Jeffrey Silvers MD
Medical Director Pharmacy and Infection Control,
Sutter Health

IDAC Antimicrobial Stewardship and the Continuum of Care

Sutter Health

How BIG is the Problem?

EXCESS ANTIBIOTIC TREATMENT - LOT

The Ambulatory Arena

- 80-90% of human antibiotic use occurs in the outpatient setting
- Over 200,000,000 outpatient prescriptions were written in US in 2020
  - Primary care
  - Physician assistants and nurse practitioners
  - Dentists
- 50% have stewardship opportunities

Clinical Practice Guidelines

Indications	Duration	Other requirement(s)	Recommending Bodies
CAP	Minimum 5 days	Clinically stable for ≥ 48 hours at day 5	IDSA
SSTI	5-7 days	Adequate debridement performed, when indicated	IDSA
Uncomplicated UTI	3-5 days	Old definition from 2011. being updated	IDSA
AECOPD	5 days	Meet specific criteria	Gold Report

The Transition of Care Arena

- ~50% of hospitalized patient receive antibiotics during inpatient stay
- 1 out of 8 have antibiotics continued after discharge
  - Many prescribed for an excess duration
- After discharge, patients complete about 50% of their prescription
- Guidelines do not emphasize discharge interventions.
- DOT versus LOT

A Community Based Example

- *Open Forum Infectious Diseases*, Volume 8, Issue 8, August 2021, ofab399, https://doi.org/10.1093/ofid/ofab399
- Multicenter, retrospective chart review of hospitalized adults
  - 2 critical access, 1 community teaching hospital (191 beds) in Indiana
  - January 1 to June 30, 2019
  - 1 stewardship pharmacist for all 3 facilities
  - Antimicrobial prescribing at discharge not monitored
- Diagnoses:

  CAP, SSTI, uncomplicated UTI, AECOPD.
- Admitted and discharged with a prescription for at least 1 antibiotic

Definitions

CAP

SSTI

UTI

AECOPD

A Community Based Example - Cohort

- 547 patients
- Median LOT for all 4 categories was 9 days with IQR of 7-11.

Diagnosis	# Patients (% of Cohort)	Median LOT	IQR	Recommended LOT
CAP	233 (42.6)	9	7-10	Minimum 5 days
SSTI	101 (18.5)	12	10-14	5-7 days
UTI	120 (21.9)	8	6-10	3-5 days
AECOPD	93 (17.0)	7	5-9	5 days

Weak Links in Continuum of Care

- Gaps in access to EMR
- Failure to follow-up culture results
- Not counting days of therapy before de-escalation as part of total treatment course
- Not counting previous days of inpatient therapy as part of total treatment course

Total Duration of Antimicrobial Resulting From Inpatient Hospitalization

- Multicenter, retrospective study
- Two community hospitals (300+ beds in each) & 1 academic medical center (Duke, North Carolina)
- Inclusion: Hospitalized patients who received ≥ 1 dose of a systemic antibiotic
  - Excluded ED and procedural areas
- April through September 2016
- 45,693 inpatient admissions
- 23,447 received antibiotics (51%)
- 7,442 received e-scripts at discharge
  - 348 were not on inpatient antibiotics
  - 30% of patients on inpatient antibiotics were given e-scripts

Methods

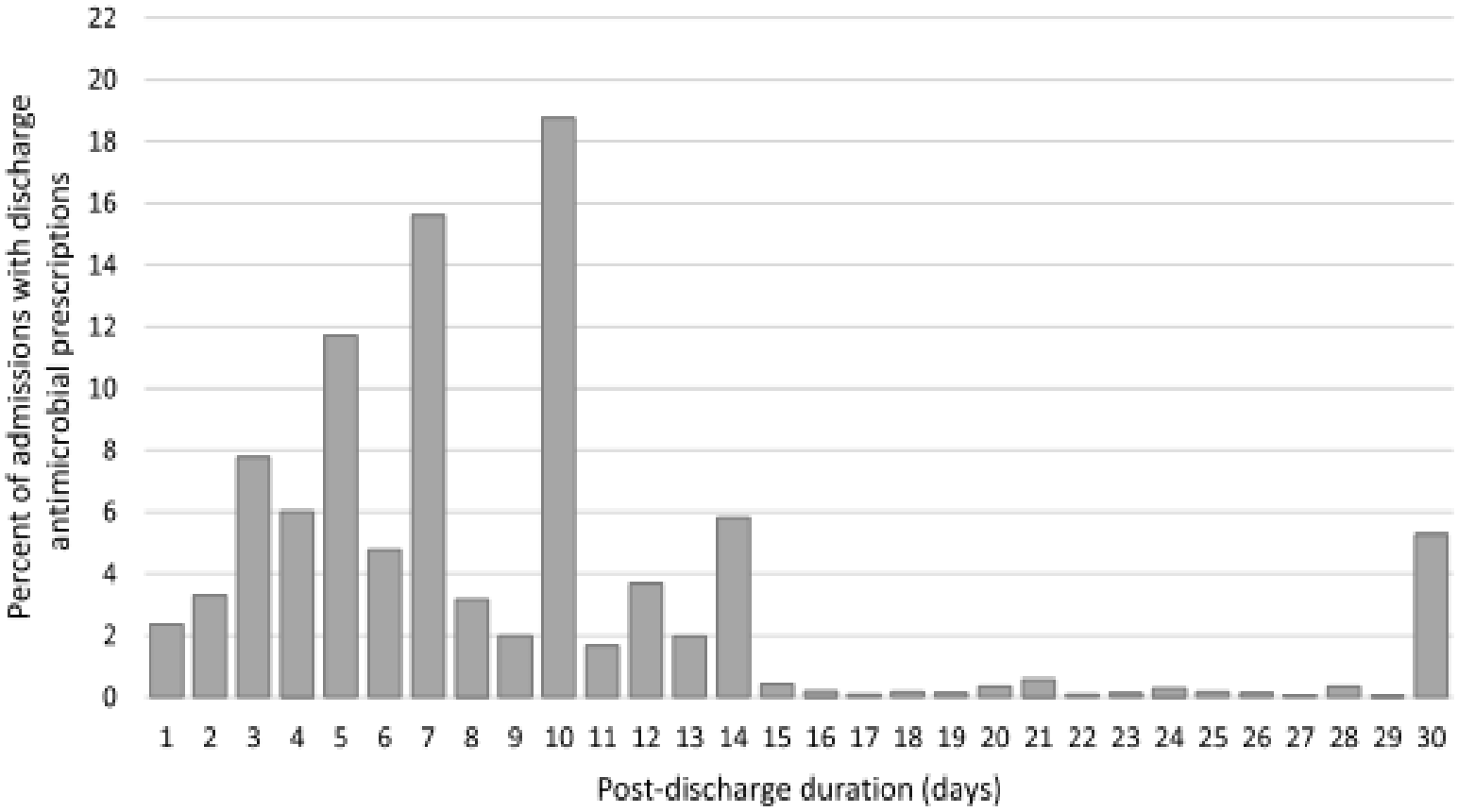
- EMR medication administration days to calculate inpatient antimicrobial days
- E-scripts to determine post-discharge antimicrobial days
  - Duration determined by directions and quantity
- Length of therapy (LOT) = inpatient LOT plus post-discharge LOT
- Calculates a calendar day as receipt of 1 or more doses of a systemic antibiotic
- Used NHSN antibiotics only to exclude counting cases e.g. HIV treatment

- Infection Control & Hospital Epidemiology 2019
  - https://pubmed.ncbi.nlm.nih.gov/31134880/

Findings

- Post-discharge length of therapy (LOT) was a median 8 days
- Post-discharge days comprised 38% of antimicrobial exposure days
- Patients with ICD-10 diagnosis of pneumonia, UTI, SSTI, or intra-abdominal infection were often discharged on antibiotics
- Over 75% who received discharge e-scripts were prescribed a total LOT > 7 days
- Only 16% of inpatients who received their full course of therapy in the hospital were treated more than 7 days
- The difference was most pronounced for patients with a diagnosis of intra-abdominal infection

Post-Discharge LOT



- Only shows LOT ≤ 30 days
- 3% were > 30 days
- > 30 days mostly oral antifungals, agents for treatment of nontuberculous mycobacteria, or outpatient parenteral antibiotics

Sutter Health

Possible Explanations for Findings

- Uncertainty about diagnosis and readiness for discharge
- Concern about reliability for follow-up
- Inadequate attention to start and stop dates to meet the intended LOT
- Lack of knowledge
- Rushed discharge process
- EMR with a default pre-checked

Weakness of the Study

- Includes patients where antibiotics were:
  - escalated empirically
  - changed because initial therapy did not cover identified organisms
- Post-discharge prescription durations were based on orders without information on compliance
- 5% of the e-scripts had durations that could not be calculated
  - Mostly oral solutions and IV antibiotics
- 23% of clinicians used written prescriptions or verbal orders
  - Not captured
  - Mostly patients discharged to long-term care facilities or dialysis centers

Approaches to Addressing Continuum of Care

- Medication reconciliation at discharge
- Education
- Ensure follow-up of pending culture results at discharge
- Order set with default LOT depending on diagnosis entered at time of order
- Prospective audit and feedback
- Creating an alert with LOT for provider, including recommendations

Weak Links

- Inpatients
  - De-escalation of antibiotics
  - Sign-off to next provider
- Ambulatory
  - Communication between specialties
- Discharge
  - SNF
  - LTAC
  - Rehabilitation
  - Psychiatric Ward
  - Board and Care
  - Home without support
  - Primary Care

Excess Antibiotics After Inpatient Hospitalization

- Annals of Internal Medicine 2019;171:153-163
- Statewide study in Michigan
- Retrospective cohort chart review, Jan. 2017-April 2018
- 43 (47%) of non-critical access and non-federal hospitals participated
- 6481 patients with diagnosis of CAP or HCAP
- HCAP defined as pneumonia with any of the following:
  - Hospitalization within last 90 days
  - Residence in SNF
  - Intravenous chemotherapy
  - Home care for wounds or infusion therapy
  - Long-term hemodialysis

Pneumonia Inclusion Diagnostic Criteria

- Requires all the following:
  - Discharge diagnosis code for pneumonia
  - Symptoms and imaging consistent with pneumonia
  - Receipt of ≥ 4 days of antibiotic treatment
  - Receipt of antibiotics on days 1 or 2 of hospitalization

Pneumonia Exclusion Diagnostic Criteria

- Received care in ICU or were on a ventilator at any point in hospitalization
- Treatment also included coverage for an additional infection
- Pregnant
- Severely immunocompromised
- Bacteremia or empyema
- Legionella or fungal infection
- Admitted under comfort care
- Left AMA

Treatment Duration

- Expected treatment duration
  - Patient stable ≥ 48 hours, defined as afebrile and ≤ 1 VS abnormality
  - CAP minimum of 5 days
  - HCAP minimum of 7 days
  - Considered appropriate ± 1 day
- Measured treatment duration
  - DOT inpatient plus outpatient prescription
  - Excluded days of ineffective therapy

Multiple Predictor Variables Assessed

- Demographics
- Pneumonia Severity Index
- FQ, linezolid, MRSA or Pseudomonas treatment in last 90 days
- Incorrect documentation of CAP versus HCAP
- Documentation of LOT in discharge summary
- Size and type of hospital
- S/S Pneumonia first 2 days of hospitalization
- Length of stay
- CAP vs HCAP
- Diagnostic testing
- Concurrent exacerbation CHF or COPD

Measured Patient Outcomes

- Excess DOT per 30-day period - primary outcome
- Death
- Hospital readmission
- Evaluation in emergency department
- C. difficile infection
- Provider documented adverse events
- Patient-reported adverse events

COHORT

- 73% CAP 26% HCAP
- Median age 70 years
- Female ~= male
- 57% severe pneumonia by pneumonia severity index
- 26% concurrent exacerbation COPD
- 8% concurrent exacerbation CHF

WORK-UP RESULTS

- 78% blood cultures
- 32% respiratory culture
- 16% molecular testing
- 8% had pathogen identified
- 1% pneumococcus (78/6481)
- 87% clinically stable or discharged by day 5

Findings

- 67.8% (4391/6481) received excess antibiotic therapy
  - 72% CAP and 57% HCAP
- CAP median duration 8 days (IQR 7- 10)
- HCAP median duration 9 days (IQR 7-11)
- 50% of antibiotics were prescribed at discharge
- Antibiotics prescribed at discharge accounted for 93% of excess duration
- Only 32% had LOT documented in discharge summary

Findings

- Excess duration of therapy more likely in the following situations:
  - Respiratory cultures or molecular testing obtained
  - Longer duration of hospitalization
  - Prior receipt of high-risk antibiotic in prior 90 days
  - CAP
  - Planned LOT not documented
- No difference in 30-day mortality, readmission, or emergency department visits.

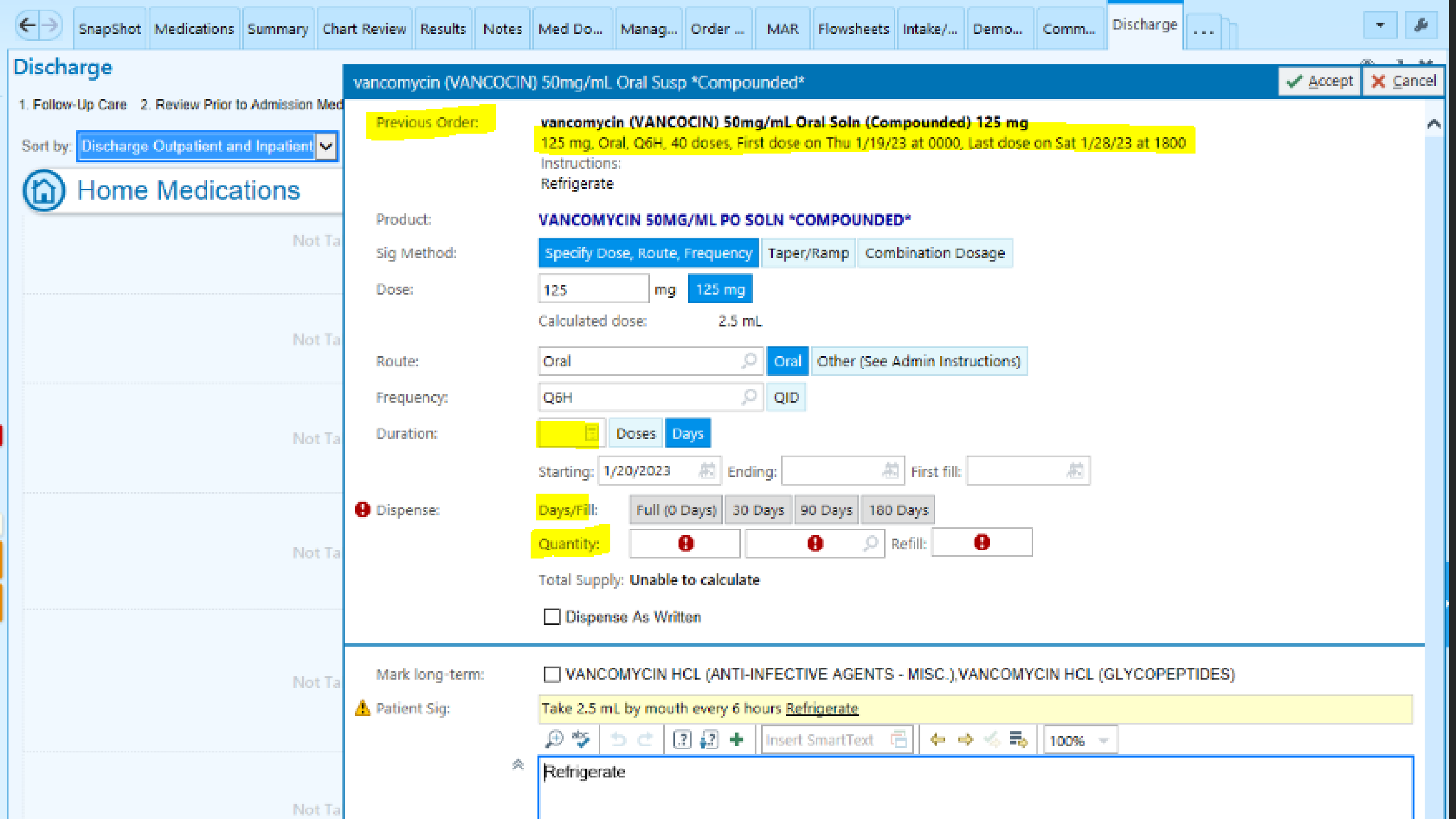
TRANSITIONS OF CARE

Making Attempts

- Some TOC pharmacists are looking at all patients discharged with a diagnosis of sepsis
- Discharging physicians are ask to document the planned LOT
- Data collection is just beginning

Issues with the EMR

- Even when a stop date/LOT has already been specified in the inpatient order, the duration of therapy/end date **DOES NOT** flow onto the outpatient prescription.
- Providers have to **manually** enter the quantity to be supplied/stop date/duration of treatment onto the outpatient prescription.
- If medications have changed during the course of treatment the EMR can't account for those changes.
- EMR encourages another full course of treatment


SnapShot
Medications
Summary
Chart Review
Results
Notes
Med Do...
Manag...
Order ...
MAR
Flowsheets
Intake/...
Demo...
Comm...
Discharge
Discharge
1. Follow-Up Care
2. Review Prior to Admission Med
Sort by:
Discharge Outpatient and Inpatient
Home Medications
vancomycin (VANCOCIN) 50mg/mL Oral Susp *Compounded*
Accept
Cancel
Previous Order:
vancomycin (VANCOCIN) 50mg/mL Oral Soln (Compounded) 125 mg
125 mg, Oral, Q6H, 40 doses, First dose on Thu 1/19/23 at 0000, Last dose on Sat 1/28/23 at 1800
Instructions:
Refrigerate
Product:
VANCOMYCIN 50MG/ML PO SOLN *COMPOUNDED*
Sig Method:
Specify Dose, Route, Frequency
Taper/Ramp
Combination Dosage
Dose:
125
mg
125 mg
Calculated dose:
2.5 mL
Route:
Oral
Oral
Other (See Admin Instructions)
Frequency:
Q6H
QID
Duration:
Doses
Days
Starting:
1/20/2023
Ending:
First fill:
Dispense:
Days/Fill:
Full (0 Days)
30 Days
90 Days
180 Days
Quantity:
Refill:
Total Supply:
Unable to calculate
Dispense As Written
Mark long-term:
VANCOMYCIN HCL (ANTI-INFECTIVE AGENTS - MISC.),VANCOMYCIN HCL (GLYCOPEPTIDES)
Patient Sig:
Take 2.5 mL by mouth every 6 hours Refrigerate
Insert SmartText
100%
Refrigerate

Transitions of Care Makes Sense

- Commitment to stewardship
- Pharmacy expertise
- Policy and procedures
- Tracking and reporting
- Education

What Do You Do With Limited Resources?

- CDC says to target “high-priority conditions”
- Antibiotic prescribing for respiratory tract infections
  - Over prescribed and excessive duration
  - **Focus on CAP and AECOPD**
- Treatment of asymptomatic bacteriuria
- Minimize discharge prescriptions of higher risk antibiotics like fluoroquinolones
- Have clinical pharmacist discuss discharge antibiotics on rounds
  - If daily rounding is part of your process.
  - Address choice of antibiotic, dosing (adjusted for renal function, if needed), and number of days of therapy left to complete course of treatment
  - Don’t underdose AKI

Education and Feedback with Limited Resources

- Track and trend your data
  - Baseline data
  - Educate pre-intervention, share baseline data
  - Collect data
  - Share with individual providers
  - Post de-identified results
- Separate medical, surgical, emergency department, and women's health
- Develop charts, including pareto charts to share

Take-Home Opportunities

- Educate
  - Importance of counting total days of therapy to include antibiotics given before de-escalation
  - Counting DOT received as part of total course of therapy
  - Pitfall of pre-checked prescriptions
  - Slower is faster
- Defining LOT for common diagnoses
- Have provider document planned LOT and ensure that the ordered amount matches the total LOT goal.
- Pharmacist (TOC) review of discharge medications
- Track and trend the data
- Prescriber feed-back reports to include prescribed LOT for common diagnoses with national guidance.

Sutter Health