University of Utah
Community Acquired Pneumonia Care Pathway
A journey through time…

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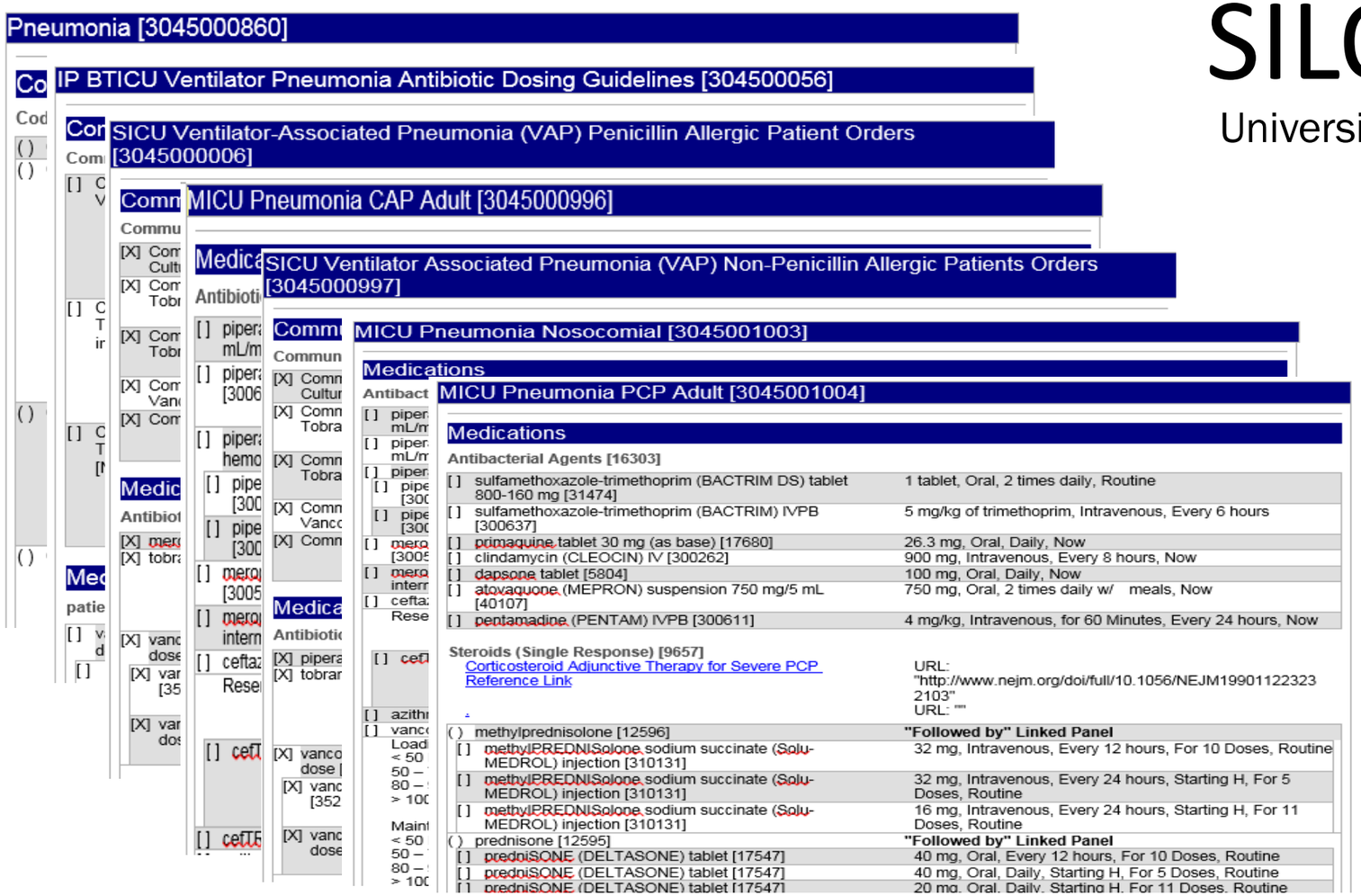
CONFLICT OF INTEREST DISCLOSURES

- The authors have no conflicts of interest to disclose

2015: THE PROBLEM



SILOS

University of Utah

WHAT DO WE KNOW ABOUT PNEUMONIA CARE?

- A leading cause of hospitalization and death worldwide
- Guidelines help improve clinical outcomes
- High cost and high volume condition for academic medical centers
  - Hospitalization LOS of 5.6 day
  - $18,000 per inpatient episode
  - $13 million annual cost in Medicare population

- Postma et al. NEJM. (2015) 372;14
- Brown et al. BMC Geriatrics (2018) 18:92

2016 CAP BUNDLE DEVELOPMENT

- Develop and implement single "Best Practice" pathway for CAP

- Do away with HCAP
- Duration of therapy
- Reducing unnecessary atypical coverage
- Early IV to PO conversion

- Assess impact of Pathway on:
  - Intravenous antibiotic duration
  - Length of stay
  - Costs
  - Balancing Measures

PNEUMONIA CARE PATHWAY TEAM LEADERS

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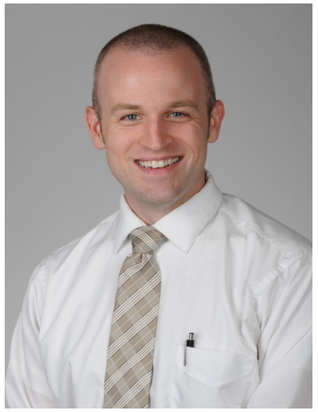

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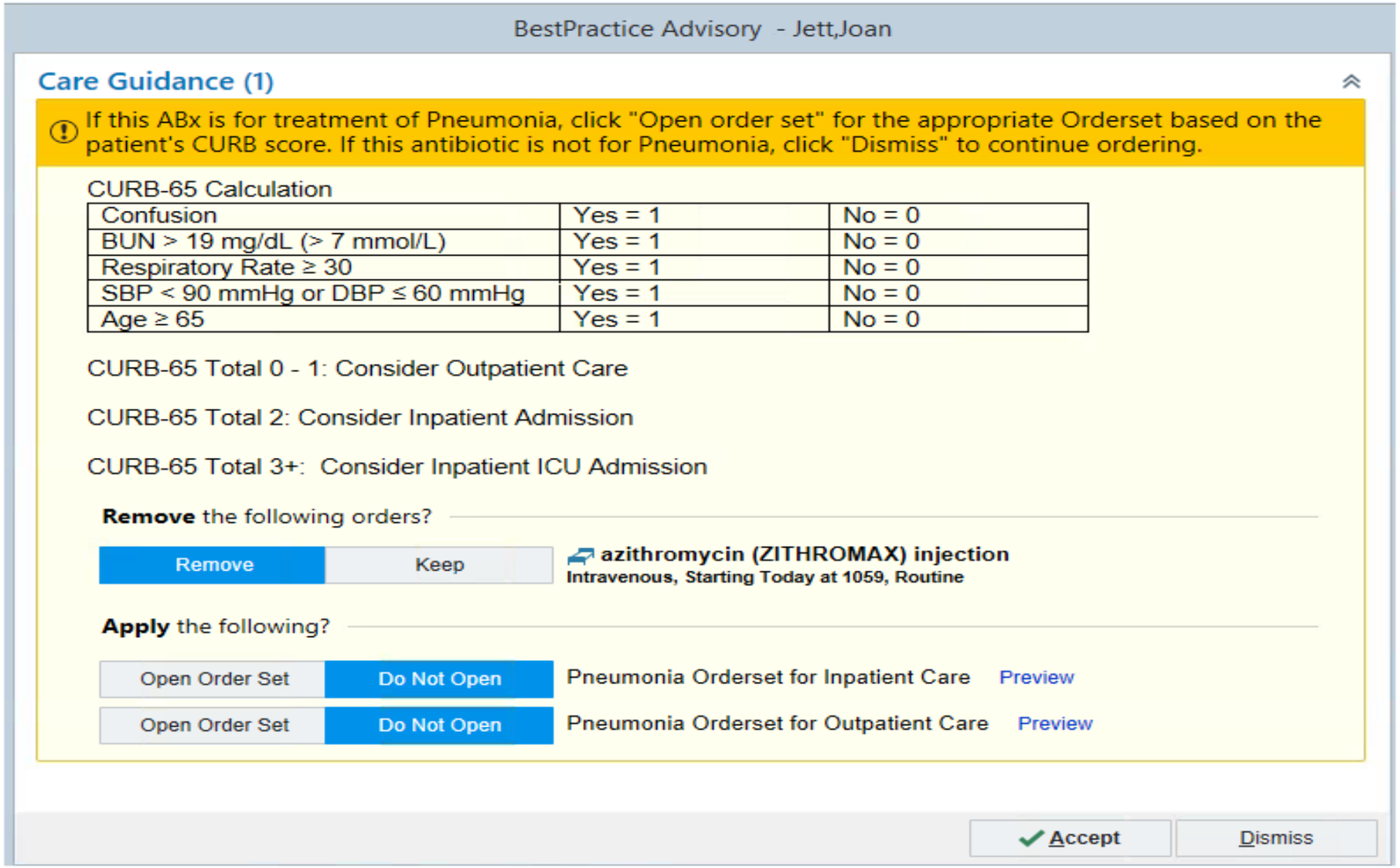
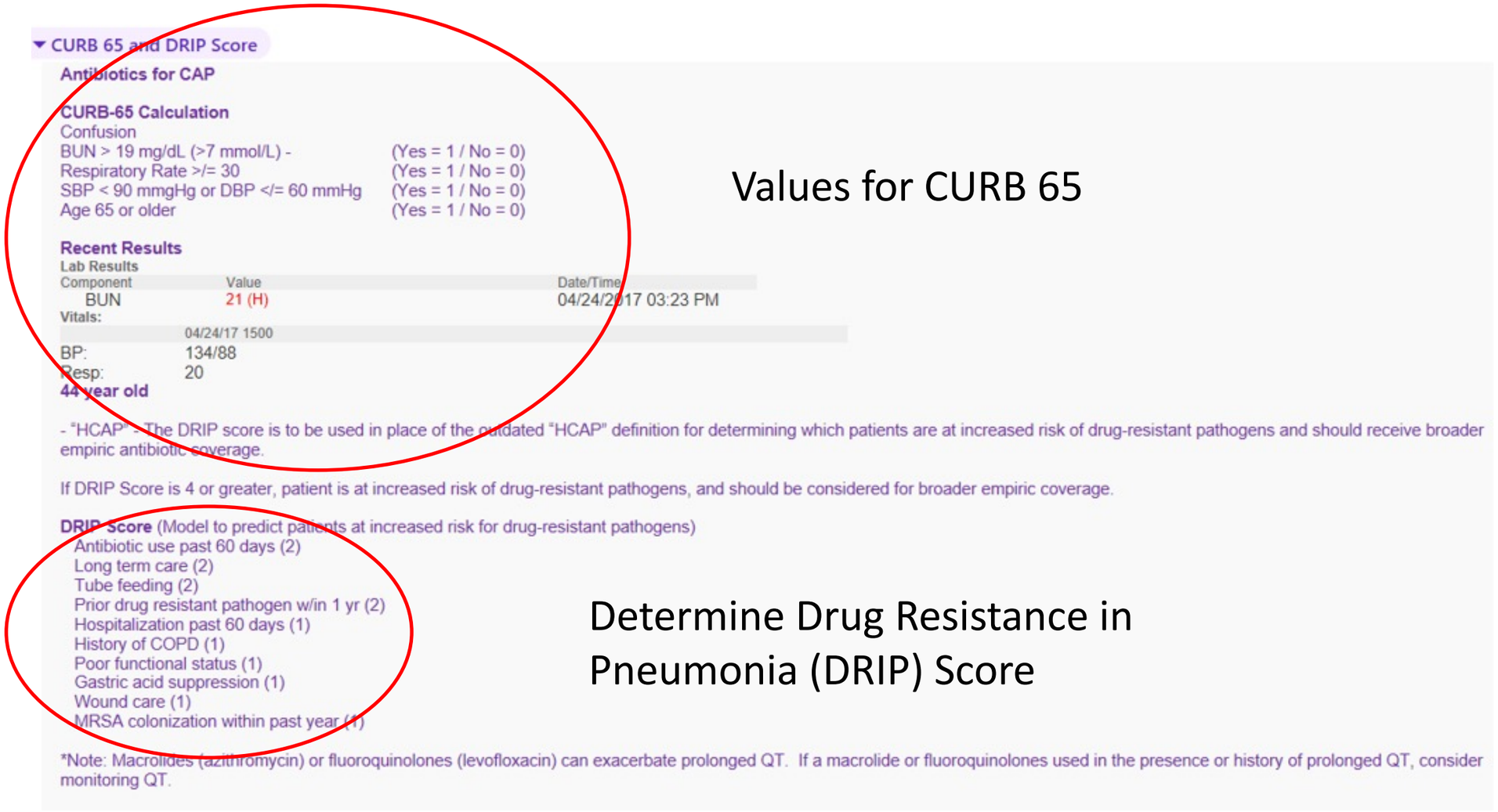
BEST PRACTICE ALERT: PATHWAY GOES LIVE 9/1/17!



Starts in the Emergency Room

*Fires when chest x-ray and antibiotics both ordered…embedded into workflow

CAP ORDER SET 2017



▼ CURB 65 and DRIP Score

Antibiotics for CAP

CURB-65 Calculation

Confusion	
BUN > 19 mg/dL (>7 mmol/L) -	(Yes = 1 / No = 0)
Respiratory Rate >/= 30	(Yes = 1 / No = 0)
SBP < 90 mmgHg or DBP </= 60 mmHg	(Yes = 1 / No = 0)
Age 65 or older	(Yes = 1 / No = 0)

Recent Results

Lab Results

Component	Value	Date/Time
BUN	21 (H)	04/24/2017 03:23 PM

Vitals:

	04/24/17 1500
BP:	134/88
Resp:	20

44 year old

- "HCAP" - The DRIP score is to be used in place of the outdated "HCAP" definition for determining which patients are at increased risk of drug-resistant pathogens and should receive broader empiric antibiotic coverage.

If DRIP Score is 4 or greater, patient is at increased risk of drug-resistant pathogens, and should be considered for broader empiric coverage.

DRIP Score (Model to predict patients at increased risk for drug-resistant pathogens)

- Antibiotic use past 60 days (2)
- Long term care (2)
- Tube feeding (2)
- Prior drug resistant pathogen w/in 1 yr (2)
- Hospitalization past 60 days (1)
- History of COPD (1)
- Poor functional status (1)
- Gastric acid suppression (1)
- Wound care (1)
- MRSA colonization within past year (1)

*Note: Macrolides (azithromycin) or fluoroquinolones (levofloxacin) can exacerbate prolonged QT. If a macrolide or fluoroquinolones used in the presence or history of prolonged QT, consider monitoring QT.

Values for CURB 65

Determine Drug Resistance in Pneumonia (DRIP) Score

CAP Treatment Options

- (●) Floor (CURB 65 score 0-2 / Drip score less than 4) - For most patients (not at an increased risk for drug-resistant pathogens)
  - [x] Antibiotics
    - (●) Preferred Antibiotics
      - azithromycin (ZITHROMAX) 500 mg in sodium chloride 0.9 % 250 mL IVPB
        500 mg, Intravenous, at 250 mL/hr, Administer over 60 Minutes, Once, Today at 1000, For 1 dose, STAT

      And

      - cefTRIAXone (ROCEPHIN) 2 g in sodium chloride 0.9% IVPB Mini-bag Plus
        2 g, Intravenous, at 200 mL/hr, Once, Today at 1000, For 1 dose, STAT

      And

      - cefuroxime axetil (CEFTIN) tablet 500 mg
        500 mg, Oral, 2 times daily, First Dose Tomorrow at 1000, For 8 doses
        Routine

    - ( ) Severe Penicillin Allergy
  - [ ] Oseltamivir Standard CrCl Adjustment Panel
  - [x] Labs
    - [x] Streptococcus Pneumoniae Antigen,Urine
      Once - Routine - Lab First occurrence Today at 0921, Urine, Urine-General
      Collection Method Override: Unit Collect
    - [x] Legionella Pneumophilia Antigen, Urine
      Once - Routine - Lab First occurrence Today at 0921, Urine
      Collection Method Override: Unit Collect
    - [x] Procalcitonin
      Once - Routine - Lab First occurrence Today at 0921
      Do you want to change the specimen collection from what it shows in the banner bar? No
    - [ ] Culture, Blood - 1st of 2 Perpheral Draw
      STAT - Lab, 1st of 2 Peripheral Draw. Phleb to determine site
    - [ ] Culture, Blood - 2nd of 2 Peripheral Draw
      STAT - Lab, 2nd of 2 Peripheral Draw. Phleb to determine site
    - [ ] Aerobic Respiratory Culture with Gram Stain
      Once - Routine - Lab, Sputum, Sputum Induced

EDUCATION

- Presentation to stakeholders and house staff
- Education through daily prospective audit and feedback

Community Acquired Pneumonia (CAP) Care Pathway

Orders are being started in the ED

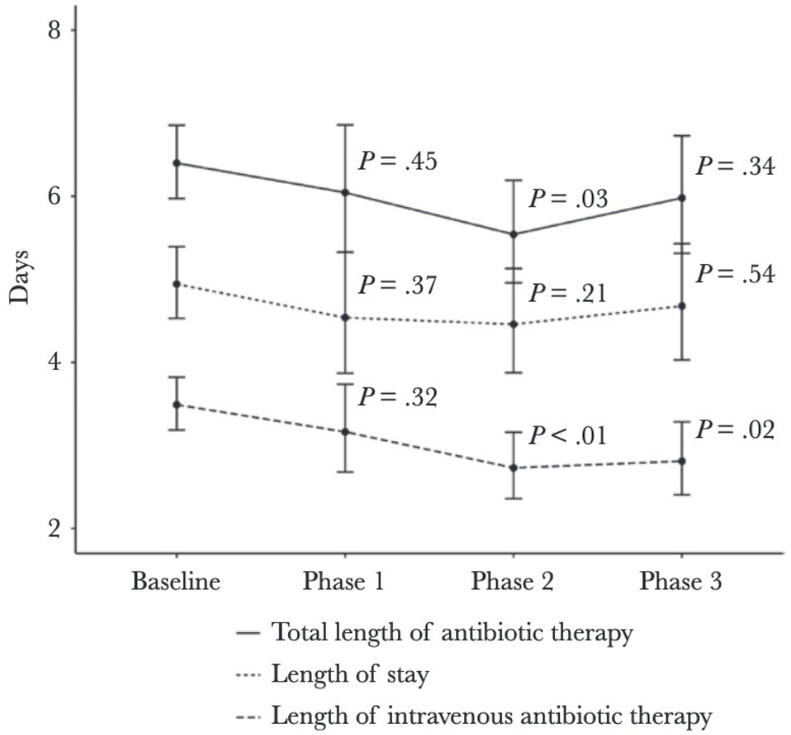
- Labs: Strep Ag, legionella Ag, procalcitonin (+/- flu testing)
  - Consider sputum cultures in patients being started on broad-spectrum antibiotics (e.g. high DRIP scores) to help with de-escalation
- Antibiotics for most floor patients with CAP
  - Ceftriaxone 2 grams IV x 1 dose
  - Azithromycin 500 mg IV x 1 dose
  - Then, Cefuroxime 500 mg PO BID x4 days (to start 24 hours after initial antibiotics)
- Most patients DO NOT NEED ongoing IV antibiotics or additional azithromycin
  - No need to continue IV antibiotics because of ongoing fever, leukocytosis or tachycardia. Switch to oral therapy as long as tolerating oral diet and PO meds.

PLEASE DO NOT DISCONTINUE ED ORDERS

- Improves antibiotic stewardship
- Reduces LOS

A Pathway for Community-Acquired Pneumonia With Rapid Conversion to Oral Therapy Improves Health Care Value

- Median cost per case decreased by 20%
- Total length of antibiotic duration decreased by 1 day
- IV duration of antibiotics decreased by 22%
- No change in readmission rate



Ciarkowski CE, et al. Open Forum Infect Dis. 2020 Oct 19;7(11):ofaa497.

IDSA/ATS 2019 CAP GUIDELINES

- We recommend obtaining pretreatment Gram stain and culture of respiratory secretions in adults with CAP managed in the hospital setting who:
  - Have severe CAP
  - Are empirically being treated for MRSA or pseudomonas
- We recommend not routinely obtaining blood cultures in adults with CAP managed in the hospital setting
  - Exceptions for severe CAP and those empirically treated for MRSA or *Pseudomonas*
- We suggest not routinely testing urine for Legionella antigen in adults with CAP except
  - Epidemiological factors (outbreak, recent travel)
  - Severe CAP
- We suggest not routinely testing urine for pneumococcal antigen in adults with CAP except
  - Severe CAP
- We recommend utilizing locally validated risk factors to identify patients at risk for drug-resistant pathogens (DRP)

Am J Respir Crit Care Med . 2019 Oct 1;200(7):e45-e67.

CAP DATA REVIEW (8/1/2019-1/31/2020)

Microbiology	89 Patients total
Respiratory culture	
Not performed	74 (83%)
No growth	3 (3%)
Normal respir	10 (11%)
Strep	1 (1%)
MSSA	1 (1%)
MRSA	0
Pseudomonas	1 (1%)
Other	5 (6%)
Blood culture	
Not performe	31 (35%)
Negative	56 (63%)
True Positive	1 (1%)- strep pneum.
Contaminant	1 (1%)

Only 1/89 patients had a respiratory culture that would influence management

None of the blood cultures would influence management

Slide courtesy of Valerie Vaughn and Guinn Dunn

CAP DATA REVIEW (8/1/2019-1/31/2020)

Microbiology	89 Patients total
Legionella urine antigen	
Not performed	9 (10%)
Negative	80 (90%)
Strep pneumo urine antigen	
Not performed	9 (10%)
Negative	69 (78%)
Positive	11 (12.4%)

None would influence management

Slide courtesy of Valerie Vaughn

LOCALLY VALIDATED RISK FACTORS: DRIP SCORE

- Retrospective case-control validation study to assess predictive performance of DRIP and identify local risk factors for Drug-Resistant Pathogens

- DRIP at the U: Sensitivity 67% and specificity 73%. AUROC curve was 0.76(95% confidence interval [CI], 0.69 to 0.82)
- Decreased performance from original published validation

- DRP within the last year only factor predictive of current DRP

Webb BJ, et al. Antimicrob Agents Chemother. 2016 Apr 22;60(5):2652-63.
Babbel D, Sutton J, Rose R, Yarbrough P, Spivak ES. Antimicrob Agents Chemother. 2018 Feb 23;62(3):e02277-17.
Oliver MB, Fong K, Certain L, Spivak ES, Timbrook TT. Antimicrob Agents Chemother. 2021 Jan 20;65(2):e01482-20.

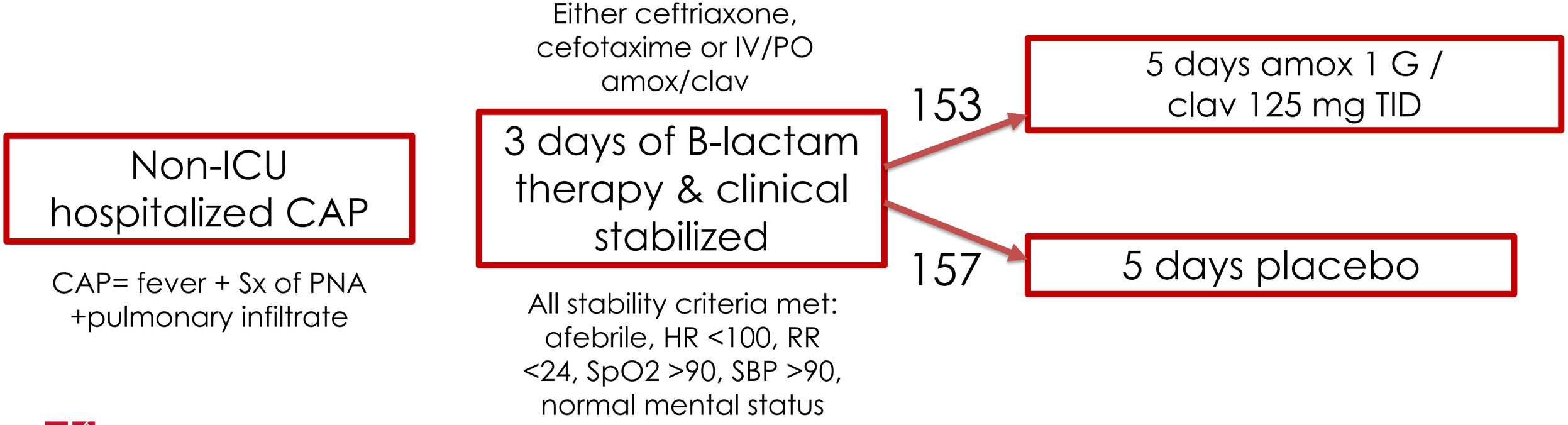
EVIDENCE BASED INTERVENTIONS

- **Atypical coverage**
  - Atypical infection uncommon
  - NO impact on survival or clinical efficacy with empirical atypical coverage in hospitalized floor patients
  - 25% of *S. pneumoniae* are macrolide-resistant
  - β-lactam monotherapy recommended in CAP guidelines in other countries

- **IV to PO conversion**
  - Time to resolution of symptoms and relapse similar with IV vs. PO in non-severe CAP and with rapid PO conversion in severe CAP

Musher DM, et al. Clin Infect Dis 2017; 65(10);1736-44.
Wiersinga WJ, et al. Neth J Med. 2018 Jan; 76(1)4-13.
Eliakim-Raz N, et al. Cochrane Database Syst Rev, 2012; 26(9);CD00418
Castro-Guardiola A, et al. Am J Med 2001; 111:367-74.

Discontinuing β-lactam treatment after 3 days for patients with community-acquired pneumonia in non-critical care wards (PTC): a double-blind, randomised, placebo-controlled, non-inferiority trial



Slide courtesy of Emily Spivak

Dinh A, et al. Lancet . 2021 Mar 27;397(10280):1195-1203.

LANCET TRIAL: 3 VS 8 DAYS

No difference in any outcomes

- Primary outcome: cure at 15 days
  - Cure was defined as afebrile, resolution of signs/symptoms, no additional antibiotics
  - 77% (3 day) vs. 68% (8 days); difference of 9.44% [95% CI: 0.15 to 20.34]→ non-inferior
- Adverse events (14% vs. 19%)
- Mortality (2% vs. 1%)

Dinh A, et al. Lancet . 2021 Mar 27;397(10280):1195-1203.

CAP BUNDLE 2.0: 11/2021

- No blood cultures
- No *Streptococcus pneumoniae* urine antigen
- Local validated risk factors for antibiotic-resistance
- Dropped empiric azithromycin
- Default antibiotic duration of 3 days
- Amoxicillin step down oral drug

CURRENT ORDER SET: 2021 – PRESENT

- Antibiotics for CAP
  - CAP Treatment Options
    - (●) Floor (NO History of antibiotic-resistant infection in the past year)
      - [x] Antibiotics
        - (●) Preferred Antibiotics

cefTRIAXone (ROCEPHIN) 2 gram in sodium chloride 0.9% Mini-Bag
2 gram, Intravenous, Administer over 30 Minutes, at 200 mL/hr, Once, today at 1600, For 1 dose
Antimicrobial Use: Empiric
Antimicrobial Indication: Respiratory, Pneumonia

Followed By

amoxicillin (AMOXIL) capsule 1,000 mg
1,000 mg, Oral, 3 times daily, First dose tomorrow at 1600, For 6 doses
Antimicrobial Use: Empiric
Antimicrobial Indication: Respiratory, Pneumonia
Routine

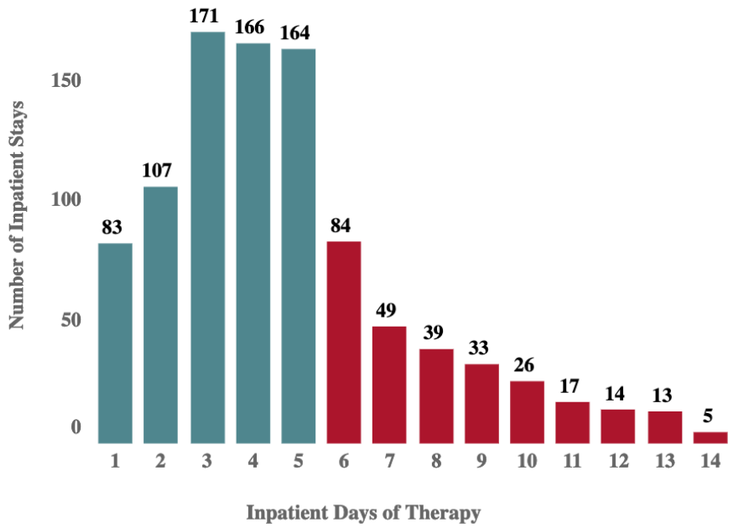
- [x] Labs
  - [ ] Streptococcus Pneumoniae Antigen,Urine
    Once - Routine - Lab, Urine
  - [x] Legionella pneumophila Antigen, Urine
    Add to specimen collected 3d ago?
    Once - Routine - Lab, today at 1553, For 1 occurrence
    Urine, Urine - Clean Catch, New collection
  - [x] Procalcitonin
    Add to specimen collected 21h ago?
    Once - Routine - Lab, today at 1553, For 1 occurrence
    Blood, Blood - Venipuncture, New collection
  - [ ] Aerobic Respiratory Culture with Gram Stain
    Once - Routine - Lab, Sputum, Sputum Induced
- [ ] Imaging - X-Ray

ASP|COMMUNITY-AQUIRED PNEMONIA (CAP)

Enter DOT Threshold: 5

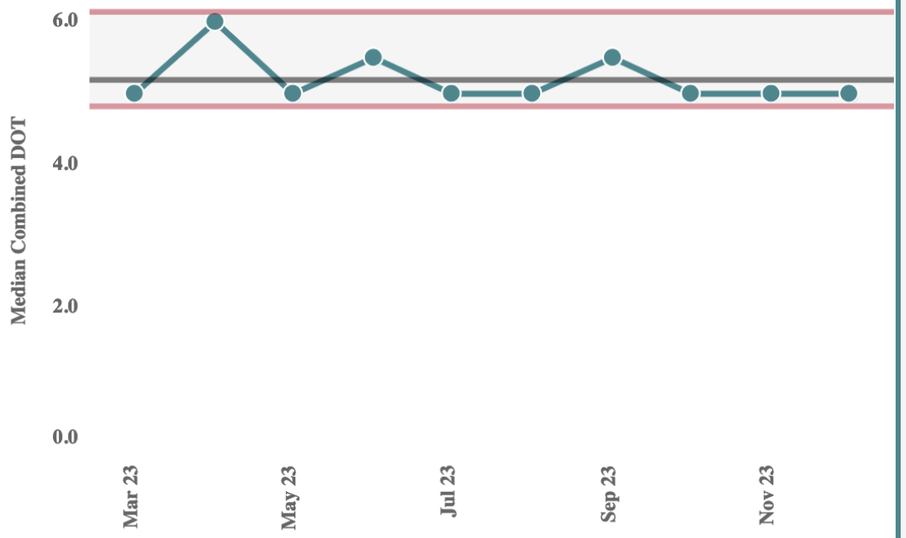
Select Date Range: Last 12 months

MEDICATION ORDERS BY DOT|INPATIENT



5 or Fewer DOT	6 or More DOT
Med Orders	Med Orders
691	280
Percent of Orders	Percent of Orders
71.16%	28.84%

MEDIAN COMBINED DOT|INPATIENT



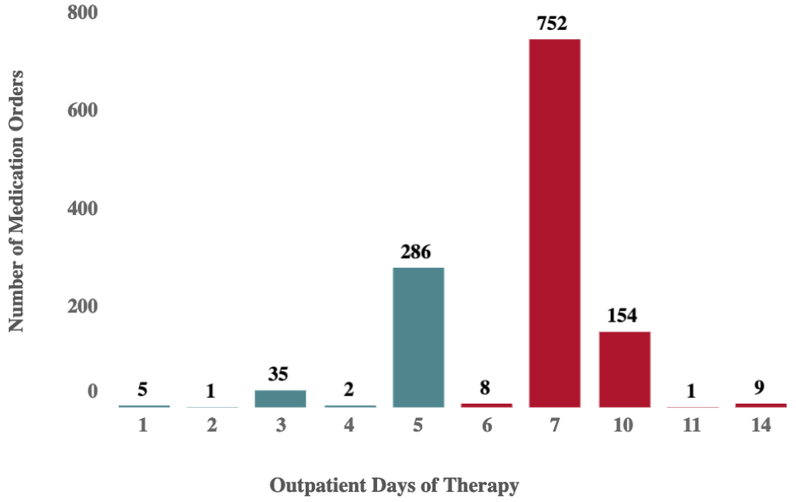
CSN COUNT| INPATIENT

971

AVERAGE COMBINED DOT|INPATIENT

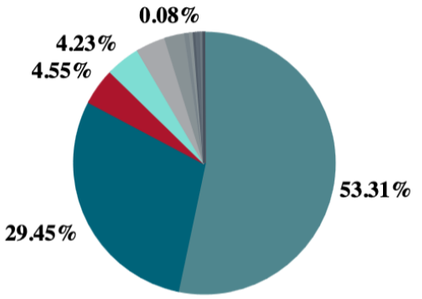
5.0

MEDICATION ORDERS BY DOT|OUTPATIENT



5 or Fewer DOT	6 or More DOT
Med Orders	Med Orders
329	924
Percent of Orders	Percent of Orders
26.26%	73.74%

MEDICATION ORDERS|OUTPATIENT



Total Med Orders
1,253

SUMMARY

- Syndrome-specific stewardship interventions very impactful given evidence-based best practices X frequent diagnosis
- Standardizing practice can have significant impact
  - Embed into workflow
  - Requires ongoing audit and feedback (decreasing over time)
- Updating local guidance over time important as data evolves

Questions?

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