

# Incorporating New Evidence into Stewardship Interventions for CAP

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Emily Spivak, MD, MHS, FIDSA  
Associate Professor of Medicine

Medical Director, Antimicrobial Stewardship Programs  
University of Utah Health and Salt Lake City VA

# Outline

- Discuss how a guideline and intervention focused on treatment selection and duration was created for CAP
- Review recent data regarding diagnosis and treatment of CAP
- Discuss how recent data and guideline recs have been incorporated into updated CAP guideline.



# 2016 CAP Care Pathway 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

# CAP: Defining our terms

- **Community Acquired Pneumonia (CAP)**
  - *With or without* risk factors for drug resistance
  - HCAP clinical criteria *did not* distinguish patients with drug resistant pathogens

HCAP + HCAP guided treatment did not improve mortality

who:

- HCAP-guided therapy *did* lead to over-use
  - was an inpatient for >48 hrs in last 90 days
  - resides in a long-term care facility
  - received recent IV antibiotic therapy / chemotherapy / wound care within last 30 days
  - attended a hemodialysis center within last 30 days

Healthcare-Associated Pneumonia Does Not Accurately Identify Potentially Resistant Pathogens: A Systematic Review and Meta-Analysis

James D. Chalmers,<sup>1</sup> Catriona Rother,<sup>1</sup> Waleed Salih,<sup>1</sup> and Santiago Ewig<sup>2</sup>

Chalmers, Clin Infect Dis 2014

Troitino, Lung 2013  
Attridge, Eur Respir J 2011  
Postma, NEJM 2015

# CAP: Drug resistant pathogens

- HCAP criteria did not distinguish CAP patients with drug resistant pathogens (DRP) from those with sensitive pathogens
- Recently published DRP prediction tool shows promise
- DRIP score >4 has 76% sensitivity and 91% specificity for drug resistant pathogen

Characteristic	No. of points
<b>Major Risk Factors</b>	
Antibiotic use within previous 60 days	2
Residence in LTCF	2
Tube Feeding	2
Prior infection with DRP (1 year)	2
<b>Minor Risk Factors</b>	
Hospitalization in previous 60 days	1
Chronic pulmonary disease	1
Poor functional status	1
Gastric acid suppression	1
Wound care	1
MRSA colonization (1 year)	1



AMERICAN  
SOCIETY FOR  
MICROBIOLOGY

Antimicrobial Agents  
and Chemotherapy



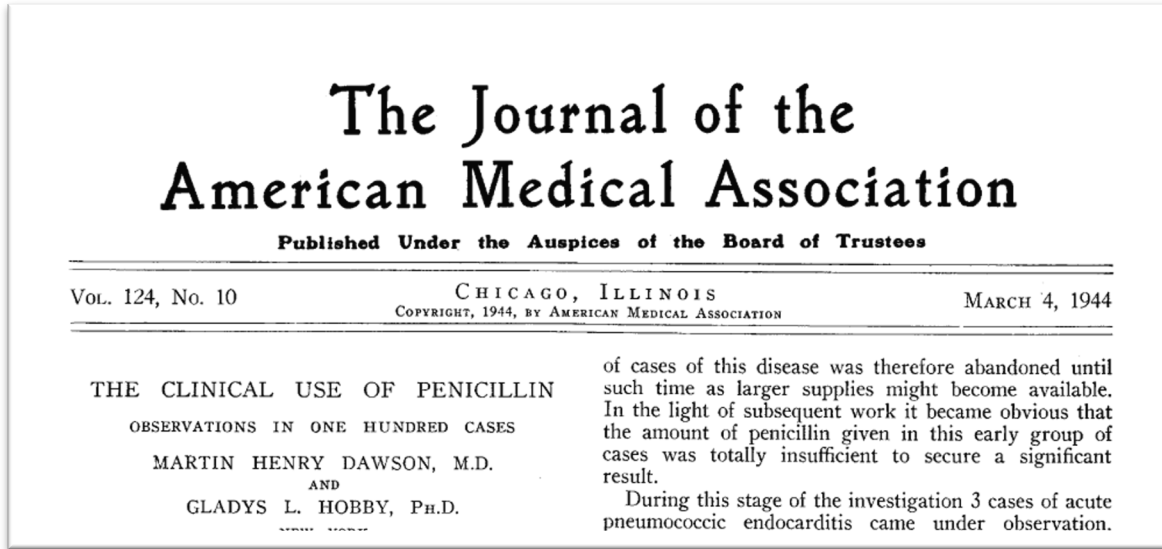
CrossMark  
click for updates

## Derivation and Multicenter Validation of the Drug Resistance in Pneumonia Clinical Prediction Score

Brandon J. Webb,<sup>a</sup> Kristin Dascomb,<sup>a</sup> Edward Stenehjem,<sup>a</sup> Holenarasipur R. Vikram,<sup>b</sup> Neera Agrwal,<sup>c</sup> Kenneth Sakata,<sup>d</sup> Kathryn Williams,<sup>e</sup> Bruno Bockorny,<sup>f</sup> Kavitha Bagavathy,<sup>f</sup> Shireen Mirza,<sup>f</sup> Mark Metersky,<sup>g</sup> Nathan C. Dean<sup>h</sup>

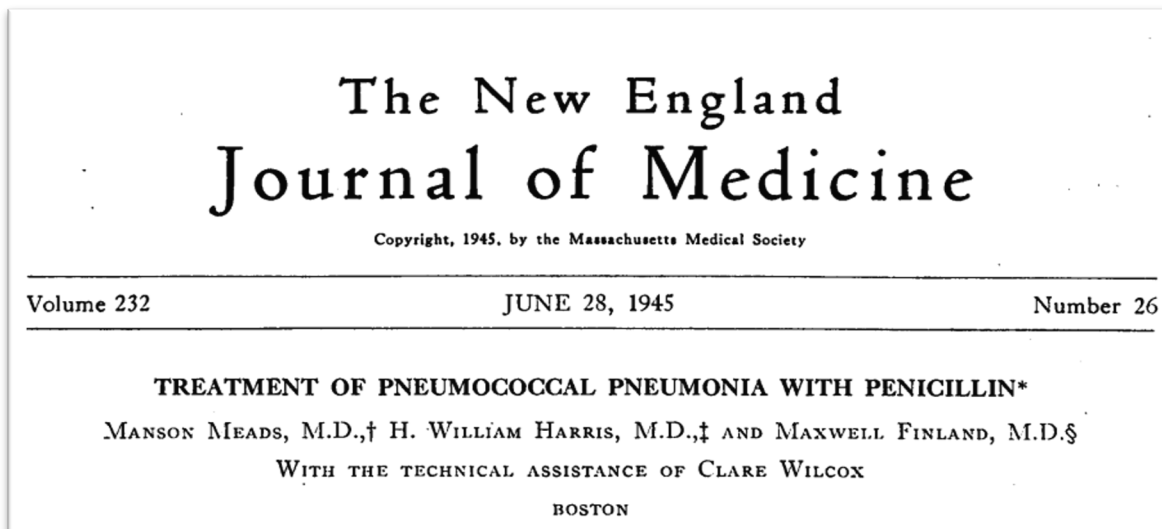
Intermountain Healthcare, Division of Epidemiology and Infectious Diseases, Salt Lake City, Utah, USA<sup>a</sup>; Mayo Clinic in Arizona, Division of Infectious Diseases, Phoenix, Arizona, USA<sup>b</sup>; Mayo Clinic in Arizona, Division of Hospital Internal Medicine, Phoenix, Arizona, USA<sup>c</sup>; Mayo Clinic in Arizona, Division of Pulmonary Medicine, Phoenix, Arizona, USA<sup>d</sup>; Mayo Clinic in Arizona, Department of Internal Medicine, Scottsdale, Arizona, USA<sup>e</sup>; University of Connecticut Medical Center, Department of Internal Medicine, Farmington, Connecticut, USA<sup>f</sup>; University of Connecticut Medical Center, Division of Pulmonary and Critical Care Medicine, Farmington, Connecticut, USA<sup>g</sup>; Division of Pulmonary and Critical Care Medicine at Intermountain Medical Center and the University of Utah, Salt Lake City, Utah, USA<sup>h</sup>

# CAP: Antibiotic duration



“...satisfactory results with 1.5-2 days of antibiotics”

- 2007 IDSA CAP guidelines: ~5 days until clinical stability
- One randomized controlled trial supports 3 days in select patients
- Durations < 3 days: limited data



Average duration of therapy (including patients in shock) was 4-5 days

# 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
- $\beta$ -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.

# How It Works



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BestPractice Advisory - Jett,Joan

**Care Guidance (1)**

! If this ABx is for treatment of Pneumonia, click "Open order set" for the appropriate Orderset based on the patient's CURB score. If this antibiotic is not for Pneumonia, click "Dismiss" to continue ordering.

**CURB-65 Calculation**

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

CURB-65 Total 0 - 1: Consider Outpatient Care

CURB-65 Total 2: Consider Inpatient Admission

CURB-65 Total 3+: Consider Inpatient ICU Admission

**Remove** the following orders? \_\_\_\_\_

**azithromycin (ZITHROMAX) injection**  
Intravenous, Starting Today at 1059, Routine

**Apply** the following? \_\_\_\_\_

<input type="button" value="Open Order Set"/>	<input checked="" type="button" value="Do Not Open"/>	Pneumonia Orderset for Inpatient Care <a href="#">Preview</a>
<input type="button" value="Open Order Set"/>	<input checked="" type="button" value="Do Not Open"/>	Pneumonia Orderset for Outpatient Care <a href="#">Preview</a>

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

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





### ▼ 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)

#### ☒ 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



#### ☒ Labs

☒ Streptococcus Pneumoniae Antigen,Urine  
Once - Routine - Lab First occurrence Today at 0921, Urine, Urine-General  
Collection Method Override: Unit Collect

☒ Legionella Pneumophila Antigen, Urine  
Once - Routine - Lab First occurrence Today at 0921, Urine  
Collection Method Override: Unit Collect

☒ 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 Peripheral 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

**\*Daily ASP  
Prospective Audit  
and Feedback**

# Education

- Presentation to stakeholders and house staff
- Partnered with hospitalists
- Education through 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



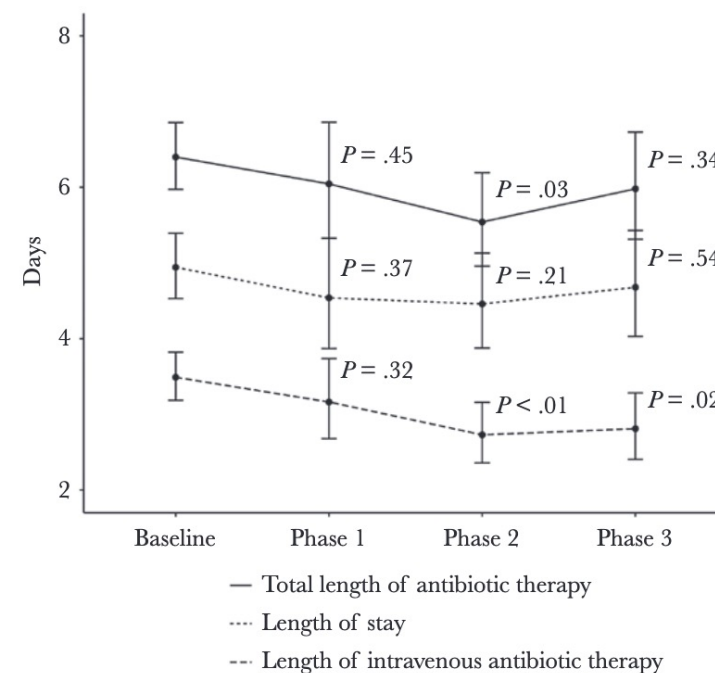
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# A Pathway for Community-Acquired Pneumonia With Rapid Conversion to Oral Therapy Improves Health Care Value



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- 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





# ANTIMICROBIAL STEWARDSHIP | EXECUTIVE DASHBOARD



[Click to open MGA Knowledge Management page](#)



**FLWSHEET DAT..** Date Filter 9/1/2020 12:00:00 AM to 9/30/2020 Sep 2020 to Jul 2021  
Updated: 7/28/2021 9:38:50 AM

## MEDICATIONS REVIEWED

	2020 Q3	2020 Q4	2021 Q1	2021 Q2	Grand Total
Ceftriaxone	13	86	63	26	188
Vancomycin	20	75	70	21	186
Piperacillin + Tazobactam	8	56	56	19	139
Metronidazole	6	27	25	14	72
Cefuroxime		35	22	13	70
Cefepime	8	27	19	4	58
Cefazolin		22	15	9	46
Fluconazole	2	21	17	4	44

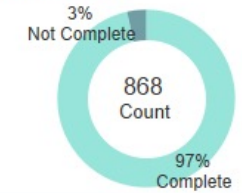
## INTERVENTION

	2020 Q3	2020 Q4	2021 Q1	2021 Q2	Grand Total
Change/de-escalate therapy	13	109	106	34	262
Stop therapy	7	109	58	29	203
Change duration	2	77	85	33	197
IV to PO conversion	3	70	66	26	165
ID Consult recommended	5	50	46	13	114
Add appropriate coverage	1	2	2	3	8
Dose optimization		6	2		8
Grand Total	26	324	241	98	689

## SMARTPHRASE

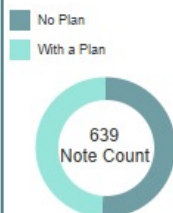
Pharmacist	1	165
Physician	2	74
Pharmacist	3	56
Pharmacist	4	56
Physician	5	22
Physician	6	21
Pharmacist	7	10

## COMPLETED FLOWSHEET DOCUMENTATION

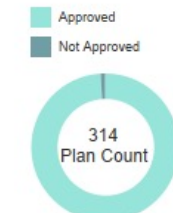


**RESTRICTED NOTE** Date Filter 9/1/2020 12:00:00 AM to 9/30/2020 Sep 2020 to Jul 2021  
Updated: 7/28/2021 9:38:50 AM

## VOLUME



## PLANS

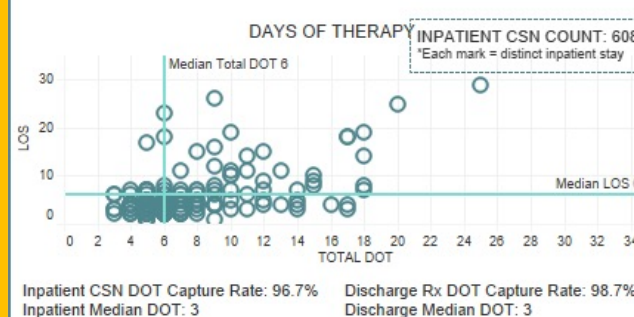


## RESTRICTED MEDICATIONS

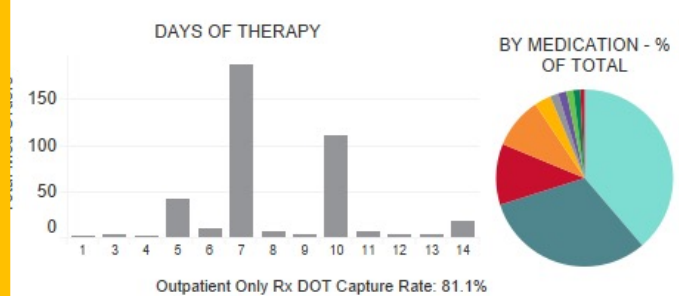
	2020 Q3	2020 Q4	2021 Q1	2021 Q2	Grand Total
Other	21	311	159	47	538
remdesivir				34	34
Linezolid	2	1	3	1	7
Fidaxomicin			1		1
caspofungin				1	1
daptomycin				1	1
Grand Total	23	312	163	83	581

**COMMUNITY-ACQUIRED PNEUMONIA (CAP)** Date Filter 9/1/2020 12:00:00 AM to 9/30/2020 Sep 2020 to Jul 2021  
Updated: 8/18/2021 1:17:01 PM

## INPATIENT + DISCHARGE Rx



## OUTPATIENT Rx ONLY



## NHSN DATA

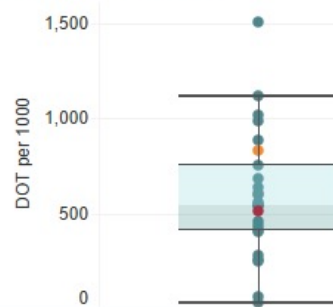
**ANTIMICROBIAL DAYS OF THERAPY PER 1000 DAYS PRESENT**  
Updated: 7/7/2021 10:23:41 AM

Select Summary Month  
6/1/2021

Select Unit  
All

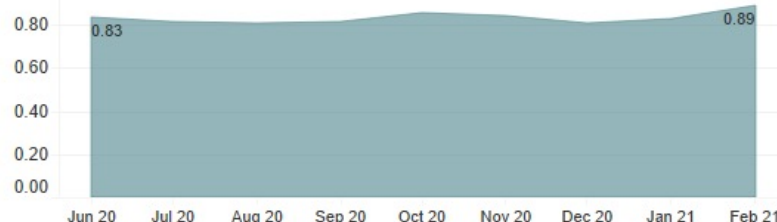
Select Medication Name  
\*Detail will only display in hover  
All

- UHosp FACWIDEIN
- HCH FACWIDEIN
- Individual Units



**STANDARDIZED ANTIMICROBIAL ADMINISTRATION RATIO (SAAR): ALL UNITS**  
Updated: 5/28/2021 12:02:04 PM

2017 Antimicrobial Agent Category Filter  
Adult All Antibacterial



Resources: [Click to open CDC SAAR page](#)

# 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

# CAP Data Review (8/1/2019-1/31/2020)



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Microbiology

89 Patients total

## Respiratory culture

Not performed	74 (83%)
No growth	3 (3%)
Normal resp	10 (11%)
Strep	1 (1%)
MSSA	1 (1%)
MRSA	0
Pseudomonas	1 (1%)
Other	5 (6%)

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

## Blood culture

Not performed	31 (35%)
Negative	56 (63%)
True Positive	1 (1%)- strep pneum.
Contaminant	1 (1%)

*None* of the blood cultures would influence management

# CAP Data Review (8/1/2019-1/31/2020)



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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

# CAP 2.0: Recent changes to pathway for floor patients

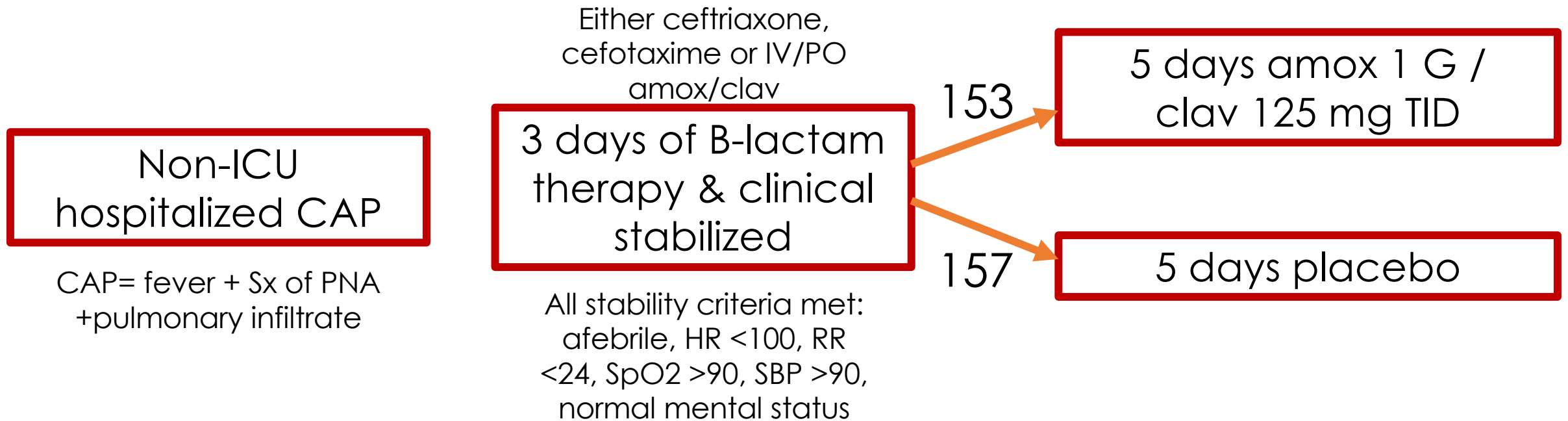
- No blood cultures
- No *Streptococcus pneumoniae* urine antigen
- Removed the DRIP score
- Dropped empiric azithromycin
- Default antibiotic duration of 3 days
- Amoxicillin step down oral drug



# Validation of a Community-Acquired Pneumonia Score To Improve Empiric Antibiotic Selection at an Academic Medical Center

- IDSA/ATS 2019 CAP Guidelines recommend **utilizing locally validated risk factors** to identify patients at risk for drug-resistant pathogens (DRP)
- Validation at the SLC VA showed broad-spectrum antimicrobial use would increase by 9%
- 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 predictive of current DRP

# Discontinuing $\beta$ -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



# Lancet 3 vs 8 Days for CAP

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%)

# CAP: Antibiotic duration

- RCT of patients with mild to moderate/severe CAP
- All pts. received IV amoxicillin for 3 days
- At 3 days pts. were randomized into two groups if they had improvement, become afebrile, and were able to take oral therapy:
  - Amoxicillin 750 mg PO TID x 5 days
  - Placebo TID x 5 days

## Research

BMJ

Effectiveness of discontinuing antibiotic treatment after three days versus eight days in mild to moderate-severe community acquired pneumonia: randomised, double blind study

Rachida el Moussaoui, Corianne A J M de Borgie, Peterhans van den Broek, Willem N Hustinx, Paul Bresser, Guido E L van den Berk, Jan-Werner Poley, Bob van den Berg, Frans H Krouwels, Marc J M Bonten, Carla Weenink, Patrick M M Bossuyt, Peter Speelman, Brent C Opmeer, Jan M Prins

	3 Days	8 Days
Clinical cure at 10 days	93%	93%
Clinical cure at 28 days	90%	88%
Adverse events	11%	21%

# New Order Set (Rolled out 11/11/21)

🔍 Orders

Pneumonia Orderset for Inpatient Care ⤴

▼ Antibiotics for CAP

▼ CAP Treatment Options

☒ Floor (NO History of antibiotic-resistant infection in the past year)

☒ 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 1300, 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 1300, For 2 days

! Antimicrobial Use: Empiric  
Antimicrobial Indication: Respiratory, Pneumonia  
Routine

☐ Severe Beta Lactam Allergy

☐ Oseltamivir Standard CrCl Adjustment Panel

☒ Labs

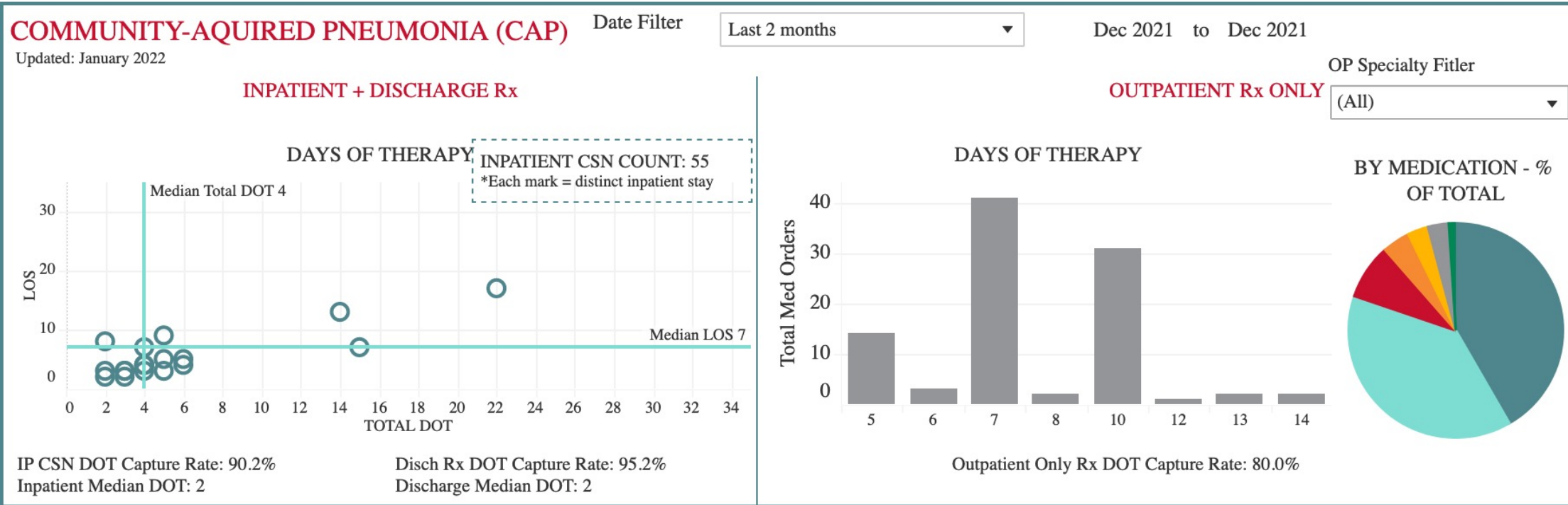
☐ Streptococcus Pneumoniae Antigen,Urine  
Once - Routine - Lab, Urine, Urine-General

☒ Legionella pneumophila Antigen, Urine  
Once - Routine - Lab, today at 1259, For 1 occurrence  
Urine, Urine-General

☒ Procalcitonin  
🔍 Add to specimen collected 9h ago?  
Once - Routine - Lab, today at 1259, For 1 occurrence  
Blood, Blood - Venipuncture, New collection

☐ Aerobic Respiratory Culture with Gram Stain  
Once - Routine - Lab, Sputum, Sputum Induced

# Tracking Adherence



# Conclusions

- 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