

THE GOOD, THE BAD AND THE RESISTANT:

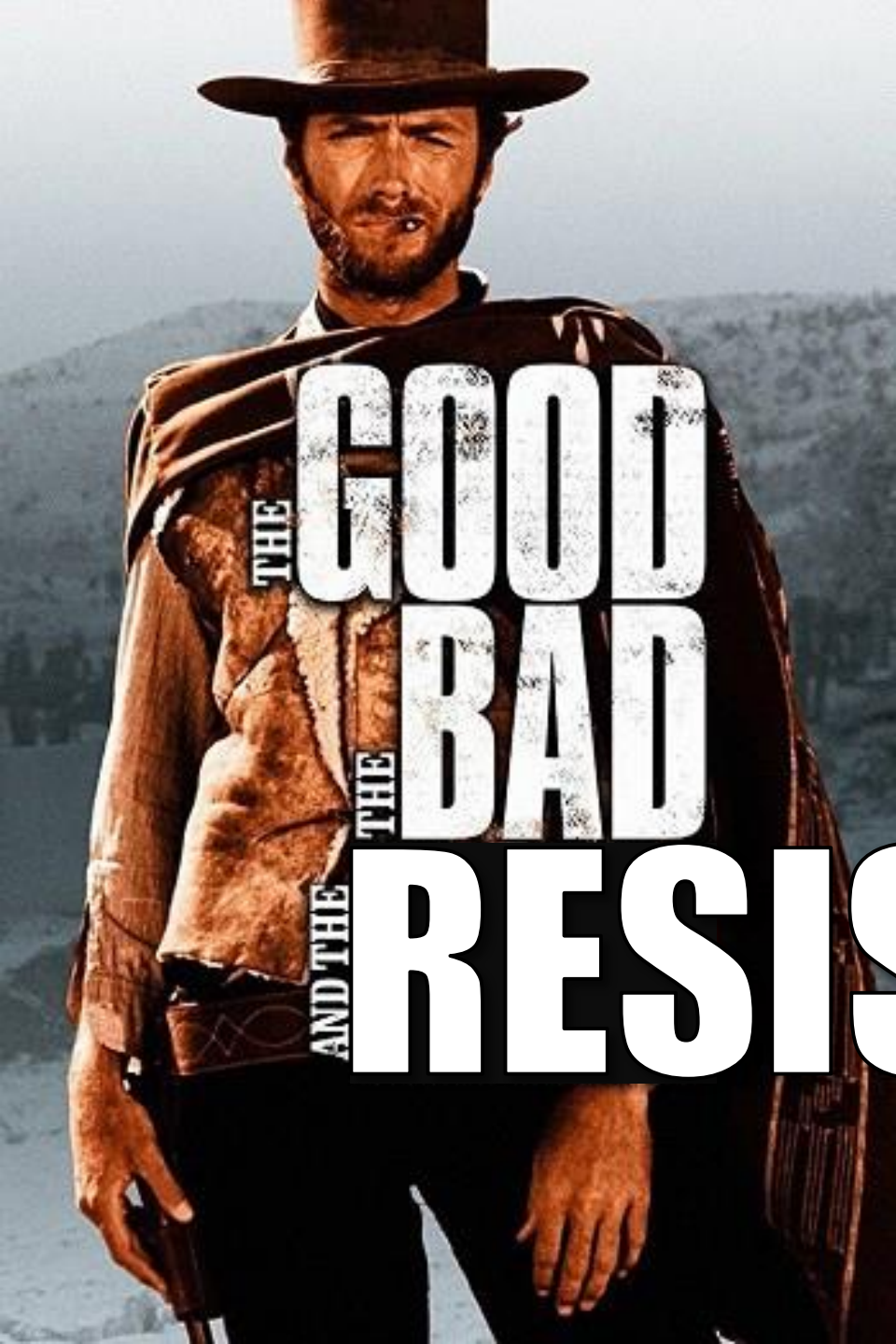
IDENTIFYING AND RESPONDING TO MULTIDRUG-RESISTANT ORGANISMS IN YOUR FACILITY

June 21, 2018



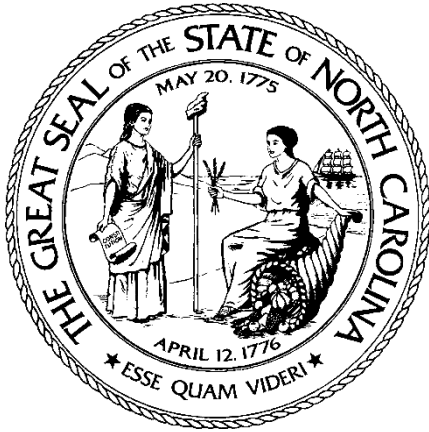
Katie Steider
MPH, CPH

*Moderator: Heather Ridge, RN, BSN, CIC
SPICE Nurse Consultant*



THE GOOD
AND THE BAD

RESISTANT



The Good, the Bad and the Resistant:

Identifying and Responding to Multidrug-Resistant Organisms in Your Facility

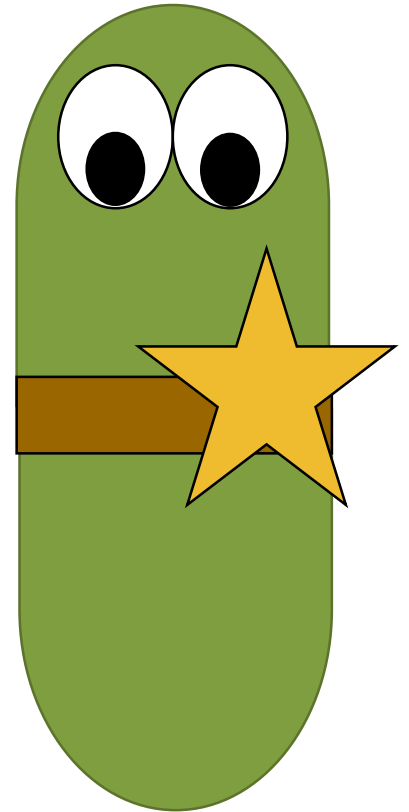
Katie Steider

HAI Epidemiologist

June 21, 2018

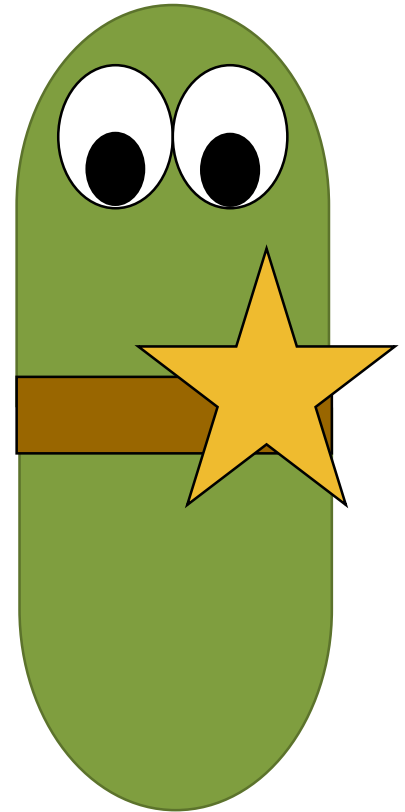
The Good

- “Normal flora”
- “Common commensals”
- Examples:
 - *Staphylococcus epidermidis* (skin)
 - *Escherichia coli* (intestine)



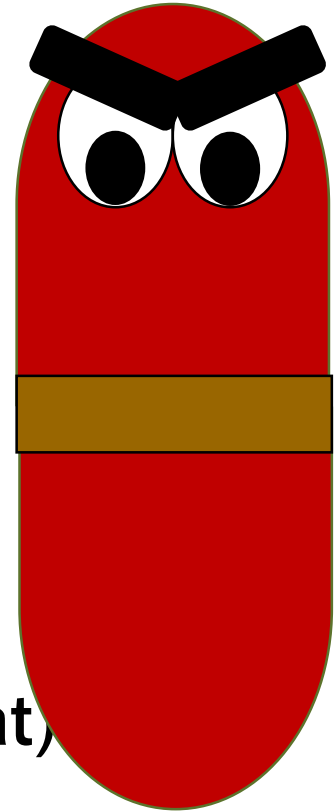
The Good

- **Benefits of normal flora:**
 - **Outcompete other types of bacteria**
 - **Produce products that kill other bacteria**
 - **Help develop immunity**
 - **Aid in metabolism**



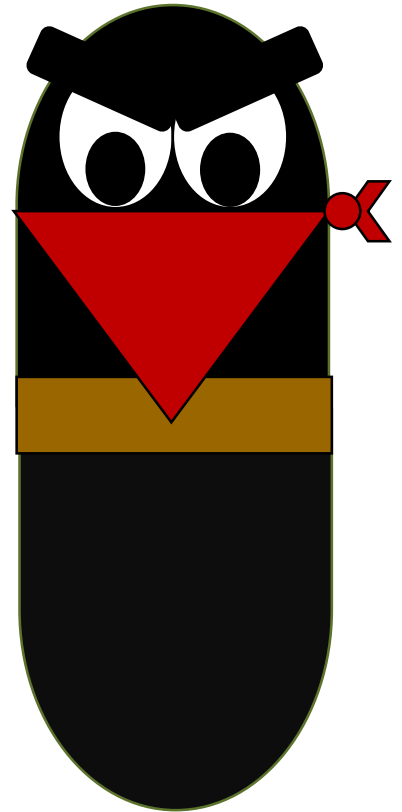
The Bad

- “Pathogens”
 - Commonly cause disease
- “Opportunistic pathogens”
- Do not provide a benefit to the host
- Examples:
 - *Salmonella* species
 - *Streptococcus pyogenes* (Strep throat)



The Resistant

- The bacteria are “resistant” to drug(s)
 - Drugs that are used to treat infections do not work
- Can cause serious infections
- There are many ways to develop resistance



Multidrug-Resistant Organisms (MDROs)



MDROs Cause Serious Infections and Death

- **Cause infection in any part of the body**
- **CDC estimates that each year, MDROs cause:**
 - **2 million infections**
 - **23,000 deaths**

MDROs Can Spread to Others

- Can be spread by contact with another person or with the environment
- Most common routes of transmission:
 - Healthcare worker hands
 - Environmental surfaces
- Spread within and between healthcare facilities



People with MDROs May Not Have Symptoms

Have MDRO?	Have Symptoms?	Person is...	Can Spread to Others?	Precautions
Yes	Yes	Infected	Yes	Contact precautions
Yes	No	Colonized	Yes	Contact precautions

More Vulnerable Persons are More Likely to Have an MDRO

- **Vulnerable persons**
 - Increased age
 - Underlying conditions
 - More healthcare exposures
 - Indwelling devices



MDROs

MRSA - Methicillin-resistant
Staphylococcus aureus

MDR Acinetobacter -
Multi-drug resistant
Acinetobacter

MDR Pseudomonas -
Multi-drug resistant
Pseudomonas

CRE - Carbapenem-Resistant
Enterobacteriaceae

VRE - Vancomycin-Resistant
Enterococci

C Diff - *Clostridium difficile*

ESBLs - Extended Spectrum
Beta-Lactamase Producers



MDROs

MRSA - Methicillin-resistant
Staphylococcus aureus

MDR Acinetobacter -
Multi-drug resistant
Acinetobacter

MDR Pseudomonas -
Multi-drug resistant
Pseudomonas

CRE - Carbapenem-Resistant
Enterobacteriaceae

VRE - Vancomycin-Resistant
Enterococci

C Diff - *Clostridium difficile*

ESBLs - Extended Spectrum
Beta-Lactamase Producers

Extended-Spectrum Beta-Lactamase-Producing Organisms (ESBLs)

- CDC: Serious threat
- ESBL: enzyme that causes resistance to certain drugs
- Considered to be relatively common in the US



Public Health Significance of ESBLs

- **Spread from direct/indirect contact with infected/colonized individuals or from contaminated environmental surfaces**
- **Opportunity for spread within and between healthcare facilities**
- **Infections are difficult to treat**
- **Improper treatment may cause organisms to produce another enzyme called carbapenemase**

Carbapenem-Resistant Enterobacteriaceae (CRE)

- CDC: Urgent threat
- Resistant to carbapenems
- May produce carbapenemase
- Usually healthcare-associated



Public Health Significance of CRE

- **Spread from direct/indirect contact with infected/colonized individuals or from contaminated environmental surfaces**
- **Opportunity for spread within and between healthcare facilities**
- **Infections are difficult to treat and associated with high mortality rates**

How Do I Spot an MDRO?

- Use a case definition
- Review lab reports



What is a Case Definition?

- **“A standard set of criteria for deciding whether, in this investigation, a person should be classified as having the disease or health condition under study”**

NC DPH MDRO Toolkit Case Definitions

- CRE
- C. diff
- ESBL
- MRSA
- MDR Acinetobacter
- VRE

2017

Multidrug-Resistant
Organisms (MDROs) Toolkit

For Long Term Care &
Assisted Living Facilities

NC SHARPPS Program

Revised August 8, 2017

Available from: http://epi.publichealth.nc.gov/cd/docs/MDROToolkit_r2.pdf

CRE and ESBL Case Definitions

Type of MDRO	Definition	Precautions
Carbapenem-Resistant Enterobacteriaceae (CRE)	Enterobacteriaceae are a family of bacteria that normally live in the human gut. CRE are Enterobacteriaceae that have developed resistance to last-resort antibiotics called carbapenems.	Contact
Extended Spectrum Beta-Lactamase Producers (ESBLs)	Extended-spectrum beta-lactamase is an enzyme (chemical tool) that allows bacteria to become resistant to a wide variety of penicillins and cephalosporins.	Contact

Lab Reports: Look for Organism Identity

- Organism identification
 - May use a culture or “NAAT” (“nucleic acid amplification test”)

Lab Reports: Look for Susceptibility Results

- Antimicrobial susceptibility results
 - Also called “MICs” (“minimum inhibitory concentration”) with “interps” (“interpretation”)
 - Look for interpretations:
 - S = “susceptible”; listed drug can be used to treat
 - I = “intermediate”; listed drug may not be effective treatment
 - R = “resistant”; listed drug can not be used to treat

Identify CRE Using a Case Definition

CDC case definition: Enterobacteriaceae resistant to imipenem, meropenem, doripenem, or ertapenem OR documentation that the isolate possesses a carbapenemase

Identify CRE Using a Case Definition

CDC case definition: Enterobacteriaceae resistant to imipenem, meropenem, doripenem, or ertapenem OR documentation that the isolate possesses a carbapenemase

Table 1. Genera of Enterobacteriaceae

Common Genera of Enterobacteriaceae			
Escherichia	Klebsiella	Providencia	Serratia
Enterobacter	Proteus	Salmonella	Shigella
Other Genera of Enterobacteriaceae			
Alishewanella	Cedecea	Leminorella	Rahnella
Alterococcus	Citrobacter	Moellerella	Raoultella
Aquamonas	Cronobacter	Morganella	Samsonia
Aranicola	Dickeya	Obesumbacterium	Sodalis
Arsenophonus	Edwardsiella	Pantoea	Tatumella
Azotivirga	Erwinia	Pectobacterium	Trabulsiella
Blochmannia	Ewingella	Phlomobacter	Wigglesworthia
Brenneria	Grimontella	Photorhabdus	Xenorhabdus
Buchnera	Hafnia	Poodoomaamaana	Yersinia
Budvicia	Kluyvera	Plesiomonas	Yokenella
Buttiauxella	Leclercia	Pragia	

Majority of CRE are the “Big 3”

1. *Escherichia coli*
2. *Enterobacter* species
3. *Klebsiella* species
 - Klebsiella pneumoniae*
 - Klebsiella oxytoca*

Look for these on lab reports!

What Do You Think?

Order		CULTURE, URINE [URC] (Order 308868132)	
Ordering Provider			
Authorizing [REDACTED]			
Acknowledgement Info			
For	At	Acknowledged By	Acknowledged On
Placing Order	05/17/17 1927	[REDACTED]	05/17/17 1957
Task		Completed by	Date/Time
Unit Sec Ack		[REDACTED]	Wed May 17, 2017 7:29 PM
Order Info			
Priority:	Start:	Process Instructions:	
STAT	05/17/17 1927	** Minimum Specimen Requirements: 25 ML Urine ** **Submit urine in a container with NO preservative** **Use Orange Screw-capped urine cup, White Screw-caped urine tube or Red top tubes**	
Order Frequency			
Antibiotic		Organism	Organism
		>100,000 cfu/ml enterobacter cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final
Lab and Collection			
CULTURE, URINE on 6/3/2017			
Result History			
CULTURE, URINE on 6/6/2017			
Reviewed by List			
[REDACTED]			
View SmartLink Info			
Culture,Urine (Order #308868172) on 6/3/17			
Ordering Provider NPI ID:			

What Do You Think?

- Organism
- Susceptibility

Antibiotic		Organism	
		>100,000 cfu/ml enterobacter	
		cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

What Do You Think?

- Organism
- Susceptibility

Antibiotic		Organism >100,000 cfu/ml enterobacter cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH- SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

What Do You Think?

- Organism
 - Organism = *Enterobacter cloacae*
- Susceptibility
 - Resistant (R) to ertapenem

Antibiotic		Organism	
		>100,000 cfu/ml enterobacter cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/AZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

What Do You Think?

- CRE

- Organism = *Enterobacter cloacae*

- Resistant (R) to ertapenem

Antibiotic		Organism	
		>100,000 cfu/ml enterobacter cloacae	
AMP/SULBACTAM	MIC	RESISTANT	Final
AMPICILLIN	MIC	RESISTANT	Final
AUGMENTIN	MIC	RESISTANT	Final
CIPROFLOXACIN	MIC	RESISTANT	Final
ERTAPENEM	MIC	RESISTANT	Final
GENTAMICIN	MIC	SUSCEPTIBLE	Final
NITROFURANTOIN	MIC	SUSCEPTIBLE	Final
PIPERACILLIN/TAZOBACTAM	MIC	RESISTANT	Final
TRIMETH-SULFAMETHOXAZOLE	MIC	SUSCEPTIBLE	Final

Take Steps to Prevent CRE Spread

1. Notify caregivers, patient, and family
2. Ensure implementation of infection control measures (contact precautions)
3. Review healthcare exposures
4. Identify any close contacts
5. Contact your local health department for assistance

Identify ESBL Using a Case Definition

Type of MDRO	Definition	Precautions
Extended Spectrum Beta-Lactamase Producers (ESBLs)	Extended-spectrum beta-lactamase is an enzyme (chemical tool) that allows bacteria to become resistant to a wide variety of penicillins and cephalosporins.	Contact

Found in:

- *Klebsiella pneumoniae*
- *Klebsiella oxytoca*
- *Escherichia coli*
- *Acinetobacter*
- *Burkholderia*
- *Citrobacter*
- *Enterobacter*
- *Morganella*
- *Proteus*
- *Pseudomonas*
- *Salmonella*
- *Serratia*
- *Shigella*

Identify ESBL Using a Case Definition

Suspect ESBL if: Resistance to one or more extended-spectrum third generation cephalosporins.

Antibiotic	Trade Name
Cefepime	Maxipime (Bristol-Myers Squibb)
Cefixime	Suprax (Lederle)
Cefotaxime	Claforan (Hoechst-Roussel)
Cefpodoxime proxetil	Vantin (Pharmacia/Pfizer)
Ceftazidime	Fortaz & Ceptaz (Glaxo SK), Tazidime (Lilly), Tazicef (Glaxo SK)
Ceftibuten	Cedax (Schering Plough)
Ceftizoxime	Cefizox (Fujisawa)
Cetriaxone	Rocephin (Roche)
Cefdinir	Omnicef
Cefditoren pivoxil	Spectracef (Vansen Pharma Inc)

What Do You Think?

Microbiology Report

VIDANT DUPLIN HOSPITAL

401 North Main Street
Kenansville, NC 28349

Name	[REDACTED]	Specimen	SWAB	Status	Final
Patient ID	[REDACTED]	Source	RECTAL SWAB	Status Date	7/27/2017
Date of Birth		Ward of leo		Collected	
Attd. Phys				Req Phys	

1	Klebsiella oxytoca	Status:	Final	7/24/2017
2	Escherichia coli	Status:	Final	7/27/2017
3	Escherichia coli ESBL	Status:	Final	7/27/2017

1 K. oxytoca			2 E. coli		
Drug	MIC	Interp	Drug	MIC	Interp
Amp/Sulbactam	<=2/4	S	Amp/Sulbactam	16/8	I
Ampicillin	>16	R	Ampicillin	>16	R
Cefazolin	16	I	Cefazolin	4	S
Cefepime	<=2	S	Cefepime	<=2	S
Cefotaxime	<=2	S	Cefotaxime	<=2	S
Cefotaxime-ESBL	<=1	S	Cefotaxime-ESBL	<=1	S
Ceftriaxone	<=1	S	Ceftriaxone	<=1	S
Ciprofloxacin	<=1	S	Ciprofloxacin	<=1	S
Ertapenem	<=0.5	S	Ertapenem	<=0.5	S
Gentamicin	<=4	S	Gentamicin	<=4	S
Meropenem	<=1	S	Meropenem	<=1	S
Pip/Tazo	<=16	S	Pip/Tazo	<=16	S
Trimeth/Sulfa.	<=2/38	S	Trimeth/Sulfa	<=2/38	S

β E. coli ESBL		
Drug	MIC	Interp
Amikacin	<=8	S
Amp/Sulbactam	>16/8	R
Ampicillin	>16	R*
Cefazolin	>16	R*
Cefepime	>16	R*
Cefotaxime	>32	ESBL
Cefotaxime-ESBL	>1	ESBL
Ceftriaxone	>32	ESBL
Ciprofloxacin	>2	R
Ertapenem	<=0.5	S
Gentamicin	>8	R
Meropenem	<=1	S
Pip/Tazo	<=16	S
Tobramycin	>8	R
Trimeth/Sulfa	>2/38	R

S = Susceptible NR = Not Reported Blank = Data not available, or drug not advisable or tested
 I = Intermediate -- = Not Tested ESBL = Extended spectrum beta-lactamase
 R = Resistant POS = Positive Sfo = Beta-lactamase positive
 MIC = mcg/ml (μg/L) NEG = Negative TFG = Thymine-dependent strain

S* = Predicted susceptible interpretation
 R* = Predicted resistant interpretation
 ESBL* = Suspected ESBL. Confirmatory tests needed to differentiate ESBL from other beta-lactamase
 IB = Inducible beta-lactamase. Appears in place of "Susceptible" with species known to possess inducible beta-lactamase; potentially they may become resistant to all beta-lactam drugs. Monitoring of patients during/after therapy is recommended. Avoid other/inducible beta-lactam drugs.

* = Reported interpretation changed

For blood and CSF isolates, a beta-lactamase test is recommended for Enterococcus species.
 RUO: Un-validated results are not intended for clinical use.

Name	[REDACTED]	Specimen	SWAB	Status	Final
Patient ID	[REDACTED]	Source	RECTAL SWAB	Status Date	7/27/2017
Date of Birth		Ward/Rm	/	Collected	

What Do You Think?

- Organism(s)
- Susceptibility

1 <i>K. oxytoca</i>			2 <i>E. coli</i>		
Drug	MIC	Interps	Drug	MIC	Interps
Amp/Sulbactam	≤8/4	S	Amp/Sulbactam	16/8	I
Ampicillin	>16	R	Ampicillin	>16	R
Cefazolin	16	I	Cefazolin	4	S
Cefepime	≤2	S	Cefepime	≤2	S
Cefotaxime	≤2	S	Cefotaxime	≤2	S
Cefotaxime-ESBL	≤1	S	Cefotaxime-ESBL	≤1	S
Ceftriaxone	≤1	S	Ceftriaxone	≤1	S
Ciprofloxacin	≤1	S	Ciprofloxacin	≤1	S
Ertapenem	≤0.5	S	Ertapenem	≤0.5	S
Gentamicin	≤4	S	Gentamicin	≤4	S
Meropenem	≤1	S	Meropenem	≤1	S
Pip/Tazo	≤16	S	Pip/Tazo	≤16	S
Trimeth/Sulfa	≤2/38	S	Trimeth/Sulfa	≤2/38	S
β <i>E. coli</i> ESBL					
Drug	MIC	Interps			
Amikacin	≤8	S			
Amp/Sulbactam	>16/8	R			
Ampicillin	>16	R*			
Cefazolin	>16	R*			
Cefepime	>16	R*			
Cefotaxime	>32	ESBL			
Cefotaxime-ESBL	>1	ESBL			
Ceftriaxone	>32	ESBL			
Ciprofloxacin	>2	R			
Ertapenem	≤0.5	S			
Gentamicin	>8	R			
Meropenem	≤1	S			
Pip/Tazo	≤16	S			
Tobramycin	>8	R			
Trimeth/Sulfa	>2/38	R			

What Do You Think?

- Organism(s)

- Klebsiella oxytoca
- Escherichia coli
- Escherichia coli ESBL

- Susceptibility - carbapenems

- Klebsiella oxytoca
 - Susceptible (S) to ertapenem, meropenem
- Escherichia coli
 - Susceptible (S) to ertapenem, meropenem
- Escherichia coli ESBL
 - Susceptible (S) to ertapenem, meropenem

1 K. oxytoca			2 E. coli		
Drug	MIC	Interps	Drug	MIC	Interps
Amp/Sulbactam	≤8/4	S	Amp/Sulbactam	16/8	I
Ampicillin	>16	R	Ampicillin	>16	R
Cefazolin	16	I	Cefazolin	4	S
Cefepime	≤2	S	Cefepime	≤2	S
Cefotaxime	≤2	S	Cefotaxime	≤2	S
Cefotaxime-ESBL	≤1	S	Cefotaxime-ESBL	≤1	S
Ceftriaxone	≤1	S	Ceftriaxone	≤1	S
Ciprofloxacin	≤1	S	Ciprofloxacin	≤1	S
Ertapenem	≤0.5	S	Ertapenem	≤0.5	S
Gentamicin	≤4	S	Gentamicin	≤4	S
Meropenem	≤1	S	Meropenem	≤1	S
Pip/Tazo	≤16	S	Pip/Tazo	≤16	S
Trimeth/Sulfa	≤2/38	S	Trimeth/Sulfa	≤2/38	S

β E. coli ESBL		
Drug	MIC	Interps
Amikacin	≤8	S
Amp/Sulbactam	>16/8	R
Ampicillin	>16	R*
Cefazolin	>16	R*
Cefepime	>16	R*
Cefotaxime	>32	ESBL
Cefotaxime-ESBL	>1	ESBL
Ceftriaxone	>32	ESBL
Ciprofloxacin	>2	R
Ertapenem	≤0.5	S
Gentamicin	>8	R
Meropenem	≤1	S
Pip/Tazo	≤16	S
Tobramycin	>8	R
Trimeth/Sulfa	>2/38	R

What Do You Think?

- Organism(s)

- Klebsiella oxytoca
- Escherichia coli
- Escherichia coli ESBL

- Susceptibility - carbapenems

- Klebsiella oxytoca
 - Susceptible (S) to ertapenem, meropenem
- Escherichia coli
 - Susceptible (S) to ertapenem, meropenem
- Escherichia coli ESBL
 - Susceptible (S) to ertapenem, meropenem

NOT CRE

1 K. oxytoca			2 E. coli		
Drug	MIC	Interps	Drug	MIC	Interps
Amp/Sulbactam	<=8/4	S	Amp/Sulbactam	16/8	I
Ampicillin	>16	R	Ampicillin	>16	R
Cefazolin	16	I	Cefazolin	4	S
Cefepime	<=2	S	Cefepime	<=2	S
Cefotaxime	<=2	S	Cefotaxime	<=2	S
Cefotaxime-ESBL	<=1	S	Cefotaxime-ESBL	<=1	S
Ceftriaxone	<=1	S	Ceftriaxone	<=1	S
Ciprofloxacin	<=1	S	Ciprofloxacin	<=1	S
Ertapenem	<=0.5	S	Ertapenem	<=0.5	S
Gentamicin	<=4	S	Gentamicin	<=4	S
Meropenem	<=1	S	Meropenem	<=1	S
Pip/Tazo	<=16	S	Pip/Tazo	<=16	S
Trimeth/Sulfa	<=2/38	S	Trimeth/Sulfa	<=2/38	S
β E. coli ESBL					
Drug	MIC	Interps			
Amikacin	<=8	S			
Amp/Sulbactam	>16/8	R			
Ampicillin	>16	R*			
Cefazolin	>16	R*			
Cefepime	>16	R*			
Cefotaxime	>32	ESBL			
Cefotaxime-ESBL	>1	ESBL			
Ceftriaxone	>32	ESBL			
Ciprofloxacin	>2	R			
Ertapenem	<=0.5	S			
Gentamicin	>8	R			
Meropenem	<=1	S			
Pip/Tazo	<=16	S			
Tobramycin	>8	R			
Trimeth/Sulfa	>2/38	R			

What Do You Think?

- Susceptibility – 3rd generation cephalosporins

1. Klebsiella oxytoca

- Susceptible (S) to cefepime, cefotaxime, ceftriaxone

2. Escherichia coli

- Susceptible (S) to cefepime, cefotaxime, ceftriaxone

3. Escherichia coli ESBL

- Resistant (R) to cefepime
- Resistant (ESBL) to cefotaxime, ceftriaxone

1 K. oxytoca			2 E. coli		
Drug	MIC	Interps	Drug	MIC	Interps
Amp/Sulbactam	<=8/4	S	Amp/Sulbactam	16/8	I
Ampicillin	>16	R	Ampicillin	>16	R
Cefazolin	16	I	Cefazolin	4	S
Cefepime	<=2	S	Cefepime	<=2	S
Cefotaxime	<=2	S	Cefotaxime	<=2	S
Cefotaxime-ESBL	<=1	S	Cefotaxime-ESBL	<=1	S
Ceftriaxone	<=1	S	Ceftriaxone	<=1	S
Ciprofloxacin	<=1	S	Ciprofloxacin	<=1	S
Ertapenem	<=0.5	S	Ertapenem	<=0.5	S
Gentamicin	<=4	S	Gentamicin	<=4	S
Meropenem	<=1	S	Meropenem	<=1	S
Pip/Tazo	<=16	S	Pip/Tazo	<=16	S
Trimeth/Sulfa	<=2/38	S	Trimeth/Sulfa	<=2/38	S
§ E. coli ESBL					
Drug	MIC	Interps			
Aztreonam	<=8	S			
Amp/Sulbactam	>16/8	R			
Ampicillin	>16	R*			
Cefazolin	>16	R*			
Cefepime	>16	R*			
Cefotaxime	>32	ESBL			
Cefotaxime-ESBL	>1	ESBL			
Ceftriaxone	>32	ESBL			
Ciprofloxacin	>2	R			
Ertapenem	<=0.5	S			
Gentamicin	>8	R			
Meropenem	<=1	S			
Pip/Tazo	<=16	S			
Tobramycin	>8	R			
Trimeth/Sulfa	>2/38	R			

What Do You Think?

- Susceptibility – 3rd generation cephalosporins

1. Klebsiella oxytoca – NOT ESBL

- Susceptible (S) to cefepime, cefotaxime, ceftriaxone

2. Escherichia coli – NOT ESBL

- Susceptible (S) to cefepime, cefotaxime, ceftriaxone

3. Escherichia coli – ESBL

- Resistant (R) to cefepime
- Resistant (ESBL) to cefotaxime, ceftriaxone

1 <i>K. oxytoca</i>			2 <i>E. coli</i>		
Drug	MIC	Interps	Drug	MIC	Interps
Amp/Sulbactam	<=8/4	S	Amp/Sulbactam	16/8	I
Ampicillin	>16	R	Ampicillin	>16	R
Cefazolin	16	I	Cefazolin	4	S
Cefepime	<=2	S	Cefepime	<=2	S
Cefotaxime	<=2	S	Cefotaxime	<=2	S
Cefotaxime-ESBL	<=1	S	Cefotaxime-ESBL	<=1	S
Ceftriaxone	<=1	S	Ceftriaxone	<=1	S
Ciprofloxacin	<=1	S	Ciprofloxacin	<=1	S
Ertapenem	<=0.5	S	Ertapenem	<=0.5	S
Gentamicin	<=4	S	Gentamicin	<=4	S
Meropenem	<=1	S	Meropenem	<=1	S
Pip/Tazo	<=16	S	Pip/Tazo	<=16	S
Trimeth/Sulfa	<=2/38	S	Trimeth/Sulfa	<=2/38	S
§ <i>E. coli</i> ESBL					
Drug	MIC	Interps			
Aztreonam	<=8	S			
Amp/Sulbactam	>16/8	R			
Ampicillin	>16	R*			
Cefazolin	>16	R*			
Cefepime	>16	R*			
Cefotaxime	>32	ESBL			
Cefotaxime-ESBL	>1	ESBL			
Ceftriaxone	>32	ESBL			
Ciprofloxacin	>2	R			
Ertapenem	<=0.5	S			
Gentamicin	>8	R			
Meropenem	<=1	S			
Pip/Tazo	<=16	S			
Tobramycin	>8	R			
Trimeth/Sulfa	>2/38	R			

So you have an ESBL, now what?

1. Notify caregivers, patient, and family
2. Ensure implementation of infection control measures (preemptive contact precautions)
3. If 2+ ESBLs, contact your local health department for assistance

What Do You Think?



Duplin County Health Department 340 Sominary Street PO Box 948 Kenansville NC 28349		Client # 32605420	Additional Information SRC:Urine clean catch
		Client Phone ██████████	
Accession/Specimen # 00682435980	Order # 104802	Collected 1/5/2017 4:28:00PM	Physician Name ██████████
Fasting No	Total volume:	Reported 1/8/2017 1:35:00PM	Report Status Final

Test	Results	Flag	Units	Reference Interval	Lab
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Urine Culture, Routine

Source of Specimen: Urine clean catch

Urine Culture, Routine Final report Abnormal BN

Result

Urine Culture, Routine
 Result 1 Klebsiella pneumoniae Abnormal BN

25,000-50,000 colony forming units per mL

Antimicrobial Susceptibility BN

** S = Susceptible; I = Intermediate; R = Resistant **
 P = Positive; N = Negative

MICS are expressed in micrograms per mL

Antibiotic	RSLT#1	RSLT#2	RSLT#3	RSLT#4
Amoxicillin/Clavulanic Acid	R			
Ampicillin	R			
Cefazolin	R			
Cefepime	R			
Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

Performing facilities :

BN - LabCorp Burlington
 MD Hancock, William F MD
 1447 York Court Burlington NC
 272153361
 (800) 782 4344

What Do You Think?

- Organism
- Susceptibility

Result				
Urine Culture, Routine				
Result 1	Klebsiella pneumoniae	Abnormal		BN
	25,000-50,000 colony forming units per mL			
Antimicrobial Susceptibility				BN
** S = Susceptible; I = Intermediate; R = Resistant **				
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Ampicillin	R			
Cefazolin	R			
Cefepime	R			
← Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

What Do You Think?

- Organism
- Susceptibility

Result

Urine Culture, Routine
Result 1

Klebsiella pneumoniae Abnormal

25,000-50,000 colony forming units per mL

Antimicrobial Susceptibility

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Ampicillin	R			
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Cefepime	R			
- Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

What Do You Think?

- Organism
- Susceptibility

Result

Urine Culture, Routine
Result 1

Klebsiella pneumoniae Abnormal BN

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Cefepime	R			
Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

What Do You Think?

- ESBL
- Organism = *K. pneumoniae*
- Resistant (R) to cefepime and ceftriaxone

Result

Urine Culture, Routine
Result 1

Klebsiella pneumoniae Abnormal

25,000-50,000 colony forming units per mL

Antimicrobial Susceptibility

** S = Susceptible; I = Intermediate; R = Resistant **
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MICS are expressed in micrograms per mL

Antibiotic	RSLT#1	RSLT#2	RSLT#3	RSLT#4
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Ampicillin	R			
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Cefepime	R			
Ceftriaxone	R			
Cefuroxime	R			
Cephalothin	R			
Ciprofloxacin	R			
Ertapenem	S			
Gentamicin	S			
Imipenem	S			
Levofloxacin	R			
Nitrofurantoin	I			
Piperacillin	R			
Tetracycline	R			
Tobramycin	R			
Trimethoprim/Sulfa	R			

How Can My Facility Prevent MDROs?

1. Staff education
2. Laboratory notification
3. Cohort residents
4. Contact precautions
5. Hand Hygiene
6. Environmental cleaning
7. Communicate MDRO status
8. Review infection prevention policies and procedures
9. Antimicrobial Stewardship

1. Staff Education

- In service education on infection prevention
- NC administrative code 10A NCAC 41A .0206



2. Laboratory Notification

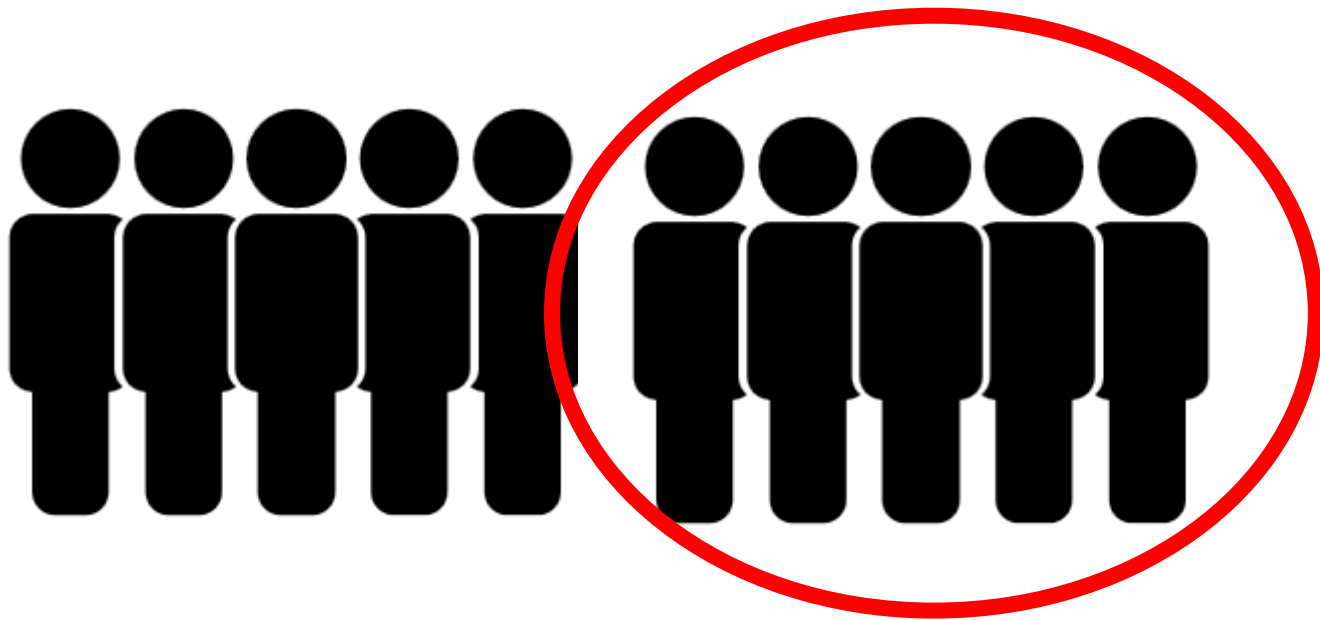
- Establish process for notification
 - What organisms are epidemiologically important?
 - Who is the point of contact for results?
 - Are isolates available for additional testing?



CRE alert

3. Cohort Residents with MDROs

- Consider: physical location, ancillary services/care, environmental cleaning, equipment



4. Contact Precautions

- Use gowns and gloves when providing care for colonized and infected individuals at higher risk for transmission
- Consider the 5 Cs:
 1. Continent
 2. Contained
 3. Cognizant
 4. Compliant
 5. Clean



5. Hand Hygiene

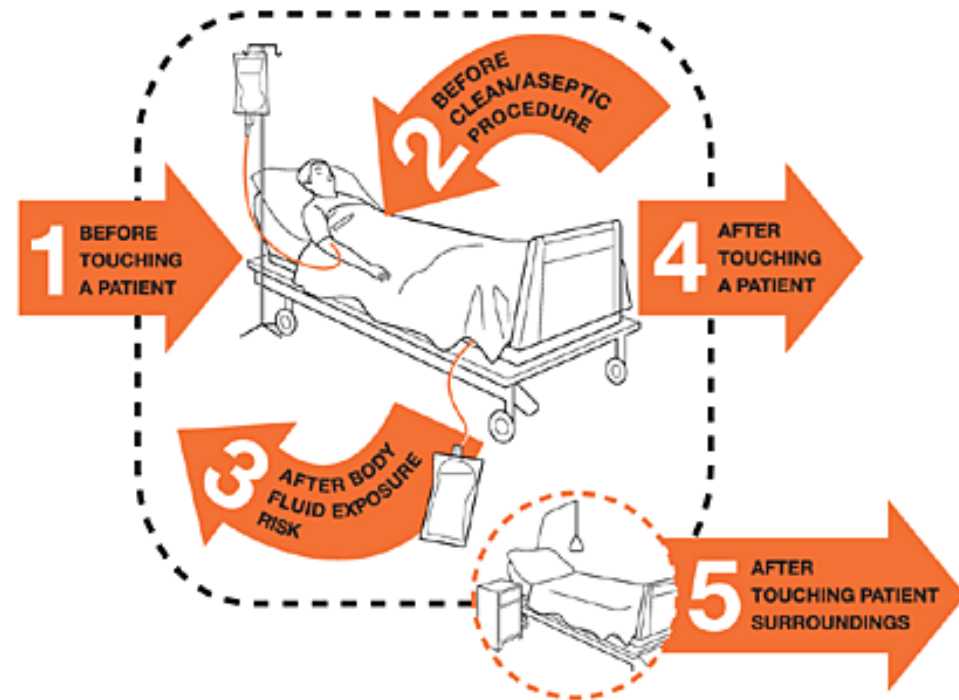
- Alcohol-based hand rub (60-95% ethanol or isopropanol) is the preferred hand hygiene agent when hands are not visibly soiled
- Ensure that hand hygiene agents are available for staff, residents, and visitors



5. Hand Hygiene

- Remember your 5 Moments of Hand Hygiene:

1. Before touching a patient
2. Before clean/aseptic procedures
3. After body fluid exposure/risk
4. After touching a patient
5. After touching patient surroundings

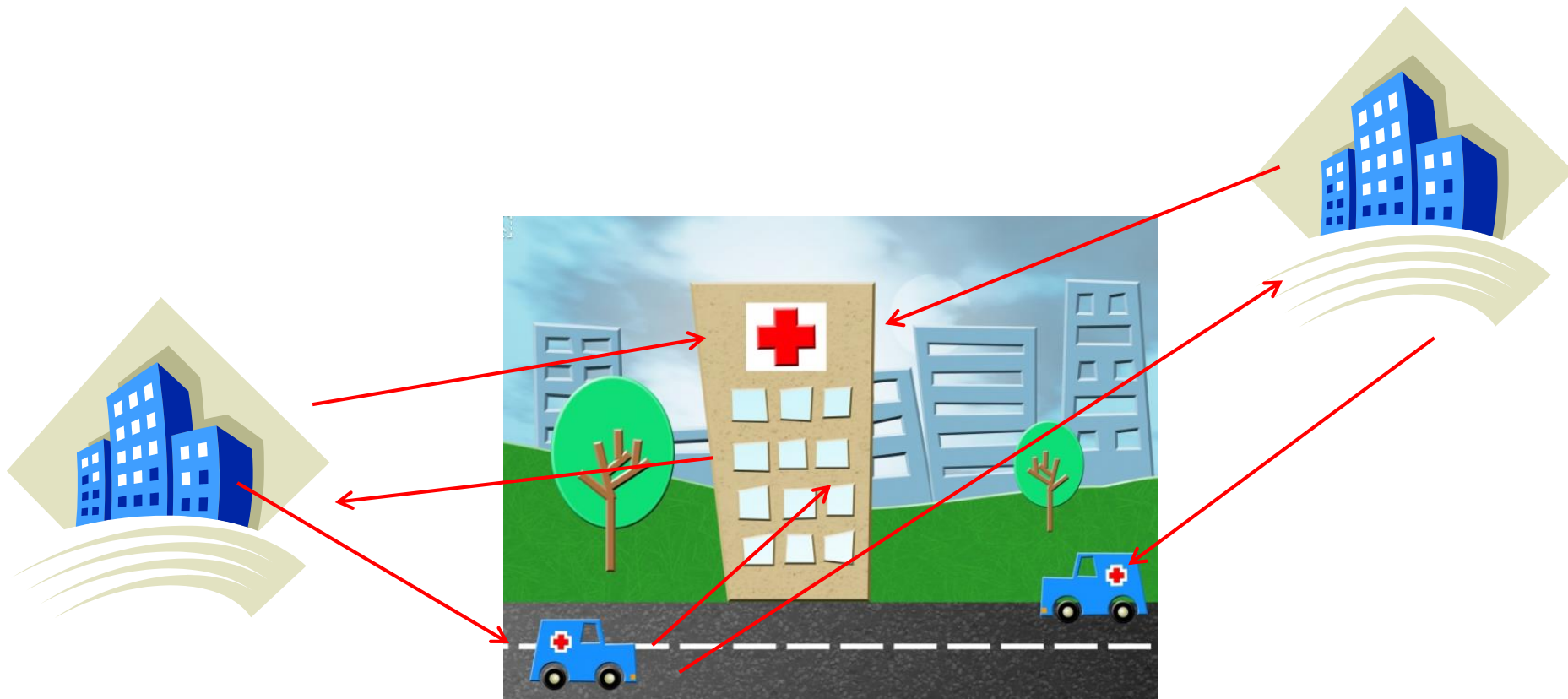


6. Environmental Cleaning

- **Notify environmental services of room(s) housing patients with a MDRO**
 - Clean these rooms last, when feasible
- **Conduct frequent cleaning of high touch surfaces with Environmental Protection Agency (EPA)-registered disinfectants**



7. Communicate CRE Status to Transferring and Receiving Facilities



8. Review Infection Prevention Policies and Procedures

- Review annually
- Assess staff competency with specific attention to the following:
 - Hand hygiene
 - Donning and doffing of PPE
 - Contact precautions

9. Antimicrobial Stewardship

- Refer to <https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html>



Contact

Katie Steider

HAI Epidemiologist

katie.steider@dhhs.nc.gov



Please either...

- ***Un-mute your line***
- ***Type in the chat box***

**THANK YOU FOR YOUR TIME AND
SUPPORTING RESIDENT SAFETY!**



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ADDITIONAL RESOURCES

- Statewide Program for Infection Control & Epidemiology (SPICE)
 - <https://spice.unc.edu/>
- Infection Management & Antibiotic Stewardship (UNC)
 - <https://nursinghomeinfections.unc.edu/>
- Centers for Disease Control & Prevention (CDC)
 - <https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html>
- Agency for Healthcare Research & Quality (AHRQ)
 - <https://www.ahrq.gov/nhguide/index.html>
- Minnesota Department of Health (MDH)
 - <http://www.health.state.mn.us/divs/idepc/dtopics/antibioticresistance/asp/Itc/index.html>