CRAB, Fungi and NDM Oh My! Pushing Back on Antibiotic Resistance

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COVID-19/SARS-CoV-2 Influenza

Respiratory Syncytial Virus Antibiotics, Antimicrobial Resistance (AMR), and Current Landscape

Power of Antibiotics

Disease	Pre-Antibiotic Death Rate	Death With Antibiotics	Change in Death	
Community Pneumonia ¹	~35%	~10%	-25%	
Hospital Pneumonia ²	~60%	~30%	-30%	
Heart Infection ³	~100%	~25%	-75%	
GNB Bacteremia ⁴	~80%	~10%	-70%	
Brain Infection ⁵	>80%	<20%	-60%	
Skin Infection ⁶	11%	<0.5%	-10%	
By comparisontreatment of myocardial infarction with aspirin or fibrinolytic drugs ⁶				
¹ IDSA Position Paper '08 Clin Infect Dis 47(S3):S249-65; ² IDSA/ACCP/ATS/SCCM Position Paper '10 Clin Infect Dis 51(S1):S150-70; ³ Kerr AJ. <u>Subacute Bacterial Endocarditis</u> . Springfield IL: Charles C. Thomas, 1955 & Lancet 1935 226:383-4; ⁴ Lancet '38 231:733-4 & Waring et al. '48 Am J Med 5:402-18; ⁵ Spellberg et al. '09 Clin Infect Dis 49:383-91 & Madsen '73 Infection 1:76-81; 7 ⁶ '88 Lancet 2:349-60; Spittel '54 Staff Proc Mayo Clin; Spittel '56 Ann Int Med 44:302-315; Hall & Gold '55 Arch Int Med 96:403-12				

Source: Dr. Brad Spellberg

The Threat of Antibiotic Resistance in the United States

Antibiotic resistance—when germs (bacteria, fungi) develop the ability to defeat the antibiotics designed to kill them—is one of the greatest global health challenges of modern time.

New National Estimate*

Each year, antibiotic-resistant bacteria and fungi cause at least an estimated: *Clostridioides difficile*** is related to antibiotic use and antibiotic resistance:









CDC, Antibiotic Resistance Threats in the US; 2019

https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

Where Are We Now?

US: ABX Resistance Increased During and Post-COVID-19 Pandemic

CDC – Special Report 2022

Available data show an alarming increase in resistant infections starting during hospitalization, growing at least 15% from 2019 to 2020.

- Carbapenem-resistant Acinetobacter (†78%)
- Antifungal-resistant Candida auris (+60%)*
- Carbapenem-resistant Enterobacterales (+35%)
- Antifungal-resistant Candida (†26%)

- ESBL-producing Enterobacterales (†32%)
- Vancomycin-resistant Enterococcus (+14%)
- Multidrug-resistant P. aeruginosa (†32%)
- Methicillin-resistant Staphylococcus aureus (+13%)

More Carbapenem Resistant Isolates Reported in NM

Healthcare-Associated Infections Program



NM HAI Dashboard for AROs

E. coli Blood Culture Isolate

Antibiotic Name	MIC (μg/mL)		Interpretation	
Aztreonam		> 16	Resistant	
Cefoxitin		> 32	Resistant	
Ceftriaxone		> 32	Resistant	
Ceftazidime	Carbapenem Resistant <i>E. coli</i> (CRE) tant			
Tobramycin	+NDM gene		tant	
Ciprofloxacin		~2	Resistant	
Ertapenem		> 4	Resistant	
Meropenem		> 8	Resistant	
Pip/tazo		> 64/4	Resistant	
SMX/TMP		> 2/38	Resistant	

Day-to-Day Implications for AMR?

- Oral ABX may not treat common infections
 - Hospital admissions, IV ABX, PICC lines
- Patients with post-operative infections that may not be treatable
- Advances such as solid organ transplant, immunosuppressive cancer treatments, and stem cell/bone marrow transplants will be impacted
- Patient morbidity, mortality, and length of hospital stay

Dadgostar P. Infect Drug Resist. 2019; 12: 3903–3910.doi: <u>10.2147/IDR.S234610</u>

CAUSES OF ANTIBIOTIC RESISTANCE



Other Contributors to AMR

- •Travel & population migrations
- •Under-dosing of ABX
- •Environmental sources of ABX resistance

Antibiotic Pipeline



FDA Antimicrobial Drug Approvals

Source: Carla Walraven

Tracking the Global Antibiotic Pipeline (link). Animation.



ANTIBIOTIC PRESCRIBING WAS NOT SUPPORTED IN:



Ambulatory Settings: Antibiotic Prescribing Can Improve Here, Too!



Keep Stemming the Tide!



ASP = Antimicrobial Stewardship Programs

IPC = Infection Prevention and Control

Drug-Resistant Gram Negative Bacteria

- Increasing in frequency
- Multitude of definitions
- CDC no formal updates of definitions since 2006 however some definitions included

o ABX Threat Report 2019

o 2022 Report (Post-Pandemic)

 TriCore has standardized definitions for MDROs but this may differ across the many labs that serve NM

- B. Multi-Drug Resistant Organism Definition
 - 1. Multi Drug Resistant Organisms (MDRO)
 - MDRO is defined as non-susceptibility of any isolate (I or R) from any site to at least one antibiotic in three or more of the following groups (include antibiotics that are not reported)

Expanded Spectrum	3rd/4th Generation	Aminoglycosides
Penicillins	Cephalosporins	Gentamicin
Amoxacillin-clavulanate	Ceftriaxone	Tobramycin
Ampicillin – sulbactam	Cefotaxime	Amikacin
Piperacillin- tazobactam	Ceftazidime	
Aztreonam	Cefepime	
Carbapenems	Fluoroquinolones	
Meropenem	Ciprofloxacin	
Imipenem	Moxifloxacin	
Ertapenem	Levofloxacin	

Use comment code MDRO. Comment: "This organism is a multidrug resistant organism (MDRO). A person infected with an MDRO should be in precautionary isolation consistent with institutional recommendations. For treatment options, please seek an appropriate consultant".

Use this comment only for the Enterobacterales family and Pseudomonas aeruginosa.

Do not use this comment for other Gram negative organisms.

Proposal

- Create statewide definitions for drug resistant Gram Negative Organisms
- Oregon and Nebraska have done this work in the past
- Preliminary work done in collaboration with:
 - \circ TriCore
 - $\circ \, \text{NM DOH}$
 - Lovelace IPC
 - \odot UNMH IPC and ASP
 - \odot Presbyterian IPC and ASP
 - \circ NM HAI Cmte

Proposed Categories



	P. aeruginosa	Enterobacterales (E coli, Klebsiella, Serratia, Enterobacter)	Acinetobacter baumanii	Comment
Carbapenemase producing	IMP, VIM, NDM (OXA, KPC)	IMP, VIM, NDM (OXA, KPC)	IMP, VIM, NDM OXA, KPC	This organism is a Carbapenemase producing organism (CPO).Treatment with any beta-lactam antibiotic, including carbapenems, should be avoided. Patient requires contact isolation. For treatment options, please seek an appropriate consultant
Difficult to Treat	I or R to all of the following Pip-tzp, ceftazidime, cefepime aztreonam mero imi-cil Cip levo	I or R to 4 (or 5) of the following categories •Extended specturm penicillins (pip-tazo, aztreonam) •3 rd /4 th cephalosporins •FQ •Aminoglycosides •Carbapenems	 I or R to at least 1 drug in 4 (or 5) classes Carbapenem FQ B-lac/b-lactamase inhib Cephalosporins Sulbactam Tetracyclines Aminoglycosides 	This organism is a difficult to treat organism (DTRO). A person infected with a DTRO should be in appropriate isolation consistent with institutional recommendations. For treatment options, please seek an appropriate consultant
MDRO	l or R to one drug in at least 3 •3 rd /4 th cephalosporins •FQ •Aminoglycosides •Carbapenems •Piperacillin- tazobactam	 I or R to one drug in at least 3 Extended specturm penicillins (pip-tazo, aztreonam) 3rd/4th cephalosporins FQ Aminoglycosides Carbapenems ?ampC 	 I or R to at least 1 drug in 3 classes Carbapenem FQ B-lac/b-lactamase inhib Cephalosporins Sulbactam Tetracyclines 	This organism is a multidrug resistant organism (MDRO). A person infected with a MDRO should be in appropriate isolation consistent with institutional recommendations. Please seek an appropriate consultant for treatment options, if needed.
ESBL producing	N/A	YES	N/A	This organism produces an extended spectrum beta lactamase demonstrating reduced susceptibility to cephalosporins. A person infected with an ESBL should be in appropriate isolation consistent with institutional recommendations. Consult current IDSA guidelines for treatment options. If additional guidance needed, please seek an appropriate consultant.
Carbapenem Resistant (non-CP)				 A carbapenem resistant organism (CRO) has been detected. This isolate will be screened for carbapenemase production. A person infected with a CRO should be placed in appropriate isolation consistent with institutional recommendations until susceptibilities are confirmed. A carbapenem resistant organism (CRO) has been confirmed but no carbapenemase has been detected. A person infected with a CRO should be placed in appropriate isolation consistent with institutional recommendations. Please seek an appropriate consultant for treatment options, if needed.

Next Steps

- Feedback on the definitions
- Implications across different healthcare settings
- Resources needed for implementation

Goal: Drive Practices For What Works Against Everything







Hand Hygiene

Cleaning

Disinfection (Low or High-Level)

Do these procedures & practices!!!

Other Tactics

- Communicate among facilities
- Ask others for their experience
- Think about response: novel vs. endemic

Interim Guidance for a Public Health Response to **Contain** Novel or Targeted Multidrug-resistant Organisms (MDROs)

