Module 1

Introduction to maternal and neonatal infections and to infection prevention and control
Learning objectives

On completion of this session the participant should be able to:

1. define a “health care-associated infection” (HAI) and describe the global burden of HAIs and the epidemiology of maternal and neonatal infection/sepsis

2. describe why infection prevention and control (IPC) is important in health care and in particular for maternal and neonatal care

3. describe the chain of transmission and how IPC precautions can break it

4. list the key preventive strategies
Core competencies

At the end of this session the participant should:

1. recognize the importance of HAIs and understand how this relates to the WHO quality of care standards in maternal and neonatal health

2. demonstrate the understanding of the key principles for the prevention of maternal and neonatal health according to risk assessment
Epidemiology of maternal and neonatal infection/sepsis
What is a health care-associated infection (HAI)?

- An HAI is an infection acquired by a patient during care delivery in a hospital or other health-care facility that was not present or incubating on admission.
- Visitors, family members and health workers can also be affected by HAI.
- HAI are mostly caused by micro-organisms resistant to one or more commonly used antibiotics.
- Common HAI include urinary tract, respiratory tract, bloodstream and wound infections.

**Effective infection prevention and control reduces HAI by at least 30%**

# Common HAI determinants

## In all settings
- Inappropriate use of invasive devices and antibiotics
- Use of high-risk diagnostic or therapeutic procedures
- Immunosuppression, other severe underlying illnesses and conditions affecting neonates and older people
- Substandard application of IPC practices

## In settings with limited resources
- Inadequate infrastructure resulting in poor water, sanitation, waste management and environmental cleaning
- Insufficient quantity of patient-care medical devices and equipment
- Understaffing and overcrowding
- Poor knowledge of basic IPC measures and relevant skills, including injection and blood transfusion safety
- Absence of local/national IPC guidelines, policies and programmes
Global burden of HAI

- On average, 1 in every 10 patients is affected by HAI worldwide and 1 in every 10 affected patients dies as a result of HAI.
- In acute care hospitals, among every 100 patients, an average of 7 in developed and 15 in developing countries will acquire at least one HAI.

Global estimates of maternal infections (1)

- Maternal infection is an important cause of maternal mortality and severe morbidity

- Latest global estimates suggest that direct (obstetric) infections are the third most common cause of maternal mortality, representing about 10.7% of deaths, almost all occurring in low- and middle-income countries

## Global estimates of maternal infections (2)

### Sepsis and maternity

<table>
<thead>
<tr>
<th>For every 1000 live births</th>
<th>70 women had a suspected or confirmed maternal infection requiring hospital management</th>
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<tbody>
<tr>
<td></td>
<td>11 women presented with severe maternal outcomes</td>
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Infection was the underlying cause or contributing cause in over one-half of the intra-hospital maternal deaths

### TOP SOURCES OF INFECTION

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Source</th>
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<tbody>
<tr>
<td>30%</td>
<td>Endometritis / Chorioamnionitis</td>
</tr>
<tr>
<td>30%</td>
<td>Urinary tract</td>
</tr>
<tr>
<td>15%</td>
<td>Skin/soft tissue</td>
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</table>


Regional disparities in intrahospital maternal infection

<table>
<thead>
<tr>
<th>Maternal infection</th>
<th>UMICs: 106 per 1000 live births</th>
<th>HICs: 39 per 1000 live births</th>
</tr>
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<tbody>
<tr>
<td>Infection-related SMO</td>
<td>LMICs: 12 to 155 per 1000 live births</td>
<td>HICs: 0.6 per 1000 live births</td>
</tr>
<tr>
<td>Intra-hospital case fatality rates with infection-related SMO (6.8%)</td>
<td>LICs: 14.8%</td>
<td>LMICs: 7%</td>
</tr>
</tbody>
</table>

HICs: high-income countries; LICs: low-income countries; LMICs: low middle-income; UMICs: upper middle-income countries; SMO: serious maternal outcome

Overview of maternal sepsis

Sources:


Wound infection following caesarean section

- **Caesarean section** is the **single most important risk factor for maternal infection** after childbirth.

- In Africa, **up to 20% of women** who have delivered through caesarian section get a **wound infection** affecting their health and ability to take care of their newborn child.

Global estimates of neonatal sepsis

- Severe neonatal infections, including sepsis, represent a significant cause of neonatal mortality and long-term morbidity
- Studies estimate that between 1.3 million and 3.9 million annual neonatal sepsis cases and between 400,000 and 700,000 annual deaths occur worldwide
- Among hospital-born infants, hospital-acquired infections account for an estimated 4% to 56% of all deaths in the neonatal period, depending on the study and geographical area investigated
- An estimated 84% of neonatal deaths due to infections could be prevented through measures such as early diagnosis and timely appropriate clinical management
- Lower birth weight and gestational age were associated with increased sepsis incidence

Global estimates of neonatal sepsis

- Higher incidence rates were found in at-risk groups of neonates and in LMICs.
- Lower birth weight and gestational age were associated with an increased sepsis incidence.
- Early-onset sepsis (EOS) was 2.6-fold more common than late-onset sepsis (LOS).
- Survival of preterm, small (low birthweight) and sick infants has improved over time. However, this population often requires hospital care, which exposes them to a new set of infectious risks in the form of hospital-acquired infections and late onset sepsis.

Early-onset neonatal sepsis

- Causes around 8% of all neonatal deaths, is indicative of underlying issues of quality of care, such as infrastructure constraints for the care of pregnant women and neonates, inconsistent use of preventive measures, such as detection of infection in the mother and preventive treatment of the neonate, delayed diagnosis, and poor management of infection and its complications in mothers and neonates.

- With approximately 21 million pregnant women colonized with Group B Streptococcus worldwide (estimation based on a global colonization of 18% of pregnant women), this pathogen represents the leading cause of neonatal sepsis, although E. coli has also recently emerged as a major threat. Together, they account for approximately 70% of cases of all EOS (early onset sepsis). Although less common, Listeria monocytogenes is also associated with invasive infections in preterm neonates.

Late-onset neonatal sepsis

- LOS occurs 3 to 90 days after birth.

- Many late neonatal infections are acquired in hospitals as a result of:
  - Low compliance with hand hygiene practices
  - Contaminated equipment and supplies
  - Poor aseptic technique when inserting and accessing medical devices
  - Lack of trained IPC professionals and limited opportunities for staff training
  - Inadequate cleaning and storing of patient care equipment
  - Overcrowding and understaffing
  - Limited resources for isolation or cohorting (grouping babies with the same condition together)

51 studies included:
28 in ICUs,
13 in NICUs
10 hospital-wide
22 from LMICs


Health care-associated (HA) sepsis

- **HA sepsis** among all hospital-treated sepsis: **23.6%** (95% CI 17–31.8%)

- Pooled incidence of **HA sepsis** per 1000 patients
  - 15.4 (95% CI 9.2–25.7) in adults
  - 112.9 cases (95% CI 64.2–191.1%) in neonates

- **56.6%** of all types of HAIs were neonatal HA-sepsis

- Among hospital-born infants, hospital-acquired infections account for an estimated **4% to 56%** of all deaths in the neonatal period, depending on the study and geographical area.

- The highest neonatal sepsis incidence rates are in LMICs, particularly in the African region.
Common types of HAI in NICU/neonatal care areas

- Blood stream infections (BSI)
  - Central line associated
    - Central Venous Catheter (CVC)
    - Peripheral inserted central catheter (PICC)
    - Umbilical catheter
  - Peripheral lines

- Ventilator-associated pneumonia

- Necrotizing enterocolitis

- Surgical site infection (SSI)
Introduction to IPC
IPC as the solution

https://www.who.int/teams/integrated-health-services/infection-prevention-control/core-components
Preventing HAIs and sepsis in health care

Here are two short videos showing the importance of IPC for patient safety and how to prevent sepsis (in community and health-care settings)

- "Health care without avoidable infections - peoples' lives depend on"

  https://www.youtube.com/watch?v=K-2XWtEjfl8

- Prevent sepsis in health care

  https://www.youtube.com/watch?v=GKRQm0i5JdI
The importance of infection prevention and control

- IPC is unique in the field of patient safety and quality of care, as it is universally relevant to every health worker and patient, at every health care interaction.

- Defective IPC causes harm and can kill. Without effective IPC it is impossible to achieve high-quality health-care delivery. In the context of the fight against antimicrobial resistance (AMR) and universal health coverage (UHC) to ensure access to integrated, people-centred health services for all, IPC has a tremendous contribution to make.

- In order to ultimately ensure safe care delivery at the point of care it is essential to establish active IPC programmes at the national level and in health-care facilities. WHO developed evidence-based recommendations on the core components of effective IPC programmes and identified the related minimum requirements.

Visual representation of the IPC Core Components
WHO’s core components for effective IPC programmes

https://www.youtube.com/watch?v=LZapz2L6J1Q&feature=youtu.be%2C
Water, sanitation and hygiene infrastructure

- Water, sanitation and hygiene (WASH) infrastructure is essential for effective infection prevention

- Factors to be assessed:
  - access to running or flowing water from a high-quality source
  - sanitation services
  - toileting facilities, including menstrual hygiene requirements in maternity areas
  - hand hygiene resources like soap and alcohol-based handrub
  - safe health-care waste disposal facilities

- Tools such as WHO WASHFIT can help to assess and monitor WASH infrastructure

Modes of organism transmission: chain of infection (1)

- To reduce the risk of harmful microorganisms, it is important to understand how different HAIs can spread. Microorganisms are found in air, soil and water, and in our bodies. Some microorganisms are helpful; others can be harmful and cause infections.

- The diagram on the next slide represents the chain of infection. For an infection to spread, all steps in the chain must occur. The key to stopping the spread of infection is to break at least one link in the chain.

- In a health-care setting, the chain of infection refers to the numerous opportunities for pathogens to spread among patients, health-care workers and the environment. Effective IPC aims to break the chain.
For an infection to spread, all links must be connected.
Breaking the chain of infection

Using elements of standard precautions can break links to stop transmission of infections.
Standard precautions

- Standard precautions are the basic practices that apply to all patient care, regardless of the patient’s suspected or confirmed infectious status.

- They apply to all settings where care is delivered.

- These practices protect health-care personnel and prevent health workers and the environment transmitting infections to patients.
Breaking the chain of infection and standard precautions

- Standard precautions are used to break the chain of infection and are used in conjunction with transmission-based precautions.

- They are designed to interrupt infection transmission when used during all patient-care activities on all patients, regardless of their suspected or confirmed infectious status.

- Standard precautions aim to protect patients, health-care workers and visitors from contact with infectious agents from recognized and unrecognized sources, and to prevent contamination of the health-care environment.
Care provision that includes standard precautions

- **WHO quality statement**: all women and newborns should receive care that includes standard precautions to prevent hospital-acquired infections

- **Rationale**: hospital-acquired infections increase morbidity and mortality, the cost of care and the duration of stay in hospital. Standard precautions are essential to prevent hospital-acquired infections

- **What this looks like in practice**: standard precautions are the basic IPC practices that apply to all patient-care activities, in any setting where health care is delivered

- Health-care providers should apply standard precautions and other IPC practices when caring for the woman, fetus and newborn

# HAIs – preventive strategies

## Standard precautions
- Optimum hand hygiene
- Appropriate personal protective equipment
- Safe injection practices and immediate disposal of sharps
- Maintaining a clean environment
- Waste management – segregation
- Handling of used linen
- Decontamination (cleaning) and sterilization of medical devices
- Respiratory hygiene
- Cleaning equipment between patient uses
- Occupational health

## Transmission-based precautions
- Precautions according to major routes of transmission:
  - contact precautions
  - droplet precautions
  - airborne precautions

Note: these are always in addition to standard precautions

## Additional precautions
- Antimicrobial stewardship
- Built environment
- Surveillance
- Staffing
- Specific guidelines to prevent the most prevalent health care-associated infections (for example, surgical site infections or central line-associated bloodstream infections), depending on the context and complexity of care
IPC skills

Health-care workers should have the knowledge and ability to perform/apply the following skills when providing patient care to prevent transmission of infections in maternity settings:

- hand hygiene
- risk assessment at the point of care
- appropriate placement of patients (segregation/isolation/cohort to limit transmission)
- appropriate use of personal protective equipment, based on risk assessment
- respiratory hygiene/cough etiquette
- aseptic technique
- sharps and injection safety and prevention of transmission of blood-borne pathogens
- safe handling and/or disposal of contaminated patient-care items and equipment (waste management)
- environmental cleaning
- linen (safe handling, transporting and processing)
- decontamination and sterilization of reusable equipment
The goal of this training package is to integrate IPC standards and practices within the key steps of the care pathway for women and newborns, from the pre-natal to the post-natal period.
All relevant maternal and neonatal clinical settings

- Antenatal clinic
- Antenatal ward
- Emergency setting
- Labour ward
- Theatre

- Post-natal wards:
  - nursery
  - special newborn care unit
  - kangaroo mother care (KMC) units/rooms
  - neonatal intensive care unit (NICU)
A 6-module training package

- **Interactive and practical resources** for trainers and students
- IPC standards and practices to be *integrated within the key steps of the care pathway* for women and newborns, from the pre-natal to the post-natal period
- **Module 1**: introduction to infection prevention and control
- **Module 2**: care of the pregnant woman in the antenatal clinic
- **Module 3**: admission of the pregnant woman, labour and uncomplicated childbirth
- **Module 4**: special interventions during labour
- **Module 5**: caesarean sections
- **Module 6**: care of the small and sick newborns