# Microbe of the month

## Breaking The Chain of Infection

Cutimed®

**NOVEMBER 2019**

Newsletter

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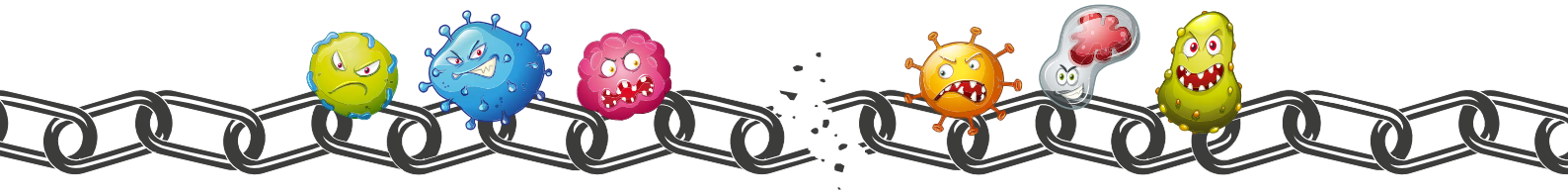

Featured this month:

## ANTIMICROBIAL RESISTANCE

World Antibiotic Awareness Week 18th – 24th November 2019

## Hello readers!

**Every November, World Antibiotic Awareness Week** raises our consciousness about antibiotic resistance and the urgency with which the medical, veterinary and farming communities need to ensure the appropriate use of these disease-fighting drugs. Antimicrobial agents are among the most important medicines ever discovered. Since antibiotics were introduced in the early 1930s, they have saved millions of lives and improved the outcomes for countless patients.

However, the effectiveness of these lifesaving resources is at risk. Many medical advances which we take for granted - including cancer treatment, surgery, transplantation and neonatal care - are now threatened by increasing antibiotic resistance and a decline in the antibiotic research and development pipeline.

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

Antibiotics are among the most commonly prescribed drugs used in human and animal medicine.
***50% of all antibiotics prescribed are not needed or are not optimally effective as prescribed!*** CDC

In **2015**, the **World Health Assembly** upgraded antibiotic resistance to an ***international emergency***, because new resistance mechanisms are constantly emerging and spreading globally, preventing our ability to treat common infectious diseases.

***If you develop an infection that can't be treated in the traditional way with antibiotics, you can die. It's as simple as that.***

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# Think twice – seek advice... or PAY THE PRICE!

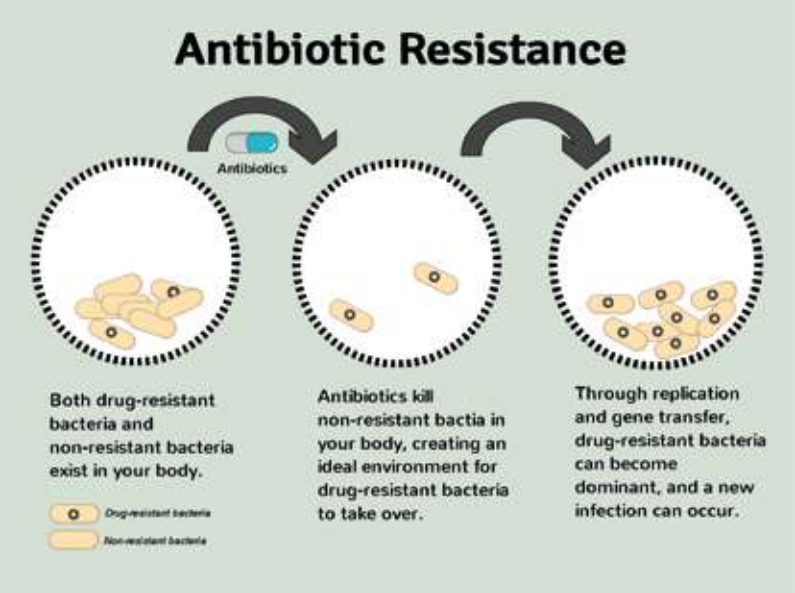
World Health Organization

## HOW DO BACTERIA BECOME RESISTANT?

There are several ways for bacteria to become antibiotic-resistant, but the main one is through '***selective pressure***'.

Selective pressure happens when not all the bacteria are susceptible to the antibiotic used to treat the infection, and the surviving bacteria continue to multiply.

*This creates a bacterial population that is resistant to the antibiotic to which the bacteria were exposed.* Antibiotic overuse helps speed up the selection for resistant bacteria.




## Clinical relevance?

- Commensal Gram-negative species such E. coli, Klebsiella, Serratia and Pseudomonas species present in the gut are often involved. Sex pili can be formed between like or different species, which has great significance in the transfer of antibiotic-resistant genes via plasmids (e.g., beta lactam and carbapenem antibiotic-resistance). Therefore, species of bacteria which previously had no resistance features will give rise to innumerable generations of bacteria capable of producing antibiotic-disabling enzymes known as beta *lactamases* and *carbapenemases*.
  - Since these pathogens are spread via contact, the importance of hand hygiene and the thorough cleaning and disinfection of patient care surfaces and equipment cannot be over-emphasized.

- Changing how antibiotics are used may be the single most important action to combat resistance, since it is estimated that only 50% of the people who receive antibiotics require them! Using antibiotics appropriately and only when necessary in people and animals is known as ***antibiotic stewardship***.
  - Antibiotic therapy should be reviewed after 72 hours, pending receipt of laboratory culture results and recommendations by the medical microbiologist.

- **An accurate diagnosis is an important step towards appropriate antibiotic use**. When a patient is seriously ill and healthcare practitioners don't have a diagnosis for an infection, they may administer multiple antibiotics until they find the best one for treatment, or simply prescribe a broad-spectrum antibiotic. This may harm the normal flora in the individual's gut (termed 'dysbiosis') and creates selective pressure that contributes to resistance.
  - Laboratory specimens for culture should always be taken prior to the commencement of antibiotics.

- **Antimicrobial stewardship (AMS)** is a coordinated programme that seeks to promote the appropriate use of all antimicrobials, including antibiotics, antivirals and antifungals.
  - AMS programmes are key in the modification of prescribing practices of physicians and other healthcare providers, creating awareness and decreasing antibiotic use.
  - Antibiotic guidelines or policies (which can be national or local / healthcare facility-specific) should focus on using the least expensive antibiotics with the narrowest spectrum, minimal toxicity, and the least impact on the development of resistance.

## The principles of prudent antibiotic prescribing[1]

**Right Antibiotic**
- What organisms could be infecting this patient?
- What risk factors for resistance does this patient have?
- Does this antibiotic penetrate to the site of infection?

**Right Patient**
- Does this patient have a true infection vs colonization?

**Right Time**
- Did we obtain cultures prior to initiating antibiotics?
- Was this patient administered antibiotics within an hour?

**Right Route**
- Is this patient a candidate for oral treatment?

**Least Harm**
- Are we choosing the most narrow spectrum antibiotic?
- Are we choosing the minimum duration of treatment?
- Are we choosing the antibiotic with the lease amont of side efects?

## THE MICROBIOLOGY LABORATORY

The microbiology laboratory plays a crucial role in managing the use of antibiotics in healthcare settings. The routine application of sensitivity tests (antibiograms) helps to identify individual levels of sensitivity and resistance to specific antibiotics, and assists clinicians in choosing appropriate therapy.

Additional microbiology laboratory information which offers general guidance in the choice of antibiotics and reduces unnecessary usage includes:

- ☑ Restricted reporting of antibiotic sensitivities to narrow spectrum agents; only reporting second and third-line antimicrobials when first-line agents will not be effective.
- ☑ Newer technologies, such as 'matrix-assisted laser desorption / ionisation time-of-flight' (MALDI TOF)mass spectrometry, have been utilised in the last few years to identify bacterial species much more rapidly and cheaply than was previously possible. In critically ill patients, it has become possible to identify isolates from blood cultures within hours of the cultures signalling positive, ensuring that tailored antimicrobial therapy can be administered at the earliest opportunity.
- ☑ Routine screening for carriage of resistant microorganisms.
- ☑ Specific microbial surveillance (e.g., MRSA, extended spectrum beta-lactamase and carbapenemase producing Enterobacteriaceae, C. difficile, etc.) and resistance trends with regular feedback to prescribers and Infection Control personnel.

## Important concepts[5]

**Microbial resistance vs 'tolerance':** Microbial resistance refers to a specific gene-mediated mechanism of drug resistance - for example, the production of a beta-lactamase enzyme that confers resistance to beta-lactam antibiotics (i.e. penicillin – refer to MOM May 2019).

However, microbial tolerance refers to the decreased susceptibility and enhanced tolerance of microorganisms to antimicrobials in a non-specific manner. Microbial biofilms are a good example of enhanced tolerance to antimicrobial substances due to limited penetration and uptake, because microbial metabolism is greatly reduced within the biofilm.

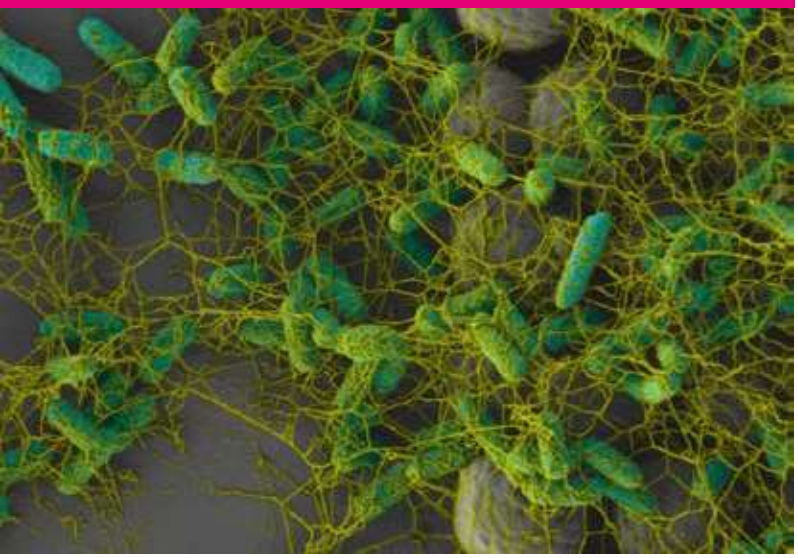
**There is also a concerning increase in the incidence of tolerance of microorganisms to antiseptic solutions when they are used inappropriately in infection control and wound care.**

NB: Antimicrobial tolerance is not caused by a permanent genetic mutation and is therefore reversible.

**Quorum sensing:**

This is a sophisticated mechanism used by microorganisms to communicate within the biofilm structure as well as between bacterial species. It is used to detect and respond to changes in the environment (e.g., the presence of antimicrobial substances – including antiseptics, other microbes or nutritional limitations). Quorum sensing induces changes in bacterial gene expression (mutation) that promote survival of the microorganisms.

# THE ROLE OF BIOFILM IN ANTIMICROBIAL RESISTANCE[4]



**Scanning electron microscope image of *Pseudomonas aeruginosa* in biofilm**

Biofilms are complex microbial communities containing bacteria and fungi. The microorganisms synthesise and secrete a protective slimy barrier of sugars and proteins that attaches the biofilm firmly to a living or non-living surface (i.e., the bacteria are 'sessile').

**The biofilm barrier protects the microorganisms and greatly increases their tolerance to external threats such as phagocytic neutrophils, antibodies and antimicrobial substances.** Biofilms change continuously - they may consist of a single bacterial or fungal species, or, more commonly, may be polymicrobial; i.e., they may contain multiple diverse species. **Maturing within 24 hours,** biofilms continuously shed planktonic (separate, 'free-floating') bacteria, micro-colonies and fragments of biofilm, which disperse and attach to other parts of the wound bed or to other devices, forming new biofilm colonies.

Another survival strategy that many bacteria in biofilms have developed is for a subpopulation to become metabolically 'quiescent'. Bacteria need to be metabolically active for antimicrobials to act, so quiescent (hibernating) bacteria in biofilms are unaffected by antibiotics that would normally kill active bacteria. **Research has shown that the lowest concentration required to kill or eliminate bacterial biofilms for most antibiotics actually exceeds the maximum prescription levels for the antibiotic many times over.** Thus, standard oral doses of an antibiotic, which would effectively kill the normally-susceptible bacteria when grown planktonically in a clinical laboratory (i.e., under 'in vitro' conditions), may have little or no antimicrobial effect on the same type of bacteria when in biofilm form in a patient!

## ANTIMICROBIAL STEWARDSHIP should be practised in wound management too!

Chronic and non-healing wounds in particular (eg. leg and foot ulcers, burns, major surgical site infections and fungating wounds) are prone to becoming colonised and infected with antimicrobial resistant pathogens such as MRSA, carbapenem resistant enterobacteriaceae (CRE) and fungi (Candida species, including Candida auris). Topical and/or systemic antimicrobial therapy may be required, but are you familiar with treatment principles so as to prevent selective pressure and the development of resistance?

**If you would like to gain insight into antimicrobial resistance, learn about the threats it poses to wound care, and explore preventative measures ...**

**The EUROPEAN WOUND MANAGEMENT ASSOCIATION** in conjunction with the **British Society for Antimicrobial Chemotherapy present a FUTURELEARN FREE on-line course** on **Antimicrobial Stewardship in Wound Care** (2 hours per week over 3 weeks) https://www.futurelearn.com/courses/antimicrobial-stewardship-in-wound-management.

## ANTIBIOTIC STEWARDSHIP IS EVERYBODY'S RESPONSIBILITY-

**Antimicrobial resistance (AMR) is a major global public health crisis and the future trend is alarming.**

**'Drug-resistant infections will kill an additional 10 million people a year worldwide by 2050 - more than currently die from cancer - unless action is taken.'** [6]

## Did you know ?

**WEBBER TRAINING offers 'Teleclass Education' - an international lecture series on infection prevention and control related topics https://webbertraining.com/teleclassesc1.php**
Expert contributors voluntarily share their knowledge and **members in developing nations are entitled to free and full access.**

**What is a teleclass?**
A teleclass is a live seminar to which people can listen and participate over the telephone, or access at a later date through an on-line recording. Each teleclass is approximately 60 minutes long and can be accessed after the scheduled date, at your convenience.

**Become a member – it's easy and it's free! https://webbertraining.com/membersc13.php?command=signup**

## Webber teleclass topics for November and December

| Date | Topic | Format |
|---|---|---|
| 7th November 2019 | Healthcare-associated pneumonia that is not ventilator-associated: a big problem, but a guideline-free zone. | On-line recording and notes |
| 12th November 2019 | The role of cleaners in infection prevention - neglected front line workers in healthcare facilities. | On-line recording and notes |
| 14th November 2019 | Ahead – a consolidated framework for behavioural infectious risks in acute care – Part 2 | On-line recording and notes |
| 18th November 2019 | Minimum requirements for starting the implementation of the World Health Organization Core Components of Infection Prevention and Control Programs: a new approach. | On-line recording and notes |
| 21st November 2019 | Prioritising research areas for antibiotic stewardship programs | On-line recording and notes |
| 5th December 2019 | How to communicate about healthcare-associated infection with x, y and z generations. | On-line recording and notes |
| 18th December 2019 | Cleaning in Healthcare | On-line recording and notes |



## Your input is important to us

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and we will do our best to address them in the next issue!

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**REFERENCES**

**1.** British Society for Antimicrobial Chemotherapy in collaboration with ESGAP/ESCMID (2018). ANTIMICROBIAL STEWARDSHIP: From Principles to Practice. **2.** Gottrup, F., Apelqvist, J., Bjansholt, T., Cooper, R. et al (2013). EWMA Document: Antimicrobials and Non-healing Wounds - Evidence, Controversies and Suggestions. J. Wound Care. 2013; 22 (5 Suppl.): S1–S92. **3.** Kirketerp-Møller, K., Jensen, P.O., Fazli, M., Madsen, K.G. et al (2008). Distribution, Organisation, and Ecology of Bacteria in Chronic Wounds. Journal of Clinical Microbiology, Aug. 2008, p. 2717–2722 **4.** World Union of Wound Healing Societies (WUWHS) Position Document. Biofilm. Wounds International 2016. **5.** International Wound Infection Institute (IWII) Wound infection in clinical practice. Wounds International 2016. **6.** US Centers for Disease Control and Prevention (CDC). Core Elements of Hospital Antibiotic Stewardship Programs. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. **7.** https://www.bbc.com/news/health-30416844