Infectious Diseases Update 2021

Edith Blondel-Hill

Interior Health
Every person matters

Disclosures

Faculty:

Edith Blondel-Hill

Relationships with commercial interests:

- Grants/Research Support: NONE
- Speakers Bureau/Honoraria: NONE
- Consulting Fees: NONE
- Other: Alberta Health Services
  - nominal payment for updating Bugs and Drugs app/website

Objectives

Review updates in:

- Medical Microbiology
- Infectious Diseases
- Antimicrobial Stewardship
- Infection Prevention and Control

What is new in Microbiology?

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Taxonomy Changes

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Taxonomy

- *Enterobacter aerogenes* - *Klebsiella aerogenes*
- *Clostridium difficile* - *Clostridioides difficile*
- *Chlamydia pneumoniae* - *Chlamydophila pneumonia*
- *Propionibacterium acnes* – *Cutibacterium acnes*
- *Bacillus* and related species:
  - *Lysinobacillus spp*
  - *Paenibacillus spp*

Gram positive anaerobes:

- *Anaerococcus / Atopobium / Parvimonas / Finegoldia / Peptoniphilius*

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MINIREVIEW

Summary of Novel Bacterial Isolates Derived from Human Clinical Specimens and Nomenclature Revisions Published in 2018 and 2019

Erik Munson,[a] Karen C. Carroll[b]

- *Mycoplasma genitalium* – *Mycoplasmoides genitalium*
- *Mycoplasma hominis* – *Metamycoplasma hominis*
- *Mycoplasma lipophilum* - *Mycoplasmopsis lipophila*
- *Mycoplasma pneumoniae* – *Mycoplasmoides pneumoniae*

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MINIREVIEW

Name Changes for Fungi of Medical Importance, 2018 to 2019

Andrew M. Borman,[a,b] Elizabeth M. Johnson[a,b]

- *C. glabrata – Nakaseiomyces glabrata*
- *C. guilliermondii - Meyerozyma guilliermondii*
- *C. krusei – Pichia kudriavzevii*
- *C. lusitaniae – Clavispora lusitaniae*

Other less common yeast :

- *Debaryomyces spp*
- *Kluyvermyces spp*
- *Yarrowia spp*
- *Wickerhamomyces spp*
- *Diutina spp*

Enhanced Microbiology Testing - Kootenays

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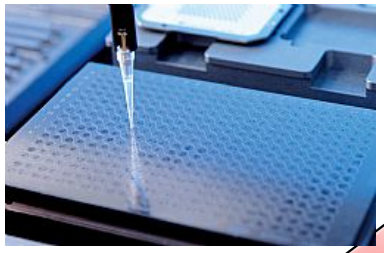
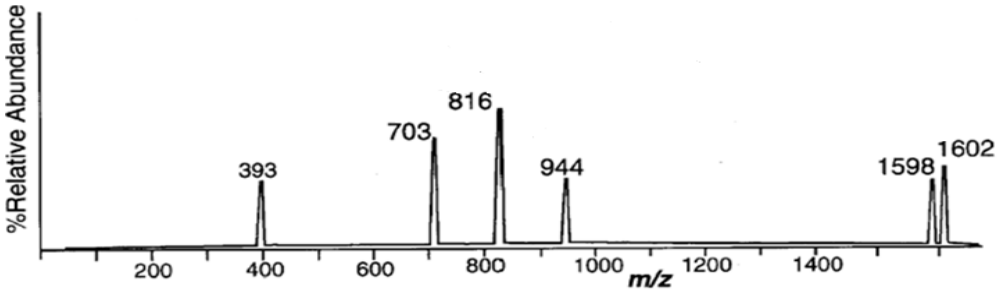
Mass Spectrometry analysis – MALDI TOF

Applied to target plate



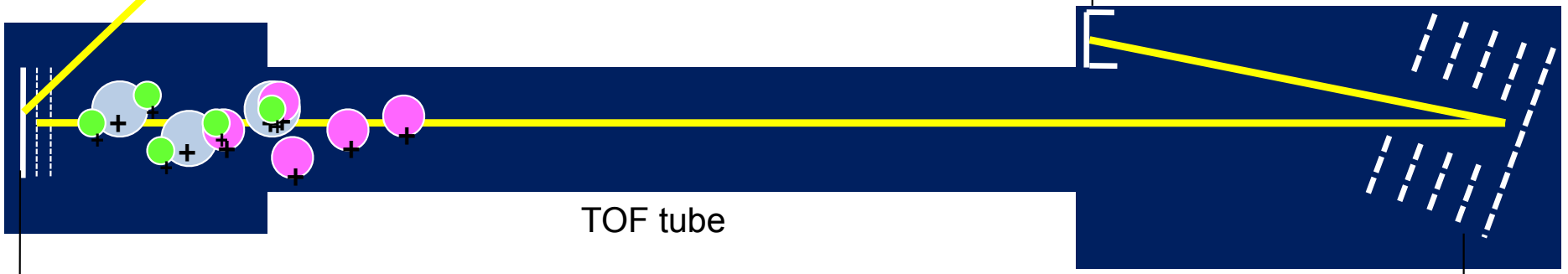
Place on instrument

Protein Spectra



Laser source

Detector



TOF tube

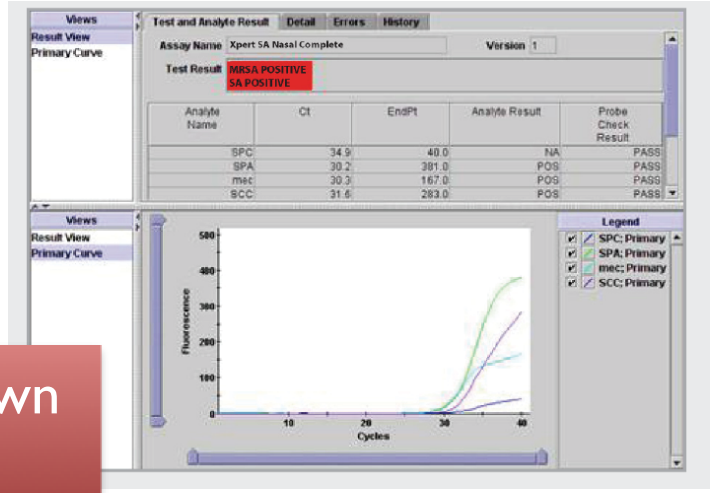
MALDI target plate

Reflector

MRSA PCR for Gram + Cocci in Clusters in Blood Cultures

12-24 hrs

Assay reports if MRSA is present or not



2 hrs

~2 <u>hours</u> until presence of MRSA known and vancomycin can be stopped!

S. Aureus / MRSA PCR Reporting

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MRP:
FamPhy:

Name:
Sex:
DOB:
PHN:
Ph:
Loc:

Acct: S00080537/17
MedRec: S000035142
Adm:
Dis:
Type: DEP ED

Laboratory Specimen Report

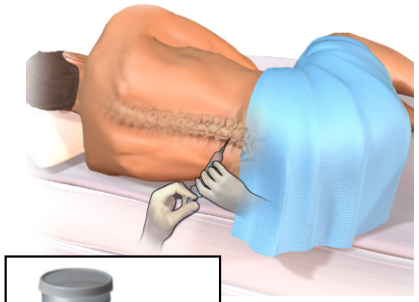
SPEC #: PT17:MB0001609U COLL: 12Jan17-1715 SUBM DR:
STATUS: RES RECD: 12Jan17-1728 OTHR DR:
QUERIES: Does patient have prosthetic device/implant or heart valve? Unknown
Is patient on antibiotics? No
ORDERED: Blood C&S
SPEC SOURCE/DESC: Blood / Venipuncture

Procedure	Result	Verified
Blood Culture *Final*		15/01/17-1236
Bottle Gram Smear:	**Gram positive cocci, clusters** - suggestive of Staphylococcus species in 4 out of 4 bottles (aerobic and anaerobic bottles) ==========	
Organism 1	**Staphylococcus aureus** ****MRSA NOT detected by molecular method**** Recommend repeat blood culture within 48-72 hrs of starting therapy to ensure clearance of bacteremia	
Time to Positivity:	Aerobic and Anaerobic bottles: 12 -24 hrs incubation TWO blood culture sets collected in this episode Four bottles received (2 aerobic and 2 anaerobic)	

****Critical Result****

HSV/VZV PCR - CSF

Lumbar Puncture



Only specimens with abnormal CSF profile tested

HSV/VZV negative

Median time to results available: 2 hours

Respiratory Pathogen Testing

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BIOFIRE

- Adenovirus
- Coronaviruses 229E, HKU1, NL63, OC43
- SARS CoV-2
- Human Metapneumovirus
- Human Rhinovirus/Enterovirus
- Influenza A
- Influenza B
- Parainfluenza Viruses 1, 2, 3, and 4
- Respiratory Syncytial Virus
- Bordetella parapertussis
- Bordetella pertussis
- Chlamydophila pneumoniae
- Mycoplasma (Mycoplasmoides) pneumoniae

Respiratory Pathogen Testing for Kootenays

Flu/RSV/COVID

- November 1st - testing all inpatients
- Admitted children < 5 yrs / Bronchoscopy specimens:
  - automatically add on Magpix
    - done in house by BioFire or sent out to BCCDC
- ICU - automatic testing with BioFire

  Note:

  - Legionella not included in Biofire - contact lab (Magpix- BCCDC)
  - Critical ICU patient / sample collected in ED - order Magpix
- Other admitted patients:
  - order Magpix separately if required

Helicobacter pylori Testing

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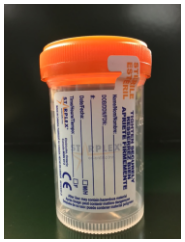
H. pylori Serology

- Negative predictive value of 98.4%
  - non-reactive serology rules out HP infection
- Positive confirms exposure to HP but not active infection
  - positive serology can be positive lifelong.
  - if positive, repeat serology testing is **NOT** indicated
- Highly sensitive screen
  - valuable first step in testing
  - reactive/equivoval results require further testing

H. pylori (HP) Stool Antigen Test

- Detection *H.pylori* antigens in stool
  - comparable to UBT

- Confirmatory test:
  - active infection if serology reactive/equivocal
  - test of cure ≥4 weeks after eradication therapy
- Collection instructions:
  - non-diarrheal stool in sterile container
  - stop PPIs, antibiotics, bismuth products
    - at least 2 wks prior to collection
    - avoids false negative results



H. pylori Management

Patients ≥ 60 years:

- endoscopy recommended for dyspepsia
- *H. pylori* testing optional

Patients < 60 years:

- First line - serology
  - If equivocal/reactive → stool antigen test (SAT)
  - If SAT equivocal / positive → eradication therapy

  Note: East Kootenay 2021: 9/159 (7.5%) tests positive

Treat - quadruple therapy regimen x14 days (7-10 days - failures)

- PPI + amoxicillin + metronidazole + clarithromycin
- PPI + bismuth + metronidazole + tetracycline

What is New in Infectious Diseases?

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Duration of Therapy

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Pneumonia

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

Aurélien Dinh, Jacques Ropers, Clara Duran, Benjamin Davido, Laurène Deconinck, Morgan Matt, Olivia Senard, Aurore Lagrange, Sabrina Makhloufi, Guillaume Mellon, Victoire de Lastours, Frédérique Bouchand, Emmanuel Mathieu, Jean-Emmanuel Kahn, Elisabeth Rouveix, Julie Grenet, Jennifer Dumoulin, Thierry Chinet, Marion Pépin, Véronique Delcey, Sylvain Diamantis, Daniel Benhamou, Virginie Vitrat, Marie-Christine Dombret, Bertrand Renaud, Christian Perronne, Yann-Erick Claessens, José Labarère, Jean-Pierre Bedos, Philippe Aegerter, Anne-Claude Crémieux, for the Pneumonia Short Treatment (PTC) Study Group

- duration of therapy: 3-5 days
- ceftriaxone 1 gram vs 2 grams – equivalent
  - IH - discontinuing automatic substitution to 2 grams

Infectious Diseases:

- doxycycline preferred over azithromycin for combination
  - protective against CDI
- azithromycin –prokinetic: diarrhea
  - inappropriate testing and treating for CDI

Resistance:

- macrolides- 24%
- Doxycycline- 26%
- TMP-SMX- 17%

- outpatient management for majority
- duration of therapy: 5 days

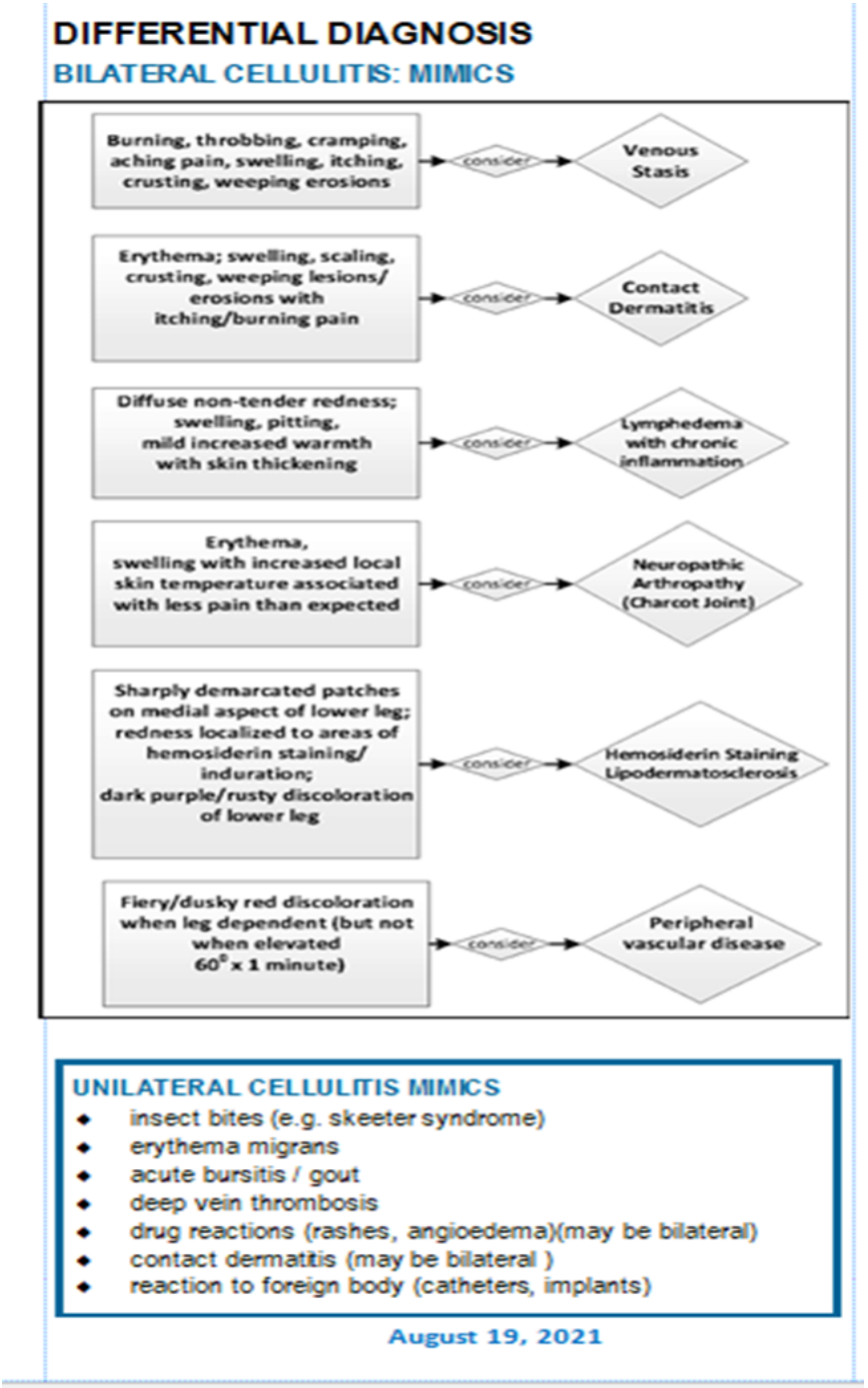
MINIMUM CLINICAL CRITERIA (ALL):

- redness
- warmth
- swelling
- pain
- unilateral

Refer to DIFFERENTIAL DIAGNOSIS if bilateral or not all minimum clinical criteria met

GENERAL MANAGEMENT:

- ELEVATION OF LIMB ESSENTIAL
- if systemic symptoms: CBC ± CRP
- if fever / chills or lymphangitis: blood cultures



Gram Negative Infections

Seven *versus* 14-days course of antibiotics for the treatment of bloodstream infections by Enterobacterales. A randomized, controlled trial

JAMA | Original Investigation

Effect of 7 vs 14 Days of Antibiotic Therapy on Resolution of Symptoms Among Afebrile Men With Urinary Tract Infection
A Randomized Clinical Trial

Dimitri M. Drekonja, MD, MS; Barbara Trautner, MD, PhD; Carla Amundson, MA; Michael Kuskowski, PhD; James R. Johnson, MD

Yeast Infections

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Emerging Issue

Sodium-glucose cotransporter-2 (SGLT2) inhibitors

- antihyperglycemic agent - improved patient outcomes
  - use expected to increase ++

However

- increase the risk of mycotic genital infections:
  - 1 in 10 women
  - 1 in 5 men

Recommendations for yeast infections:

"continue the SGLT2i, and treat infection with fluconazole"

Urinary Tract Infections

Azoles:

- itraconazole, voriconazole, posaconazole:
  - minimal excretion of active compound in urine

Echinocandins

- do not achieve significant concentrations in urine
- percent of plasma concentrations:
  - caspofungin- 1.4%
  - micafungin - 0.7%
  - anidulafungin - <0.1%

Clinical Infectious Diseases
MAJOR ARTICLE

Echinocandins Compared to Fluconazole for Candidemia of a Urinary Tract Source: A Propensity Score Analysis

Guillermo Cuervo,[1,2] Carolina Garcia-Vidal,[3,4] Mireia Puig-Asensio,[5] Antonio Vena,[6] Yolanda Meije,[7] Mario Fernández-Ruiz,[8] Eva González-Barberá,[9] María José Blanco-Vidal,[10] Adriana Manzur,[11] Celia Cardozo,[3,4] Carlota Gudiol,[1,2] José Miguel Montejo,[10] Javier Pemán,[9] Josefina Ayats,[1,2] Jose María Aguado,[8] Patricia Muñoz,[6] Francesc Marco,[3,4] Benito Almirante,[5] and Jordi Carratalà[1,2]; for Grupo de Estudio de Micología Médica (GEMICOMED), Sociedad Española de Enfermedades Infecciosas y Microbiología Clínica (SEIMC); and Red Española de Investigación en Patología Infecciosa (REIPI)

Cuervo et al CID 2017

- multi-centre study 9 hospitals
- 128/2176 episodes candidemia from UTI source
  - *C. albicans* 52.7%
  - *C. glabrata* 25.6%
  - *C. tropicalis* 16.3%

Results:

Initial echinocandin therapy not associated with clinical failure

Therapy for Candidemia

Crude mortality (60%)

Attributable mortality (40%)

Micafungin- empiric drug of choice for yeast BSI

- treatment for at least 14 days after documented clearance and resolution of symptoms
- step down to fluconazole if clearance of blood cultures
  - as effective full course with echinocandin
  - decreases risk of echinocandin resistance

Fluconazole

Underdosing:

- pediatric cancer patients (CID 2014)
- obese populations (AAC 2016)
- renal replacement therapy (AAC 2021)
- increased renal clearance (AAC 2021)

Overdosing adverse events:

- Up to 38.5% of patients
- CNS, liver dysfunction, GI effects, rash

Antimicrobial Agents and Chemotherapy

PHARMACOLOGY

Suboptimal Dosing of Fluconazole in Critically Ill Patients: Time To Rethink Dosing

Eline W. Muilwijk,[a,b]* Dylan W. de Lange,[c] Jeroen A. Schouten,[d]* Roeland E. Wasmann,[a,b] Rob ter Heine,[a] David M. Burger,[a] Angela Colbers,[a] Pieter J. Haas,[e] Paul E. Verweij,[b,f] Peter Pickkers,[b,g] Roger J. Brüggemann[a,b]

Muilwijk et al AAC 2020

- open label multi-centre observational study
- dosing of fluconazole in critically ill patients /renal dysfunction

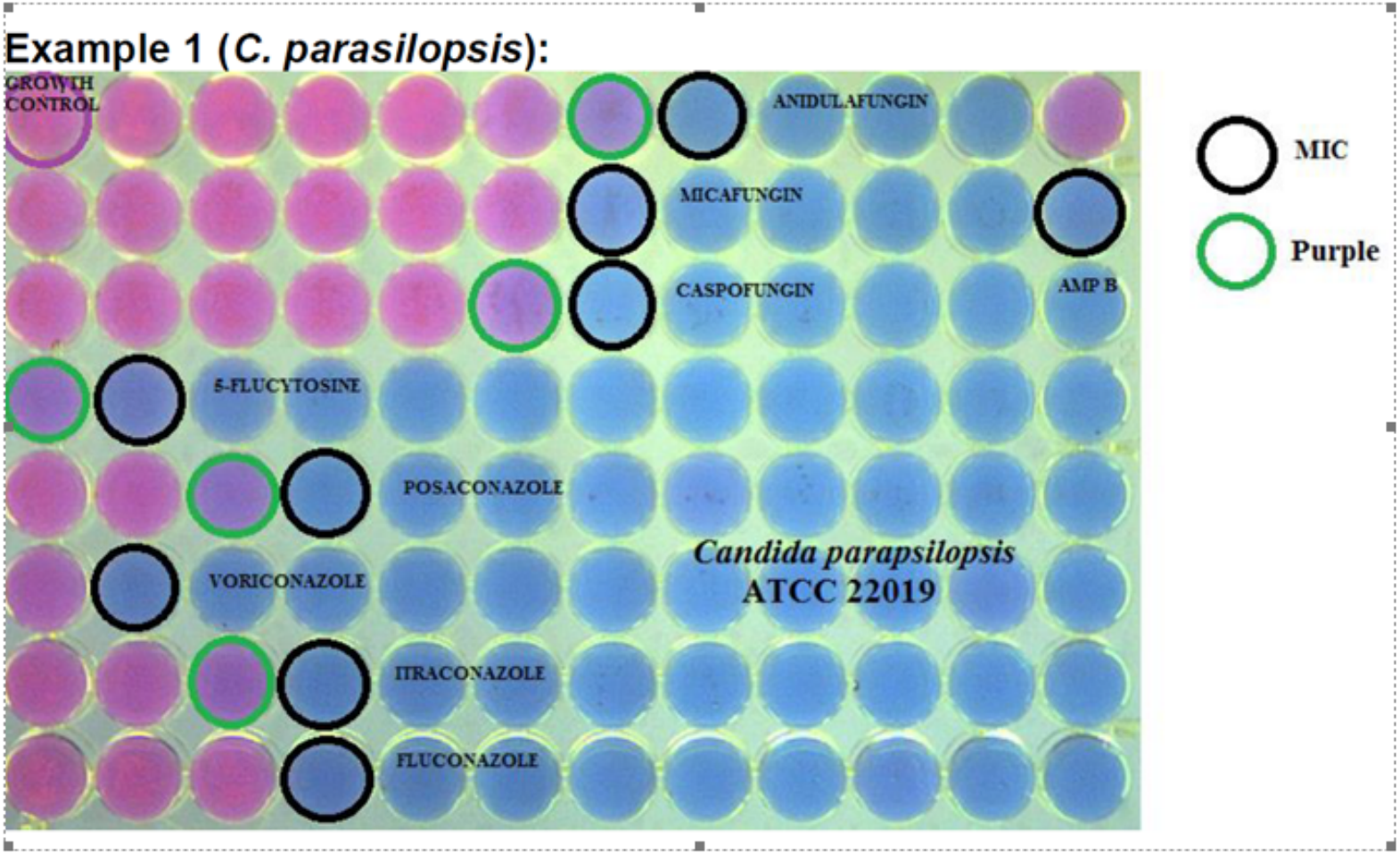
Results:

- higher clearance than normal in critically ill patients
- suboptimal dosing of fluconazole in critically ill

Recommended dose:

- 400 mg - poor to moderate renal function
- 600 mg - normal renal function
- 800 mg – CRRT

Yeast Susceptibility Testing



Lyme Disease

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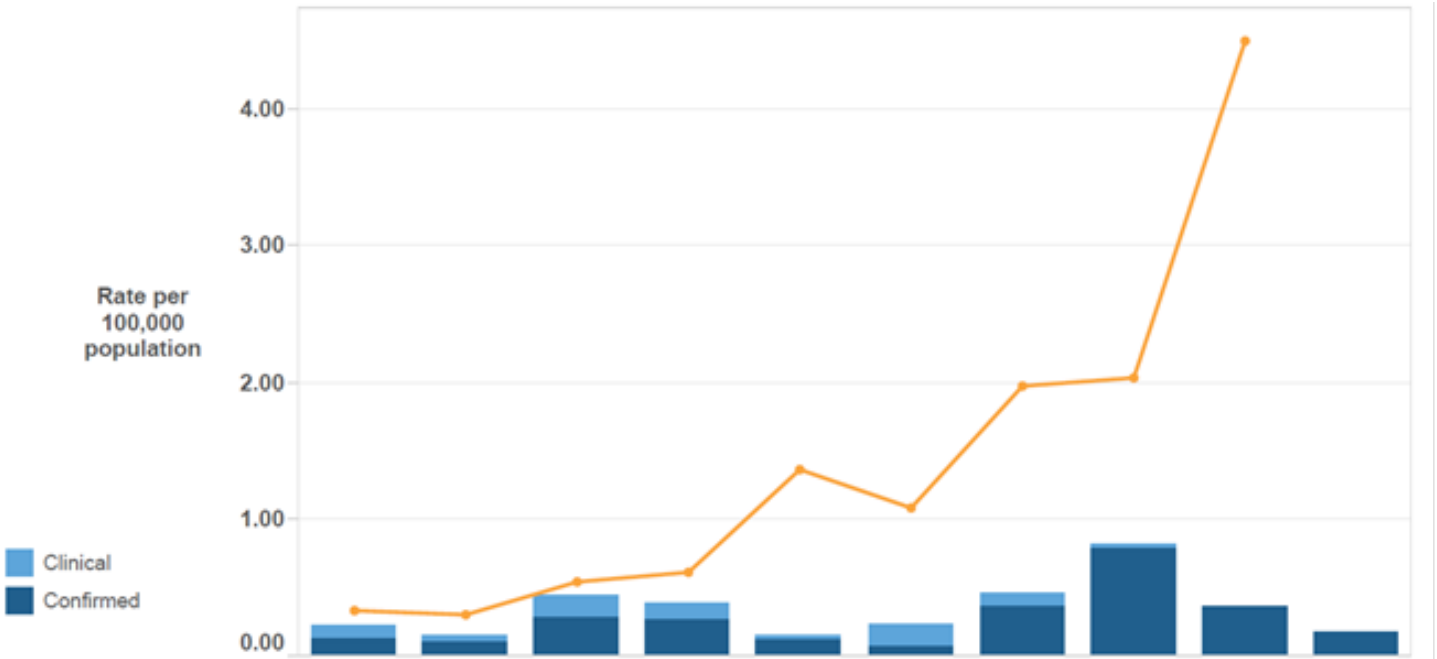
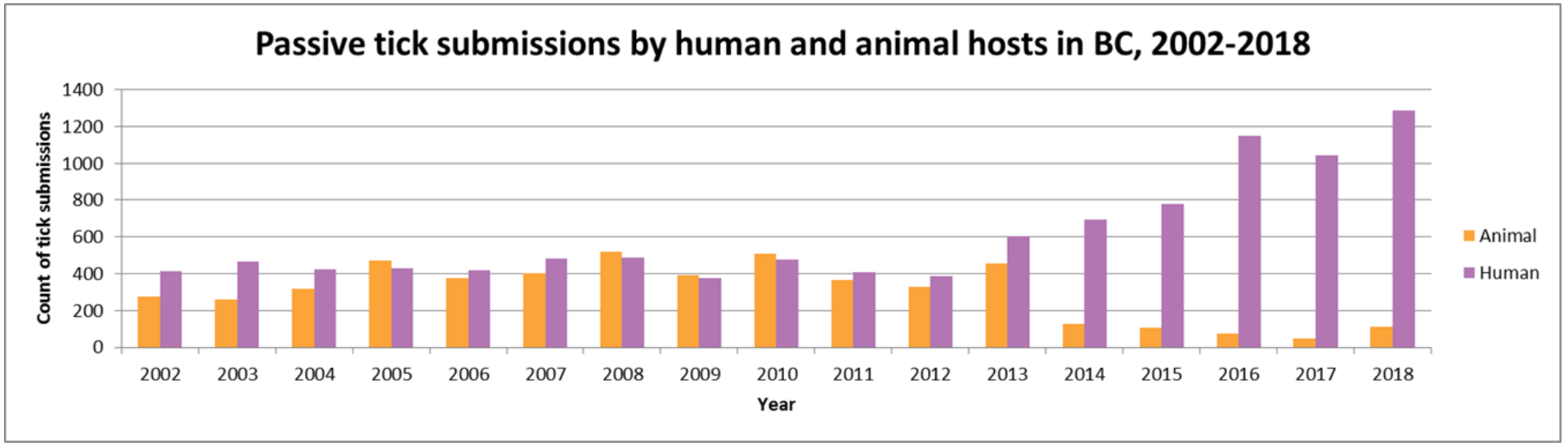
Lyme disease in BC: 2009-2018



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Reports	10	7	20	18	7	11	22	40	18	9
BC Rate	0.23	0.16	0.44	0.39	0.15	0.23	0.46	0.82	0.37	0.18
Canada Rate	0.34	0.31	0.55	0.62	1.37	1.09	1.98	2.04	4.50	

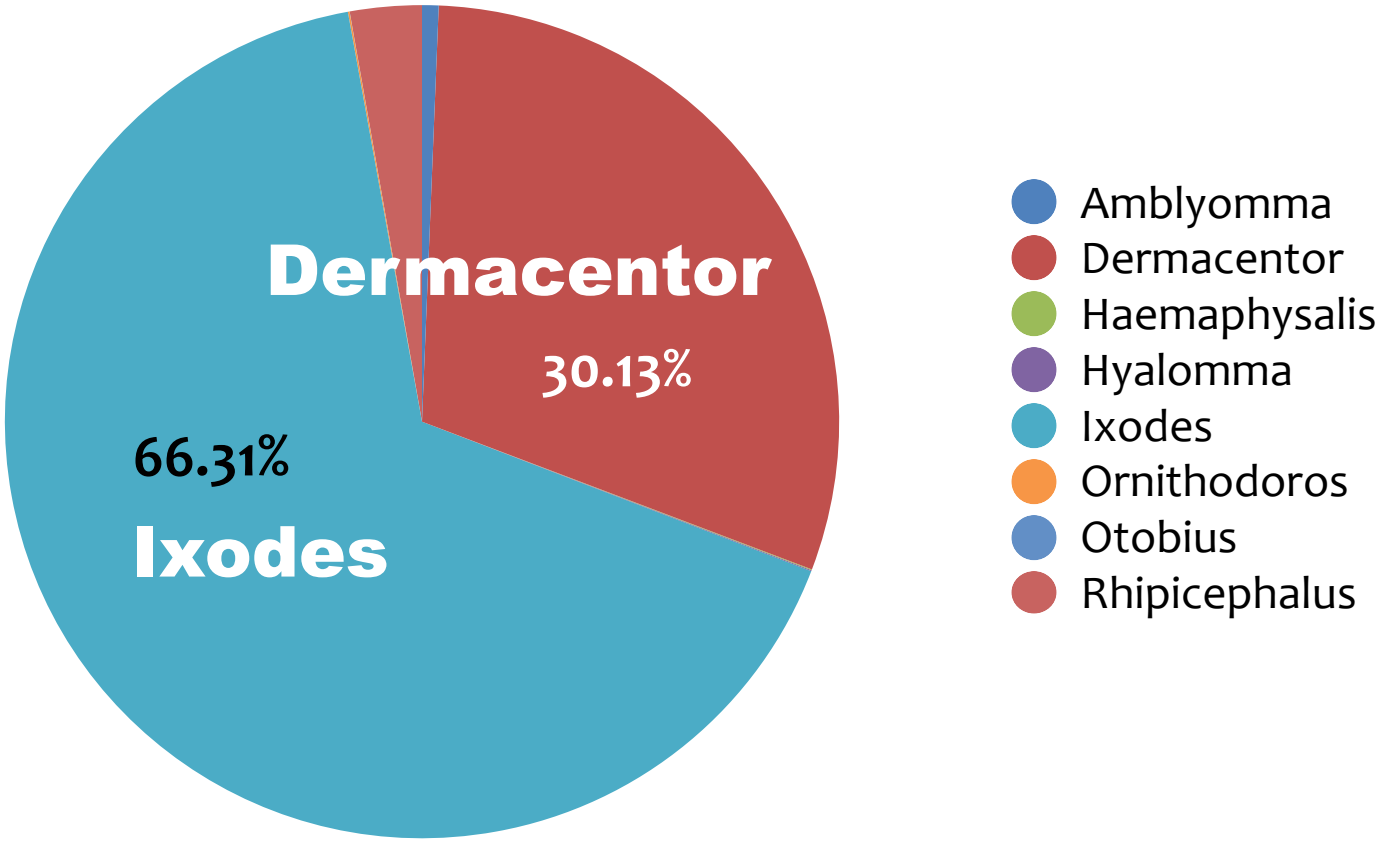
Ixodes pacificus

- western black-legged tick
- western coast of North America
- principal vector of Lyme disease

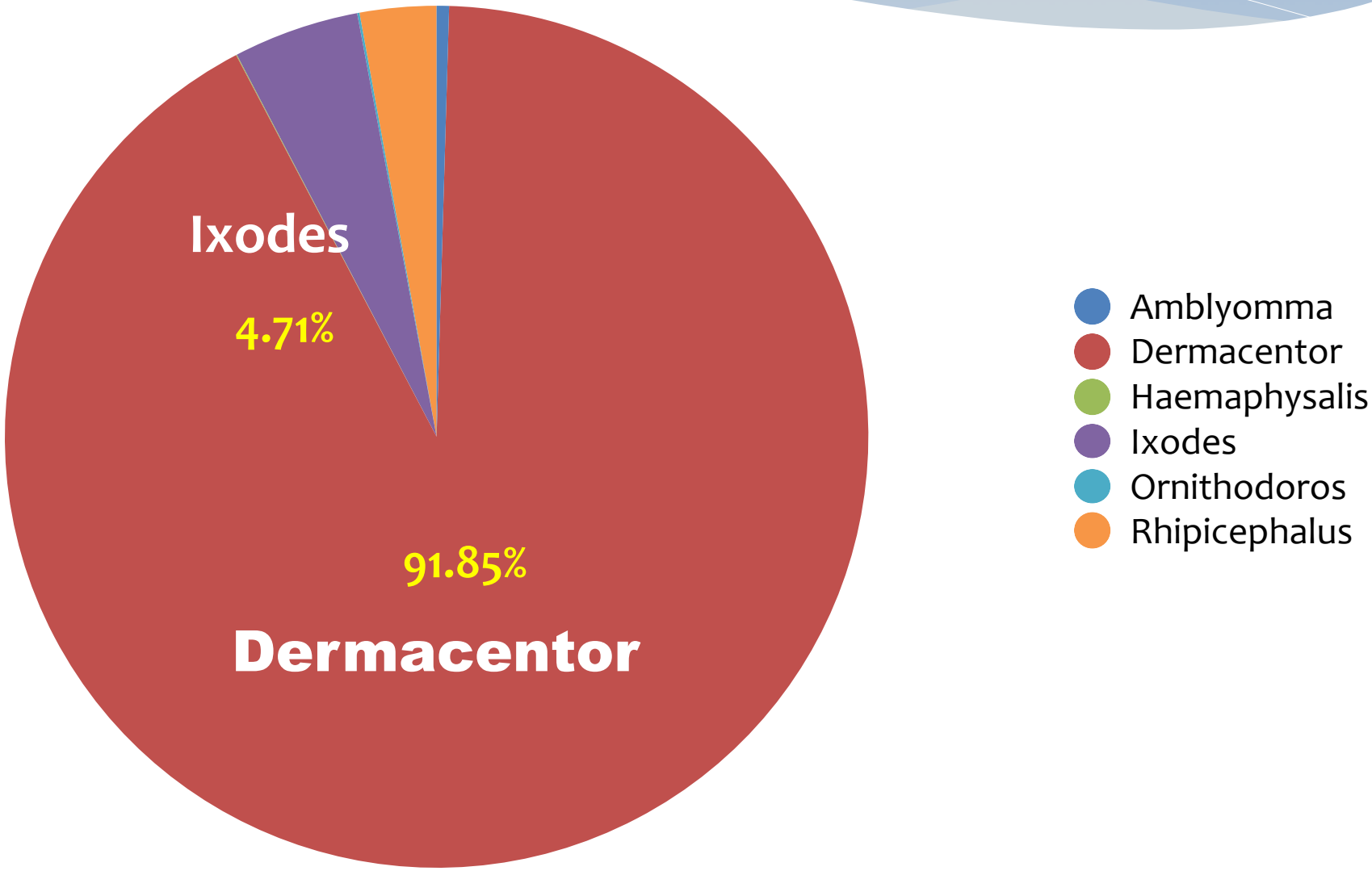


Morshed et al, Vector Borne Zoonotic Dis. 2021 Apr 7. doi: 10.1089/vbz.2020.2743

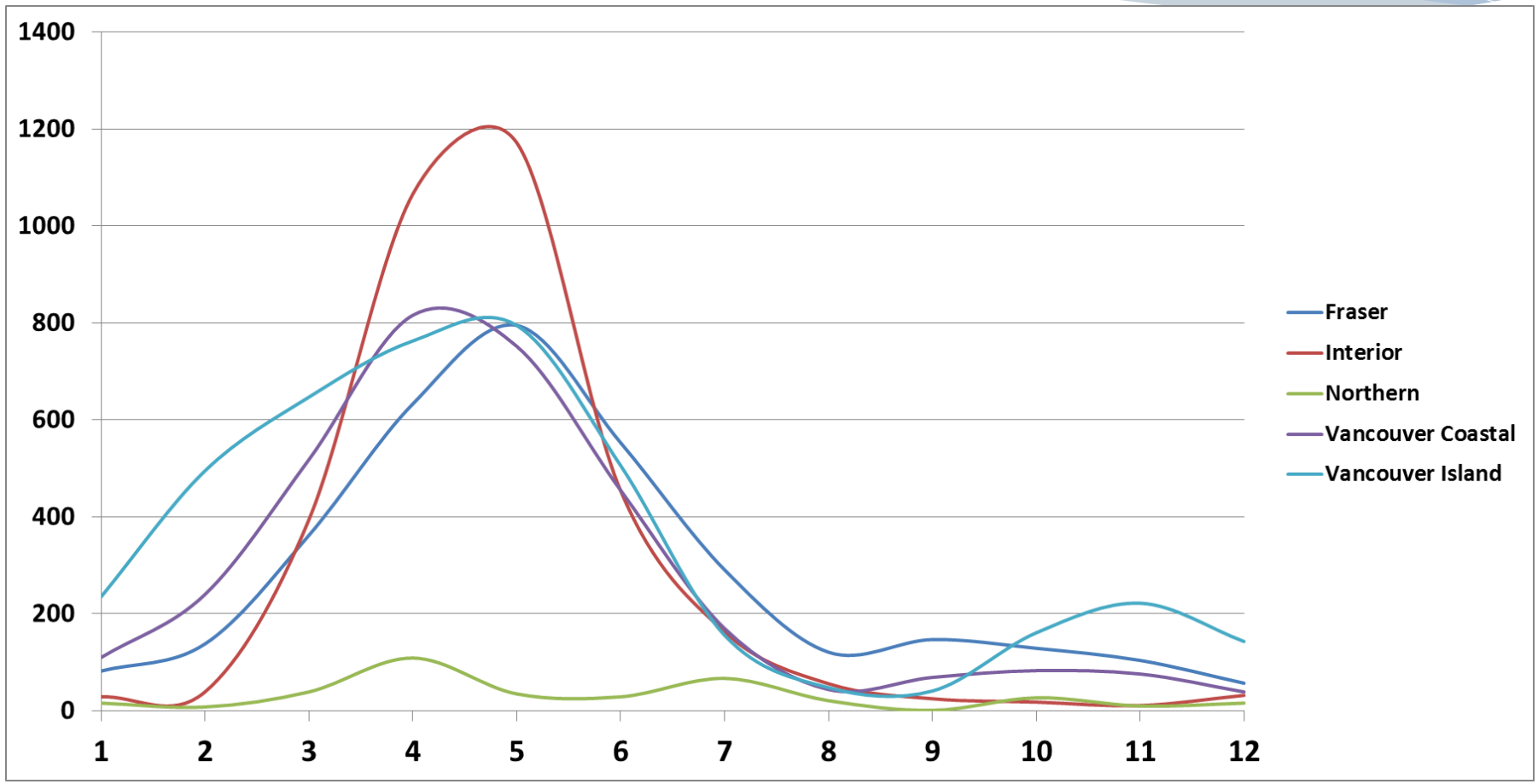
Tick Composition in BC (2002-2018)



Tick Composition in Interior Health (2002-2018)



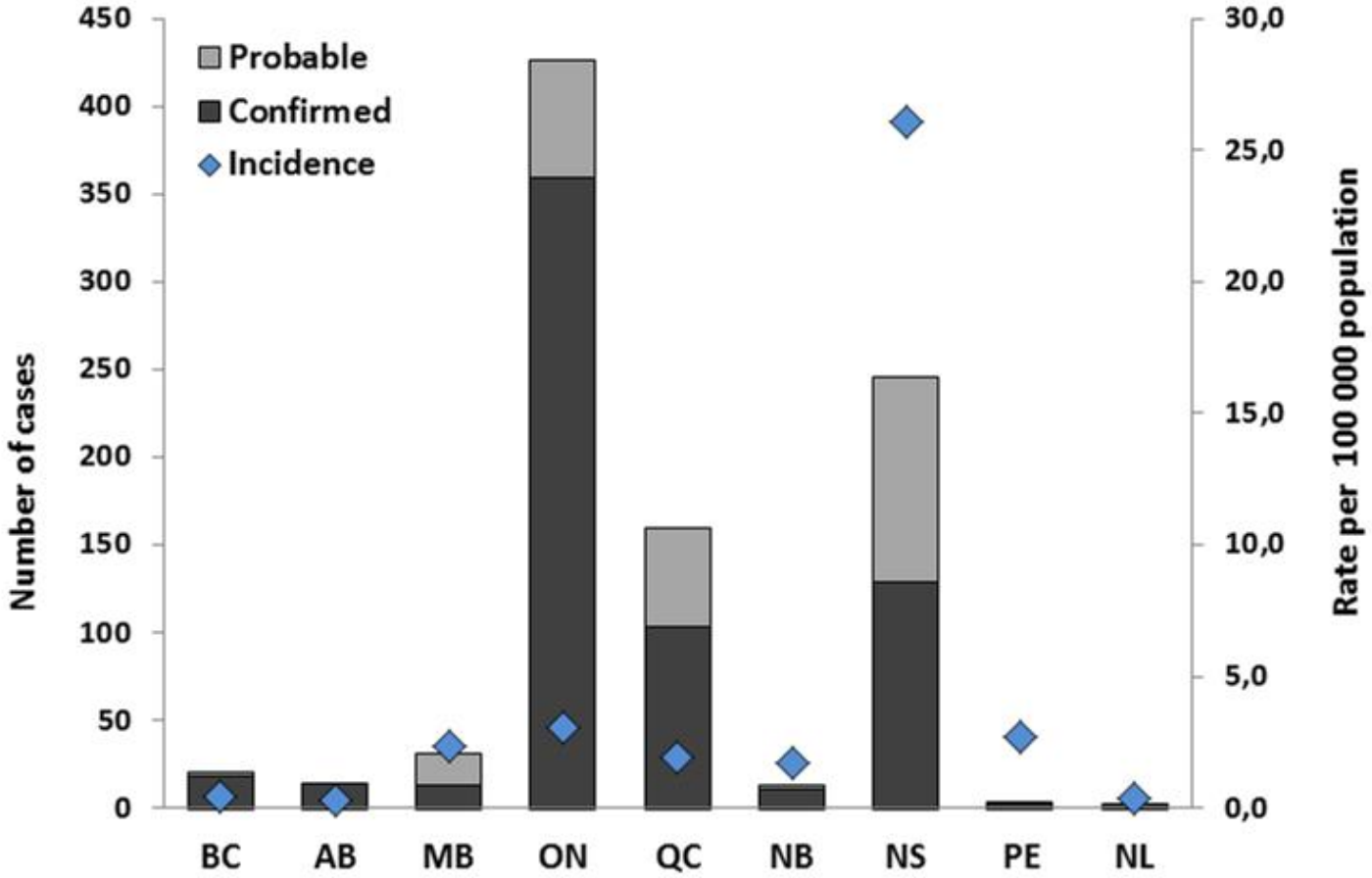
Health Authority Specific Tick Seasonality



State	2017	Incidence 3-Year average
Washington	0.4	0.3
Oregon	0.3	0.2
Idaho	0.9	0.5
California	0.2	0.2
Maine	106.6	89.2
Vermont	103.6	86.7
New Jersey	40.3	40.5

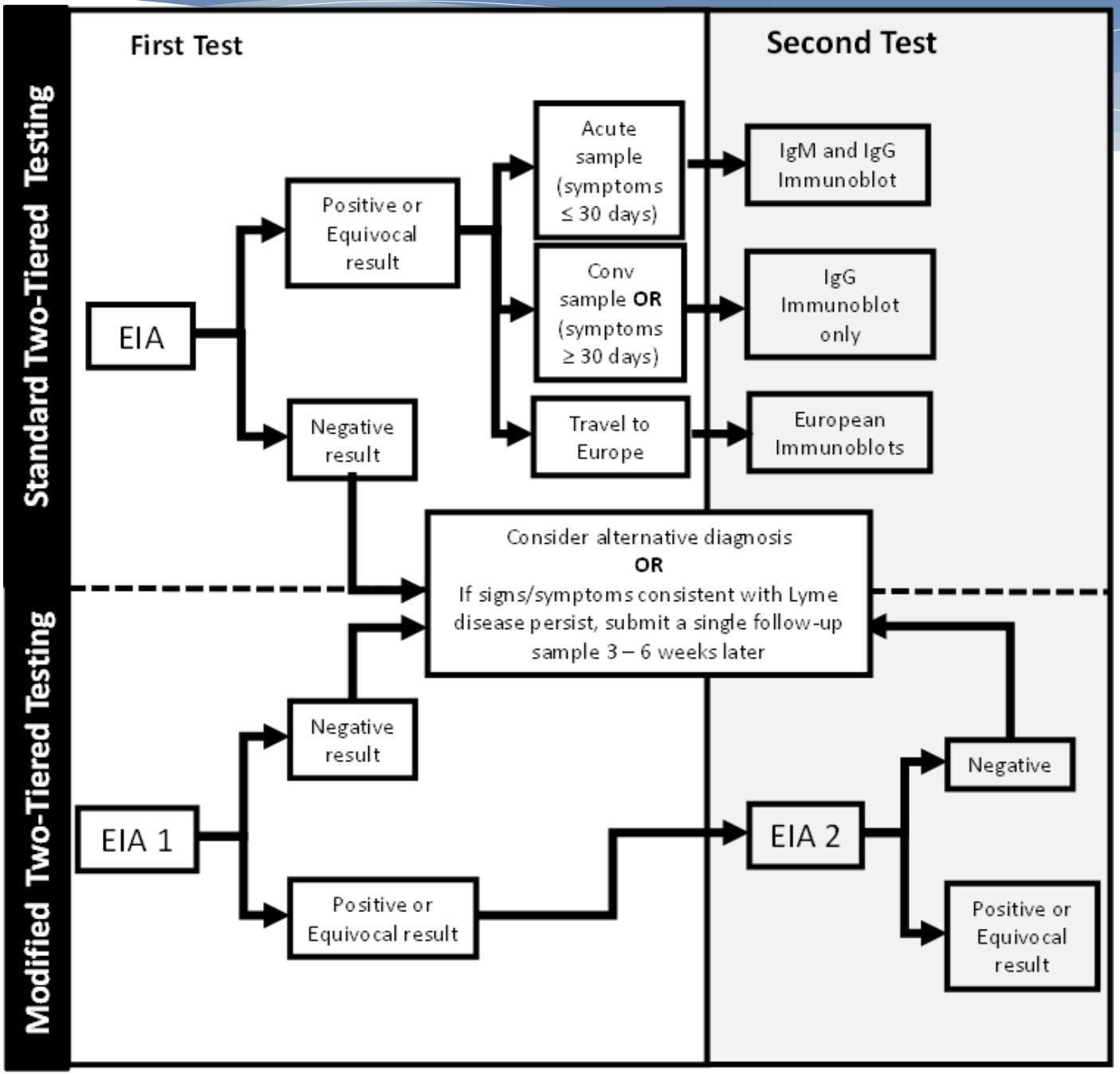
British Columbia- 0.2%

Lyme Disease in Canada 2016



All the cases recorded for Alberta and Newfoundland and Labrador were acquired on travel outside the province. Data source: Health Canada

Standard and Modified Two-tiered Testing for Lyme disease



Modified Two-Tiered Testing for Lyme disease

- > 25% improvement in sensitivity for detection of early infection
- technically less laborious / less subjectivity
- faster turnaround time
  - facilitate acute / convalescent testing
    - non-EM early localized LD
- patients presenting with EM
  - still require empiric antibiotics - sensitivity still not >90%
- cannot differentiate between recent and past infections
  - same as standard wo-tiered testing
- impact of MTTT on specificity in low prevalence areas unclear

Hantavirus

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Reported Hantavirus Cases in British Columbia, 1994-2020

Hantavirus case

- Locally acquired
- Travel related (place of exposure)

Total case count by Health Authority (23)

- 17 Interior
- 1 Fraser
- 1 Vancouver Coastal
- 1 Vancouver Island
- 3 Northern

Map created July 2020

Atlin - 2013
Groundbirch - 2015
Prince George (Bolivia) - 2006
Williams Lake - 1995
150 Mile House - 2017
Riske Creek - 1994
Hanceville - 2020
Kamloops (2) - 2016, 2017
Falkland - 2013
Vernon - 2020
Invermere (Calgary) - 2018
Windermere - 2007
Fauquier - 2005
Sparwood - 2017
Nicola - 1994
Madeira Park - 2014
Oyama - 2002
Winfield - 2019
Naramata - 2006
Okanagan Falls - 1994
Saltspring Island - 1996
Mission - 1994

Serum → IgG, IgM

EDTA blood, Lung aspirate → PCR, Sequencing

What is New in Antimicrobial Stewardship?

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Antibiotic Utilization

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Community Antimicrobial Stewardship in BC

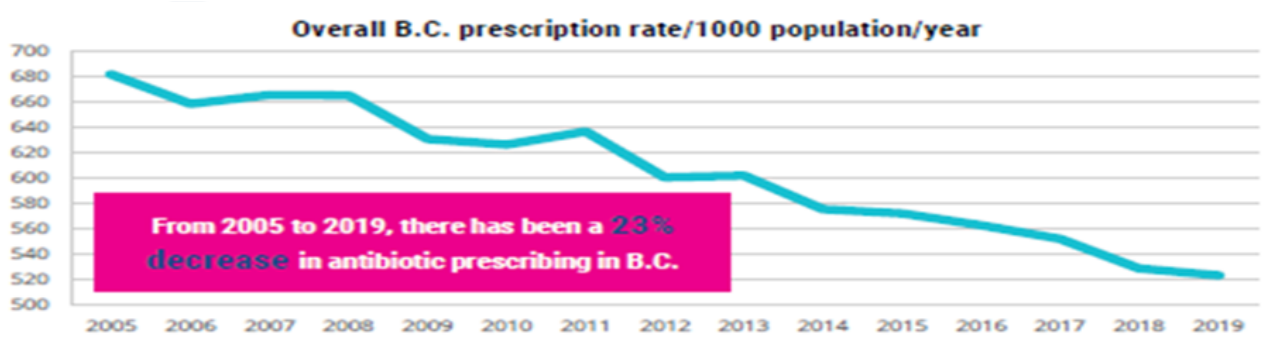
Since 2005

- implementation of Alberta Do Bugs Need Drugs? program
- BCCDC: establishment of Community Antimicrobial Stewardship program
- multifaceted educational programs:
  - public/school children/daycares/elderly
  - teachers/early childhood educators/medical/nursing students
  - healthcare professionals
    - physicians, nurse practitioners, dentists
  - expansion to online presence
    - *Antibiotic Wise* campaign
    - social media channels

antibiotic wise.ca

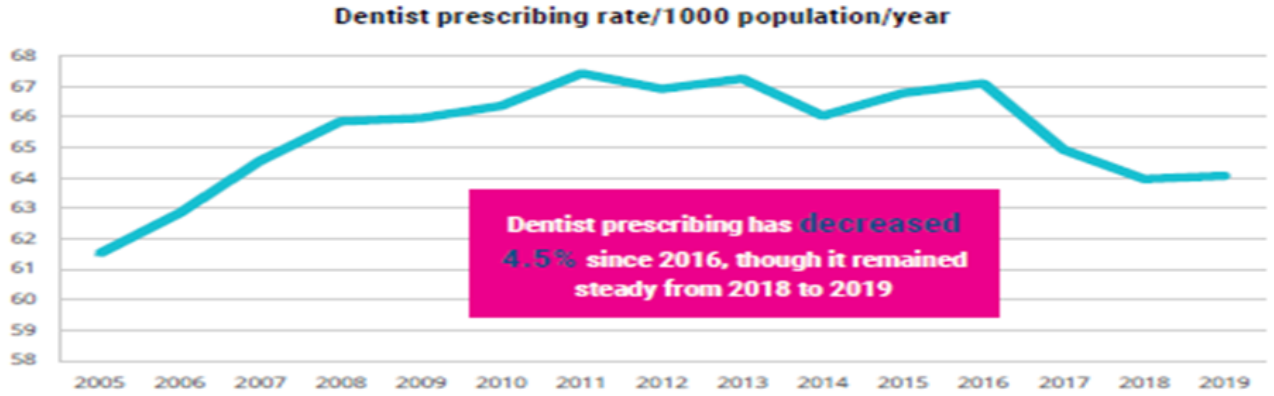
DO BUGS NEED DRUGS?

Antimicrobial utilization



Top prescribed antibiotics in B.C.

Amoxicillin | Cefalexin | Nitrofurantoin | Amoxicillin and enzyme inhibitors | Azithromycin



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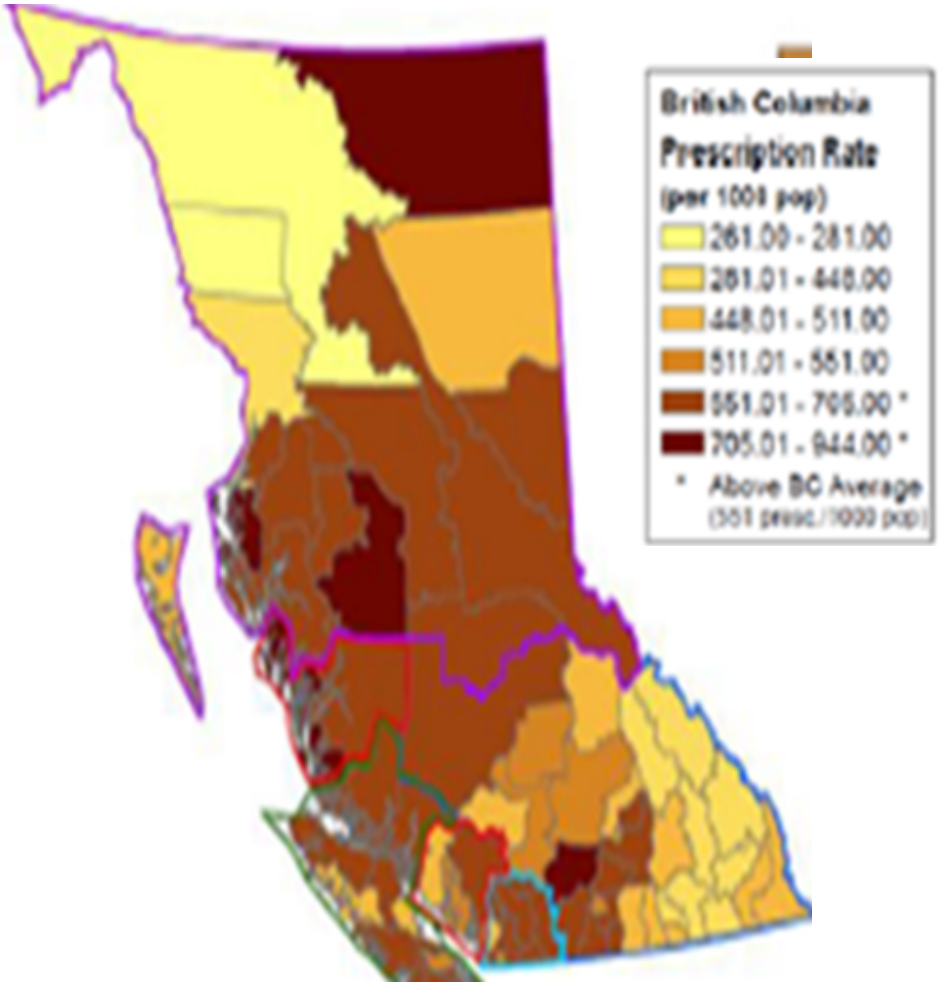
DO BUGS NEED DRUGS?

Antibiotic Utilization



Mean and median days of antibiotic prescription by practitioner group (1996-2018)

Profession	Median (IQR)	Mean ± SD
Naturopathic physician	16 (10-30)	22.7 ± 18.3
Podiatrist	8 (8-10)	9.0 ± 4.6
Dentist	7 (7-8)	7.4 ± 5.1
Midwife	7 (5-10)	7.8 ± 4.3
Nurse Practitioner	7 (3-10)	9.2 ± 14.3
Optometrist	7 (7-10)	10.3 ± 11.7
Pharmacist	7 (5-10)	8.6 ± 0.7
Physician	7 (7-10)	10.8 ± 12.9

East Kootenay Hospital
Antimicrobial Consumption
2020-2021

Cumulative Antimicrobial Consumption

Indicator	2019-2020	2020-2021*	2019-2020.	2020-2021.*	2020-2021.*
		EKH	KBH	PRH	VJH
DDD/1000 pt-days	498	506	536	558	492
DOT/1000 pt-days	421	437	481	485	406
*April 1, 2020 to March 31, 2021					

-Stable cumulative consumption (DOT/1000 patient-days ↑4%)
-Cumulate consumption 3rd highest of the regional hospitals
~44% of inpatients receiving antimicrobials/day

Top 10 Antimicrobial Consumption

Defined Daily Dose (DDD)/1000 Patient-Days†

†Standard Adult Daily Dose Defined by the WHO

Antimicrobial	2019-2020	2020-2021*	% Change	2020-2021*2	2020-2021.	2020-2021.2
		EKH		KBH	PRH	VJH
cefTRIAXone	88.6	118.6	34%	83.3	90.1	77.2
ceFAZolin	94.1	77.0	-18%	102.8	74.5	123.6
piperacillin-tazobactam	34.7	43.4	25%	56.3	36.9	38.2
metroNIDAZOLE IV	28.8	42.0	46%	19.7	13.0	19.2
doxycycline	37.1	31.0	-17%	22.1	27.2	40.6
amoxicillin-clavulanate	24.5	28.7	17%	31.2	43.7	24.5
ampicillin IV	14.6	19.0	30%	12.4	14.5	7.1
vancomycin IV	22.6	15.0	-33%	25.9	14.3	13.5
azithromycin IV	9.5	11.8	24%	12.9	14.4	13.8
azithromycin PO	17.5	11.7	-33%	12.2	15.1	13.4

Days of Therapy (DOT)/1000 Patient-Days

Antimicrobial	2019-2020	2020-2021*	% Change	2020-2021*	2020-2021.*	2020-2021*
		EKH		KBH	PRH	VJH
cefTRIAXone	89.2	117.2	31%	82.4	88.9	76.2
piperacillin-tazobactam	41.5	52.4	26%	68.1	48.7	44.2
metroNIDAZOLE IV	32.1	46.8	46%	25.4	17.7	24.8
ceFAZolin	51.7	40.9	-21%	54.5	44.2	66.5
amoxicillin-clavulanate	14.5	17.2	19%	19.0	29.1	16.7
vancomycin IV	20.7	15.7	-24%	33.1	19.0	13.7
doxycycline	18.9	15.7	-17%	12.0	16.0	16.2
metroNIDAZOLE PO	32.1	15.3	-52%	9.2	11.6	10.6
azithromycin IV	10.5	12.1	15%	12.9	15.2	14.4
azithromycin PO	14.2	11.0	-23%	9.0	14.3	6.2

**Highest of regional hospitals

Increased consumption:
amoxicillin-clavulanate ↑19%
ceftriaxone ↑31%**
metronidazole IV ↑46%**
piperacillin-tazobactam ↑26%

Decreased consumption:
cefazolin ↓21%
metronidazole PO ↓52%
vancomycin IV ↓24%

Analysis:
- Broad-spectrum antibiotic has increased for amoxicillin-clavulanate, ceftriaxone, piperacillin-tazobactam,
- Consumption of ceftriaxone and metronidazole IV is highest of the 4

Asymptomatic Bacteriuria

Interior Health
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Symptom-Free Pee: LET IT BE

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

STOP treating asymptomatic bacteriuria; it is not an infection

STOP testing foul-smelling, dark, or cloudy urine

WAIT and rehydrate residents who develop changes in mental status, behaviour, or function <u>without</u> typical urinary tract infection symptoms

GO to urinalysis and urine culture if typical signs and symptoms of urinary tract infection are present

For more directions and guidance:
www.ammi.ca
#SymptomFreeLetItBe

AMMI™ Canada

Symptom-Free Pee: LET IT BE

Myths and Truths about Urinary Tract Infections in Long Term Care Residents

AMMI™ Canada

MYTH → **TRUTH**

Cloudy or smelly urine = UTI

Changes in the appearance and/or odour alone should not be used to diagnose a UTI or as an indication for urine culture.

Colour, clarity and smell are often affected by diet, certain medications and hydration status.

Do not send urine for culture unless resident has symptoms of an infection.

MYTH → **TRUTH**

Positive test for leukocyte esterase and/or nitrites = UTI

Positive leukocyte esterase and/or nitrites may indicate the presence of white blood cells (WBCs) or bacteria in the urine (bacteriuria), but it does not confirm that there is an infection.

Signs and symptoms of UTI are necessary for a diagnosis as pyuria (WBCs in the urine), bacteria and nitrites can also be present in a condition called asymptomatic bacteriuria which is a common colonization state in elderly residents.

Note: A negative leukocyte esterase and negative nitrite test can rule out UTI in most residents.

MYTH → **TRUTH**

Pyuria (WBC in urine) = UTI

Pyuria indicates the presence of WBC and inflammation, which are not specific for infection.

In addition, the degree of pyuria does not differentiate between asymptomatic bacteriuria and infection.

Pyuria and bacteriuria are common in the elderly (especially those with indwelling catheters).

MYTH → **TRUTH**

The urine should be sterile, therefore bacteria in the urine = UTI

Bacteriuria is common

Incidence of bacteriuria in residents of long term care homes:

- Women: 25-50%
- Men: 15-40%
- Nearly 100% of catheterized residents are colonized within 2-4 weeks

Bacteriuria without signs and symptoms of infection should not be treated with antibiotics as it represents a colonized state in the elderly.

MYTH → **TRUTH**

Falls or change in mental status in the elderly = UTI

A fall or a change in mental status in a resident without any other signs and symptoms of infection should be investigated for other causes. The diagnosis of a UTI in this case is a diagnosis of exclusion.

Even if urine cultures are positive, in stable residents without any signs and symptoms of UTI, 24 hours of hydration (unless on fluid restriction) can be safely tried before starting an antibiotic.

MYTH → **TRUTH**

Fever and bacteriuria always indicates a UTI

A fever in a non-catheterized resident, with bacteria in the urine, and with no other signs and symptoms of UTI should be investigated for other sources of infection. The diagnosis of a UTI in this case is a diagnosis of exclusion.

Bacteriuria is common, especially in the elderly and in residents of long term care facilities.

MYTH → **TRUTH**

Candida or yeast in the urine should be treated

Candida or yeast in the urine often reflects colonization rather than infection.

Treatment of Candida or yeast is rarely required and should only be considered if there are obvious signs and symptoms of a UTI and no alternate source is identified.

MYTH → **TRUTH**

Urine should be periodically sent for culture

Urine cultures for residents without signs and/or symptoms of UTI should NOT be sent for screening purposes except prior to undergoing invasive genitourinary procedures.

Asymptomatic bacteriuria is common in the elderly. It is not harmful and should not be treated with antibiotics unless the resident is undergoing an invasive urinary procedure.

MYTH → **TRUTH**

You must treat a UTI for 7-14 days

Cystitis (bladder infection) can be treated in as few as 3-5 days in women and 5-7 days in men.

Even uncomplicated pyelonephritis (kidney infection) in women can be successfully treated with only 5-7 days of antibiotics.

Unnecessarily long durations of treatment increase the risk for adverse effects including *C. difficile*.

MYTH → **TRUTH**

You need to repeat urine cultures after treatment

There is no reason to re-culture urine after treatment unless the resident is not improving clinically.

Bacteriuria can occur even after effective therapy and is not a reason to prolong therapy in an asymptomatic resident.

References

Schulz L. et al. *Top ten myths regarding the diagnosis and treatment of urinary tract infections.* The Journal of Emergency Medicine, 2016;51(1):25-30.

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Acknowledgements: Christel Johanson, BSc Pharm, ACPR and Craig Lee, MD, FRCPC – The Ottawa Hospital

S. aureus Bacteremia Management

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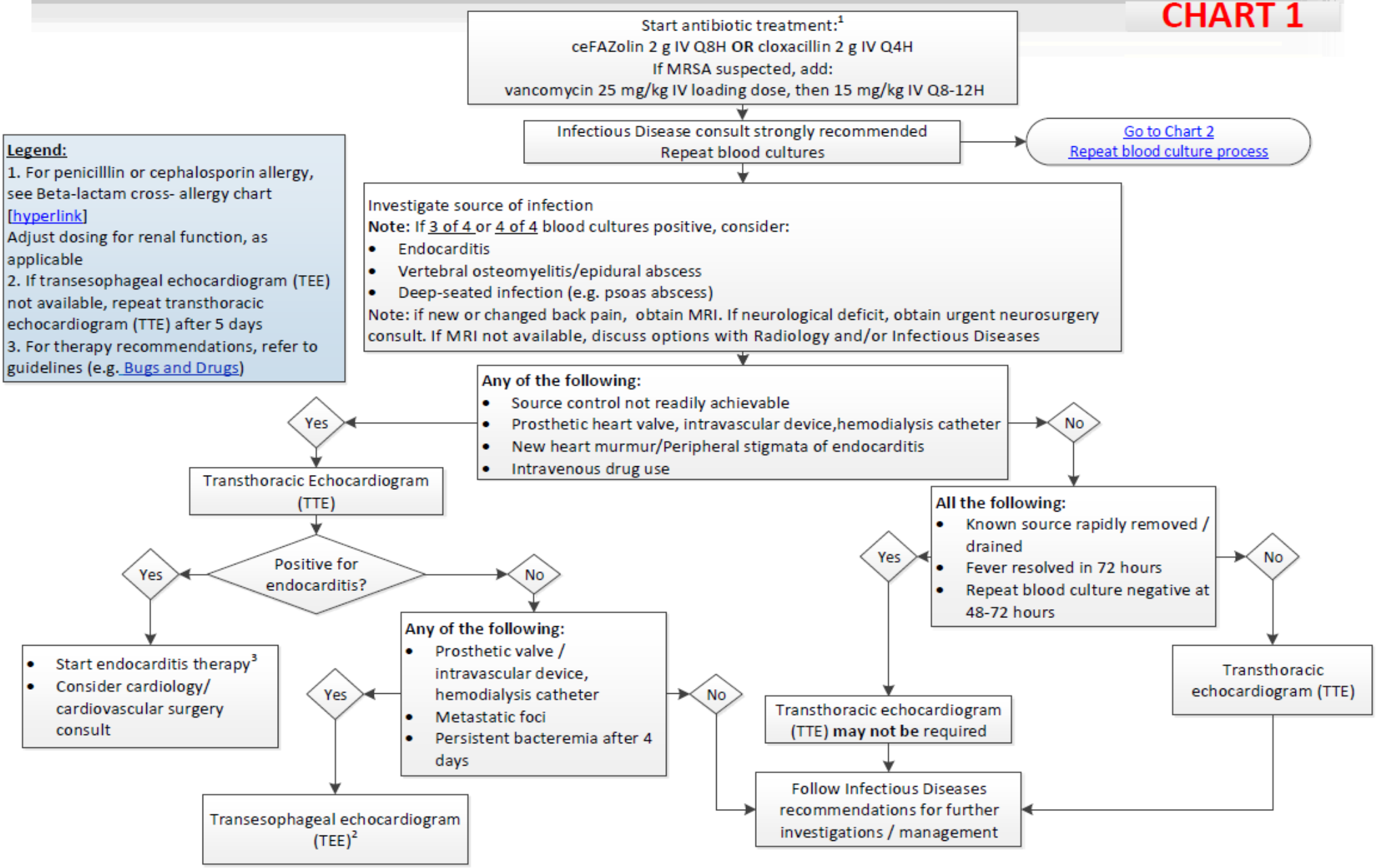
Staphylococcus aureus Bacteremia Management

CHART 1

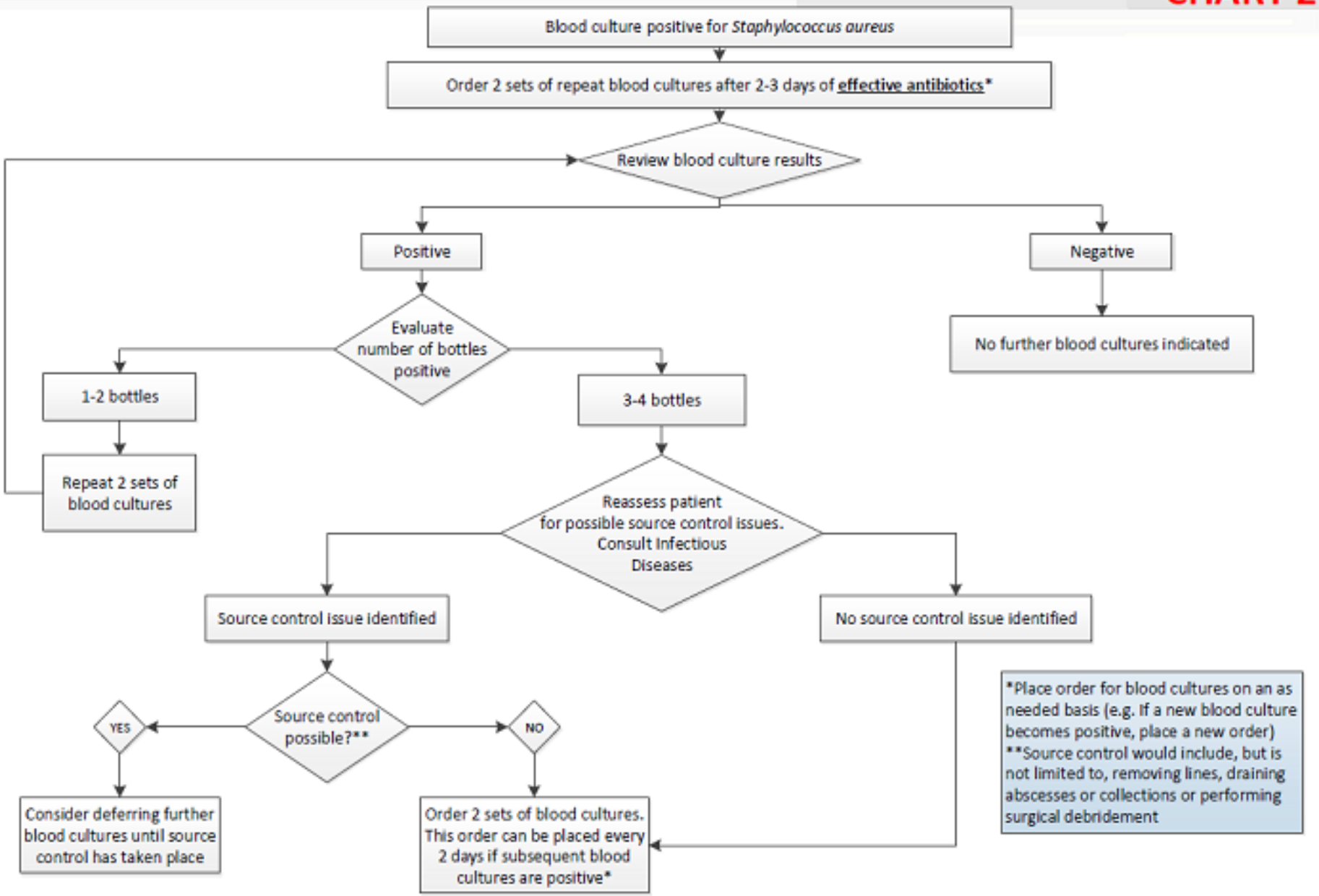


Legend:

1. For penicilllin or cephalosporin allergy, see Beta-lactam cross- allergy chart [hyperlink]
Adjust dosing for renal function, as applicable
2. If transesophageal echocardiogram (TEE) not available, repeat transthoracic echocardiogram (TTE) after 5 days
3. For therapy recommendations, refer to guidelines (e.g. Bugs and Drugs)

Staphylococcus aureus Bacteremia – Repeat Blood Culture Process

CHART 2



Vancomycin

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Vancomycin – Therapeutic Drug Monitoring in Adults Update

The Key Messages

- Area-under-the-curve to minimum inhibitory concentration ratio (AUC:MIC)-based vancomycin therapeutic drug monitoring (TDM) is **NOT** recommended as standard of practice in the non-pregnant adult population
- Vancomycin trough-based monitoring that target steady-state trough levels of 10 to 15 mg/L is recommended for treatment of most infections
- Higher trough level targets of 15 to 20 mg/L may be considered for severe infections, based on expert guidance (e.g. infectious diseases physician) regarding the risk and benefits

TABLE 1. INITIAL DOSE PER INTERVAL		
TOTAL BODY WEIGHT	LOADING DOSE (suggested maximum 3000 mg/dose)	MAINTENANCE DOSE*
kg	(25 mg/kg)	(15 mg/kg)
40-50	1250 mg	750 mg
51-60	1500 mg	1000 mg
61-70	1750 mg	1000 mg
71-80	2000 mg	1250 mg
81-90	2250 mg	1250 mg
91-100	2500 mg	1500 mg*
101-110	2750 mg	1500 mg*
111-120	3000 mg	1500 mg*

TABLE 2. INITIAL VANCOMYCIN DOSING INTERVAL

Pre-vancomycin Level 10-15 mg/L	Pre-vancomycin Level 15-20 mg/L
Usual target	Target in selected patients Associated higher acute kidney injury

TABLE 3 USUAL TARGET 10-15 mg/L INITIAL DOSING INTERVAL (hours)						
SCr (mcmol/L)	Age Group (years)					
	20-29	30-39	40-49	50-59	60-69^	70-79^
40-60	8	8	12	12	12	18
61-80	8	12	12	12	18	18
81-100	12	12	12	18	18	18
101-120	12	12	18	18	18	24
121-140	12	18	18	18	24	
141-160	18	24	24	24		
161-180	24	24				
181-200	24					
Above 200						
Dialysis	See TABLE 5 (back of card)					

Beta-lactam allergy

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Beta-lactam Allergy Matrix Chart

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Beta-lactam Antibiotic Cross-Allergy Chart

Beta-lactams	AMOXICILLIN*	AMPICILLIN	CLOXACILLIN	PENICILLIN	PIPERACILLIN*	CEFADROXIL	CEFAZOLIN	CEPHALEXIN	CEFOXITIN	CEFPROZIL	CEFUROXIME	CEFIXIME	CEFOTAXIME	CEFTAZIDIME	CEFTRIAXONE	CEFEPIME	ERTAPENEM	IMIPENEM	MEROPENEM
AMOXICILLIN*		X1	X5	X4	X3	X1	✓	X1	✓	X2	✓	✓	✓	✓	✓	✓	✓	✓	✓
AMPICILLIN	X1		X5	X4	X3	X2	✓	X2	✓	X2	✓	✓	✓	✓	✓	✓	✓	✓	✓
CLOXACILLIN	X5	X5		X5	X5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PENICILLIN	X4	X4	X5		X5	✓	✓	✓	X3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PIPERACILLIN*	X3	X3	X5	X5		X3	✓	X3	✓	X3	✓	✓	✓	✓	✓	✓	✓	✓	✓
CEFADROXIL	X1	X2	✓	✓	X3		✓	X1	✓	X2	✓	✓	✓	✓	✓	✓	✓	✓	✓
CEFAZOLIN	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CEPHALEXIN	X1	X2	✓	✓	X3	X1	✓		✓	X2	✓	✓	✓	✓	✓	✓	✓	✓	✓
CEFOXITIN	✓	✓	✓	X3	✓	✓	✓	✓		✓	X2	✓	✓	✓	✓	✓	✓	✓	✓
CEFPROZIL	X2	X2	✓	✓	X3	X2	✓	X2	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
CEFUROXIME	✓	✓	✓	✓	✓	✓	✓	✓	X2	✓		X3	X1	X3	X1	X2	✓	✓	✓
CEFIXIME	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X3		X3	X3	X3	X3	✓	✓	✓
CEFOTAXIME	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X1	X3		X3	X1	X1	✓	✓	✓
CEFTAZIDIME	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X3	X3	X3		X3	X3	✓	✓	✓
CEFTRIAXONE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X1	X3	X1	X3		X1	✓	✓	✓
CEFEPIME	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X2	X3	X1	X3	X1		✓	✓	✓
ERTAPENEM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		X5	X5
IMIPENEM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X5		X5
MEROPENEM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X5	X5	

* Also applies to beta-lactamase inhibitor combinations (amoxicillin-clavulanate and piperacillin-tazobactam)

AVOID ALL beta-lactam antibiotics if:

- ICU admission related to allergy
- Delayed beta-lactam antibiotic allergy causing:
  - interstitial nephritis
  - hepatitis
  - hemolytic anemia
- Delayed severe skin allergic reactions:
  - Stevens-Johnson syndrome
  - toxic epidermal necrolysis
  - exfoliative dermatitis
  - acute generalized exanthematous pustulosis (AGEP)
  - drug reaction with eosinophilia and systemic symptoms (DRESS)

LEGEND:	
Penicillins	
1st Generation Cephalosporins	
2nd Generation Cephalosporins	
3rd Generation Cephalosporins	
4th Generation Cephalosporins	
Carbapenems	
✓	Different structure. CONSIDERED SAFE TO PRESCRIBE
Reaction likely based on side chain:	
X1	Same side chain - clinical evidence of cross reaction. DO NOT PRESCRIBE
X2	Same side chain - Theoretical risk of cross reaction, no clinical studies. DO NOT PRESCRIBE
X3	Similar side chain - Potential for cross reaction. DO NOT PRESCRIBE
Reaction likely based on Beta-lactam ring	
X4	Clinical evidence of cross reaction. DO NOT PRESCRIBE
X5	Theoretical risk of cross reaction, no clinical studies. DO NOT PRESCRIBE

Febrile Neutropenia-Beta-lactam Allergy

Antibiotic Allergy	Treatment Option(s)
Allergic to any of: Amoxicillin Amoxicillin-clavulanate Ampicillin Cephalexin Cloxacillin Penicillin Piperacillin Piperacillin-tazobactam	**AVOID: amoxicillin-clavulanate, piperacillin-tazobactam (cross-allergy)**
	Low Risk: Oral Option: cefuroxime axetil plus metronidazole IV Option: ceftriaxone If MRSA colonization or infection: add TMP-SMX PO or vancomycin IV If previous infection with *Pseudomonas aeruginosa*, add ciprofloxacin IV/PO
	High Risk: Ceftazidime plus vancomycin IV plus metronidazole IV/PO If hemodynamic instability or previous ESBL or AmpC: meropenem plus vancomycin IV If previous VRE, add daptomycin or linezolid (instead of vancomycin IV, if applicable)
Allergic to: Cefazolin	**No cross-allergy with other beta-lactam antibiotics**
	Low risk: Refer to Chart 2
	High Risk: Refer to Chart 3
Allergic to any of: Cefepime Cefixime Cefotaxime Ceftazidime Ceftriaxone Cefuroxime	**AVOID: ceftazidime, ceftriaxone, cefuroxime (cross-allergy)**
	Low Risk: Oral Option: amoxicillin-clavulanate IV Option: clindamycin plus ciprofloxacin If MRSA colonization or infection: add TMP-SMX PO or vancomycin IV If previous infection with *Pseudomonas aeruginosa*, add ciprofloxacin IV/PO
	High Risk: Refer to Chart 3
Allergic to any of: Ertapenem Imipenem-cilastatin Meropenem	**No known cross-allergy with other beta-lactam antibiotics**
	Low Risk: Refer to Chart 2 **High Risk:** Piperacillin-tazobactam Piperacillin-tazobactam in last 90 days or previous ESBL or AmpC: Consult Infectious Diseases If MRSA colonization or infection, catheter-related infection, skin/soft tissue infection, pneumonia, hemodynamic instability: add vancomycin If previous VRE, add daptomycin or linezolid (instead of vancomycin IV, if applicable)

What is New in Infection Control?

Clostridioides difficile Infections

Interior Health
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Probiotics

- recommend **against** probiotics for the prevention of CDI in patients being treated with antibiotics

- recommend **against** probiotics for the prevention of CDI recurrence

Probiotics removed from Provincial Formulary 2019

American College Gastroenterology 2021

Prevention of recurrence

- ≥ 2 recurrences of CDI treat with FMT
  - colonoscopy
  - capsules
  - enema
- repeat FMT if recurrence of CDI within 8 weeks of initial FMT
- suppressive oral vancomycin

Diarrhea Algorithm for Inpatients

Interior Health

New onset diarrhea or increased stool output

Begin Bowel Record (850619)

Acute onset of vomiting in addition to diarrhea

YES

Possible Viral Gastroenteritis

- Start Droplet & Contact precautions #807904
- Private room preferred
  If not available use a dedicated commode - contact ICP if required
- Continue precautions until 48 hrs after symptoms resolve
- Isolation clean prior to removing isolation sign

NO

Assess patient for suspected *C.difficile* infection (CDI):

- **More than 3 loose stools** (type 6 or 7 on Bowel Record) within 24 hour period
- **AND** stool output greater than baseline
- **AND** no other clinical reason for diarrhea (e.g. laxatives, bowel preparation, medical condition: IBD, Crohn's, ulcerative colitis) MRP to assess.

Patient meets criteria for suspected CDI?

NO

Start Contact Precautions #807902
MRP to reassess
Consult ICP if needed

- Start Contact Plus precautions #807914 (document date and time)
- Send stool for *C. difficile* test or obtain order from MRP

C.difficile test result

Negative

- Place on Contact Precautions #807902 until other sources of infectious diarrhea are ruled out or until 48 hrs after symptoms resolve
- Discontinue Contact Plus Precautions
- Consult ICP if needed

Positive

- Place *C. difficile* Pre-Printed Order #829517 on patient chart and contact MRP for orders
- Initiate *C. difficile* Infection (CDI) Clinical Pathway # 826690
- Private room preferred.
  If not available use a dedicated commode - contact ICP if required

February 2021

Interior Health

CLOSTRIDIOIDES difficile INFECTION

Acute and Long-term Care

Weight (kg)

Bulleted orders are initiated by default, unless crossed out and initialed by the physician/prescriber. Boxed orders (☐) require physician/prescriber check mark (☑) to be initiated.

1. ALLERGIES: See Allergy/ADR record

2. CURRENT MEDICATIONS
   - Discontinue bowel protocols, laxatives and stool softeners. Specify: _____
   - Discontinue antidiarrheals (attapulgite [Kaopectate®], loperamide [Imodium®] and/or diphenoxylate-atropine [Lomotil®]). Specify: _____
   - ☐ Discontinue antibiotics if possible; specify antibiotic(s) to be discontinued: _____
   - ☐ Discontinue proton pump inhibitors (e.g., esomeprazole [Nexium®], lansoprazole [Prevacid®], omeprazole [Losec®], pantoprazole [Pantoloc®, Tecta®]). Specify: _____

3. LABORATORY
   - Do not repeat stool for *Clostridioides difficile* testing if positive within the last 30 days
   - ☐ Stool for *C. difficile* if positive test greater than 30 days

4. TREATMENT (select only ONE option from list below)

First Episode/Recurrence:

☐ **vancomycin 125 mg PO or by feeding tube Q6H × 10 days**

Alternative

If unable to take PO/feeding tube: ☐ **metroNIDAZOLE 500 mg IV Q8H × 10 days**

If vancomycin allergic or intolerant: ☐ **metroNIDAZOLE 500 mg PO or by feeding tube Q8H × 10 days**

NOTE:

- IV metroNIDAZOLE is not as effective as PO/feeding tube vancomycin. Change to PO or by feeding tube as soon as possible
- IV vancomycin is not effective against *C. difficile* infection
- vancomycin dose administered by feeding tube is compounded from injectable vancomycin
- Recurrent *Clostridioides difficile* infection defined as greater than or equal to 3 diarrheal stools/day within 8 weeks of completion of therapy

Multiple recurrences *(Choose one option):*

☐ **Pulse therapy**
- **vancomycin 125 mg PO QID × 14 days, then**
- **vancomycin 125 mg PO EVERY THREE DAYS × 10 doses**

☐ **Taper therapy**
- **vancomycin 125 mg PO QID × 14 days, then**
- **vancomycin 125 mg PO BID × 7 days, then**
- **vancomycin 125 mg PO DAILY for 7 days, then**
- **vancomycin 125 mg PO EVERY 3 DAYS × 21 days, then stop**

For fulminant disease – see Page 2

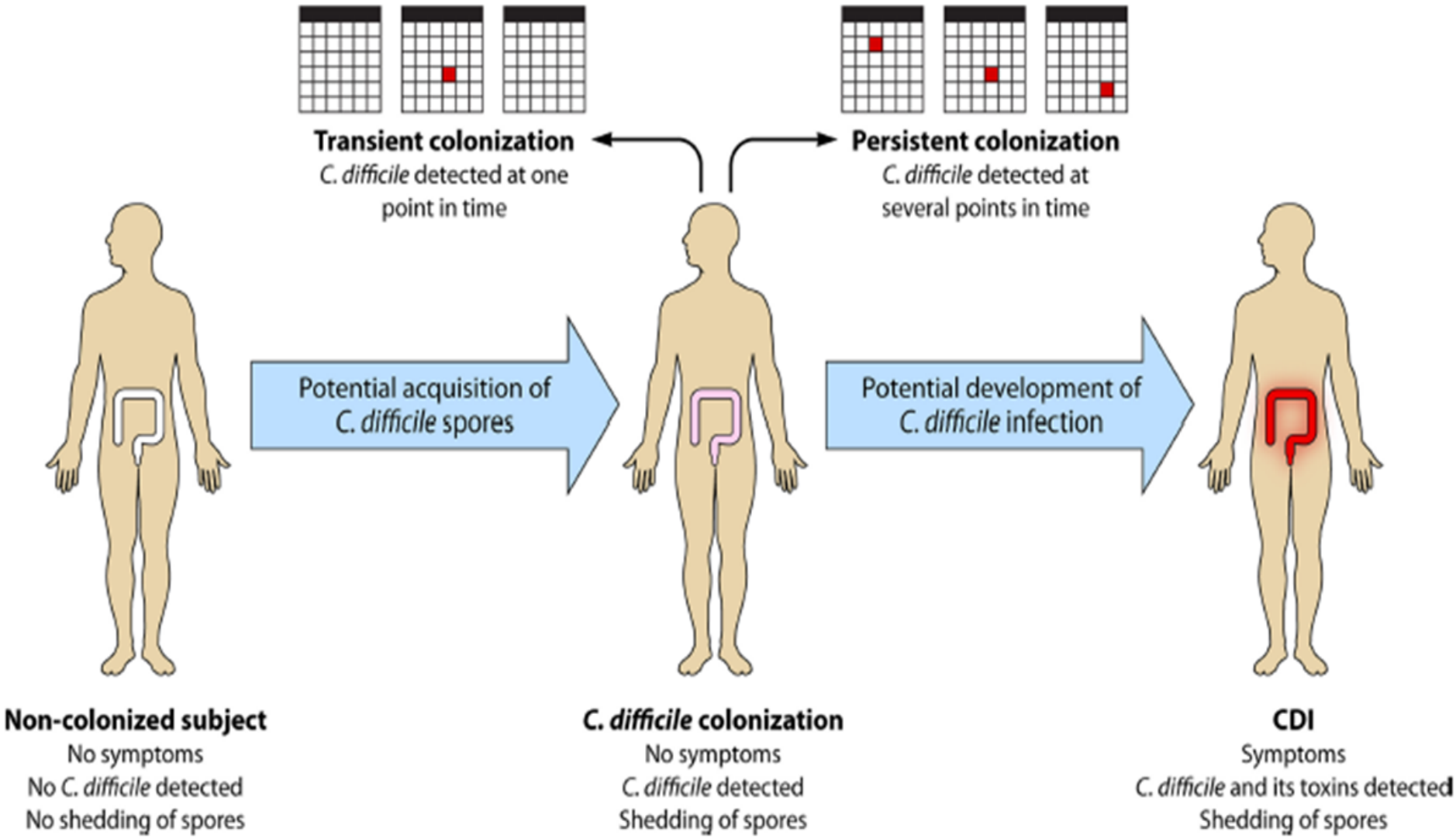

FIG 1 *C. difficile* colonization versus *C. difficile* infection. CDI, *Clostridium difficile* infection.

C. difficile Colonization

Acute care / long-term care facilities: 8-10%

- Asymptomatic carriers:
  - capable of shedding spores
  - reservoir for environmental contamination to other patients
- Canadian study:
  - 4% carriage among patients on admission
  - 3% patients acquired *C.difficile* during hospitalization
- USA study:
  - 20% prevalence of *C.difficile* colonization on admission
    - 15% toxigenic vs 5% vs non-toxigenic

COVID-19

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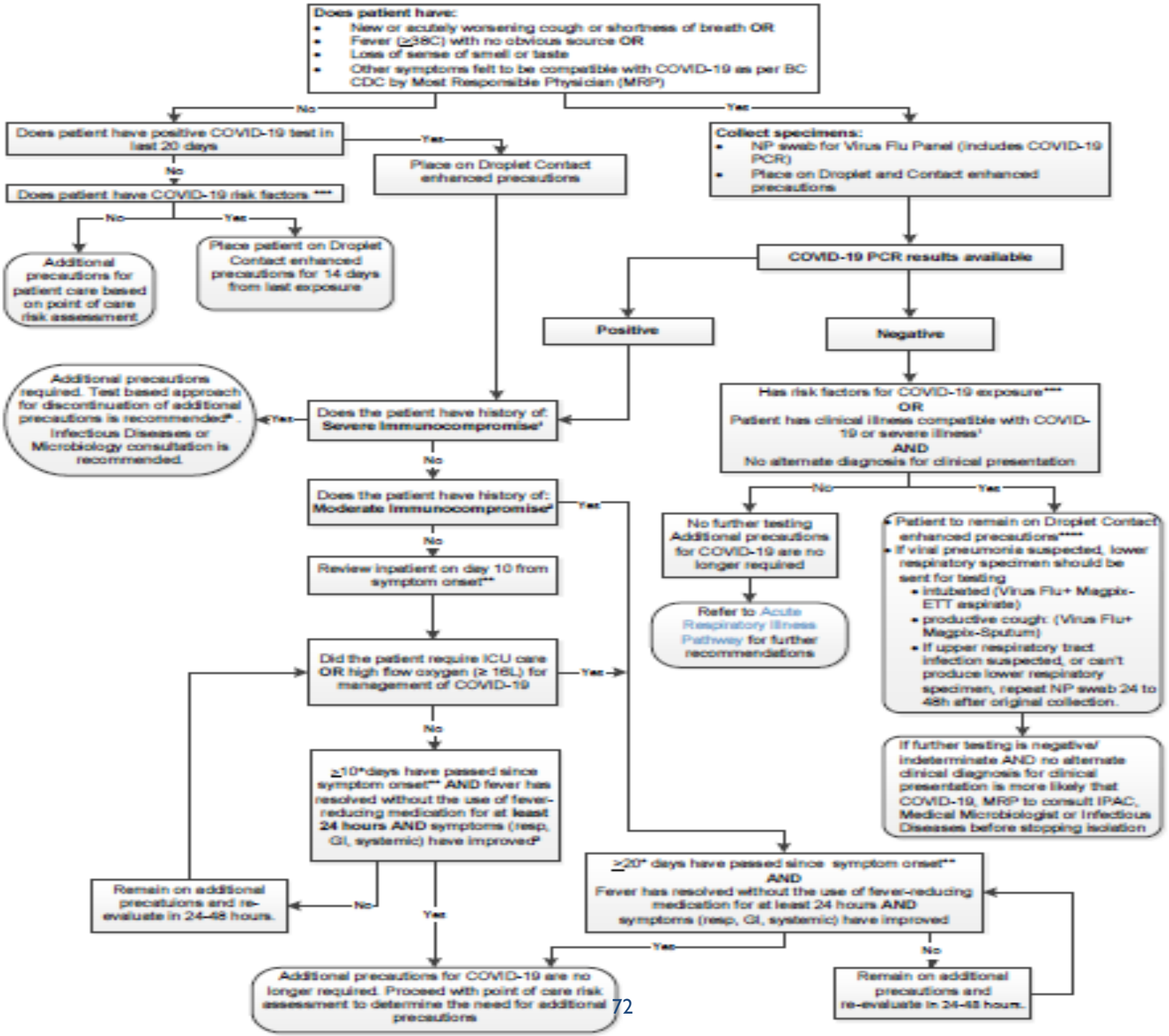
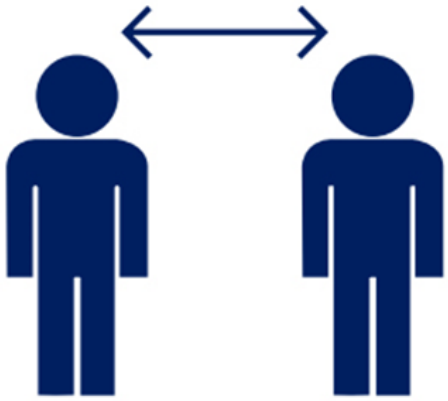
Isolation Pathway for Adult Inpatients Under Investigation for COVID-19

NOTE: This is a two page document and should be printed double-sided where possible



VACCINATION



2m / 6ft