From “Walking Pneumonia” to a” Touch of the Flu”: Exploring Controversies in Pediatric Lower Respiratory Tract Infections

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Objectives

- Describe the epidemiology of lower airway infections in pediatrics
- Review diagnostic modalities for lower airway disease
- Explore lower respiratory tract management controversies

Ground rules

- Informal
- Case-based
- No wrong answers

Case 1

- A previously healthy 13 year goes to the ED because of fever and cough for four days. The cough is dry, and non-productive. She complains of sore throat. Her temperature is 38.5C, heart rate 98/minute, respirations 16/minute, and oxygen saturation of 96% on room air. She has occasional crackles in the right base.

- What do you want to do?

CAP in children

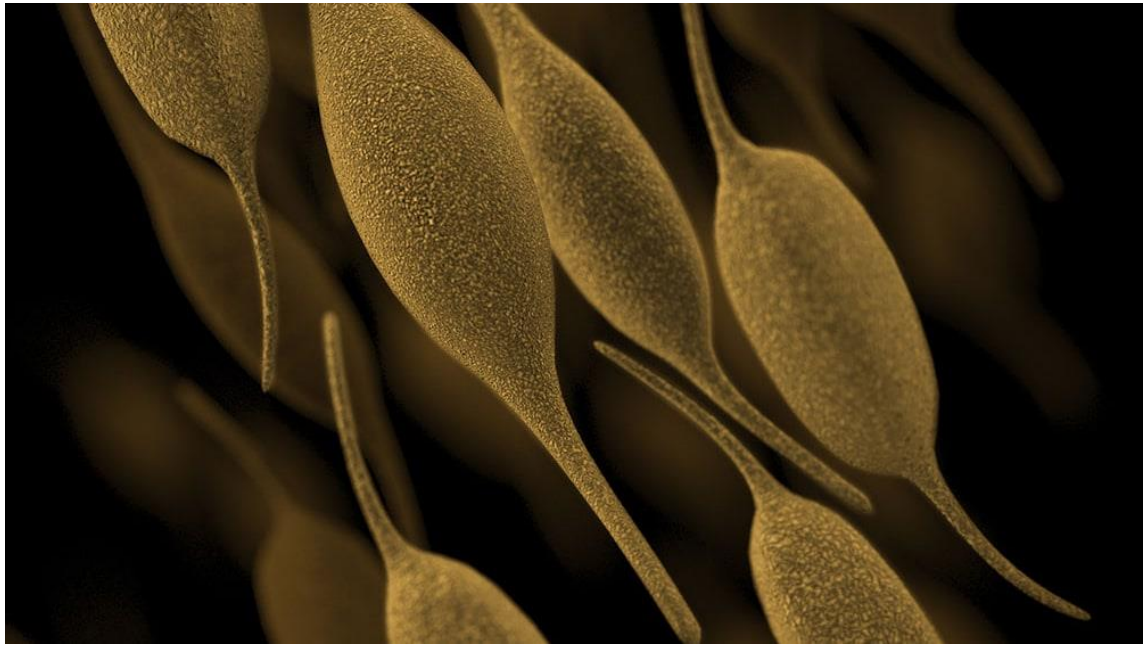
- Unless admitted, a clinical diagnosis
  - No chest radiograph
  - No CBC
  - No PCT
  - No blood culture

Causal organisms

- Remarkably little data!
- Under 5
  - Viral
- School age
  - *S. pneumoniae* (and perhaps Mycoplasma)
- Teens
  - *S. pneumoniae* (and perhaps Mycoplasma)
- Other organisms
  - S. aureus (usually in context of influenza)
  - GABHS
  - Eikenella

Mycoplasma

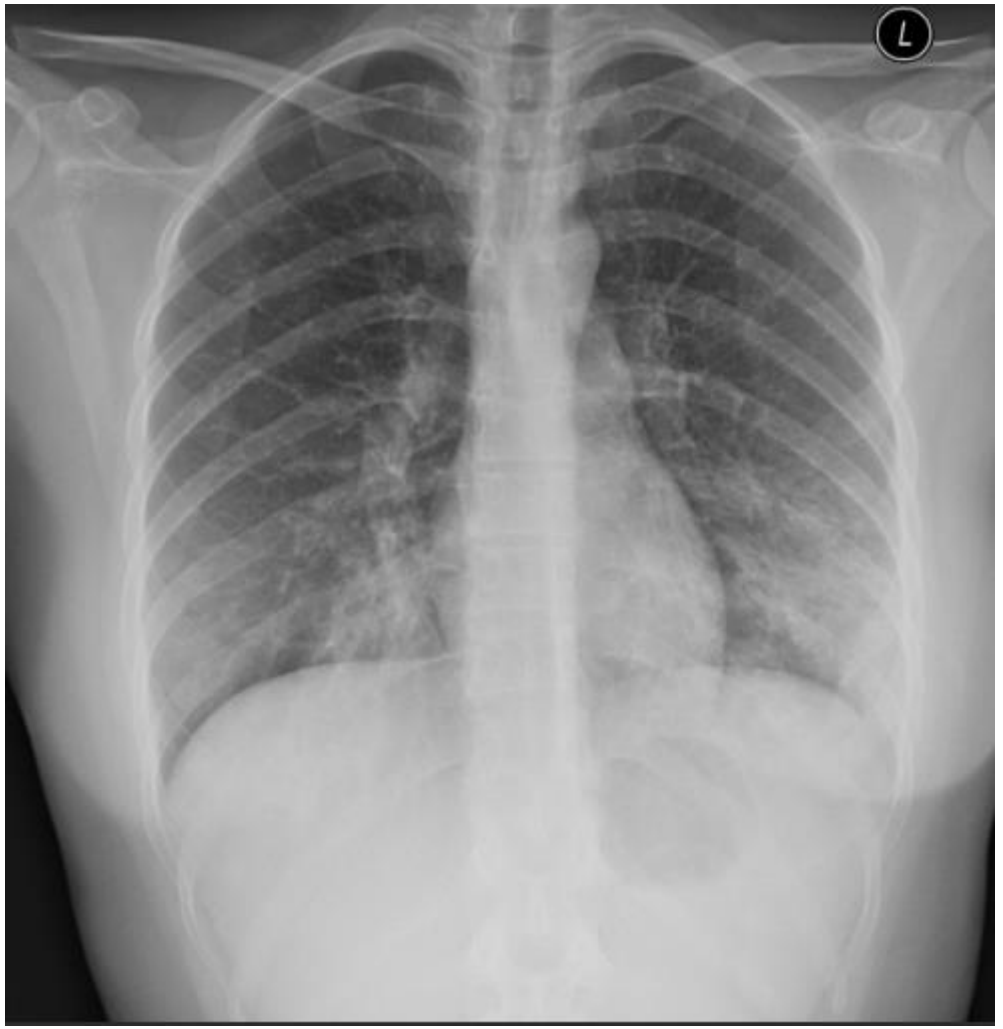
- Small free-living bacteria
- No cell well (no peptidoglycan)



CDC

Mycoplasma pneumoniae pneumonia

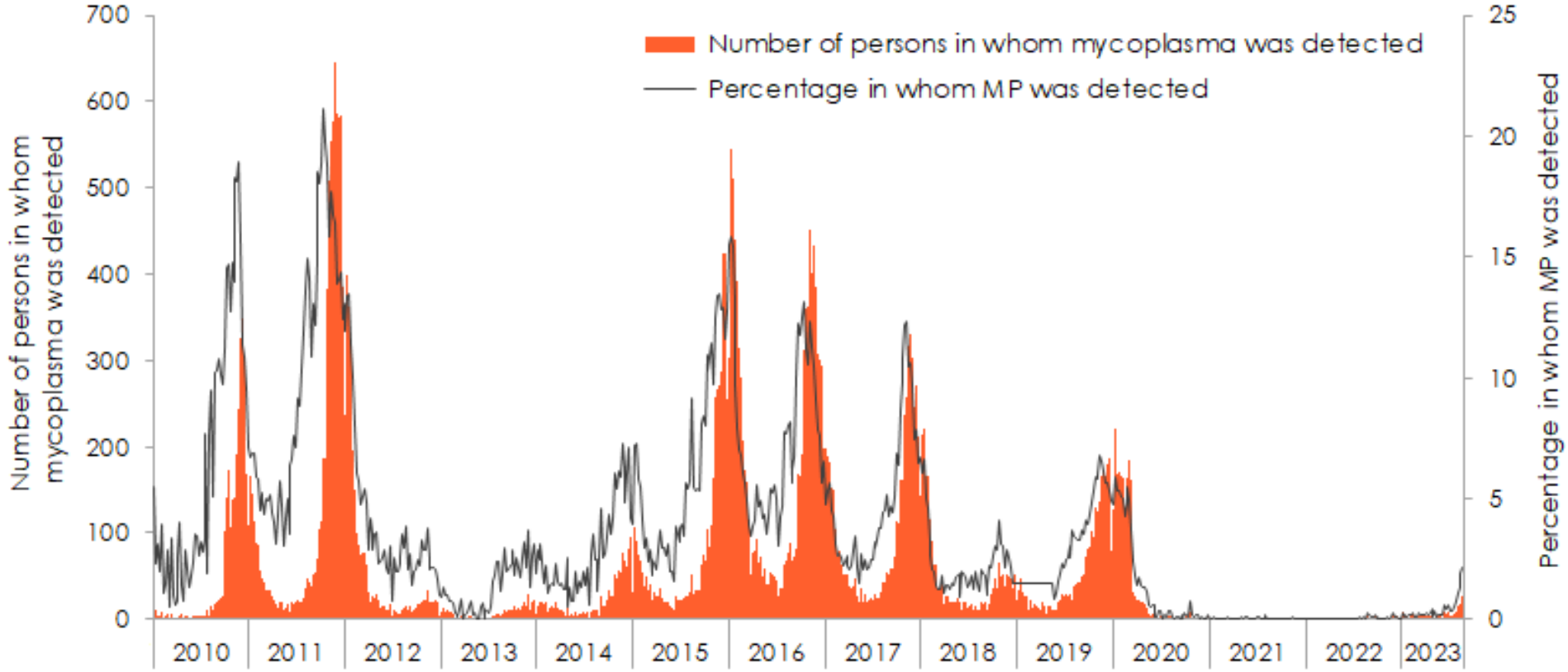
- Spread through respiratory droplets
- Variable incubation period
  - 1-4 weeks
- Variable symptoms
  - Cough, fever, sore throat, headache, malaise, and chest discomfort
- Variable clinical findings
- Variable radiography findings



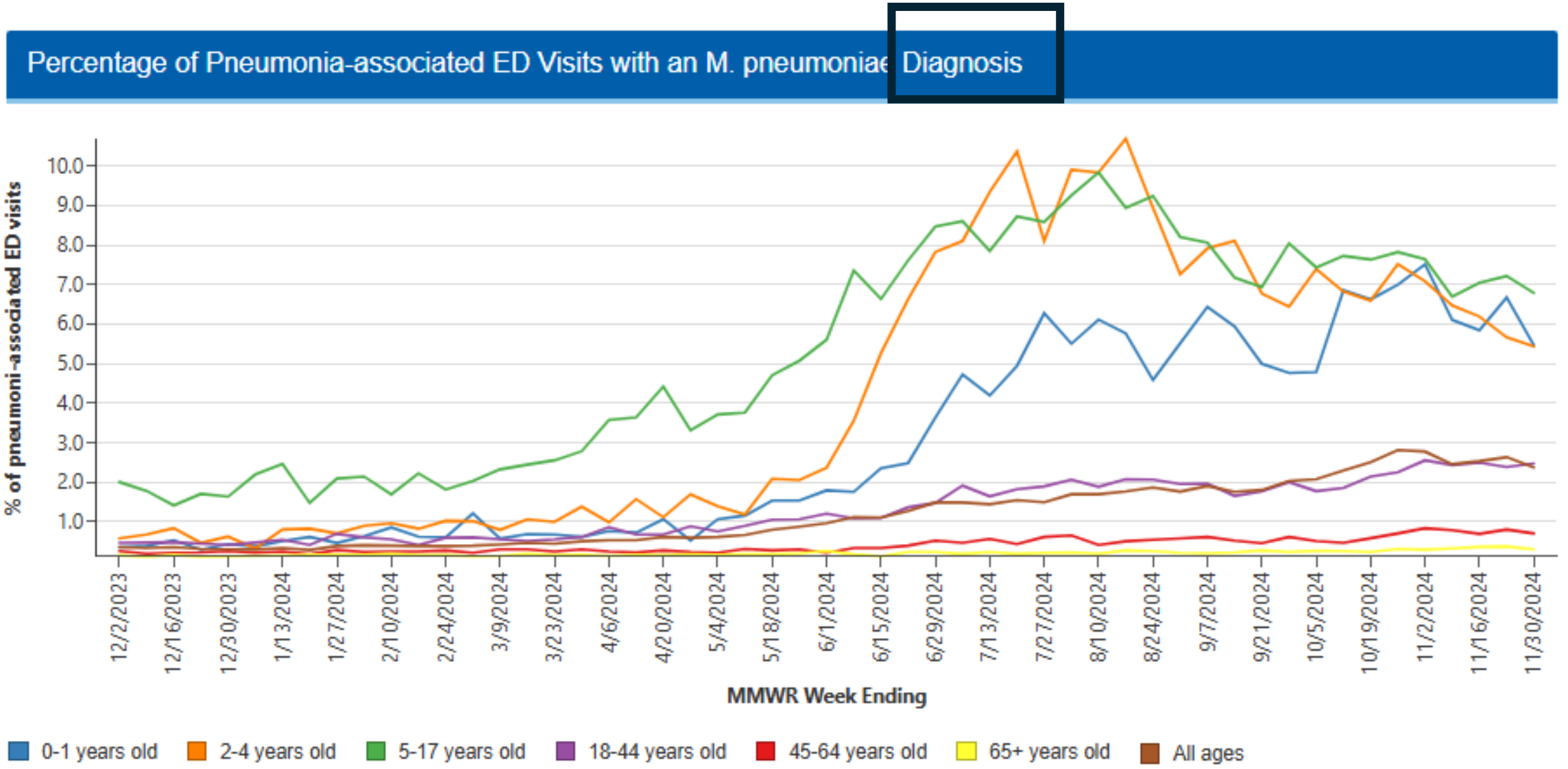
chest radiograph mycoplasma - Search Images

Mycoplasma pneumoniae epidemiology

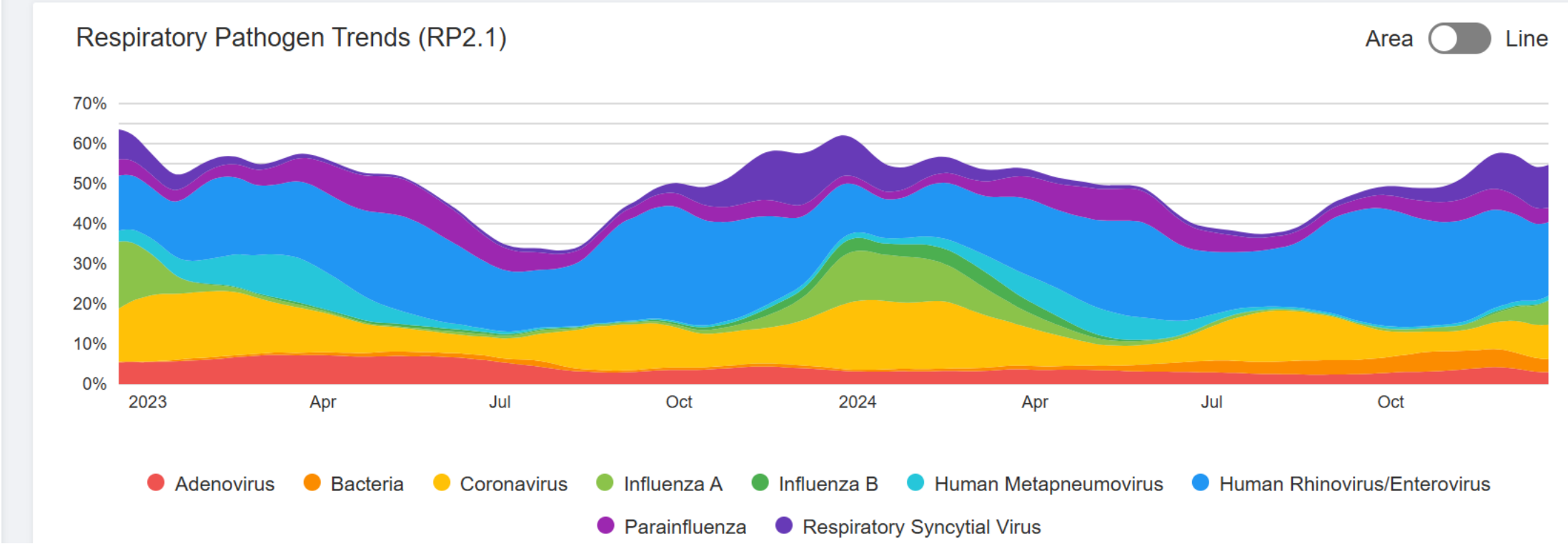
Figure 1. Laboratory-confirmed *mycoplasma pneumoniae* (MP) and percentage in whom MP was detected among tested persons in Denmark, based on MiBa data extraction, 2010-week 34, 2023



https://en.ssi.dk/news/epi-news/2023/no-35---2023

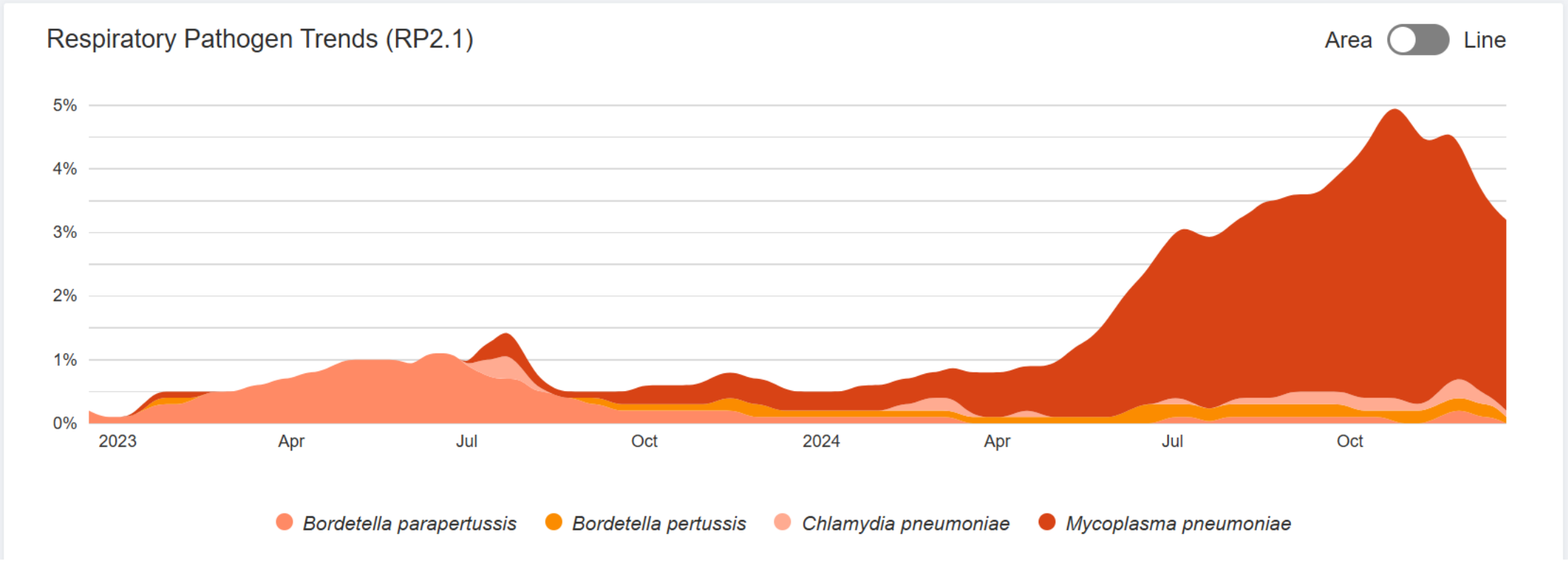

Percentage of Pneumonia-associated ED Visits with an M. pneumoniae Diagnosis
% of pneumoni-associated ED visits
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
12/2/2023
12/16/2023
12/30/2023
1/13/2024
1/27/2024
2/10/2024
2/24/2024
3/9/2024
3/23/2024
4/6/2024
4/20/2024
5/4/2024
5/18/2024
6/1/2024
6/15/2024
6/29/2024
7/13/2024
7/27/2024
8/10/2024
8/24/2024
9/7/2024
9/21/2024
10/5/2024
10/19/2024
11/2/2024
11/16/2024
11/30/2024
MMWR Week Ending
0-1 years old
2-4 years old
5-17 years old
18-44 years old
45-64 years old
65+ years old
All ages

BIOFIRE® Syndromic Trends

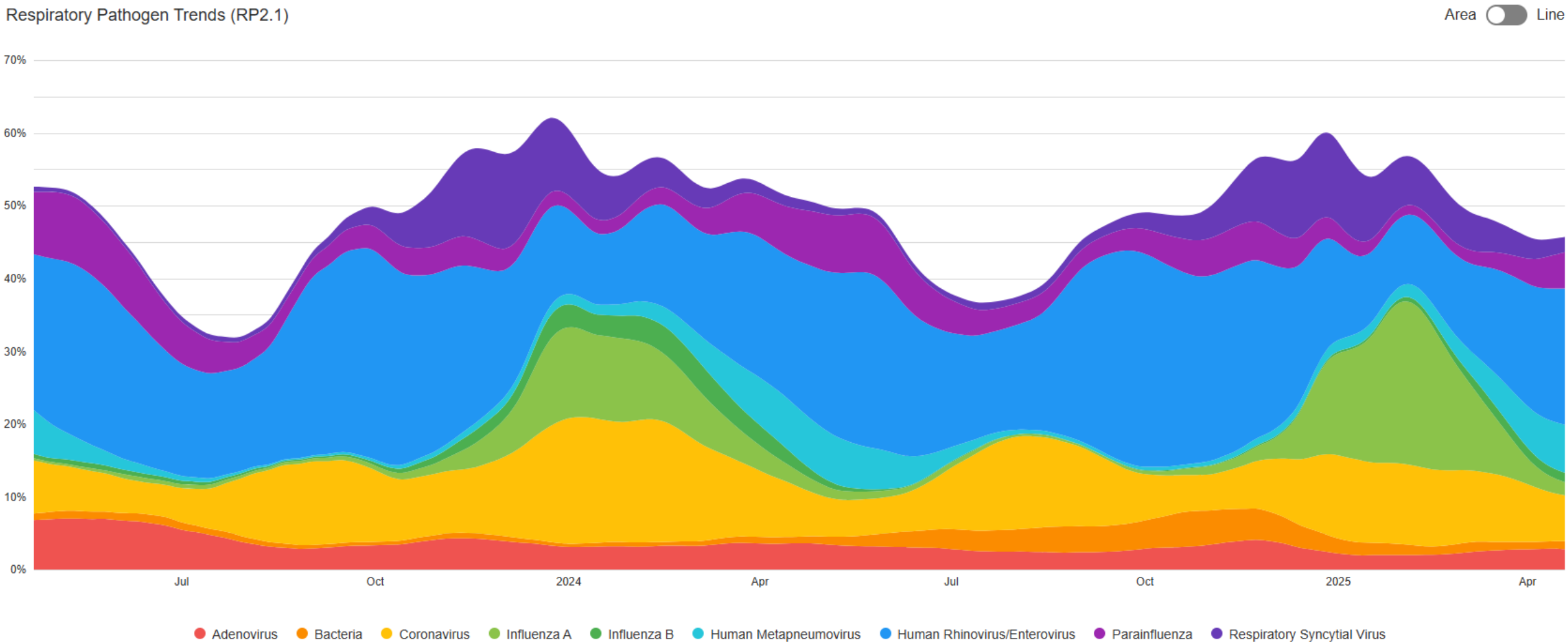


CDC

BIOFIRE® Syndromic Trends



CDC


Respiratory Pathogen Trends (RP2.1)
Area
Line
70%
60%
50%
40%
30%
20%
10%
0%
Jul
Oct
2024
Apr
Jul
Oct
2025
Apr
Adenovirus
Bacteria
Coronavirus
Influenza A
Influenza B
Human Metapneumovirus
Human Rhinovirus/Enterovirus
Parainfluenza
Respiratory Syncytial Virus

Why more Mycoplasma?

- Immunity deficit
- New strain?
- Antimicrobial resistance?

Diagnosis of *M. pneumoniae* pneumonia

- Clinical
- Serology
  - Dicey; delay in confirmatory testing
- Antigen detection
- Culture
  - Turn around time about one week
- Nucleic acid amplification panel
  - Limited use in VT (BIOFIRE)

Recommended antibiotics for *M. pneumoniae*

- First line
  - Macrolides
- Second line*
  - Tetracyclines
  - Fluoroquinolones

*Consider using a second-line antibiotic regimen to treat patients with suspected or *confirmed M. pneumoniae* infection who aren't improving on macrolides

M. pneumoniae macrolide resistance

- Overall global prevalence of macrolide resistance is 28%
- Significant geographical variation:
  - China: 80%
  - Japan: > 50%
  - Canada: 12%
  - Europe: Averages around 5%
  - United States: < 10% overall
    - Geographic variability
- Lots of interest in treatment of persistent/severe/resistant *M. pneumoniae* pneumonia

Data supporting the use of macrolides for the treatment of *M. pneumoniae*

- Extremely mixed

In most studies of pneumonia, however defined, clinical response did not differ between children or adults with Mycoplasma randomized to a macrolide antibiotic regimen and children or adults randomized to a non-macrolide antibiotic regimen

Recommendations for CAP in children

- Epidemiology:
  - Still a lot of *M. pneumoniae* in the community
    - But decreasing
    - Increasing pertussis?
- Diagnostics
  - Controversial (high cost, TAT, change in practice)
- Empiric treatment
  - Amoxicillin vs. amoxicillin + azithromycin
    - Reserve fluoroquinolones for hospitalized patients who do not respond

Case 2

A three-year-old male is seen because of fever and cough for two days.

He appears mildly ill; RR is 28/minute and oxygen saturation is 96% on RA

On exam, he has occasional crackles in the right base

He is started on amoxicillin for CAP and the following day, the parent reports that he is better

How long would you treat with amoxicillin?

Short- vs Standard-Course Outpatient Antibiotic Therapy for Community-Acquired Pneumonia in **Children < six years old**

Less than 6 years

POPULATION

194 Boys, 186 Girls

Outpatient children with nonsevere pneumonia who demonstrate early clinical response

Mean age, 36 mo

INTERVENTION

385 Individuals randomized

192 Short-course strategy
5 d of antibiotics, plus 5 additional d of matching placebo

193 Standard-course strategy
10 d of antibiotics

SETTINGS / LOCATIONS

Clinic, urgent care, or emergency settings in 8 US cities

PRIMARY OUTCOME

End-of-Treatment Response Adjusted for Duration of Antibiotic Risk (RADAR): composite end point that takes into account each child's clinical response, resolution of symptoms, antibiotic adverse effects, and the duration of treatment

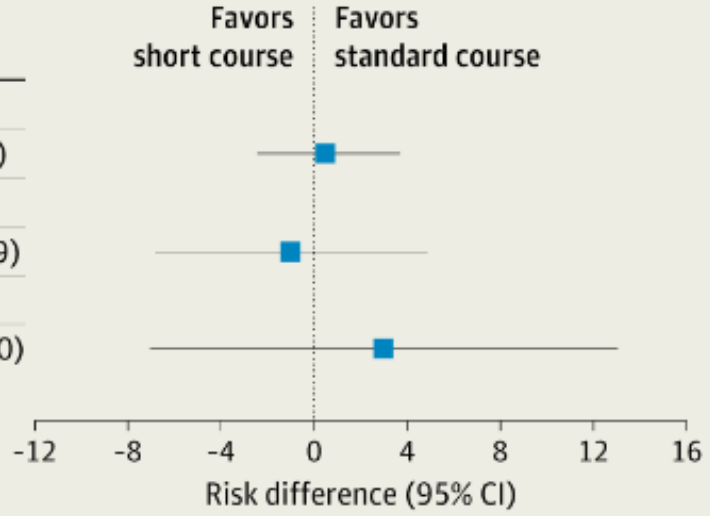
JAMA Pediatr. 2022;176(3):253-261.

Short- vs Standard-Course Outpatient Antibiotic Therapy for Community-Acquired Pneumonia in Children

FINDINGS

The short-course strategy was superior to the standard approach (69% probability [95% CI, 63-75] of a more desirable RADAR outcome) because the short-course strategy demonstrated similar outcomes over a shorter duration of treatment

Source	Short course (n = 189) n (%)	Standard course (n = 191) n (%)	Risk difference (95% CI)
Inadequate clinical response			
Any	2 (1)	1 (<1)	0.5 (-2.4 to 3.7)
Persistent symptoms			
Any	13 (7)	15 (8)	-1.0 (-6.8 to 4.9)
Antibiotic-associated adverse effects			
Any	75 (40)	70 (37)	3.0 (-7.0 to 13.0)



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Conclusions

- 5 days of antibiotics as effective as 10 days in
  - **Young children (under age 6)**
  - **Who have improved on therapy**
  - **With non-severe CAP**
- Most CAP likely viral!
  - or most infections resolved quickly with antibiotics
    - Adults- pushing to three days!

Case 3

- A friend of yours who knows that you work with children with respiratory illness asks your opinion about black mold. The parent reports that the 5-year-old child has had a chronic cough for two months. They found black mold on the wallboard in the basement. The parent would like to know if the child should be treated for a mold infection.

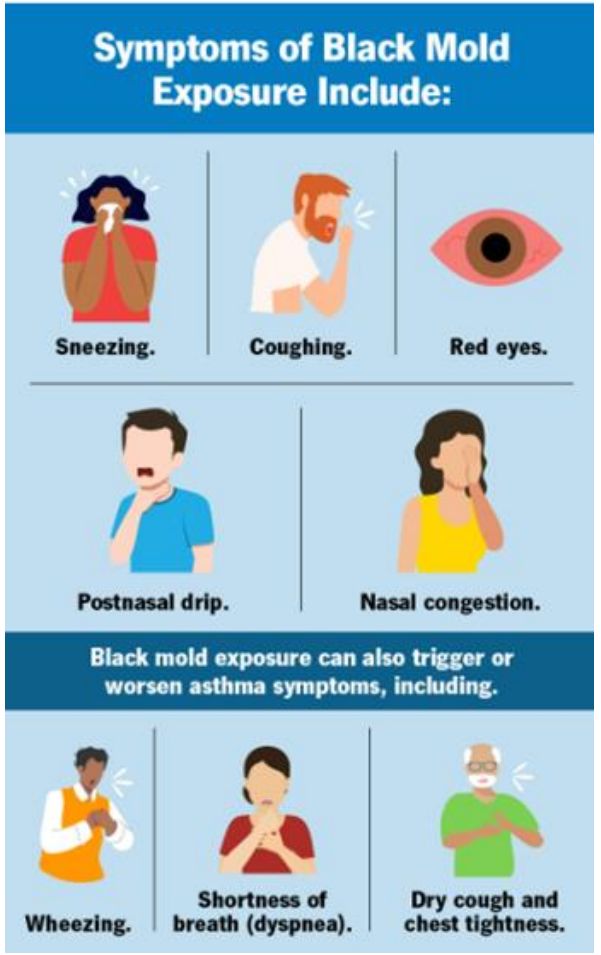
- How would you respond?

Black mold

- Stachybotrys chartarum
- Grows and spreads on materials that contain a lot of cellulose
- Needs warmth and moisture

Black mold

- Benign
- May have allergic symptoms
- May worsen asthma symptoms
- Excused to fungi in incredible amounts every day!



Black mold

- Address water leak
- Reassure parents

Case 4

- A six-year-old child goes to the ED because of fever and cough for three days. Five days ago, she returned from a trip to eastern Europe. She appears moderately ill. Her temperature is 38.4C, respiratory rate 20/minute, and oxygen saturation on room air 96%. She has red eyes and a runny nose, but her lungs are clear to auscultation.

- What would you like to do?

Measles

- Cough, coryza, and conjunctivitis (and fever) before the rash begins
- Suspect in unimmunized children who have traveled
- Extremely contagious
- Required airborne precautions
- I did not think this would be controversial BUT:
  - Vaccination is highly effective in preventing measles

Measles caveats

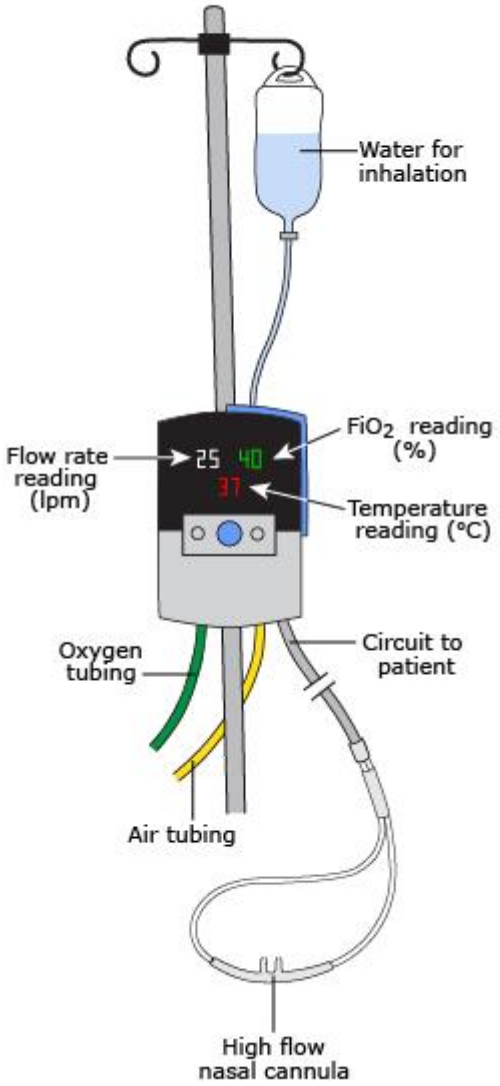
- Only test for measles (serology and PCR) if the patient has risk for measles!

Case 5

- The pediatric team asks you to see a healthy four-month-old born at term admitted two days ago with presumed bronchiolitis. The child is currently on ceftriaxone, inhaled albuterol, and oral prednisone but has not improved. Oxygen saturation on room air remains steady at 90-92% and rarely dips into the high 80s while asleep. The temp is 38.4C. Physical examination reveals diffuse crackles and wheezes in all lung fields and mild intercostal retractions.

- What do you recommend?

B Enclosed individual components



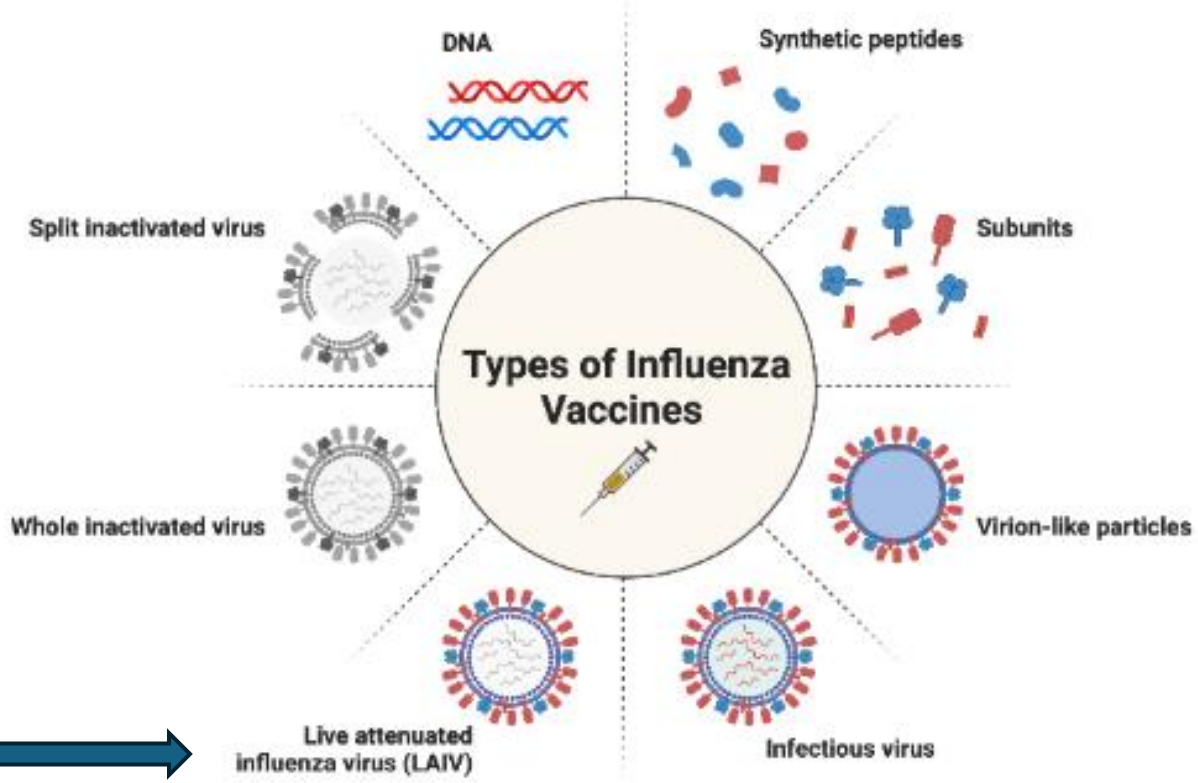
Take home points

- Criteria for HFNC
  - Few contraindications
- Continuous pulse oximetry prolongs hospitalization
- Bronchiolitis is a clinical diagnosis
  - Treatment is supportive

Case 6

- In the fall, nurses are in the hallway offering employees influenza vaccination. A friend walking with you reports that they got the flu from the vaccine a few years ago and now refuses to get the vaccine.
- What would you do?

Influenza vaccines



Influenza vaccine

- Live attenuated influenza virus vaccine
  - 2-49 years of age
  - Cold adapted
    - May cause runny nose or mild symptoms
- Injectable influenza
  - No replicative material
  - Cannot get influenza from the injectable influenza vaccine

Thanks!