Antibiotic Stewardship for Pediatric UTI

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- I have no financial disclosures to report.

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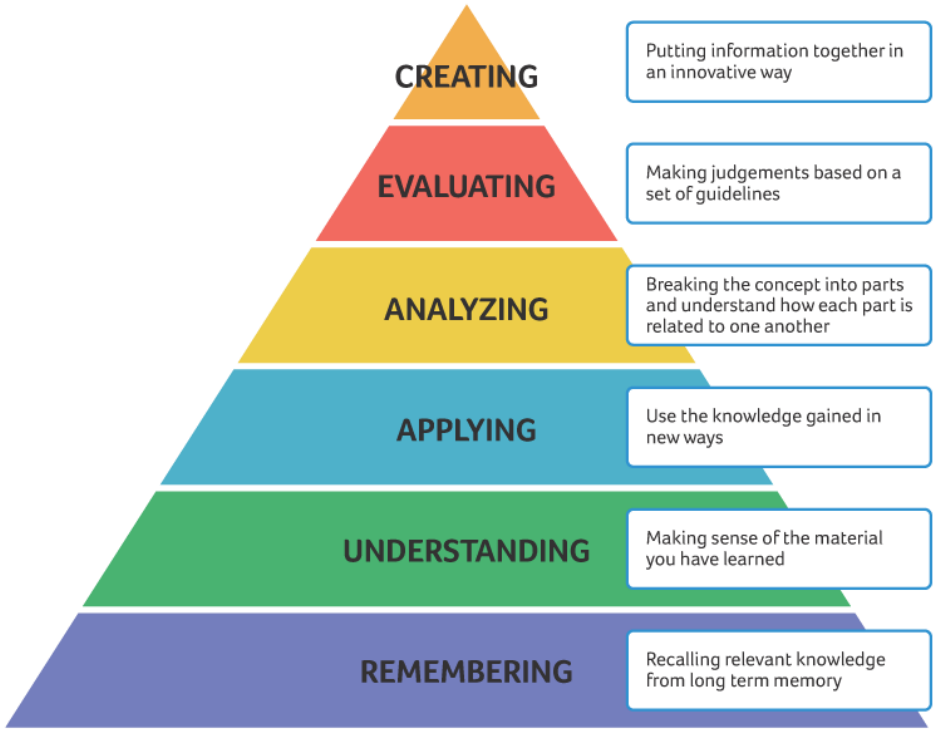
- What percentage of *your* Urine Dip/UA in office do you estimate result in a positive culture?
  - A. < 20%
  - B. 20-30%
  - C. 30-50%
  - D. >50%

- What group has the highest prevalence of urinary tract infection?
  - A. Febrile female 0-3 months of age
  - B. Febrile female 3-6 months of age
  - C. Febrile uncircumcised male 0-3 months of age
  - D. Febrile circumcised male 0-3 months of age
  - E. Febrile female 6-12 months of age

Objectives



- Recognize benefits and limitations of point of care urine dip/urinalysis to appropriately risk stratify patients for with suspected UTI
- Apply standardized approach for UTI testing and treatment with a lens of antibiotic stewardship
- Evaluate local PCCN opportunities for antibiotic stewardship around UTI evaluation and treatment using evidence-based QI methodology

Recognize: pros and cons of POC urine testing and UTI epidemiology

Recognize

- Urine Culture often obtained for fever without a source or prolonged fever in pediatric patients, particularly in females < 2 years old, or males < 1 year old.
- UA or Udip results determine ED and UC initial antibiotic prescribing practices
  - Pitfalls: bag specimen (overall discourage, but some providers still do), antibiotics prescribed with isolated hematuria or sterile pyuria
    - One study found 94% of pts prescribed antibiotics had pyuria, where as only 55% of those specimens went on to have + urine culture (Watson et al, 2018)
  - Median duration of therapy 7-10 days

Recognize

- Hawkins et al, 2023:
  - Antibiotics de-escalated (narrow spectrum based on culture results or discontinued for neg culture) in only 8% of eligible patients from ED
- Watson et al, 2018:
  - Only 55% of ED patients who received antibiotics based on UA/dip results had + urine cultures.
- Forster et al, 2023
  - Of 404 included patients, 389 (96.2%) were discharged on antibiotics and 243 (62.4%) did not have a culture + UTI.
- Poole et al, 2020
  - Successful implementation of a clinical pathway resulted in improved prescribing patterns of antibiotics for UTI (decreased third generation cephalosporin, increased cephalexin)

Recognize: UTI Epidemiology

- Shaikh et al, 2008 (meta analysis)
  - Among older children (<19 years) with urinary symptoms, the pooled prevalence of UTI (both febrile and afebrile) was 7.8%
  - Among infants presenting with fever, the overall prevalence (95% confidence interval) of UTI was 7.0% (CI: 5.5– 8.4).
- Wrotek et al, 2019:
  - Looked at 459 patients admitted for bronchiolitis, compared to 8k+ control group without bronchiolitis.
  - Frequency of UTI accompanying bronchiolitis was comparable to that in the control group (8.9% vs. 10.9% respectively).

- What group has the highest prevalence of urinary tract infection?
  - A. Febrile female 0-3 months of age 7.5%
  - B. Febrile female 3-6 months of age 5.7%
  - C. Febrile uncircumcised male 0-3 months of age 20.1%
  - D. Febrile circumcised male 0-3 months of age 2.4%
  - E. Febrile female 6-12 months of age 8.3%

Discussion: Counting the cost

- Operating costs: high burden of negative UA/Ucx
  - Additional cost if you automatically culture vs. reflex to culture
  - Time for reviewing culture results and responding/communicating with families +/- charting
- Family costs
  - Costs of med they may not need
  - Additional care burden if GI side effects acutely
- Societal costs
  - Increase in antibiotic resistance patterns
    - Pediatrics, 2021: ”Pathogens causing UTI are increasingly becoming resistant to commonly used antibiotics, and their indiscriminate use in doubtful cases of UTI must be discouraged”
  - Combatting the antibiotics for everything culture

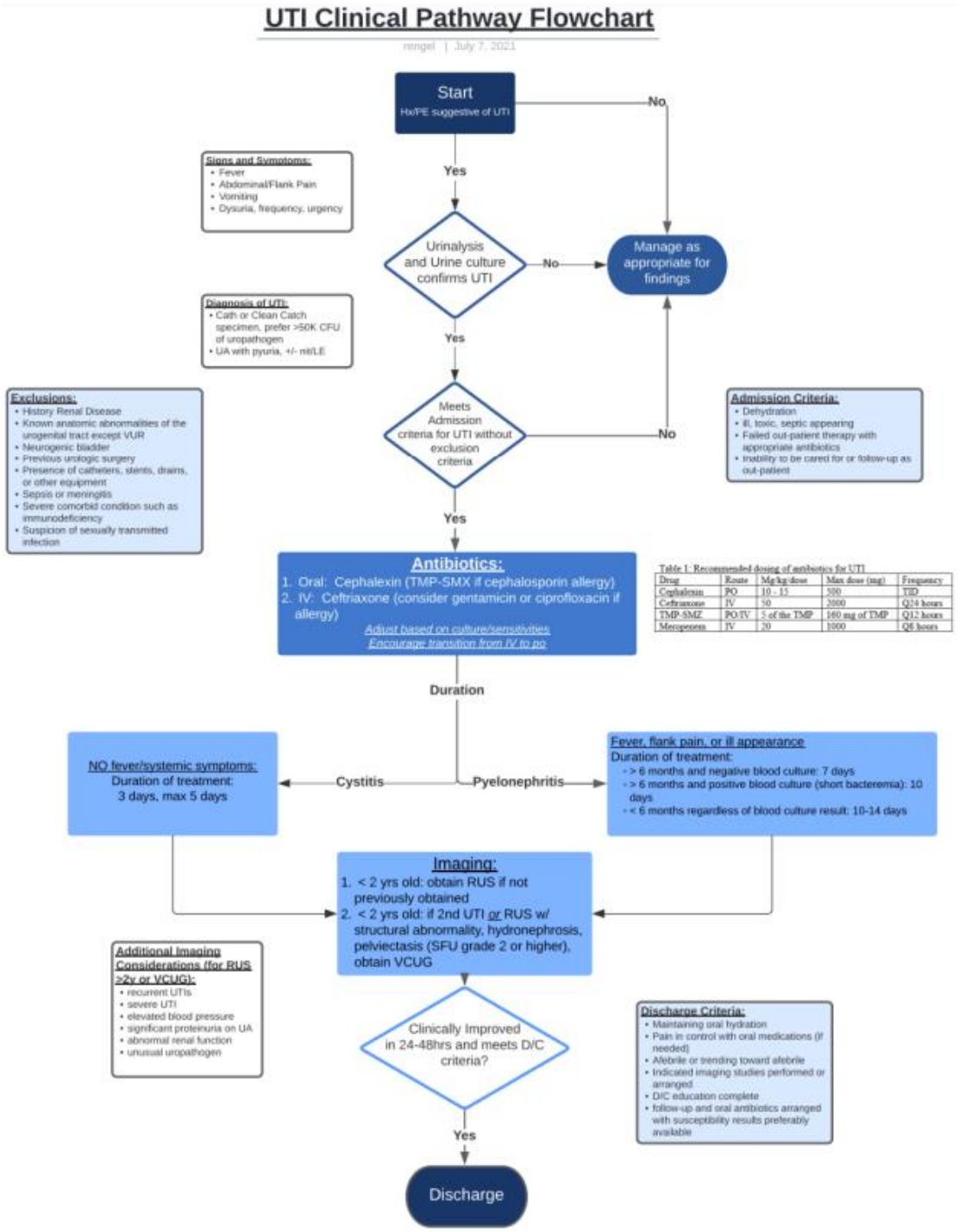
Apply: standardized approach for UTI testing and treatment

The 5 Ds of Stewardship for UTI	Description	Main Challenge	Successful Intervention Strategies
 **Diagnosis**	Make and document the right diagnosis	Determining which patients have UTI	Clinical decision aids Appropriate collection of cultures Urine procurement by catheterization Reflex urine cultures Computerized decision support systems Selective reporting of urine culture results Text accompanying results to provide interpretation
 **Drug**	Use the right empiric antibiotic	Rising resistance makes empiric treatment challenging	Local susceptibility reports and stratified antibiograms Selective and cascade reporting of antibiotic susceptibility Provider education Computerized decision support systems Post-prescription review by pharmacists Audit and feedback
 **Dose**	Use the right dose of antibiotic based on site of infection and renal or hepatic dysfunction	Dosage errors are common	Computerized decision support systems Electronic order sets Audit and feedback
 **Duration**	Use antibiotics for the recommended duration	Many studies show a "longer is better" mentality	Computerized decision support systems Electronic order sets Audit and feedback
 **De-escalation**	De-escalate therapy based on susceptibilities and when urine cultures are negative	Labor intensive and occurs too late with UTI to make much impact	Post-prescription review by pharmacists

Goebel et al, 2021

New Literature - Short Course Antibiotics for Febrile UTI

- SCOUT trial (Zaoutis et al, 2022):
  - “In this randomized clinical trial, children assigned to standard-course therapy had lower rates of treatment failure [2 vs. 14 patients] than children assigned to short-course therapy. However, the low failure rate of short-course therapy suggests that it could be considered as a reasonable option for children exhibiting clinical improvement after 5 days of antimicrobial treatment”
- G. Montini et al, 2024
  - “RESULTS: From May 2020 through September 2022, 175 children were assessed for eligibility and 142 underwent randomization. The recurrence rate within 30 days of the end of therapy was 2.8% (2/72) in the short group and 14.3% (10/70) in the standard group. The difference between the 2 groups was −11.51% (95% confidence interval, −20.54 to −2.47). The recurrence rate of fUTI within 30 days from the end of therapy was 1.4% (1/72) in the short group and 5.7% (4/70) in the standard group (95% confidence interval, −10.4 to 1.75).
  - CONCLUSIONS: This study demonstrates that a 5-day course is noninferior to a 10-day course of oral amoxicillin-clavulanate”



Example Standardize Approach

- Main TakeAways
  - Judicious use of limited antibiotic duration (rather than 10 days for simple cystitis *without fever*)
  - Limiting UTI evaluation for asymptomatic patients with fever with known source
    - Acute otitis media
    - Croup
    - Strep throat
    - Skin/soft tissue infections

Apply: clinical guidelines and resources

- UTI Calculator (pitt.edu): https://uticalc.pitt.edu/

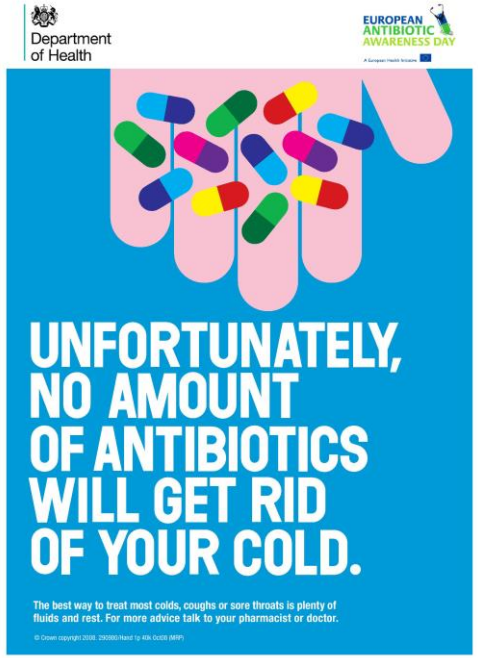
- Scenario 1: 7 month old female comes in for sick visit: 24 hours fever tmax 39.5, mild uri symptoms (but is in daycare, that's nothing new). 1 episode of diarrhea but no vomiting. Abd soft, vitally stable in office. No previous history of UTI, but mother concerned because of diarrhea.
  - POC testing
    - A. Yes or
    - B. No
  - Treatment
    - A. Yes or
    - B. No

- Scenario 2: 13 month old uncircumcised male with no previous history of UTI presents with vomiting and fever tmax 38.5 x 2 days. No previous history of UTI, no other symptoms.
  - POC testing
    - A. Yes or
    - B. No
  - Treatment
    - A. Yes or
    - B. No

Evaluate: Local PCCN Antibiotic Stewardship Opportunities for UTI

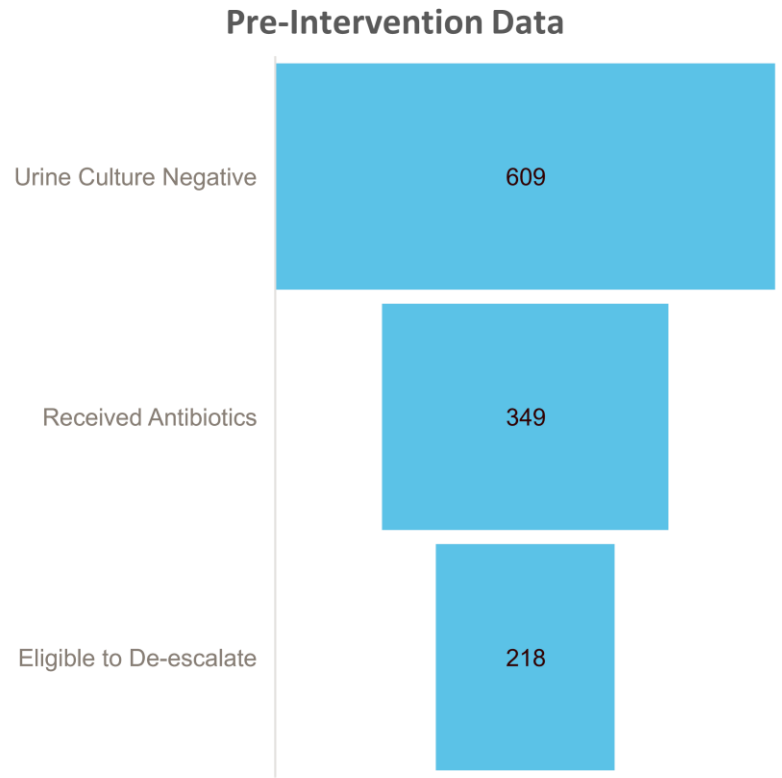
Background: Pre-Intervention State

- EHR inbox is shared by ED APP group and an MA to follow positive culture results (blood, CSF, urine, etc).
  - Mon-Fri business hours MA calls back any cultures that are + and not on appropriate antibiotic therapy.
  - Weekends Daytime APPs do the callbacks
- No mechanism to follow NEGATIVE urine cultures that received antibiotic prescription to discontinue or de-escalate therapy.

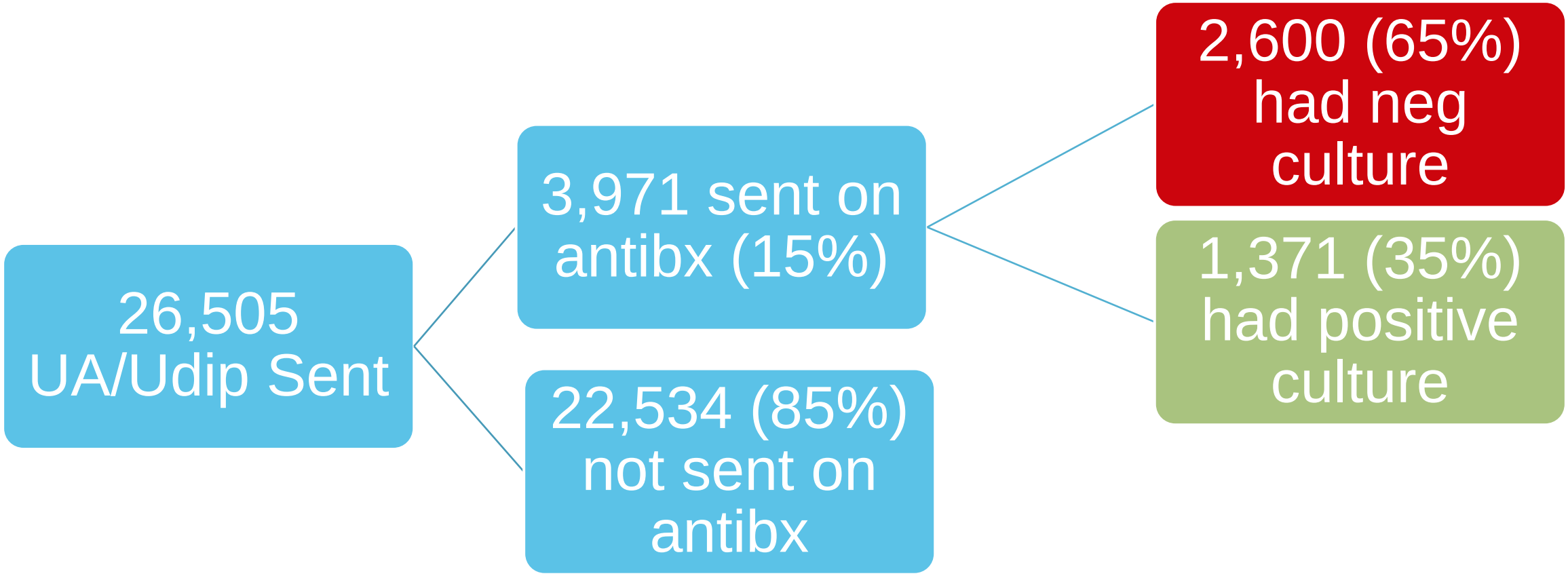


Pre Intervention

- Pre-intervention data shows 609 encounters between January-February 2023 were sent home on antibiotics with urine cultures pending.
- 349 (57%) encounters had a negative urine culture and did not meet exclusion criteria.
- 218 (62%) of these encounters were eligible for de-escalation.
- The average length of antibiotic course was 9 days.



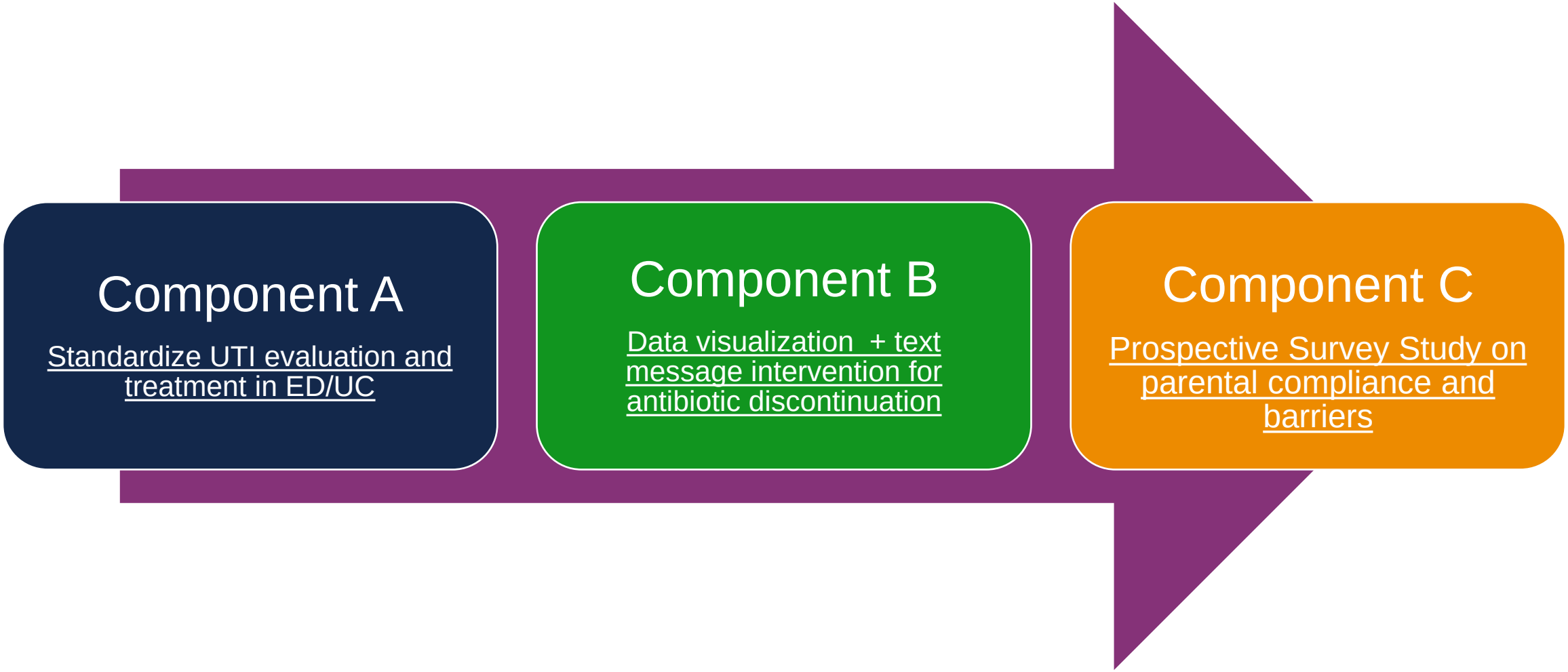
Retrospective Data: June 1, 2021 – June 1, 2023



Aims

- The primary aim of this QI is to notify 50% of discharged patients prescribed antibiotics for presumed UTI from PCH ED and UC sites who ultimately are found not to have a UTI of negative culture results and instructions to stop antibiotics over a 6 month trial period.
  - Positive UTI defined as: >5 white blood cells per high-power field or dipstick positive for leukocyte esterase) and a positive urine culture (≥50,000 colony-forming units/mL of a uropathogen)
- Secondary aim: The secondary aim of this study is to decrease the average duration of therapy for outpatient treatment of UTI for PCH ED/UC from 9 days to 7.6 days (15% reduction) within 6 months.

Interventions

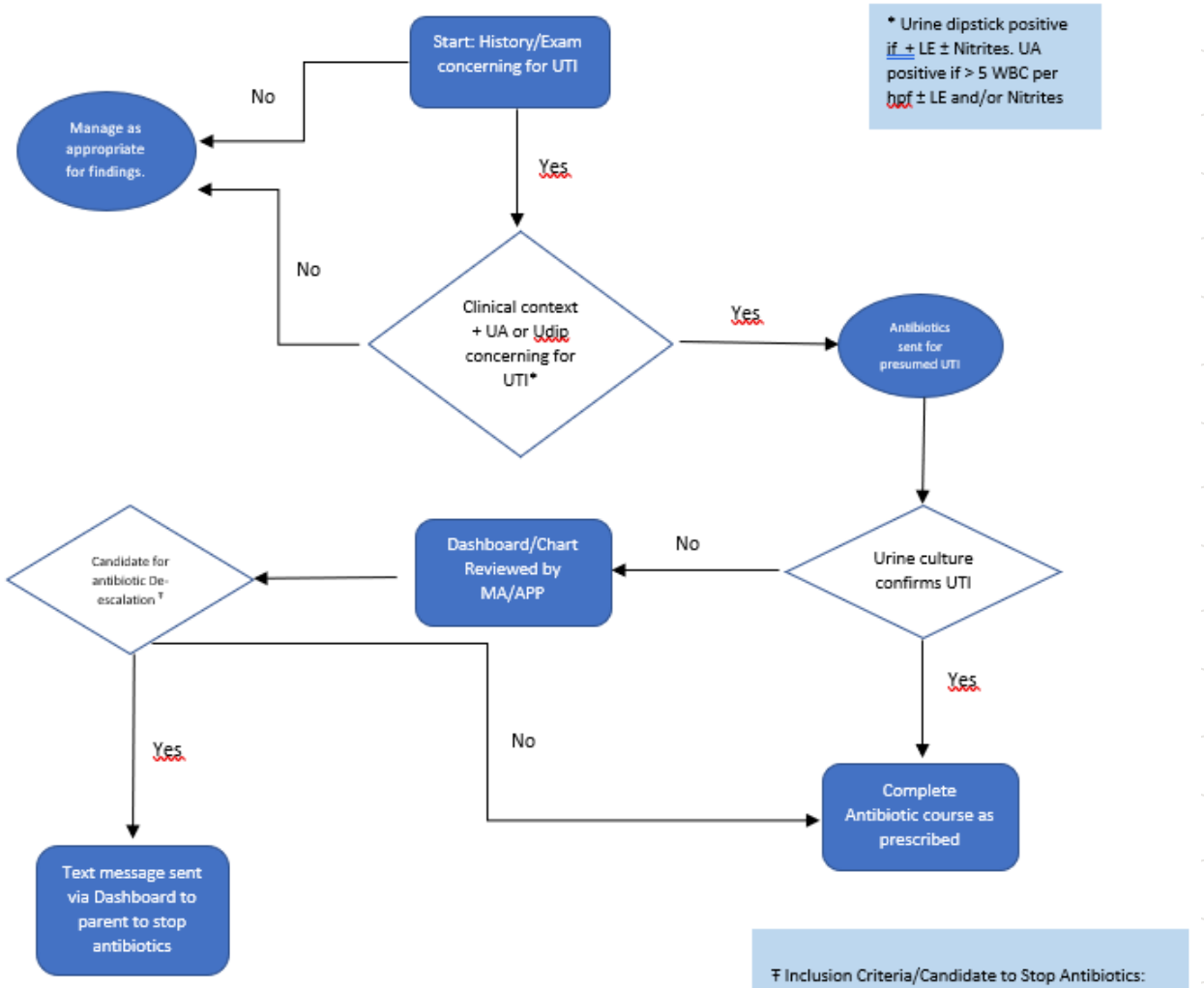


Multidisciplinary Team

- Emergency Medicine
  - Karen Yeager
  - Carol Thrall (NP)
  - Ilyssa Bain (NP)
  - Denise Ortiz (MA)
- Clinical Informatics
  - Vinay Vaidya
  - Mary Kay Walsh
  - Stuart Stough
- Infectious Disease/Antibiotic Stewardship
  - Wassim Ballan
  - Christian Armstrong
- Graduate Medical Education
  - Nisha Isaac
  - Priya Prasher
  - Tatiana Jerome

Component B

- Dashboard to isolate eligible ED/UC DC patients + Antibiotic Rx for presumed UTI + Negative final Ucx.
- Daily Email Report to MA/APPs with eligible patients →
  - Patient Name, MRN, Age
  - Acute and Chronic Dx
  - Culture results
  - Link to smart chart
  - Link to send text message
  - Link to smart sheet
  - Text in English/Spanish and reminder of inclusion/exclusion criteria in email

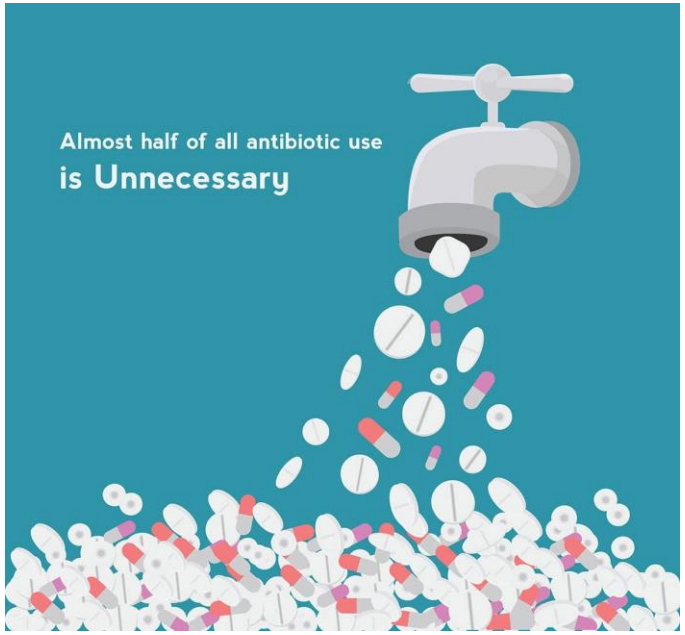


PDSA Cycles

- PDSA Cycle 1:
  - Review and adaptation of UTI clinical pathway and ID recommendations for outpatient UTI treatment with Infectious Disease (Dr. Ballan) and Antibiotic Stewardship team March – April 2023
- PDSA Cycle 2:
  - Educational sessions with ED and UC providers, reviewed UTI pathway and prescribing recommendations for simple cystitis/UTI vs. pyelonephritis
  - May 3, 2023 (UC Division Meeting)
  - May 10, 2023 (ED Division Meeting)
- PDSA Cycle 3: Email reminders with updates on progress and reminders
  - April 27, 2023 GO Live Email with UTI pathway reminders and tutorial for dashboard
  - May 31, 2023 – Updates on progress from first month and reminders to reinforce education
  - August 4th, 2023 – Updates on progress from first quarter and reminders to reinforce education.
- PDSA Cycle 4: Adding in Mixed flora
  - Go Live for mixed flora results to dashboard/email June 1, 2023

Component C

- Prospective Survey Study
- IRB approved – data collection of 47 surveys completed
- Explored parent receipt of text message, compliance with stopping antibiotics and any barriers



10c. Table B: Survey Questionnaire

Questions	Response Options
1) Did the patient/patient receive a text message from PCH that child's urine culture is negative and to stop antibiotics	• YES • NO
2) After receiving a text message from our EHR system, did the patient discontinue antibiotics?	• YES • NO
3) If the patient did not stop taking antibiotics, why?	• Patient continued to be symptomatic • Advised to continue by healthcare provider • Patient is/was taking antibiotic for other indication ○ Insert other indication • The antibiotics was helping with symptoms • Patient did not understand text message instructions • Other: (insert reason)
4) How many days of antibiotics were you/your child prescribed	• Insert Number
5) How many days of antibiotics did the patient complete before stopping medication?	• Insert number
6) Does patient still have any of the following symptoms: • Abdominal pain/suprapubic pain • Pain with urination • Fever • Frequent need to urinate • Blood with urination	• Abdominal pain/suprapubic pain • Pain with urination • Fever • Frequent need to urinate • Blood with urination
7) If the answer to any questions from Questions 4 are yes, has the patient sought medical attention?	• YES • NO If the answer to Question 6 is yes, please advise patient to seek follow up with Primary Care Provider or return to ED or UC

Phoenix Children's

Demo Dashboard + Report

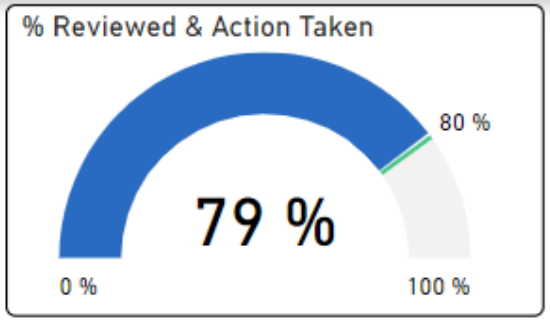
Urine Cx, Antibiotic De-Escalation

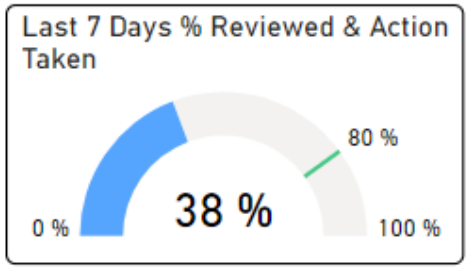
Main Page

Abx Stop/De-Escalate

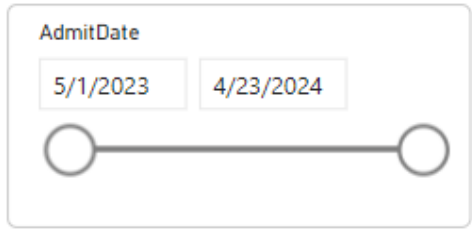
Measures

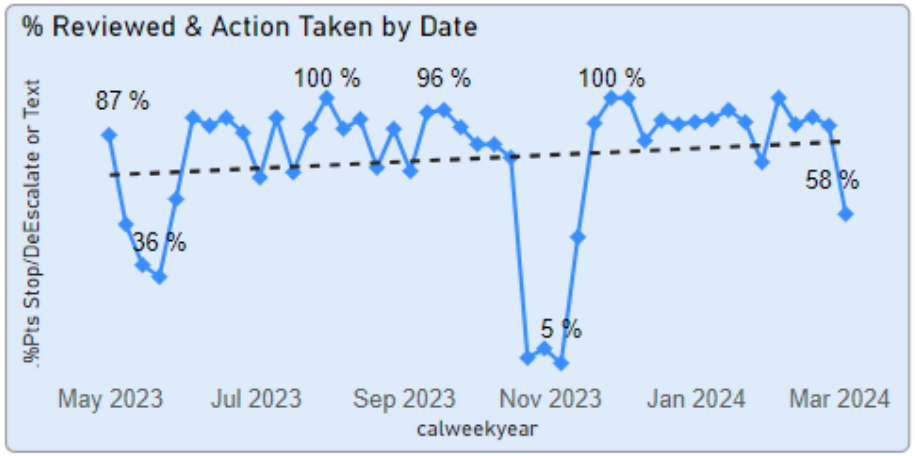
Report Access

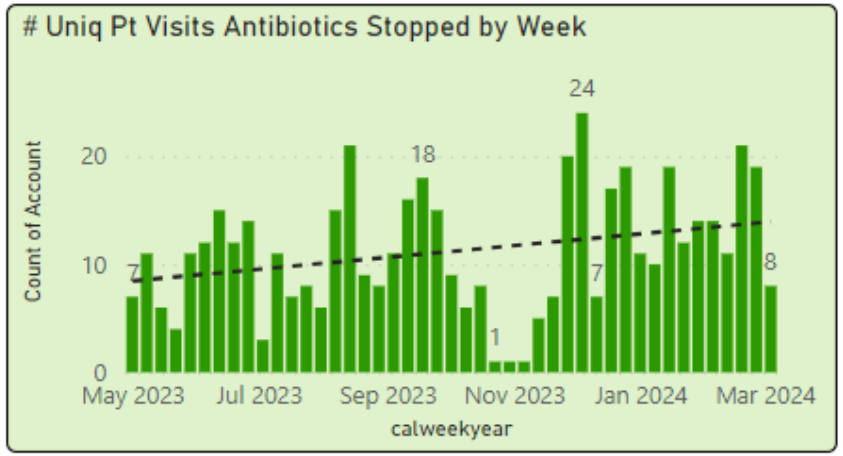


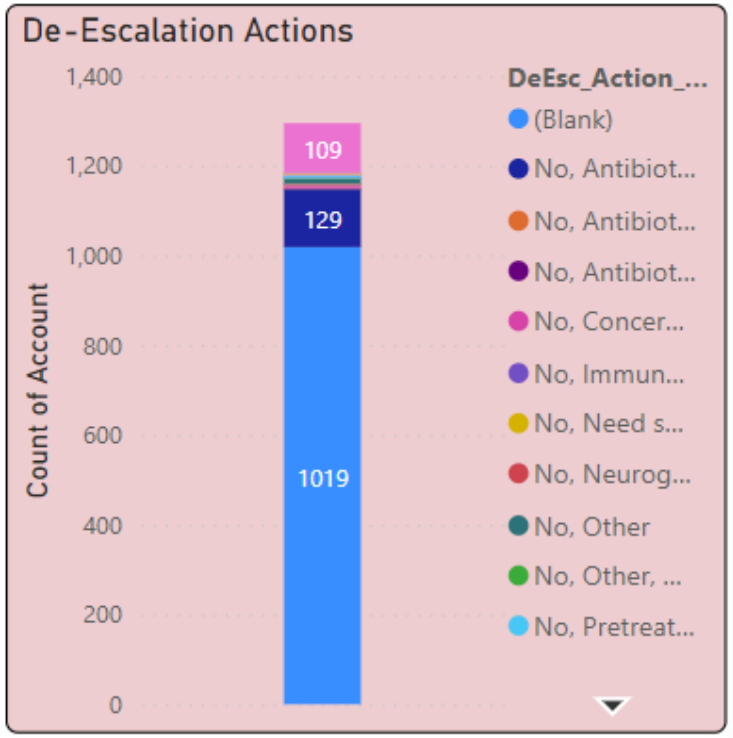


GO LIVE: 1) No Growth on 5/1/2023,
GO LIVE: 2) Mixed Flora on 5/31/2023









Antibiotic Stop/De-escalate

No Growth or Mixed Flora (no predominate organism) & On Antibiotics

No Action No Text

Clear Filters

GO LIVE: No Growth on 5/1/2023, Mixed Flora on 5/31/2023

MixedFlora_NoGro...
- Select all
- (Blank)
- 1
- 2

AdmitDate
3/3/2024 – 3/9/2024

Urine Culture Results

SC	#Uniq Visits	Pt Name	Age at Visit (Yrs)	Admit DT	AcuteDxThisVisit	Extrapolated Result	Culture Result
	1	[redacted]	3.4	3/9/2024	Acute upper respiratory infection, unspecif...	NO GROWTH	NO GROWTH
	1		5.2	3/8/2024	Constipation _K59.00 // Urinary tract infect...	NO GROWTH	NO GROWTH
	1		5.5	3/8/2024	Constipation _K59.00 // Nonspecific mese...	NO GROWTH	NO GROWTH
	1		3.4	3/8/2024	Urinary tract infection, site not specified _...	MIXED FLORA - ...	30000 CFU/ML MIXED FLOR
	1		0.7	3/8/2024	Urinary tract infection, site not specified _...	NO GROWTH	NO GROWTH
	1		6.6	3/7/2024	Urinary tract infection, site not specified _...	MIXED FLORA - ...	50000 CFU/ML MIXED FLOR
	1		14.6	3/7/2024	Acute pyelonephritis _N10 //	NO GROWTH	NO GROWTH
Total	**7**						

Displays the Percentage of De-Escalate Actions

DeEsc_Action...
- (Blank)

DeEsc_Action_SS
- Select all
- (Blank)

DeEscalateActio...
- 0
- 1

TextMessageFo...
- No

(Blank)
Abx Days Saved

Rx Writer & Days Saved

# visits	Pt Name	GenericName	Duration (days)	Days between Abx&Text	Days Saved	RxEntered Date	RequestedBy
1	[redacted]	cephalexin	7			3/9/2024	Spontak, Jessica
1		cephalexin	7			3/9/2024	Brown, Rebecca E
1		cephalexin	5			3/8/2024	Bowe, Michael
1		cephalexin	7			3/8/2024	Huntley, Jennifer
1		cephalexin	7			3/8/2024	Spontak, Jessica
7							

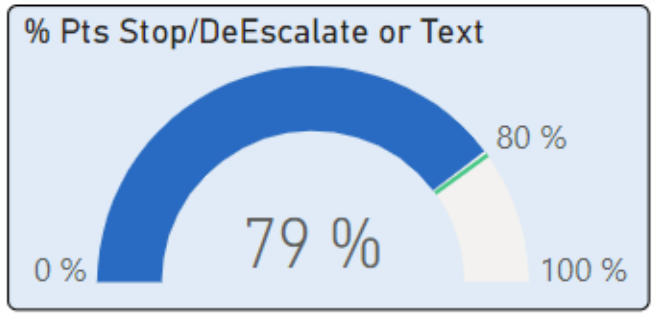
Pt Name, MRN
Search
[redacted]

Non_UTI_infection...
- 0
- 1

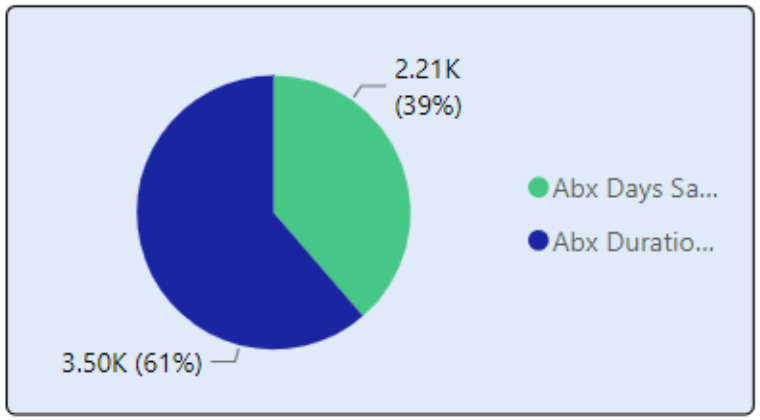
AntibioticRx
- 0
- 1

Outcome and Process Measures

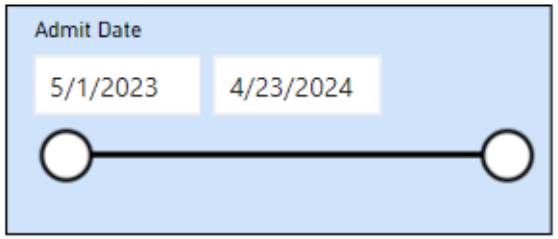
GO LIVE: No Growth on 5/1/2023
GO LIVE: Mixed Flora on 5/31/2023

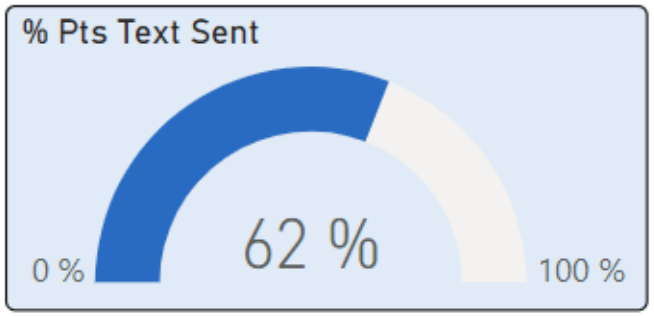


Denominator: The number of patients **without** a non-UTI infection and a negative urine culture (no growth or MF no significant growth) and a prescription for antibiotics
Numerator: The number of patients where the Stop/De-Escalate smart sheet was complete or a text was sent to the patient to stop antibiotics

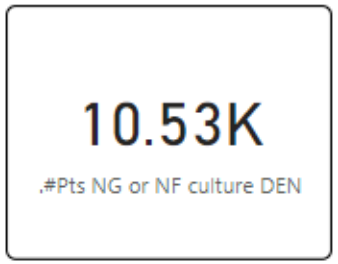


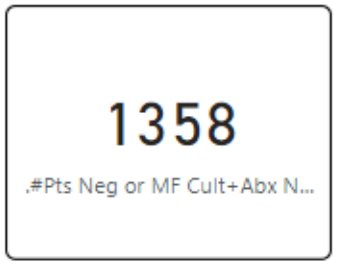
The number of days saved after antibiotics discontinued for negative cultures



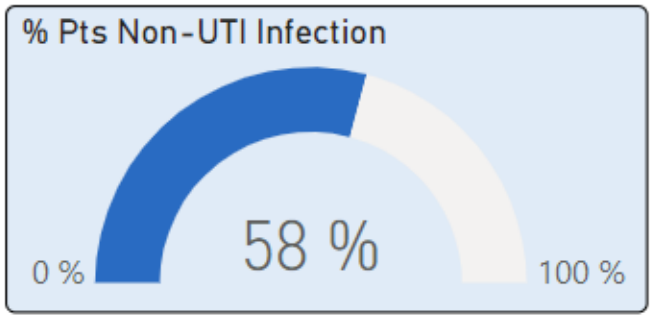


Denominator: The number of patients **without** a non-UTI infection and a negative urine culture (no growth or MF no significant growth) and a prescription for antibiotics
Numerator: The number of patients sent a text message to stop antibiotics





Denominator: The number of patients with a negative urine culture (no growth or MF no significant growth)
Numerator: The number of patients with a prescription for antibiotics



Denominator: The number of patients with a negative urine culture (no growth or MF no significant growth) and a prescription for antibiotics
Numerator: The number of patients **with** a non-UTI infection

Inclusion Criteria/Candidate to Stop Abx: 1) Patient >60 days old; 2) Seen in ED or UC; 3) Negative urine culture; 4) Abx started for UTI (not other indications)

Exclusion Criteria/Do NOT Stop Abx: 1) Patient </= 60 days old; 2) H/O renal ds; 3) Known anatomic abnormalities of urogenital tract except VUR; 4) Presence of indwelling catheters, stents, drains; 5) Severe comorbidity condition such as immunodeficiency, active chemotherapy; 6) Neurogenic bladder; 7) Already on Abx in past 72 hrs; 8) Concern for sexually transmitted infection

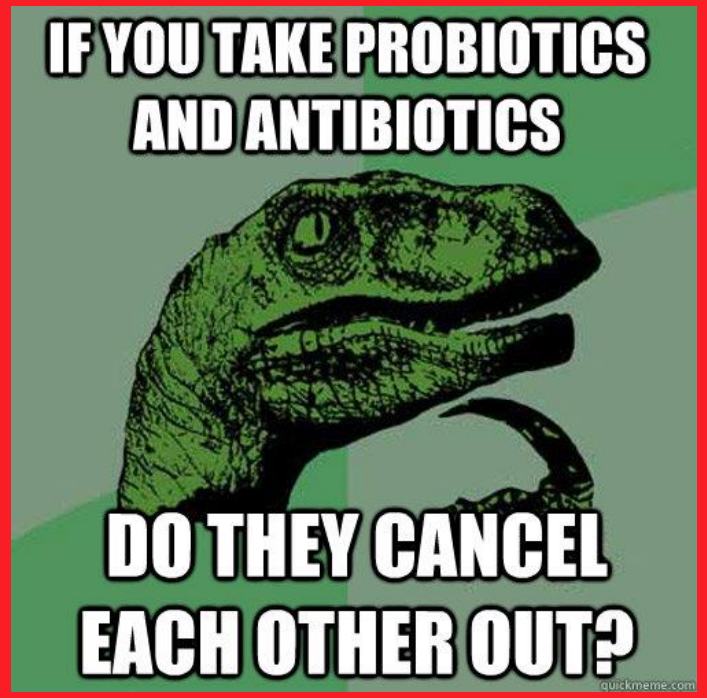
Patient Name	Age	Admit Date	Generic Name	Duration Days	Acute Dx This Visit	Chronic Dx	MRN	Culture Result Extrapolated	Culture Result	Abx Stop/De-escalate	Needs Text	SC
[redacted]	3.4	6/12/2023	sulfamethoxazole-trimethoprim	10	// Vomiting, unspecified _R11.10 //		[redacted]	MIXED FLORA - No Org Predom	40000 CFU/ML METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS 20000 CFU/ML MIXED FLORA OBSERVED	Abx Stop/De-escalate	Send Text	SC
[redacted]	0.3	6/13/2023	cephalexin	7	// Fever, unspecified _R50.9 // Urinary tract infection, site not specified _N39.0 //		[redacted]	NO GROWTH	NO GROWTH	Abx Stop/De-escalate	Send Text	SC
[redacted]	4.3	6/13/2023	cephalexin	5	// Urinary tract infection, site not specified _N39.0 //		[redacted]	MIXED FLORA - No Org Predom	40000 CFU/ML MIXED FLORA, NO ORGANISM PREDOMINATES. PLEASE SUBMIT NEW SPECIMEN IF CLINICALLY INDICATED.	Abx Stop/De-escalate	Send Text	SC
[redacted]	0.4	6/13/2023	cephalexin	7	// Fever, unspecified _R50.9 // Urinary tract infection, site not specified _N39.0 //		[redacted]	NO GROWTH	NO GROWTH	Abx Stop/De-escalate	Send Text	SC

Urine Culture ED/UC Dashboard can be accessed at: Dashboard link

Text message prompt to discontinue antibiotics:

Your child's urine test at PCH's Emergency Department/Urgent Care was negative. Child DOB: **/**/**. Please stop antibiotics for urinary tract infection and follow up with your PCP or PCH if your child has painful urination, belly pain, fever and/or vomiting after stopping antibiotics.

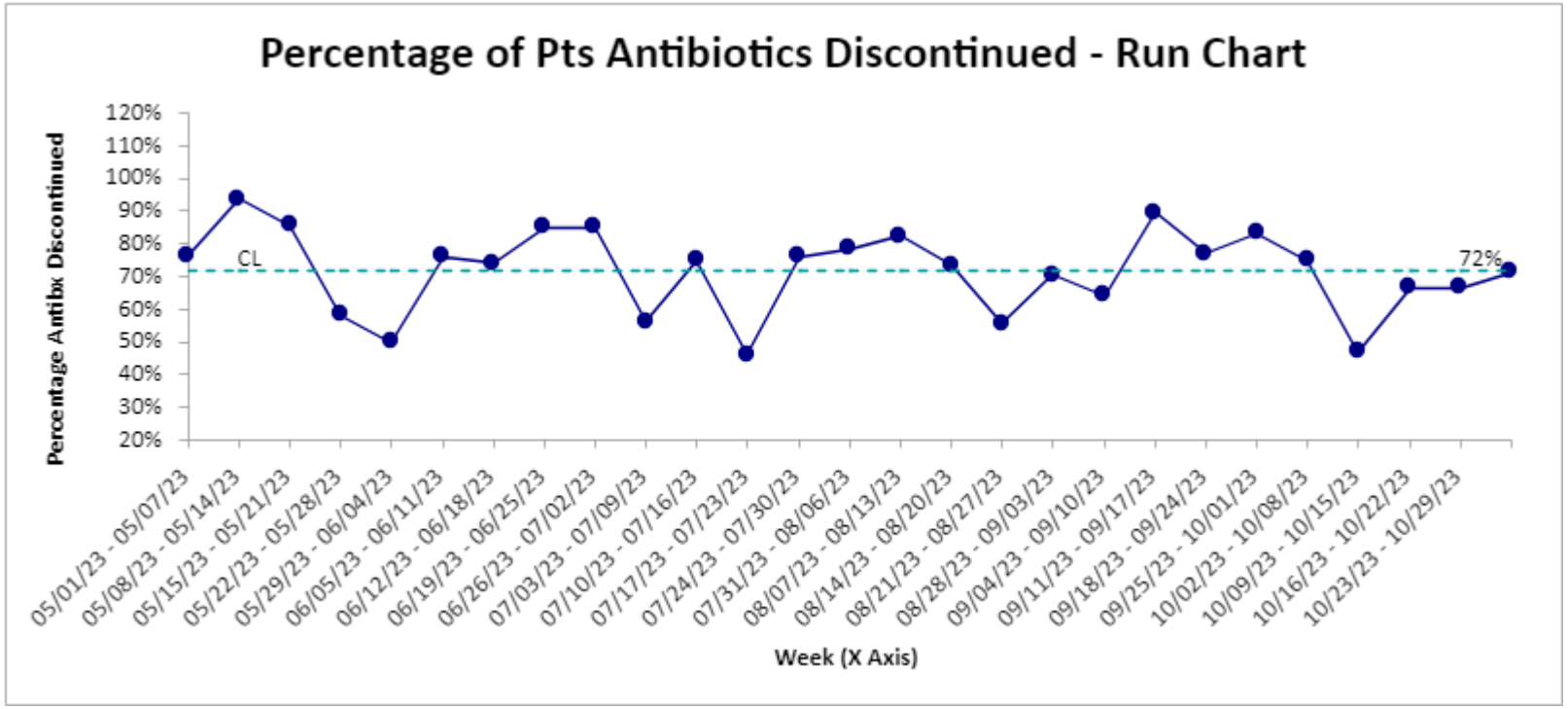
El análisis de orina en la sala de emergencia/urgencia de PCH dio negativo. Fecha de nacimiento del niño: **/**/**. Suspenda los antibióticos para infección urinaria y contrólese con el médico si le aparece dolor al orinar, en la panza, fiebre y vómitos luego de suspenderlos.



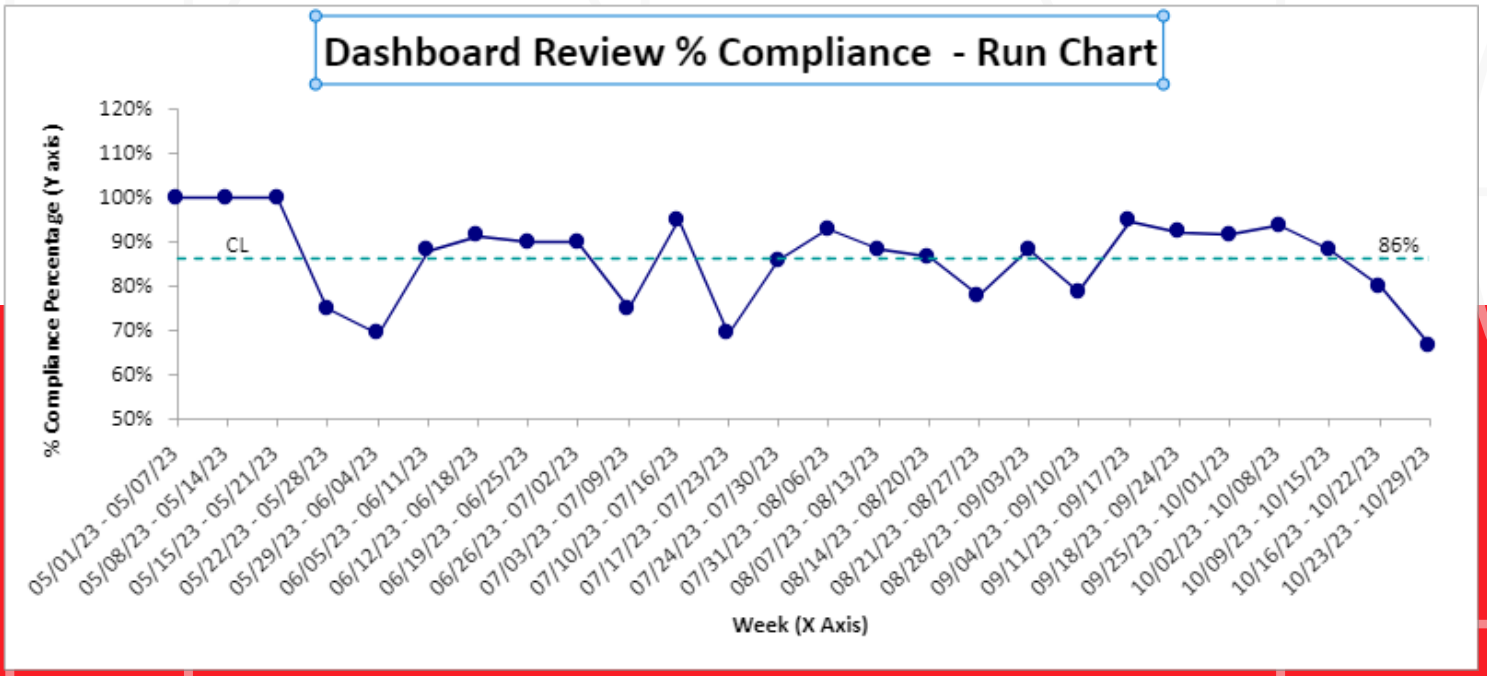
Data and Results

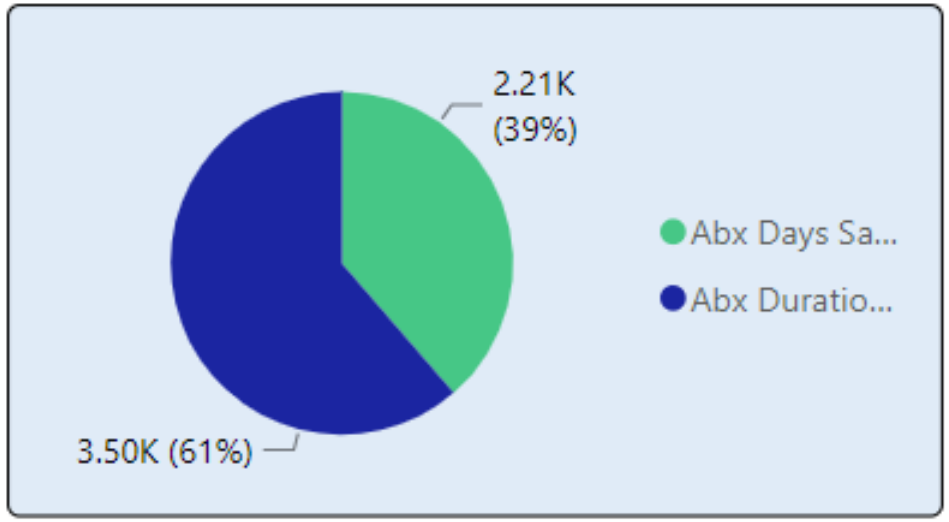
Primary Aim

- Of all patients with Negative Urine Culture + Antibx Rx (Excluding non-uti dx)
  - > 50% receiving text to stop antibiotics
  - Reasons not to send text: see exclusion criteria

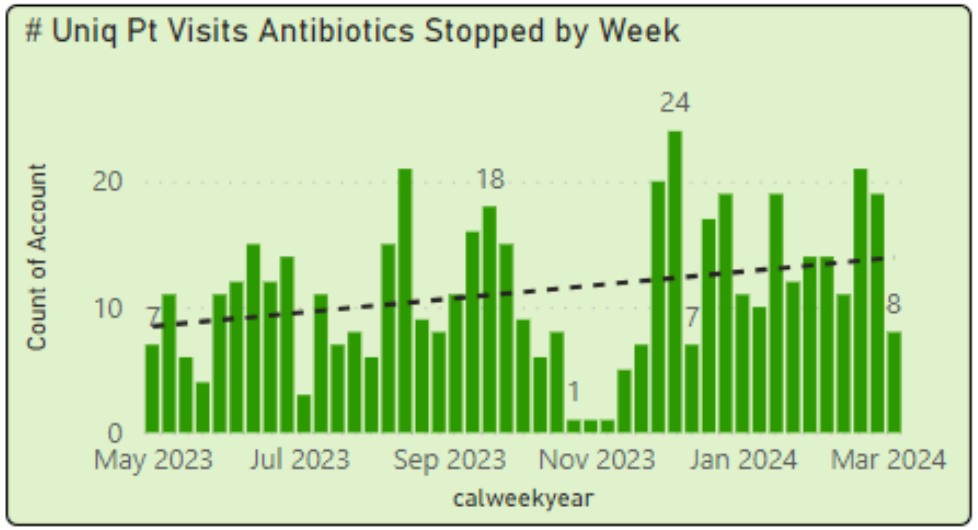


Post Intervention



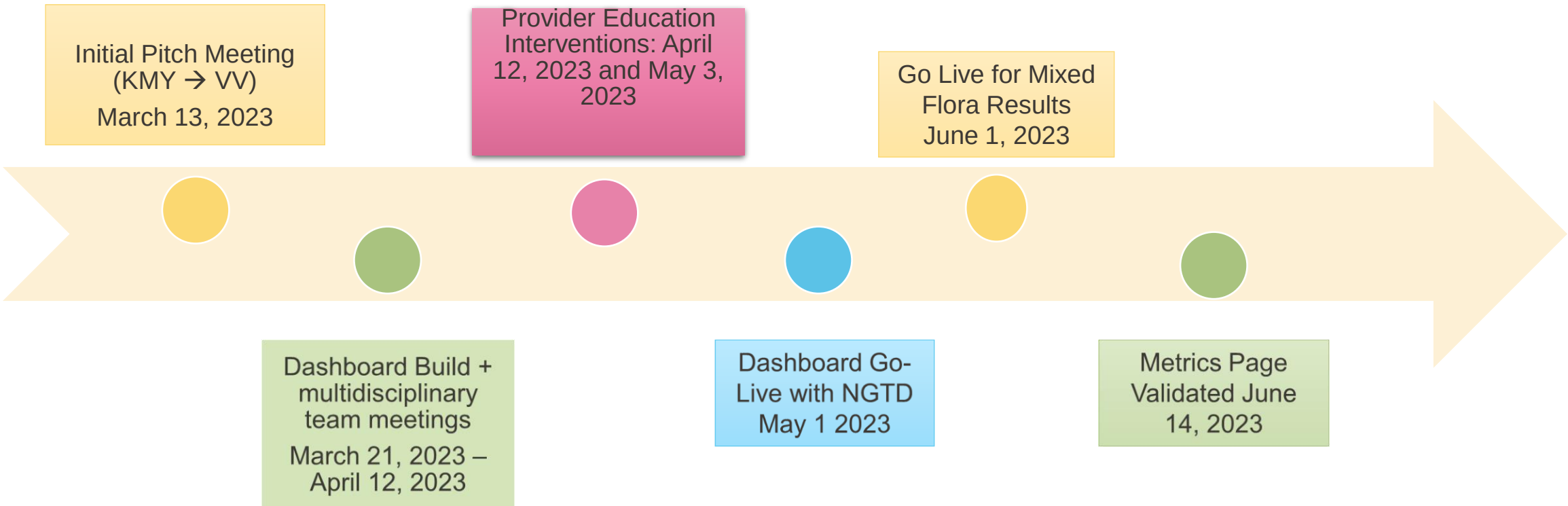


The number of days saved after antibiotics discontinued for negative cultures



502 discrete patients where antibiotics discontinued to date – with an average duration of therapy of 7.1 days (improved from 9 days pre intervention). 21% Decrease!

Timeline


Initial Pitch Meeting (KMY → VV)
March 13, 2023
Dashboard Build + multidisciplinary team meetings
March 21, 2023 – April 12, 2023
Provider Education Interventions: April 12, 2023 and May 3, 2023
Dashboard Go-Live with NGTD May 1 2023
Go Live for Mixed Flora Results June 1, 2023
Metrics Page Validated June 14, 2023

Next Steps:

- Retrospective Analysis of Antibiotic Stewardship Opportunities (2 years) + case-controlled cohort – manuscript drafting underway

- Design/Feasibility manuscript: pending

- Component C: Prospective Survey study: data collected, statistical analysis and manuscript drafting underway

- QI project: Reinforce education, continue monitoring metrics → report out quarterly
Potentially a dedicated educational intervention for new hire APPs in ED/UC.

Discussion

- What are the local areas for improvement in your practice setting in outpatient UTI diagnosis and management?
  - Diagnosis
  - Drug
  - Dose
  - Duration
  - De-escalation

- Are there other common outpatient infectious conditions that would benefit from similar treatment?

Lessons Learned

- Successes
  - Multidisciplinary Team Approach
  - Iterative Design Process including end-users
  - Divide and Conquer multi-directional approach
  - Early and thorough learner engagement
  - Quick and frequent communication and check-ins
  - Eye towards sustainability early
- Areas for Improvement
  - More thoughtful pre-project planning, particularly for data/metrics reporting and timeline
  - Start IRBs sooner
  - Stay more organized with my notes and milestones (things happening quickly and often)
  - Have a plan for scaling back check ins.

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Questions?