

# Which Antibiotic Should I Choose?

A review of common syndromes, guidelines  
and local antibiograms.

McGill Refresher Course 2018

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Infectious Diseases & Medical  
Microbiology

# Speaker / Disclosures

- Trong Tien Nguyen, MDCM, FRCPC
- Speaker has no conflict of interest.

# Learning Objectives

As a result of attending this session, participants will be able to:

-  Find and apply clinical practice guidelines to common Infectious Disease syndromes
-  Interpret local antibiograms, understanding their utility and limitations
-  Prescribe antibiotics responsibly, applying antimicrobial stewardship principles

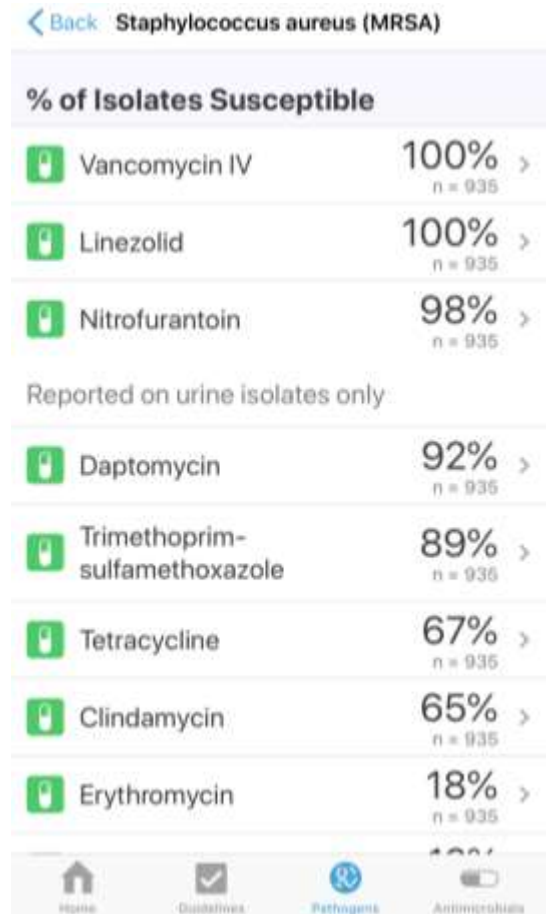
# How to choose an antibiotic?

- Empiric therapy
  - Best guess based on clinical syndrome
  - Based on local resistance pattern
  - Based on clinical practice guidelines
- Targeted therapy
  - Based on culture and susceptibility result

# Antibiograms reflect local antibiotic resistance patterns

Table 2: Antimicrobial resistance of MRSA isolates (clinical and blood), 2008 to 2013

Antimicrobial	Clinical Isolates						Blood Isolates					
	2008 (N=376) (%)	2009 (N=312) (%)	2010 (N=631) (%)	2011 (N=288) (%)	2012 (N=274) (%)	2013 (N=298) (%)	2008 (N=234) (%)	2009 (N=241) (%)	2010 (N=277) (%)	2011 (N=249) (%)	2012 (N=236) (%)	2013 (N=260) (%)
Clindamycin	241 (64.1)	146 (46.8)	223 (61.8)	180 (62.5)	150 (54.7)	178 (59.7)	152 (65.0)	109 (45.2)	188 (67.9)	163 (65.5)	137 (58.1)	103 (39.6)
Erythromycin	324 (86.2)	279 (89.4)	306 (84.8)	240 (83.3)	221 (80.7)	268 (89.9)	197 (84.2)	217 (90.0)	246 (88.8)	226 (90.8)	207 (87.7)	228 (87.7)
Ciprofloxacin	324 (86.2)	278 (89.1)	309 (85.6)	249 (86.5)	223 (81.4)	257 (86.2)	196 (83.8)	223 (92.5)	249 (89.9)	217 (87.1)	202 (85.6)	222 (85.4)
Fusidic Acid	16 (4.3)	16 (5.1)	31 (8.6)	19 (6.6)	17 (6.2)	27 (9.1)	19 (8.1)	14 (5.8)	21 (7.6)	14 (5.6)	13 (5.5)	30 (11.5)
Gentamicin	28 (7.4)	22 (7.1)	11 (3.0)	13 (4.5)	6 (2.2)	16 (5.4)	16 (6.8)	6 (2.5)	11 (4.0)	5 (2.0)	2 (0.8)	12 (4.6)
Mupirocin	48 (12.8)	22 (7.1)	34 (9.4)	31 (10.8)	29 (10.6)	17 (5.7)	23 (9.8)	18 (7.5)	19 (6.9)	30 (12.0)	15 (6.4)	12 (4.6)
Tetracycline	30 (8.0)	20 (6.4)	17 (4.7)	7 (2.4)	7 (2.6)	12 (4.0)	22 (9.4)	9 (3.7)	13 (4.7)	13 (5.2)	12 (5.1)	13 (5.0)



# Antibiograms require clinical judgment

< Back Staphylococcus lugdunensis

## % of Isolates Susceptible

 Vancomycin IV	100% > n = 105
 Linezolid	100% > n = 105
 Trimethoprim-sulfamethoxazole	100% > n = 105
 Nitrofurantoin	100% > n = 105

Reported on urine isolates only

 Ciprofloxacin	95% > n = 105
 Tetracycline	94% > n = 105
 Erythromycin	91% > n = 105
 Clindamycin	91% > n = 105



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Guidelines



Pathogens



Antimicrobiols

- Empiric therapy can be effective even without 100% susceptibility

- Final susceptibility results trump antibiogram predictions


< Back Klebsiella pneumoniae

## % of Isolates Susceptible

 Meropenem	100% > n = 599
 Gentamicin	94% > n = 599
 Ciprofloxacin	94% > n = 599
 Tobramycin	93% > n = 599
 Ceftriaxone	88% > n = 599
 Cefazolin	84% > n = 599

Cefazolin predicts results for oral cephalosporins in patients with uncomplicated UTI

 Trimethoprim-sulfamethoxazole	83% > n = 599
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	20% >
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Home



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Pathogens



Antimicrobiols

# Adverse Drug Events Occur in 20% Patients on Antibiotics

- Common & serious adverse effects
  - Gastrointestinal (42%)
  - Renal (24%)
  - Hematologic (15%)
  - *Clostridium difficile* infection
- Societal burden
  - Drug costs
  - Emergency department visits, hospital readmission
  - Emergence of resistant bacteria

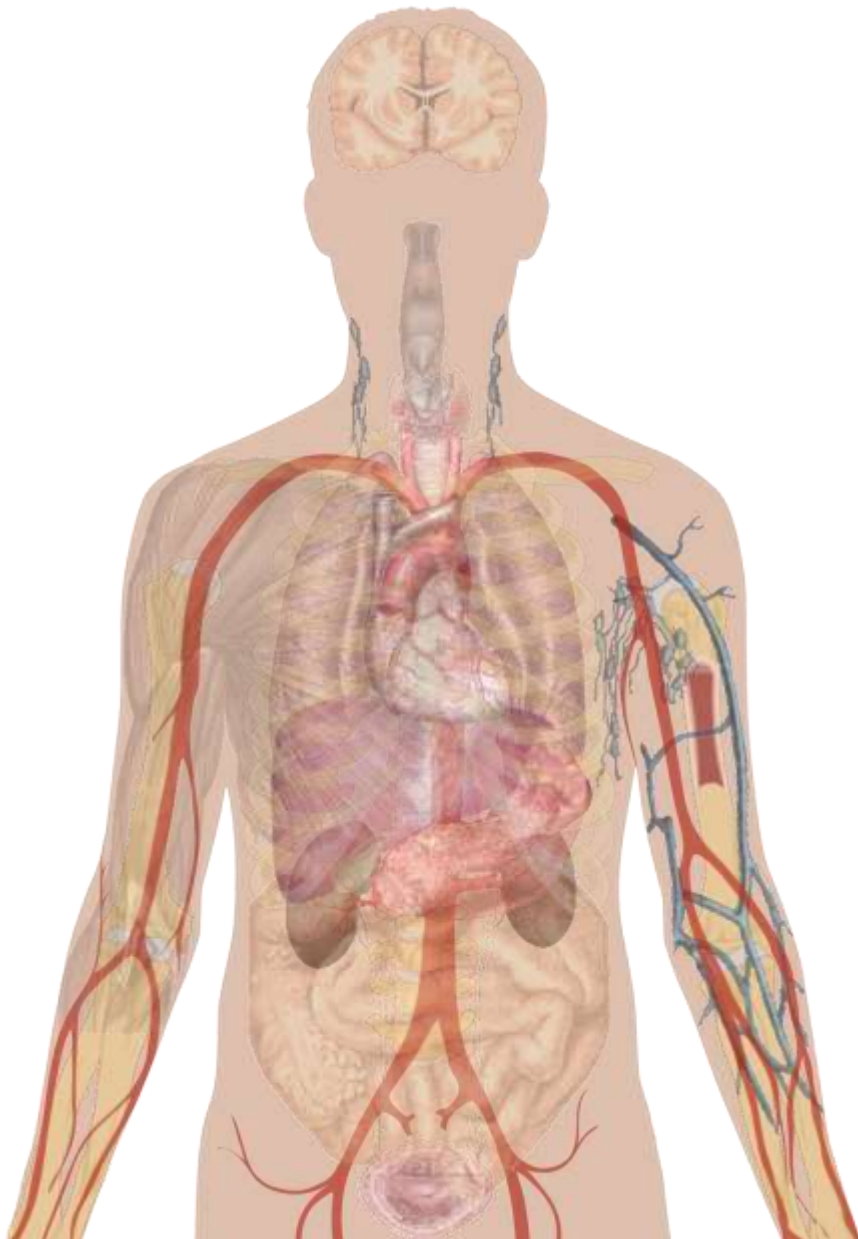
# Local clinical practice guidelines are often the most applicable





# Guidelines recommend many antibiotic options

- Alternatives allow individualized therapy
  - Allergies and intolerances
  - Contraindications
  - Resistance
- If options are equal, select the least harmful
  - Shorter duration
  - Less adverse effects
  - Less frequent dosing
  - Less expensive



### Upper Respiratory Tract Infection

- Otitis media
- Rhinosinusitis
- Bronchitis

### Lower Respiratory Tract Infections

- Pneumonia
- Acute exacerbation  
of COPD

### Skin & Soft Tissue Infection

- Nonpurulent  
cellulitis
- Purulent cellulitis

### Urinary Tract Infection

- Cystitis
- Pyelonephritis
- Prostatitis

# Urinary tract infection diagnosis relies on clinical symptoms

- Fever
- Dysuria
- Frequency
- Urgency
- Suprapubic pain
- Costovertebral pain

- Acute hematuria
- New onset incontinence
- Rigors
- Altered mental status without other cause
- Increased spasticity or autonomic dysreflexia if spinal cord injury

# Urine Culture Should Not be Sent for Asymptomatic Bacteriuria (ASB)

- Prospective studies in LTCF<sup>1</sup>
  - Prevalence 10-50%
  - New pyuria/bacteriuria within 4 days of catheter
  - Persists up to 1–2 years
  - No increased morbidity or mortality
- Up to 2/3 patients with ASB still receive antimicrobial therapy<sup>2</sup>

1. High KP. *Clin Infect Dis*. 2009;48(2):149–171.

2. Leis JA. *Clin Infect Dis*. 2014;58(7):980–983.



# Symptom- Free Pee: LET IT BE

A national initiative to stop inappropriate antibiotic use for asymptomatic bacteriuria in long-term care residents.

For more direction and guidance:

[www.ammi.ca](http://www.ammi.ca)

#SymptomFreeLetItBe



# Do Not Screen for or Treat ASB



“Don’t use antimicrobials to treat **asymptomatic bacteriuria.**”

- Canadian Geriatrics Society
- Canadian Society for Hospital Medicine
- Canadian Urological Association
- Canadian Nurses Association
- American Geriatrics Society
- Infectious Diseases Society of America
- Canadian Association of Physical Medicine and Rehabilitation



“Don’t perform **urinalysis or urine culture** unless patients have signs or symptoms of infection.”

- American Academy of Pediatrics
- Society for Healthcare Epidemiology of America
- Long Term Care Medical Directors Association of Canada
- AMDA – The Society for Post-Acute and Long-Term Care Medicine

# Uncomplicated Cystitis



**Table 1a: E. coli resistance against first-line agents in Quebec**

Nitrofurantoin	Fosfomycin
5-10%	<5%
TMP-SMX	Trimethoprim
15-20%	N/A



**Table 1b: E. coli resistance against second-line agents in Quebec**

Ciprofloxacin	B-lactams
10-15%	Variable



>75% cases

***E. coli***

Other agents

***E. faecalis***

***S. saprophyticus***

***K. pneumoniae***

# Know your first line urinary antibiotics

Nitrofurantoin	Fosfomycin	TMP-SMX
Safe in pregnancy (T1-2)	Single dose Safe in pregnancy	Renal tissue penetration
<p>Avoid</p> <ul style="list-style-type: none"> <li>•CKD (eGFR &lt;40)</li> <li>•T3 pregnancy</li> </ul> <p>Ineffective</p> <ul style="list-style-type: none"> <li>•Pyelonephritis</li> <li>•Catheter-associated UTI</li> </ul>	<p>Limitations</p> <ul style="list-style-type: none"> <li>•E. coli and E. faecalis only</li> <li>•Susceptibility testing not done routinely</li> <li>•CKD?</li> <li>•Inferior to nitrofurantoin?</li> </ul> <p>Ineffective:</p> <ul style="list-style-type: none"> <li>•Pyelonephritis</li> <li>•Catheter-associated UTI</li> <li>•S. saprophyticus</li> </ul>	<p>Adverse effects</p> <ul style="list-style-type: none"> <li>•Rash / photosensitivity</li> <li>•Renal injury</li> <li>•Hyperkalemia</li> <li>•Kernicterus in neonates</li> </ul> <p>Ineffective:</p> <ul style="list-style-type: none"> <li>•Variable local resistance</li> </ul>



# Fluoroquinolones are not benign

First FQ Introduced

Boxed warning:  
worsening  
**myasthenia gravis**

FDA enhanced label warning:  
possible permanent side effects  
– joint pain, tendon rupture,  
tendinitis, anxiety, depression,  
altered mental status

1962

2008

2011

2013

2016

2018

Black box warning:  
**tendinitis** and  
**tendon rupture**

Updated labeling:  
potentially  
irreversible  
**peripheral  
neuropathy**

Safety  
communication:  
adverse **psychiatric**  
side-effects &  
**hypoglycemic** risks

# Complicated Cystitis

- Second Line
  - Beta-lactams
    - Amoxicillin-clavulanate
    - Cefadroxil
    - Cefixime
    - Cephalexin
  - Fluoroquinolones
    - Norfloxacin
    - Ciprofloxacin
    - Ciprofloxacin XL
    - Levofloxacin



*E. coli*

*E. faecalis*

*K. pneumoniae*

*P. mirabilis*

*E. cloacae*

*P. aeruginosa*

*S. aureus*

# How long should UTIs be treated?

Uncomplicated  
cystitis

3-5 days

Uncomplicated  
pyelonephritis

7 days

Complicated  
cystitis

5-7 days

Complicated  
pyelonephritis

7-14 days

# Acute prostatitis is a clinical diagnosis

- Duration of therapy
  - 10 days to 4-6 weeks
- Antibiotics that penetrate the prostate well:
  - Ciprofloxacin
  - Levofloxacin
  - TMP-SMX



Age < 35

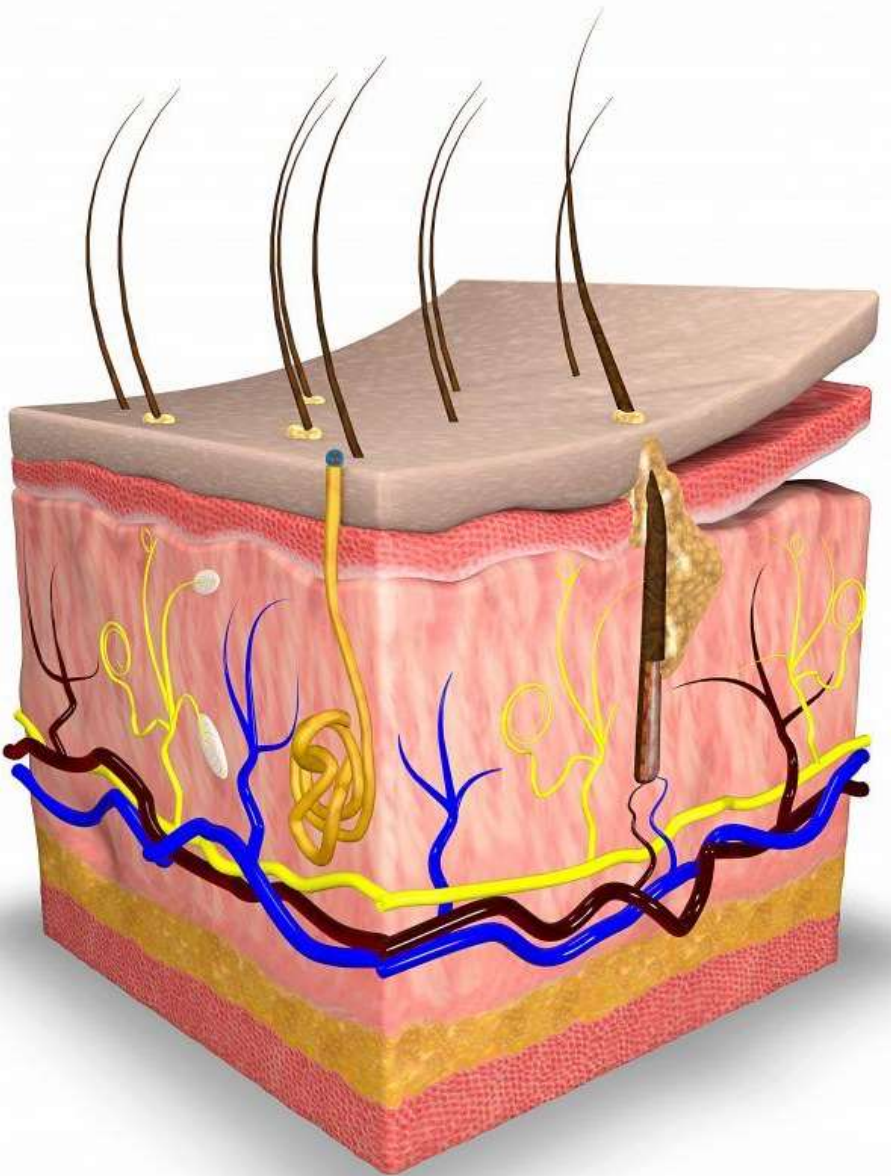
***N. gonorrhoeae***

***C. trachomatis***

Age ≥ 35

***Enterobacteriaceae***

***Enterococcus sp.***



Epidermis

- Erysipelas

Dermis

- Cellulitis

Hypodermis

- Abscess

Deeper Soft  
Tissues

- Fasciitis, tenosynovitis
- Pyomyositis
- Osteomyelitis

# The microbiology of SSTI is predictable

- First-line antibiotics
  - Cefadroxil
  - Cephalexin
  - Cloxacillin
- Don't prescribe antibiotics after **incision and drainage** of uncomplicated skin abscesses unless extensive cellulitis exists.
  - Canadian Association of Emergency Physicians



Nonpurulent

*S. pyogenes*

>>>

*S. aureus*

Purulent

*S. aureus*

>>>

*S. pyogenes*

# MRSA

- In Quebec, 10 % of *S. aureus* isolates from the community are MRSA
- Local prevalence may vary
- Local resistance rates may vary



**Table 2: MRSA resistance against oral agents in Quebec**

Doxycycline	TMP-SMX	Linezolid	Clindamycin
>99%	>99%	>99%	<30%

# Think of unusual causes & exposures



Bite

Pasteurella  
Capnocytophaga  
Eikenella

Amoxicillin-clavulanate  
Doxycycline  
Moxifloxacin

Water

Aeromonas  
Vibrio  
Pseudomonas

Variable

Dental

S. viridans  
Oral anaerobes

Amoxicillin  
Amoxicillin-clavulanate  
Clindamycin  
Levo-/Moxifloxacin

Rhinogenic

S. pneumoniae  
H. influenzae

Amoxicillin-clavulanate  
Levo-/Moxifloxacin



# Acute rhinosinusitis is usually viral

- Resolves within 10-14 days, without treatment
- Consider antibiotics if:
  - Persistent & not improving  $\geq 10$  days
  - Severe symptoms  $\geq 3-4$  days (fever, facial pain, purulent nasal discharge)
  - Worsening or double-sickening  $\geq 3-4$  days



>70%, if bacterial

***S. pneumoniae***

***H. influenzae***


Rarely

***M. catarrhalis***

***S. pyogenes***


***S. aureus***

# Antibiotics do not treat viruses



Don't use antibiotics for upper respiratory infections that are likely **viral** in origin, such as influenza-like illness, or self-limiting, such as **sinus infections of less than seven days** of duration.

– College of Family Physicians of Canada



Don't routinely use antibiotics in adults and children with **uncomplicated sore throats**.

– Canadian Association of Emergency Physicians



Don't use antibiotics in adults and children with **uncomplicated acute otitis media**.

– Canadian Association of Emergency Physicians

# Bronchitis



*Influenza*

*Rhinovirus*

*Adenovirus*

*HMPV*

*Coronavirus*

*Parainfluenza*

*RSV*

Rarely

*B. pertussis*

*Mycoplasma*

*pneumoniae*

*Chlamydophila*

*pneumoniae*

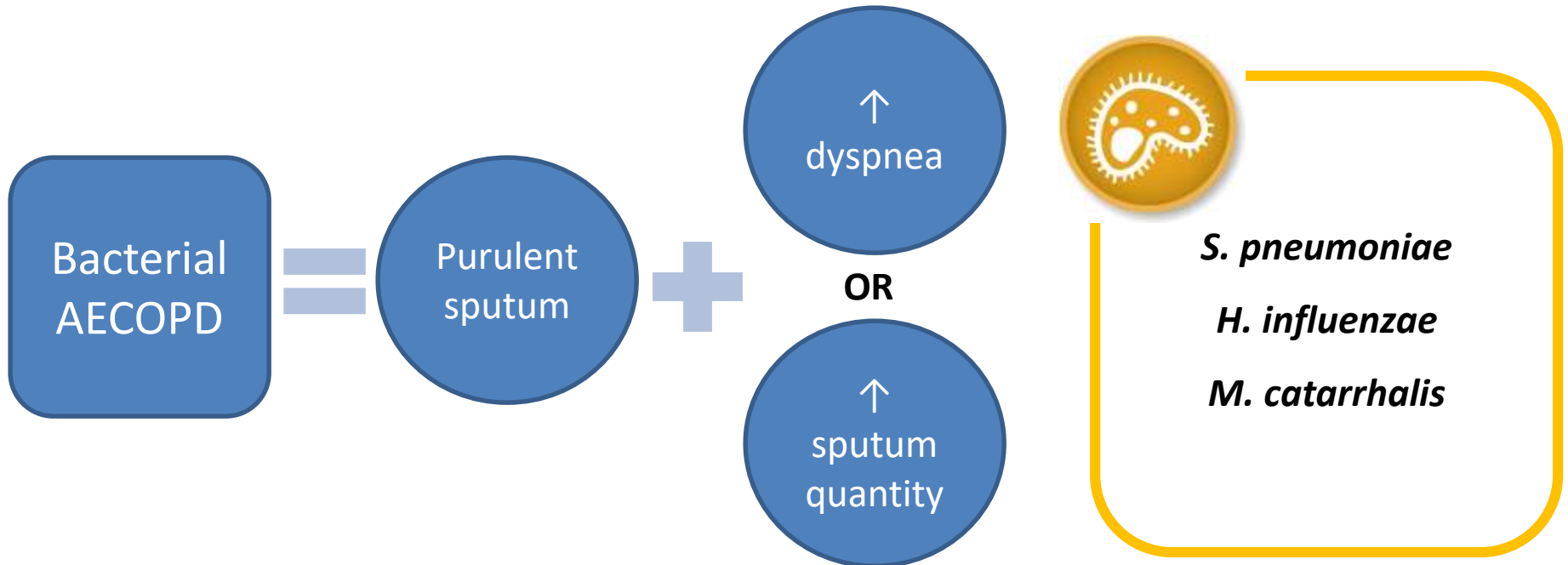
Don't prescribe antibiotics in adults with bronchitis / asthma and children with bronchiolitis.

– Canadian Association of Emergency Physicians

# Simple AECOPD

- Amoxicillin
- Cefuroxime
- Cefprozil
- Clarithromycin

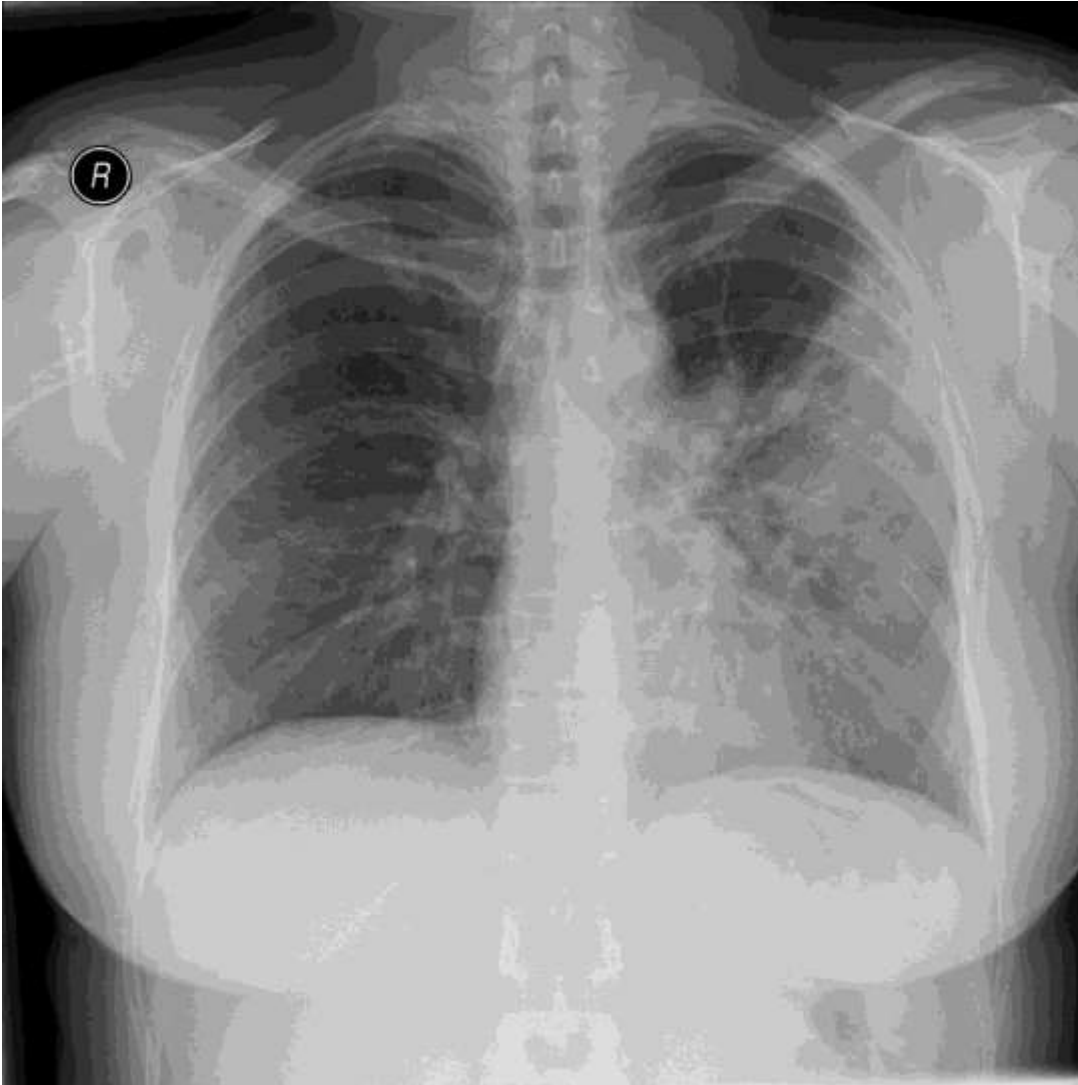
- Clarithromycin XL
- Doxycycline
- TMP-SMX
- Azithromycin



# Complex AECOPD

- Second line antibiotics
  - Amoxicillin-clavulanate
  - Levofloxacin / Moxifloxacin
  - Ciprofloxacin (if proven *Pseudomonas*)
- Diagnosis
  - FEV1 < 50%
  - Frequent exacerbations (>3 per year)
  - Significant comorbidity (e.g., heart disease or lung cancer)
  - Oxygen therapy
  - Chronic oral corticosteroid therapy
  - Use of antibiotics in the past month

# Lobar pneumonia is usually bacterial



*S. pneumoniae*

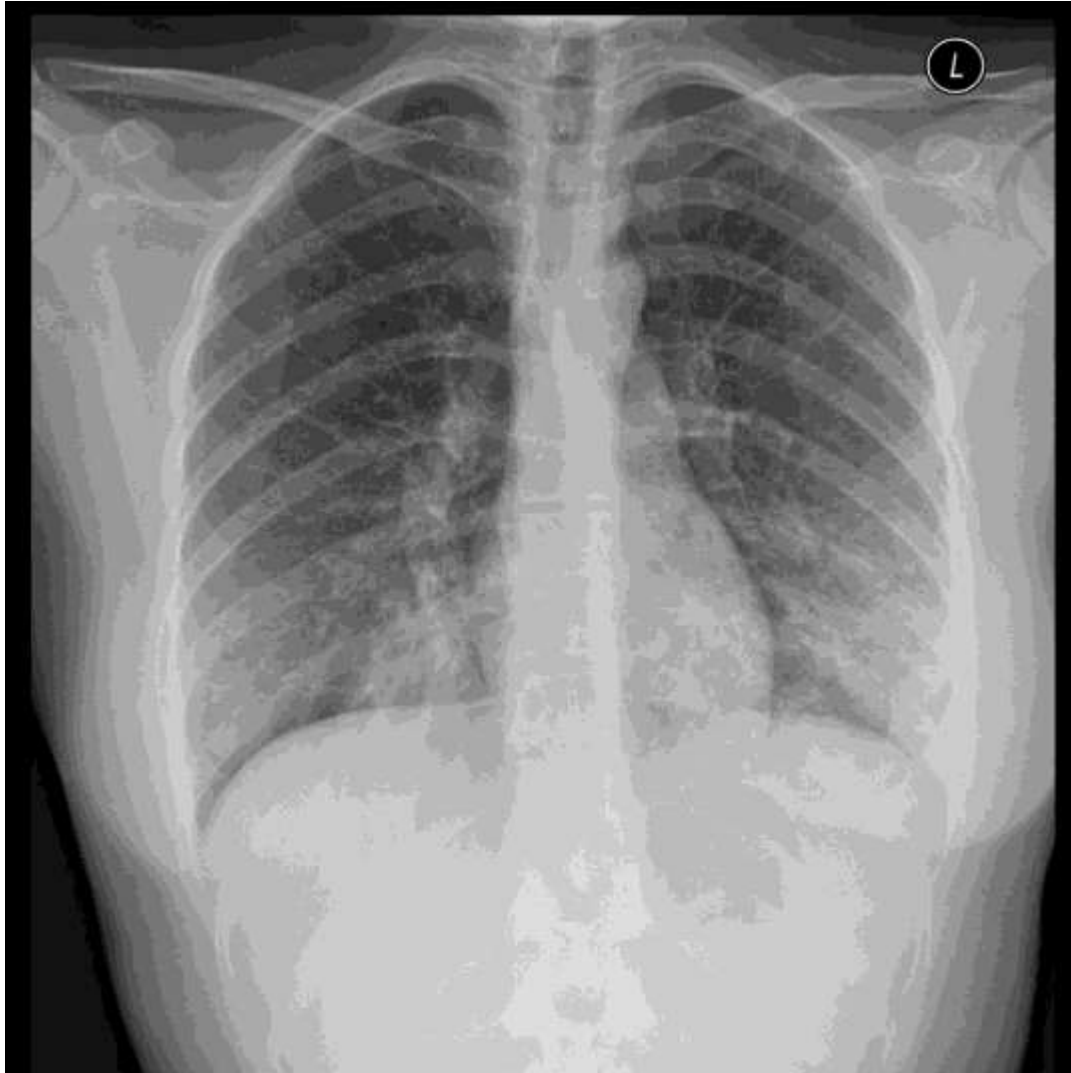
*H. influenzae*

*K. pneumoniae*

*Legionella*

*M. tuberculosis*

# Multifocal pneumonia is viral or atypical



**Respiratory viruses**

***Mycoplasma***

***Chlamydophila***

***Legionella***

**Q fever**

# Atypical pneumonia is often associated with extrapulmonary findings

- Clinical course
  - Insidious onset & protracted clinical course
  - Low-grade fever
  - Persistent dry cough
  - Mixed upper/lower respiratory tract symptoms
- Extrapulmonary manifestations
  - Hepatitis
  - Diarrhea
  - Erythema multiforme (*Mycoplasma*)



# Treatment of pneumonia usually requires 5-7 days therapy

	Antibiotics	
First line	Clarithromycin Clarithromycin XL Azithromycin Doxycycline Amoxicillin (1g PO TID)	
First line, if comorbidities	Amoxicillin Amoxicillin/clavulanate	Clarithromycin Clarithromycin XL Azithromycin Doxycycline
Second line	Any option in “first line, if comorbidities” Levofloxacin Moxifloxacin	



*S. pneumoniae* azithromycin resistance in Quebec is 19%.

# Key Messages

Do not routinely:

- Treat asymptomatic bacteriuria
  - Unless: pregnancy, pre-urologic procedure
- Order urinalysis/urine culture if asymptomatic
- Prescribe antibiotics following skin abscess drainage
  - Unless: extensive cellulitis
- Use antibiotics for respiratory viral infections

# Key Messages



- *S. pneumoniae*
  - Increasing resistance to macrolides
- *E. coli*
  - Most common cause of uncomplicated UTI
  - Remains susceptible to first line agents in Quebec
- *S. aureus*
  - High resistance to clindamycin
  - Doxycycline and TMP-SMX for MRSA

# Guideline & Resource Links

- Choosing Wisely
  - <http://www.choosingwisely.org/>
  - <https://choosingwiselycanada.org/>
- INESSS Guidelines
  - <https://itunes.apple.com/ca/app/inesss-guides/id1206046869>
  - [https://play.google.com/store/apps/details?id=com.inesss&hl=fr\\_CA](https://play.google.com/store/apps/details?id=com.inesss&hl=fr_CA)
- IDSA Guidelines
  - [https://www.idsociety.org/practice-guidelines/#/date na dt/DESC/0/+/](https://www.idsociety.org/practice-guidelines/#/date%20na%20dt/DESC/0/+/)

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