

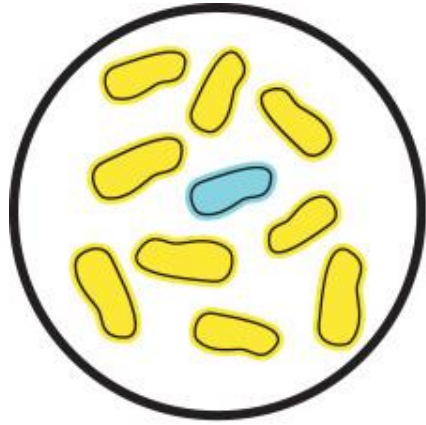


# ANTIMICROBIAL-RESISTANT ORGANISMS (AROs) TOOLKIT FOR LTCH, RH, AND OTHER CLS - RVH IPAC HUB

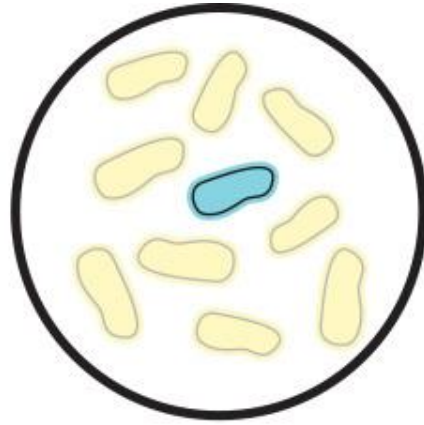
Mustansir Diwan MSc, CIC, LTC-CIP – June 2023

# WHAT IS ANTIMICROBIAL RESISTANCE?

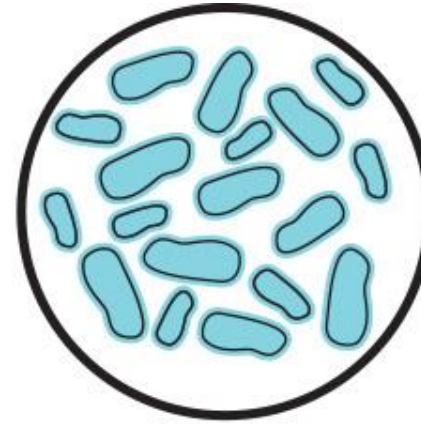
- Occurs when germs like bacteria and fungi develop the ability to defeat the antimicrobials designed to kill them. That means the microbes are not eliminated and continue to grow.
- Causes significant level of morbidity and mortality worldwide. Infections caused by resistant germs are difficult—sometimes even impossible—to treat.
- Drug resistance to even one antimicrobial can develop into a serious condition.
- Presence of antibiotics and antifungals can cause bacteria and fungi to adapt, accelerating antimicrobial resistance.
- Antibiotics are the most common treatment for bacterial infections. But they **do not** work for viral infections like colds, flu, or COVID-19. Misuse and overuse of antibiotics is a significant contributor to development of antimicrobial resistance.



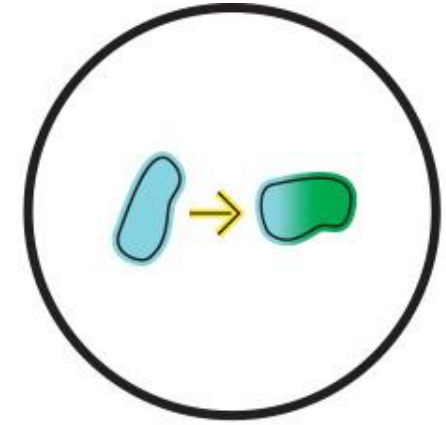
Our body is **home to countless microbes**.  
Some may be resistant to antibiotics



**Antibiotics kill the bacteria**  
causing the infections as well as the good bacteria



The antibiotic-**resistant bacteria** are now able to **grow and take over**



Some bacteria may **give** their antibiotic **resistance to other bacteria**



Normal bacterium



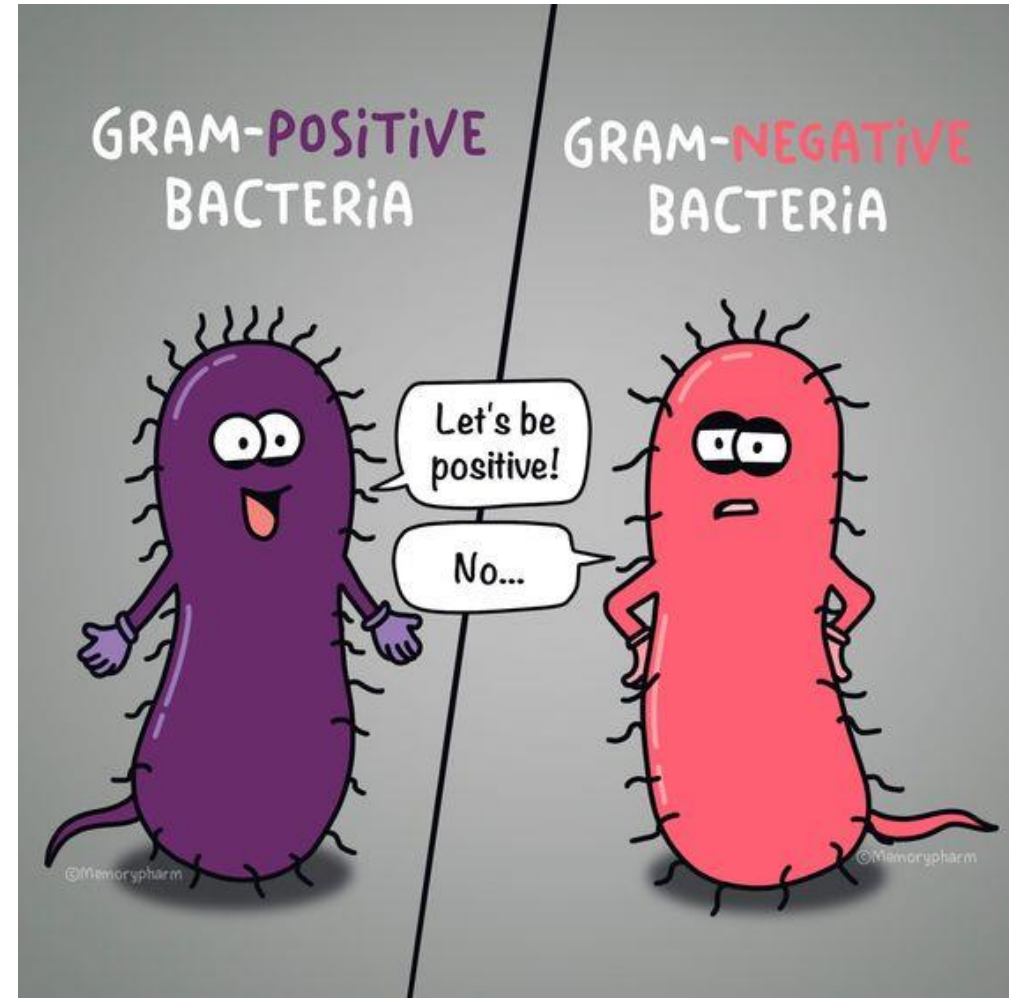
Resistant bacterium



Dead bacterium

# GRAM STAINING FOR CLASSIFICATION OF BACTERIA

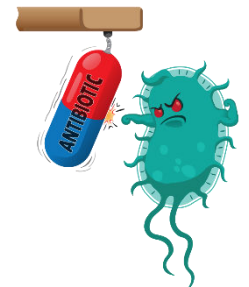
There are mainly two types of bacteria when it comes to gram stain: gram positive and gram negative. Based on the differences in their cell wall structure, gram positive bacteria will retain the original stain and show as purple under a microscope, while gram negative bacteria will appear reddish pink.

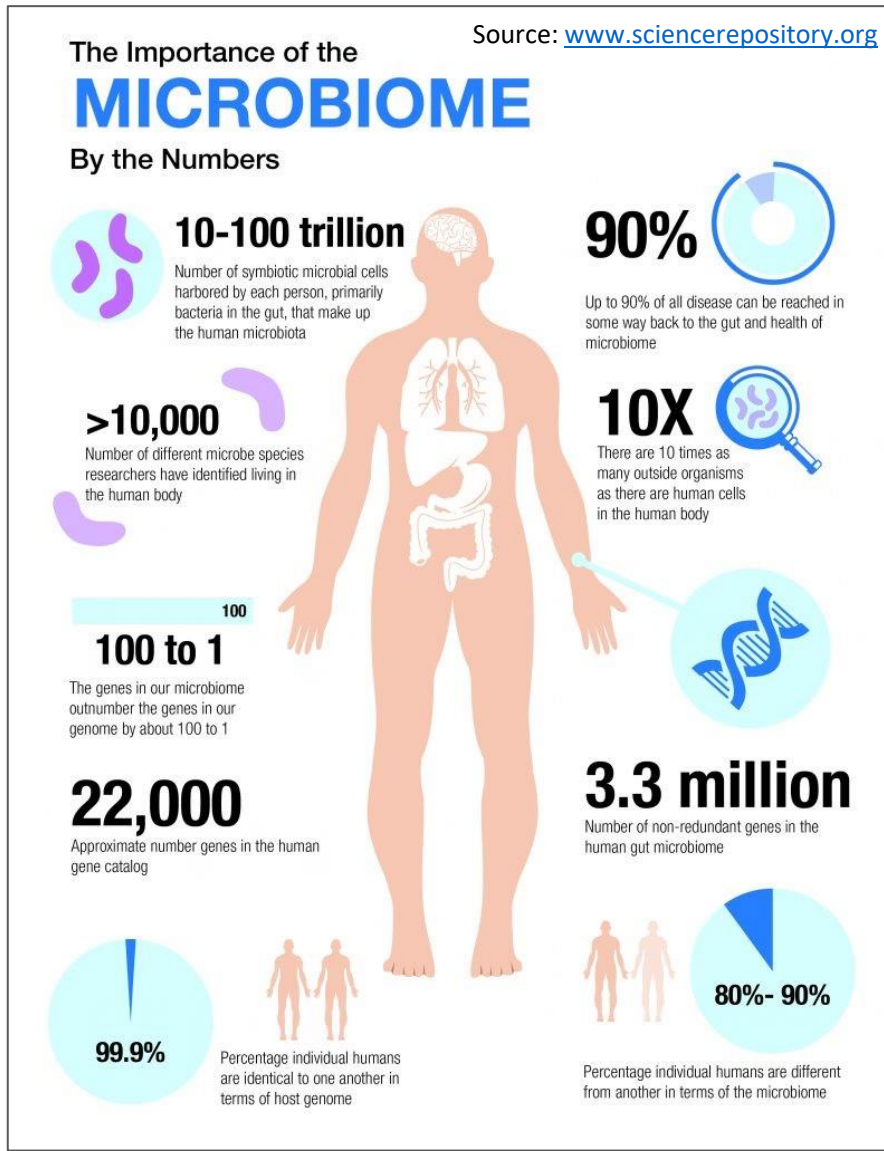


# ANTIMICROBIAL-RESISTANT ORGANISMS (AROs) OF CONCERN

In recent years, many health care facilities have seen a dramatic increase in the numbers of AROs. Drug-resistant microbes continue to emerge but organisms that are currently of importance in health care settings are:

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-resistant enterococcus (VRE)
- Carbapenemase-producing *Enterobacteriaceae* (CPEs)
- *Candida auris*
- Extended spectrum  $\beta$ -lactamase producing *Enterobacteriaceae* (ESBLs)
- *Clostridioides difficile*\* (not an antibiotic-resistant organism per se, but it is directly associated with antibiotic usage)





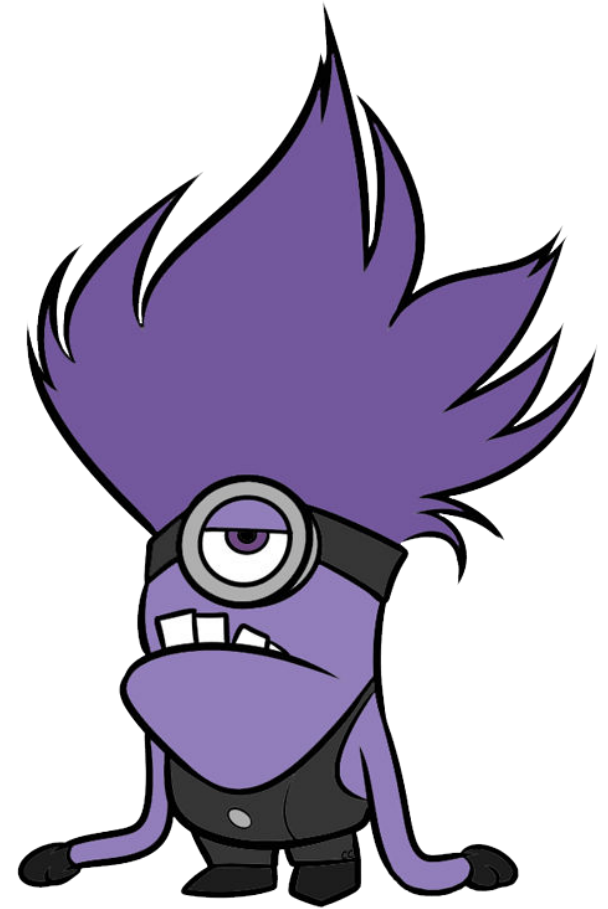
- Humans are colonized with around the same number of microbes as cells in the body (1:1).
- >10,000 number of different species identified living **in and on** the human body.
- Colonized areas include skin, conjunctiva, urethra and bladder, vagina, uterus, oral cavity, lungs, nasal cavity, and the gastrointestinal (GI) tract.



# COLONIZATION VS INFECTION



**Colonization:** Organisms are present with **no** symptoms or illness, but can be transmitted to others.



**Infection:** Organisms start invading bodily tissue, show clinical symptoms and cause disease.

# METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* (MRSA)

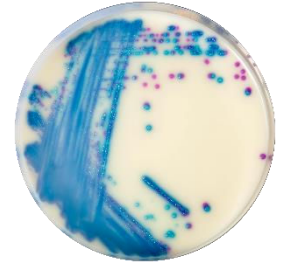
MRSA is a group of gram-positive bacteria that are genetically distinct from other strains of *Staphylococcus aureus* and cause infections that are difficult to treat. It can be either health care-associated or community associated (CA-MRSA).



- It typically spreads via **direct contact** with an infected wound or from contaminated hands, usually those of health care workers (HCWs).
- Colonized residents are a major reservoir in a health care setting, including long-term care homes.
- MRSA can cause severe problems including bloodstream infections, pneumonia, surgical site infections, sepsis, and death. In Canada, the rate of MRSA bloodstream infections has been increasing since past few years.
- Hand hygiene and environmental surface cleaning are two important preventative measures that can mitigate the spread of MRSA.



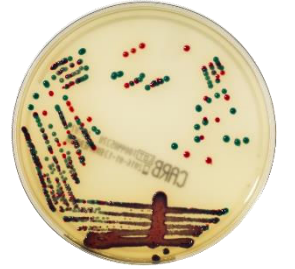
# VANCOMYCIN-RESISTANT *ENTEROCOCCUS* (VRE)



VRE are strains of enterococci bacteria that are resistant to the antibiotic vancomycin. *Enterococci* commonly live in the GI tract of most people without causing illness.

- VRE spreads from person to person through **contact**, often via the hands of caregivers. VRE transmission via environmental sources is well recognized and includes most items in the health care environment, such as blood pressure cuffs, electronic thermometers, monitoring devices, stethoscopes, call bells, bed rails, and even cell phones of HCWs.
- Contamination of the environment with VRE is more likely when a client/resident has diarrhea.
- Clients/residents with colonized GI tract are the major reservoir for transmission.
- VRE can easily survive under dry conditions in the environment for up to few months.
- Strong hand hygiene, effective cleaning and disinfecting, and using the correct contact time for the disinfectant are effective preventative measures to limit the spread of VRE.

# CARBAPENEMASE-PRODUCING *ENTEROBACTERIACEAE* (CPE/CPO)



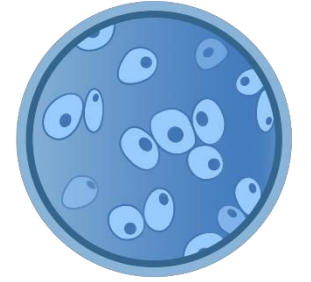
CPE are *Enterobacteriaceae* that produce enzymes, called carbapenemases, that inactivate carbapenems and several other classes of antibiotics. This causes infections that are difficult to treat, with mortality rate of up to 50% of severely infected patients. They are sometimes also referred to as CPO, which stands for carbapenemase-producing organisms.

- Transmission of CPE occurs via direct and indirect **contact**. Apart from carbapenemase, CPEs are also usually resistant to first, second, and third-generation cephalosporins and penicillins.
- Colonized clients/residents are the main reservoir for CPE and is mainly found in the lower GI tract of a person. It can also be found in environmental reservoirs such as sinks, shower drains, and endoscopes that have not been properly reprocessed.
- New Delhi metallo- $\beta$ -lactamase (NDM) is the most widespread carbapenemase in south central Ontario.

## CPE (CONT.)

- CPE usually spreads from person to person by the hands of HCWs when hand hygiene is missed, or via shared medical equipment that is not properly cleaned and disinfected between clients/residents.
- Individuals may remain colonized if they are in good health but *are* still a reservoir for transmission to others. Factors that impair the function of the immune system, and interventions that permit colonizing bacteria to invade, like indwelling devices, increase the probability of infection with CPE.
- Confirmed cases of CPE (colonization and infection) are designated **reportable** under the *Ontario Health Protection and Promotion Act*.

# CANDIDA AURIS

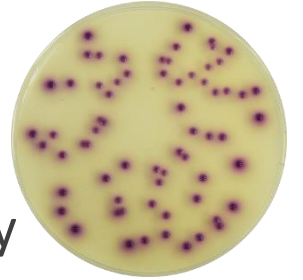


*Candida auris* is a fungal pathogen that has recently emerged as a global threat to public health. It was first described in Japan in 2009 after being isolated from the external ear canal discharge of a patient. The name of the species comes from the Latin word for the ear, *auris*.

- Transmission of *C. auris* occurs from person to person via direct or indirect **contact**.
- *Candida* infections are often multidrug-resistant and acquired by clients/residents with weakened immune systems. *Candida* cause infections, ranging from mild oral and vaginal yeast infections to severe invasive infections.
- It is difficult to identify *C. auris* with standard laboratory methods and misidentification may lead to incorrect treatment. Antibiotics used for bacterial infections can increase the risk of *Candida* infections.
- Adherence to hand hygiene, appropriate use of additional precautions, and environmental cleaning are important prevention measures.
- Alcohol-based hand rub (ABHR) is recommended when hands are not visibly soiled.

# ESBL-PRODUCING BACTERIA

ESBL are a group of gram negative bacteria that produce enzymes called extended spectrum  $\beta$ -lactamases. These enzymes can break down and destroy some commonly used antibiotics, including penicillins and cephalosporins, and make the drugs ineffective.



- Transmission occurs from person to person via direct or indirect **contact**.
- ESBL infections most commonly occur in people with exposure to healthcare settings, including those in hospitals and nursing homes. Risk factors are similar to other AROs but it can cause urinary tract infections (UTIs) in healthy people.
- ESBL-producing *Enterobacteriaceae* are capable of causing colonization and infection, similar to other AROs.
- Hand hygiene, cleaning and disinfection of medical equipment, and thorough environmental cleaning are important preventative measures.

# *CLOSTRIDIoidES DIFFICILE* INFECTION (CDI)

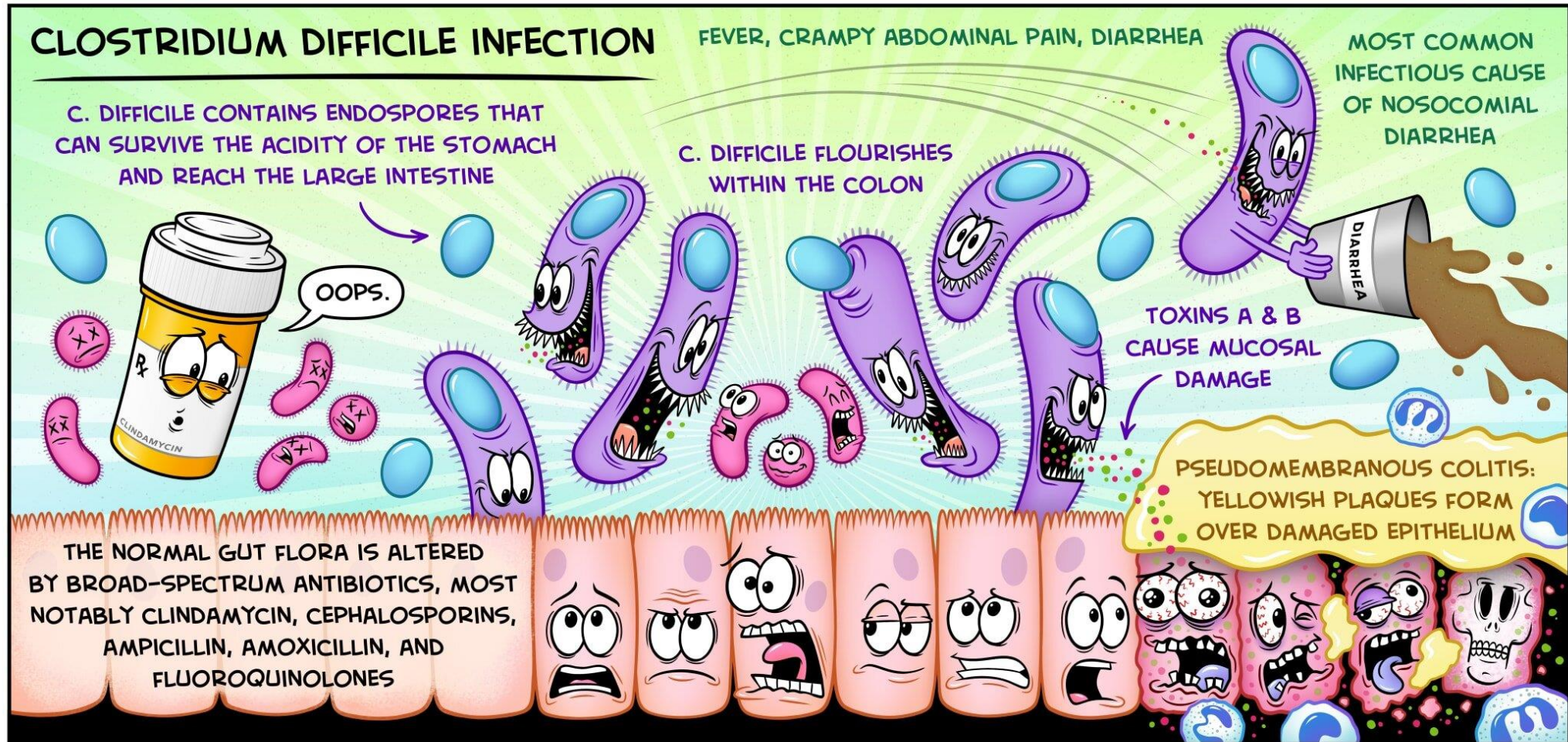


*C. difficile* is a spore-forming, gram positive anaerobic bacteria that is the most frequent cause of antibiotic-associated diarrhea and inflammation of the colon, including the life-threatening condition called toxic megacolon, in hospitals and long-term care facilities in Canada, as well as in other industrialized countries.

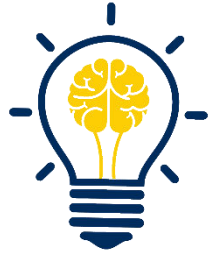
Usage of antibiotics for prolonged period or in high doses can change the levels of bacteria that are normally found in the intestines or bowel. When there are fewer good bacteria in our intestines and colon, *C. difficile* has the chance to thrive and produce toxins that cause the disease.

- Transmission occurs from person to person via direct or indirect **contact**.
- *C. difficile* is capable of producing spores that are resistant to destruction, can survive for long periods in the environment (up to 5 months), and are intrinsically resistant to antibiotics. When a person has *C. difficile*, the bacteria in their feces can contaminate surfaces such as toilets, bedpans, commode chairs, and door handles (if feces is on hands).
- Household bleach in dilution of 1:10 or a Health Canada-approved sporicidal agent specifically for *C. difficile* should be used for environmental cleaning. ABHR is not effective against *C. difficile* spores and hand washing with soap and water is required to remove the spores.
- Confirmed outbreaks and outbreak-associated cases are designated as **reportable** under the *Ontario Health Protection and Promotion Act*.





## DID YOU KNOW?



- Antibiotic resistance cost Canadian hospitals about **\$1.4 billion** a year according to a 2018 report by the Council of Canadian Academies (CCA).
- Antibiotic resistance can affect people at any stage of life. In many cases, infections caused by resistant germs require extended hospital stays, and the use of treatments may be potentially toxic to the client/resident.
- Antibiotics specifically target bacteria and are used to treat bacterial infections. Whereas antimicrobials encompass a broader range of products, including antivirals, antifungals, and antiparasitics. Microbes that develop antimicrobial resistance are sometimes referred to as “**superbugs**”.

# IPAC MEASURES

- All AROs mentioned primarily spread via **contact**, either through contaminated hands, medical equipment, or environmental surfaces.
- Strong adherence to hand hygiene practices is one of the most important prevention measures that should be followed by staff, visitors, and residents.
- **Contact or Enhanced Contact Precautions** should be implemented, when appropriate, for residents colonized or infected with an ARO. The purpose to implement additional precautions for residents, who are colonized with an ARO, is to prevent transmission to another client/resident, and also to prevent colonization from turning into an infection in the colonized individual.
- Apart from additional precautions, cleaning and disinfection of patient's environment and shared equipment is also crucial as a prevention measure.
- Most MRSA, VRE and CPE guidelines recommend some form of targeted screening of high-risk clients/residents, but differ in their definition of 'high-risk'. IPAC should assess whether AROs of significance to their health care setting should be tracked and flagged.



# RECOMMENDATIONS FOR ADDITIONAL PRECAUTIONS

ORGANISM	COLONIZATION	INFECTION
MRSA	✓	✓
VRE	✓	✓
CPE	✓	✓
<i>C. Difficile</i>	✗	✓
<i>Candida auris</i>	✓	✓
ESBLs	✗	✓

\*There is a trend in nursing homes and hospitals to not screen for ESBLs anymore or to isolate a client/resident colonized with ESBL. Routine practices like strong hand hygiene and thorough environmental cleaning are sufficient to mitigate transmission. However, a home should do their own infection control risk assessment for isolation of residents colonized with ESBL and develop a policy at their discretion. Some hospitals have also discontinued risk-factor-based screening and using Contact Precautions for residents colonized with VRE.

# CLEANING AND DISINFECTION

For cleaning and disinfection of environmental surfaces, appropriate product approved by Health Canada with a drug identification number (DIN) should be used.

- For C. diff, low-level disinfectants are not effective and an approved sporicidal disinfectant or 1:10 dilution of household bleach should always be used. The same recommendation is applicable for Candida auris. Alcohol and common hospital disinfectants **are not** effective against bacterial spores.
- Accelerated hydrogen peroxide (AHP) one-step cleaning and disinfectant wipes (0.5%) can kill most AROs with a short contact time of usually 1-3 min.
- Quaternary ammonium compound or quats can also kill most of the AROs. However, the contact time is usually longer depending on the product used (usually 4-5 minutes).



# DECOLONIZATION

Decolonization is the attempt to remove the antimicrobial-resistant pathogens from a colonized individual, like using chlorhexidine rinses for bathing or showering, a mouthwash to clean the oral cavity, nasal spray containing Mupirocin, or using antibiotics, antifungals, or antiseptics.

- The process can reduce the likelihood of colonization developing into a serious infection. Common sites of bacterial colonization include the nasal passage, groin, oral cavity, and skin.
- One of the caveats with decolonization is that prolonged or widespread use of antibiotics for decolonization may promote antibiotic resistance.
- Decolonization is generally not recommended for VRE, CPE, and ESBL but decision would be made based on the discretion of the clinical care provider.
- Decolonization for MRSA might be considered in certain conditions.



# QUESTIONS?

Please contact your RVH IPAC Hub liaison.

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