Antibiotics have changed modern medicine and since the 1940s and with that their role:

- Treatment of serious infections
- Protecting cancer patients
- Treatment of immune compromised conditions
- Prophylactic use in complicated surgical procedures
- Promotion of growth and prevention of disease in livestock and other food animals.
DEFINITIONS

Antimicrobial- derived from the Greek words anti (against) mikos (little) & bios (life)=this refers to any substance natural, synthetic or semisynthetic that inhibits or kills other micro-organisms.

Antimicrobial agents: disinfectants of called “non-selective antimicrobials” kill everything.

Antiseptics: Used to reduce bacterial loading on skin

Antibiotic- is a low molecular substance produced by a microorganisms that in low concentrations inhibits or kills other microorganisms.

To treat infection = Antimicrobial chemotherapy
To prevent infection= Antimicrobial prophylaxis

“All antibiotics are antimicrobials but not all antimicrobials are antibiotics”
“Antimicrobial resistance threatens the very core of modern medicine and the sustainability of an effective, global public health response to the enduring threat from infectious diseases. Effective antimicrobial drugs are prerequisites for both preventative and curative measures, protecting patients from potentially fatal diseases ensuring that complex procedures, such as surgery and chemotherapy, can be provided at low risk” (WHO, 2015).
MECHANISM OF ANTIBIOTIC RESISTANCE

Bacteria resist the effects of antibiotics by using genetic strategies in multiple ways:

- Producing destructive enzymes that neutralize antibiotics
- Modifying the antimicrobial targets by mutation so that they can’t be recognised by drugs
- Removing antimicrobial agents by pumping them out (efflux)
- Preventing antibiotics from entering by creating a “biofilm” or otherwise reduce permeability
- Create bypass that allow bacteria to function without enzymes targeted by antibiotics.
MRSA

**FIGURE 1-1**: Percentage of *Staphylococcus aureus* isolates that are methicillin resistant (MRSA), by country (most recent year, 2011–14).

FIGURE 1-3: Percentage of carbapenem-resistant *Klebsiella pneumoniae*, by country (most recent year, 2011–2014)

Source: CDDEP 2015, WHO 2014 and PAHO, forthcoming
CARBAPENEM RETAIL SALES IN SELECTED COUNTRIES, 2005–2010 (PER 1,000 POPULATION)
INAPPROPRIATE ANTIBIOTIC USE

From 20 to 50 % of total antibiotic use is estimated to be inappropriate (Cizman, 2003).

“Inappropriate” can mean either of two things:

▪ the use of antibiotics when no health benefit is possible, such as to treat upper respiratory tract infections caused by viruses; or

▪ the suboptimal use of antibiotics for responsive conditions, such as the choice of drugs with an unnecessarily broad spectrum, an incorrect dosage or duration, or poor patient adherence to the prescribed treatment (Starrels et al. 2009).
SETTINGS FOR ANTIBIOTICS USE

Antibiotics in the community

An estimated 80% of all antibiotics are used outside hospitals—in outpatient settings such as clinics, health posts, and private physicians’ offices (Kotwani and Holloway 2011).

Community use also includes antibiotics purchased by or for consumers directly, without prescription.

Nonprescription use of antibiotics can range from 19% to well over 90% outside the United States and Europe (Morgan et al. 2011).

In rural and urban pharmacies in Vietnam, 88 to 91% of all antibiotic sales in a sample of pharmacies in 2010 were without a prescription (Do Thi Thuy Nga et al. 2014).

Similarly, in Saudi Arabia and Syria, 78% and 87 to 97% of pharmacies, respectively, dispensed antibiotics without a prescription (Al-Faham et al. 2011; Bin Abdulhak et al. 2011).
Antibiotics in hospitals

Even when a specific pathogen is identified, many patients are still given broad-spectrum antibiotics. These drugs are effective against a wide range of pathogens, they may contribute to the spread of resistant strains.

In a study involving six U.S. hospitals in 2009 and 2010, only 59% of patients received appropriate cultures and by the fifth day of therapy, 66% of antimicrobial therapy regimes were unchanged, despite negative cultures in 58% of patients (Braykov et al. 2014).

In addition, 30 percent of the patients were afebrile and had a normal white blood cell count at the start of antibiotic therapy.
Even when antibiotics are administered before surgery, the regimen or duration of the therapy may be suboptimal: from 19 to 86% of patients in hospitals in India received inappropriate antibiotic prophylaxis (Belagali et al. 2013; Rana et al. 2013; Rehan et al. 2010).

In addition to preoperative antibiotic prophylaxis, improved hygiene and better surgical techniques can decrease rates of surgical site infections in developing countries (Aiken et al. 2012, 2013).
DIAGNOSIS OF WOUND INFECTION

- Characteristics of the individual
- Characteristics of the wound
- Characteristic of the environment
WOUND INFECTION

1. **Contamination** – Presence of non-replicating micro-organisms in the wound

2. **Colonisation** – Micro-organisms multiply but do not cause damage to host

3. **Local Infection** Increased bacterial burden, between colonization and infection. Clinical signs: Friable tissue, pain, increased exudate, odour, absence of or abnormal granulation tissue.

4. **Spreading infection**– Bacterial invasion overwheels host. Erythema, fever, warmth, oedema, pain, odour and/or pus. Systemic infection throughout the body via the blood stream and causes fever, chills and tachycardia.

5. **Systemic Infection: Severe sepsis, septic shock, organ failure death**
**COMMON FLORA OF WOUNDS**

Burns: do not usually become infected unless patients have systemic factor most commonly *S.aureus* and later *P. aeruginosa*.

Bite wounds: contain more exotic flora reflecting the source of the bite. Pasteurella (50%), Streptococcus (46%), Staphylococcus (46%), Neisseria (32%), and Corynebacterium (12%) species.

Surgical wounds: Clean wounds do not usually become infected but when they do it is more likely to be transmitted infection such as MRSA.

Diabetic foot ulcers: limited signs of infection *S.aureus*, *S. epidermidis*, *streptococcus*, *P. aeruginosa*, *Enterococcus*, and coliform bacteria.

Deeper penetrating wounds: Associated with all sorts of bacteria
COMMON ANTIBIOTICS IN WOUND CARE

▪ **Bite wounds:** Amoxicillin cavulanate 500+125 mg, three times daily, for seven days.

▪ **Boils:** Should be mostly treated with drainage alone if surrounding cellulitis: Flucloxacillin 500mg four times daily 5-7 days of treatment.

▪ **Diabetic Foot Infections:** Amoxicillin cavulanate 500+125 mg, three times daily, for seven day.

▪ **Mastitis:** Flucloxacillin 500mg four times daily 7 days of treatment

▪ **Recurrent skin infections:** Educating patients and their families about infection control measures and the principles of good hygiene is first treatment.
“Biofilm consists of multi-layered cell clusters embedded in a matrix of extracellular polysaccharide which facilitates adherence of these microorganisms to wound surfaces and protects them from host immune system and antibiotic therapy.”

(Ramakrishnan, Putli & Babu, 2016)

“an aggregate of bacteria tolerant to treatment and the host defence.”

(World Union of Wound Healing Societies (WUWHS), 2016).
IDENTIFYING BIOFILM

- Failure of antibiotic therapy
- Recurrence of delayed healing on cessation of antibiotic therapy
- Increased exudate / moisture
- Low level chronic inflammation, erythema
- Low-level Poor granulation / friable hypergranulation
- Secondary signs of infection

In 2016 study on paediatric burns patients 30 wound swabs were isolated from 14 patients. 47% burn isolates showed a biofilm after five days, 80% staphylococcus aureus biofilm and 75% of these were MRSA. (Ramakrishnan, Putli & Babu, 2016)
BIOFILMS THE CHALLENGE

- Locating and diagnosing is difficult and identification a challenge in standard microbiological laboratories.
- How biofilms inhibit healing is still not fully understood.
- It is widely accepted that non-healing wounds have biofilm 60-100% they suspect.
- Antibiotics will not remove biofilm but will create resistance.
- Biofilms need a combination of Prevention (anti-biofilm agents), removal (clean, deslough, debride) and prevention of reformation with (antimicrobial agents) for management.
GENERAL PRINCIPLES OF ORAL ANTIBIOTICS

▪ Knowledge of common pathogens and local laboratory data on cumulative susceptibility to guide empiric therapy

▪ Broad-spectrum antimicrobial only when necessary

▪ Perioperative antibiotic prophylaxis appropriately (i.e., avoid giving for longer than 24 hours).

▪ A local policy may indicate a range of drugs for general use, and permit other drugs only on the advice of the microbiologist or physician responsible for the control of infectious diseases.
BEFORE STARTING THERAPY

Viral infections should not be treated with antibacterials;

- Samples should be taken for culture and sensitivity testing; Know what bacteria is causing the infection!

- Generally, narrow-spectrum antibacterials are preferred to broad-spectrum antibacterials unless there is a clear clinical indication (e.g. life-threatening sepsis).

- The dose varies make sure it is patient specific

- The route of administration of an antibacterial often depends on the severity of the infection. Life-threatening infections require intravenous therapy. Antibacterials that are well absorbed may be given by mouth even for some serious infections.

- Duration of therapy depends on the nature of the infection and the response to treatment.
INFECTION CONTROL IN WOUND CARE

Aim: to prevent further contamination or reduce exposure to microorganisms

Standard precautions at all times

- Aseptic technique
- Using non-touch technique
- Effective hand hygiene
- Correct use of gloves (sterile and non-sterile)
- Environment controls aseptic / negative pressure / general cleanliness
- Working clean-dirty
- Correct use of PPE
ANTIMICROBIAL STEWARDSHIP PROGRAMMES

Programs in health care facilities, key components of which include:

- Identification of key personnel who are responsible for this team that would include ID, pharmacist and nursing.
- Surveillance of antibiotic resistance and antibiotic consumption
- Prescriber education
- Consumer education
- Regular review of charts and follow-up with patients on antibiotics
REFERENCES

Ramakrishnan M.,1* Putli Bai S.,2 Babu M.3 (2016) Study on biofilm formation in burn wound infection in a pediatric hospital in chennai, india Étude de la formation de biofilm dans les infections de Brûlures au sein d’un hôpital pédiatrique à chennai
