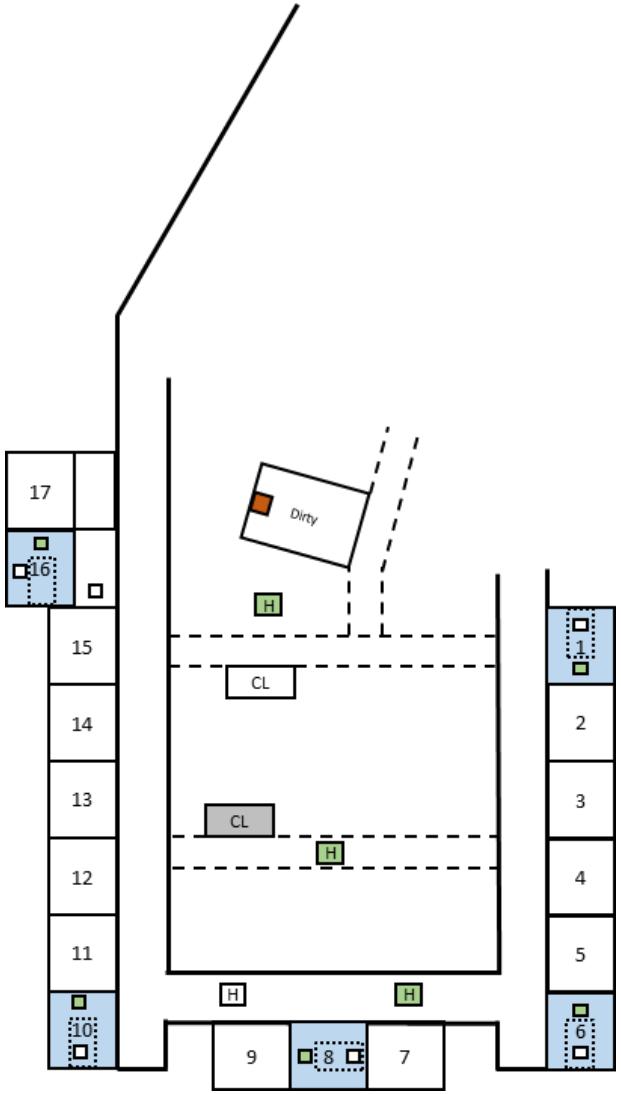
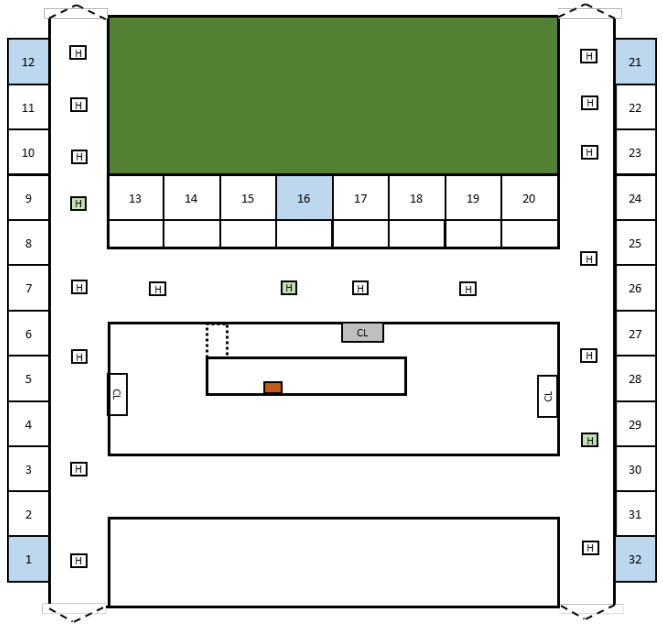
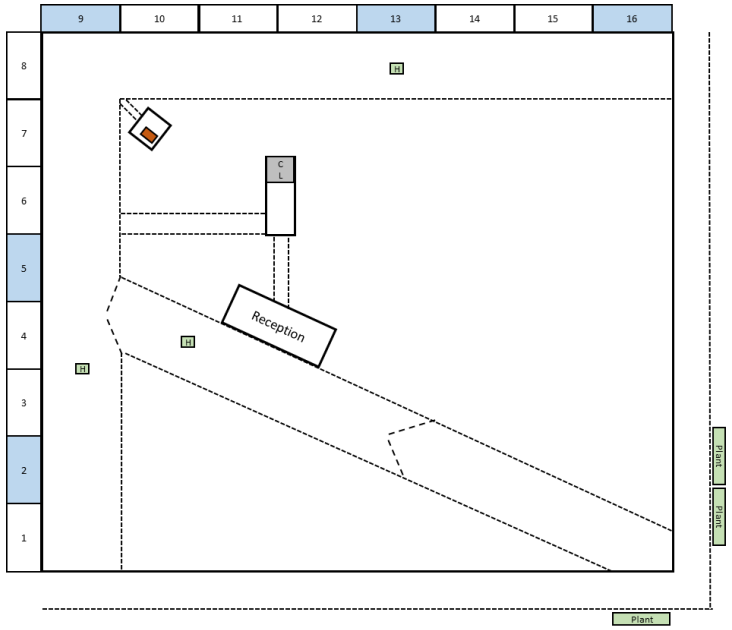
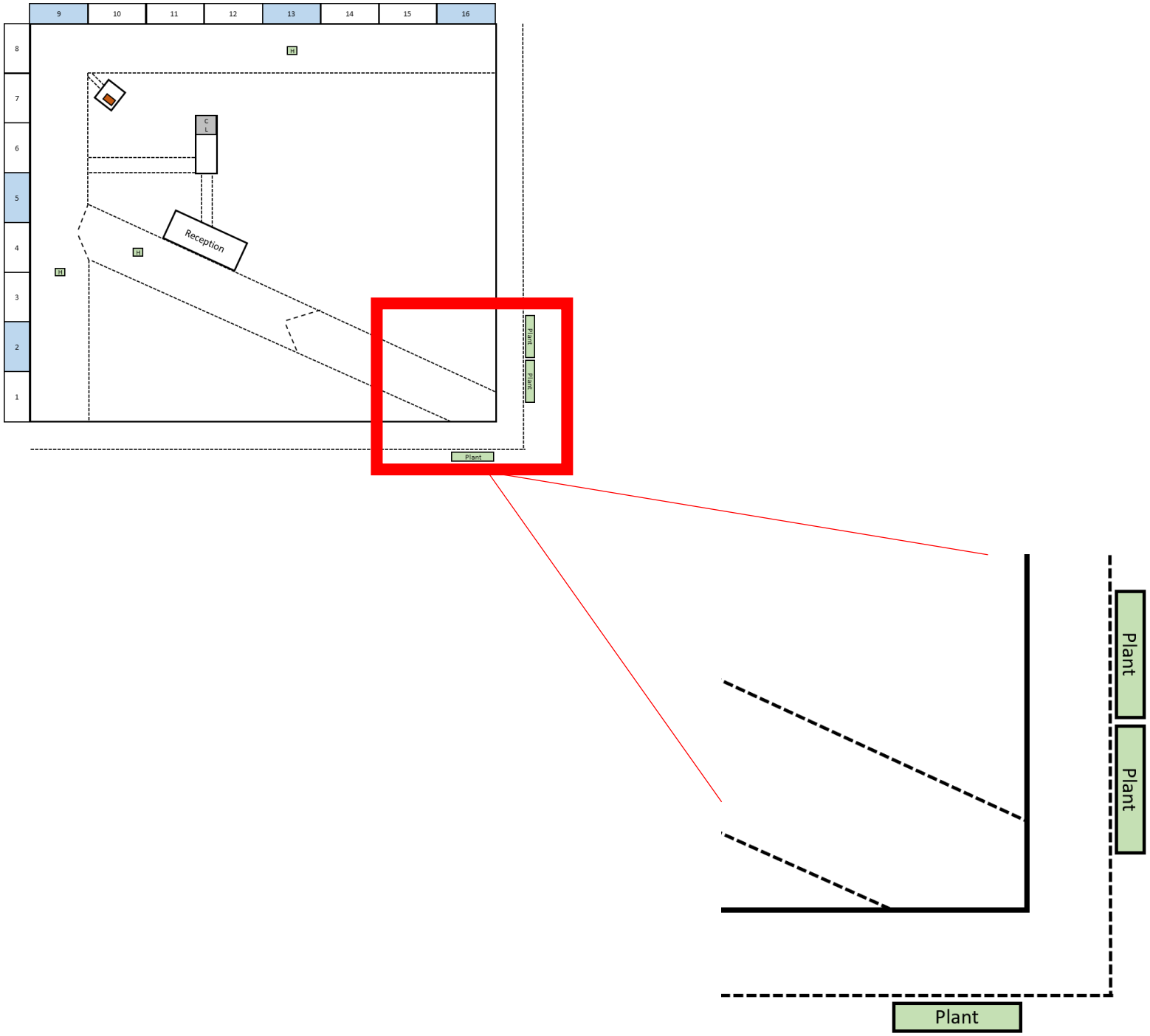






Additional Sample of Interest



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Upcoming…

- *C. difficile*
  - Wastewater
  - Surface water
- Disinfection
  - Continuously disinfectant spray
  - Hydrogen peroxide chamber, PT/OT/hard to disinfectant with wipe items
- Prevention
  - CH2OPPP – Water filters and drain covers
  - Sink CRE contamination interventions

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Diversity, Equity, Inclusion Research

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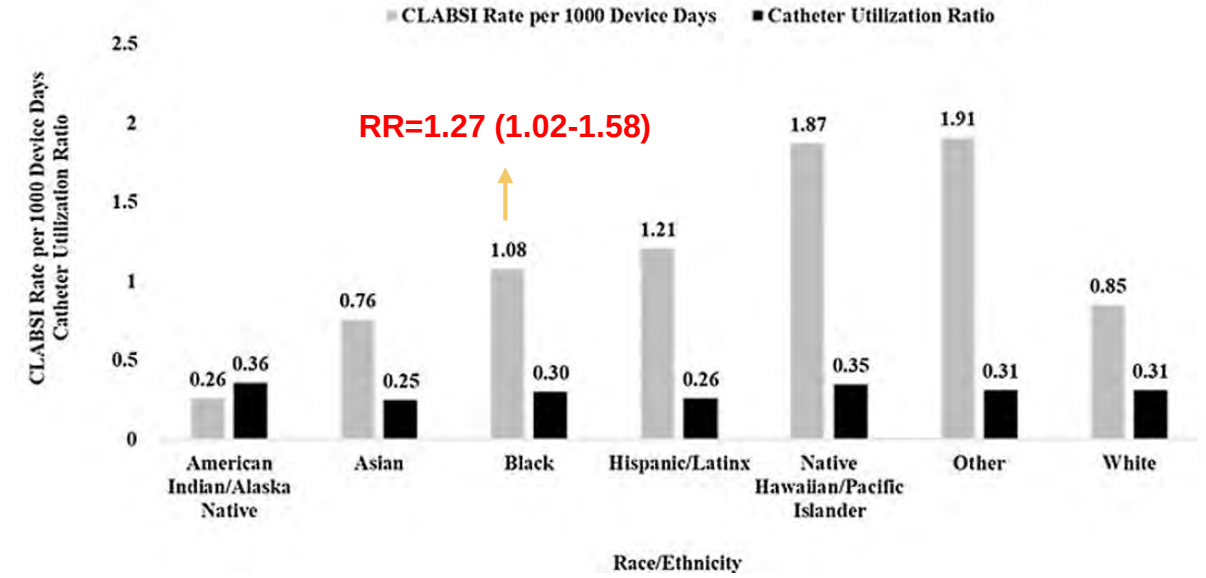
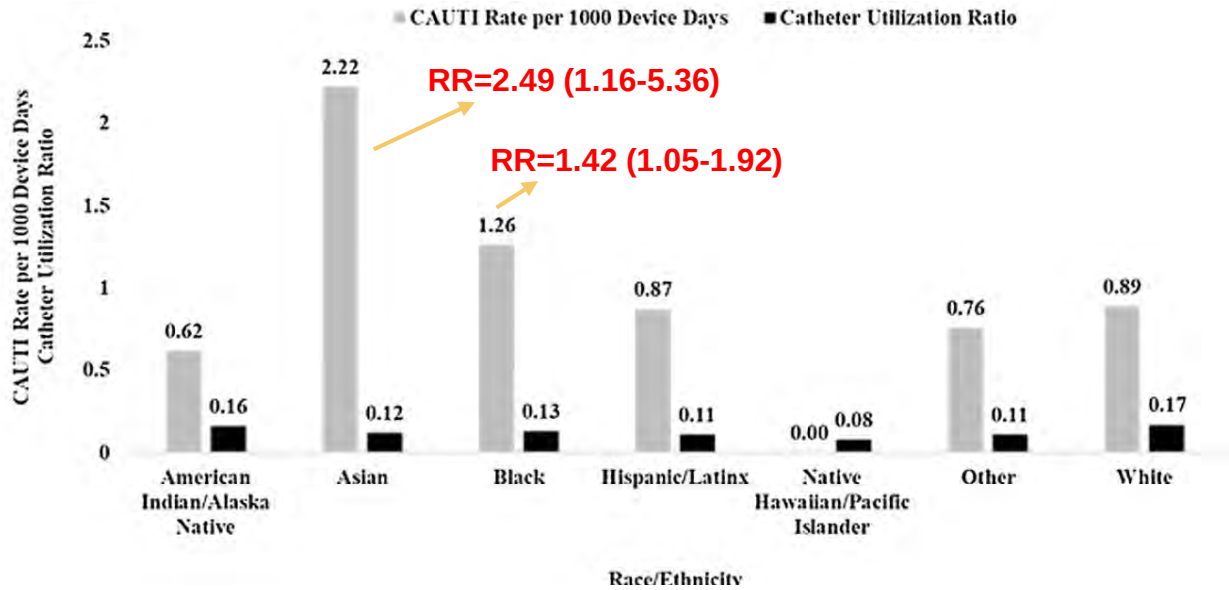
CLABSIs and CAUTIs

4 years of surveillance data – DUH

- 450 CLABSIs
- 233 CAUTIs

Reference group: Non-Hispanic White





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Gettler et al. ICHE 2023 doi:10.1017/ice.2023.63

C. difficile Testing Racial Health Disparities

- **Background**: Previous studies found higher *C. difficile* testing in white individuals compared to non-white, however, denominators of patient days were not race specific, inflating white tests.
- **Objective**: Validate previous findings while accounting for race specific patient days:
- **Results**:
  - 35,160 C. difficile tests and 2,571,850 patient days across all three hospitals (Duke main, Reg and Ral) from 2015-2021 were analyzed
  - White patients *C. difficile* tests (14.46 per 1,000 patient days) v Black patients (12.96, $p<0.0001$) and NWNB race patients (10.27, $p<0.0001$).
  - White patients (15%) tested positive at a similar rate to Black patients (15%, $p=0.3655$)
- **Conclusion**: Lower rates of C. difficile testing among Black inpatients despite similar overall prevalence rates for positives may suggest 1) inequity in testing or 2) a difference in underlying disease rates between races that could be related to health inequity such as access to healthcare.

Warren et al. *Infect Control Hosp Epidemiol* 2023, in press.

CDC SHEPheRD Project

- Investigating reporting of social determinants of health variables
  - What is included in EHR?
  - Is the data valid?
- Work ongoing
  - Completed Narrative Review (n=43): what SDOH are most frequent documented during hospitalization and/or used for quality reporting
  - Systematic Review (n=45) of impact of race, ethnicity and SDOH on HAI outcomes
  - Validation exercise planned
    - Compare what is documented in EHR to patient responses

Wrap Up

- THANK YOU! For learning along with us.
- Many exciting projects ongoing and coming soon.
- The more involvement from DICON and/or DASON hospitals, the better.
- Talk with your liaisons about your interest areas.
- We love a good clinical or program implementation question. Keep them coming!

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Extra slides