



# Infection Prevention and Control in Healthcare Facilities Part 1

Prof (Col) Dr RN Basu

# Introduction

- Healthcare Associated Infection <sup>1</sup>

- ❖ Health care-associated infections (HAI) are one of the most common adverse events in care delivery
  - It is a major public health problem with an impact on morbidity, mortality and quality of life.
- ❖ At any one time, up to 7% of patients in developed and 10% in developing countries will acquire at least one HAI.
- ❖ These infections also present a significant economic burden at the societal level.
- ❖ A large percentage of HAI are preventable through effective infection prevention and control (IPC) measures.
- ❖ Definition of HAI<sup>2</sup>
  - “an infection occurring in a patient during the process of care in a hospital or other health-care facility that was not present or incubating at the time of admission.
  - This also includes infections acquired in the hospital but appearing after discharge, and occupational infections among staff of the facility”.

# Introduction

- ❖ HCAs have major impacts on
  - Hospital stay – the stay is prolonged,
  - Disability – it may be long-lasting
  - Resistance of microorganisms to antimicrobial agents – it is increased,
  - High additional financial burden for the health system,
  - High costs for patients and their families, and
  - Mortality - Excess deaths
- ❖ The risk to acquire HCAI is universal
  - Invades every health-care facility and system worldwide,
  - The true burden remains unknown in many nations,
  - It is more so in developing countries.

# Introduction

- History of Infection Control

- ❖ In the United States, the discipline of infection control was established in hospitals in 1950
  - The establishment of this discipline was prompted by a nationwide epidemic of nosocomial *Staphylococcus aureus*.
  - For infection control, a need was felt for nosocomial infection surveillance
- ❖ Much before this, Louis Pasteur had propounded the germ theory of disease
  - The theory was arrived at by observing fermentation process to produce wine from grapes

# Introduction

- ❖ During the nineteenth century the theory was controversial
  - The prevailing notion of causation of disease was “spontaneous generation” or “bad air” or miasma
- ❖ Many consider that the concept of infection control was born with an observation made by an Hungarian physician, Ignaz Semmeleweis (1818-1865)
- ❖ Semmeleweis was working at the Allgemeine Krankenhans teaching hospital at Vienna,
- ❖ There, he observed that :
  - Women delivered by physicians and medical students had 13-18% post-delivery mortality
  - While women delivered by midwife trainees or midwives had only 2% mortality<sup>3</sup>

# Introduction

- ❖ This case control analysis led Semmelweis to consider several hypotheses
- ❖ He observed that:
  - Physicians and medical students were handling corpses during autopsies before delivering women
  - The midwives were not doing this
- ❖ He associated that the higher rates of infection in case of physicians was because of this fact
- ❖ Semmelweis introduced compulsory hand washing policy by physicians and medical students

# Introduction

- ❖ He conducted a controlled trial by using a chloride of lime solution for hand washing by physicians and medical students
  - Mortality fell to 2% - the same level as the midwives
- ❖ Later he started washing medical instruments and the rate further decreased to about 1%
- ❖ Another British physician, John Snow, did a pioneering work
  - In 1854 there was a cholera epidemic in London
  - Applying statistical principles and epidemiologic approaches he found the source of infection
  - And he could eradicate the source (well known story of cook Marie)

# Introduction

- ❖ The theories put forward by these two physicians that the disease could be spread by contaminated hand and faecal-oral transmission<sup>4</sup>
  - These theories were rejected by the then medical fraternity in favour of miasma theory
- ❖ Healthcare Associated Infection (HAI) is one of the main causes of morbidity and mortality
- ❖ Centre for Disease Control (CDC) in USA estimated in the year 2002 that in US hospitals the estimated number of HAIs is 1.7 million

# Introduction

## ❖ Of these HAIs,

- 32% were Urinary Tract Infection (UTI),
- 22% were Surgical Site Infection (SSI),
- 15% were Ventilator Associate Pneumonia (VAP), and
- 14% were Central Line Associated Blood Stream Infection (CLABSI)

# Introduction

- ❖ CDC defined Nosocomial Infection as an infection occurring after 48 hours of hospital admission
  - This 48 hours cut off time is used to differentiate between hospital and community acquired infection
- ❖ What is Infection (Definition)?
  - Invasion by and multiplication of pathogenic microorganisms in a bodily part or tissue, which may produce subsequent tissue injury and progress to overt disease through a variety of cellular or toxic mechanisms.<sup>2</sup>
- ❖ Faced by the increasing incidences of nosocomial infection, the CDC imitated a study between 1970 and 1975 in US hospitals

# Introduction

- ❖ The study was known as Study on the Efficacy of Nosocomial Infection Control
- ❖ The essential components of the programme included:
  - Conducting organised surveillance and control activities
  - Having a trained, effectual infection control physician
  - An infection control nurse per 250 beds
  - A system of reporting infection rates to practicing surgeons
- ❖ Programmes with these components reduced their hospital infection rates by 32%
- ❖ Among hospitals without effective programme , the overall infection rates increased by 18% from 1970 to 1976

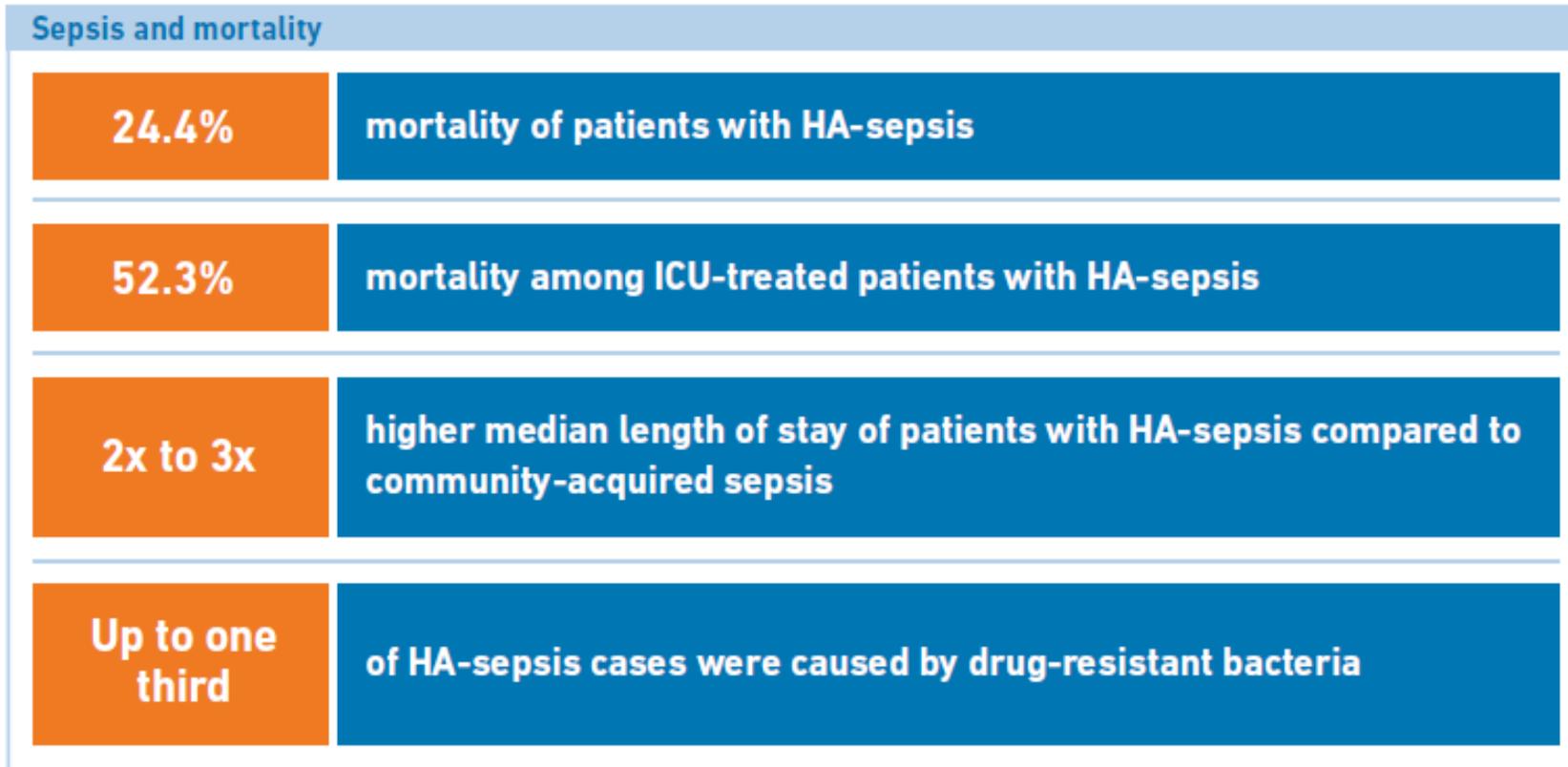
# Burden of Sepsis

- **Global estimates of health care-associated sepsis<sup>5</sup>**
  - ❖ Among all hospital-treated sepsis cases, 23.6% were health care-associated.
  - ❖ Estimates for the incidence of hospital-acquired sepsis treated in ICUs ranged from 13.8 to 175.0 cases per 100 000 adult population per year, depending on the setting;
    - **Mortality was found to be 52.3%.**
  - ❖ In ICU patients, approximately one-half (48.7%) of sepsis cases were acquired in the hospital.

# Burden of Sepsis

- ❖ Patients with hospital-acquired sepsis have
  - Longer lengths of stay
  - High rates of AMR, and
  - At-risk populations (neonates, ICU patients) are the most affected.
- ❖ Over one-half (56.6%) of all HAIs were in neonates;
  - The estimated incidence of hospital-acquired sepsis in neonates was 112.9 cases per 1000 ICU-treated neonates.

# Sepsis and Mortality<sup>5</sup>



HA-sepsis: health care-associated sepsis. ICU: intensive care unit.

Data on sepsis epidemiology are missing from most Low and Middle Income Countries, although they bear the highest burden of sepsis.

# Sepsis and Mortality

- These findings highlight that HA-sepsis is a common complication in patient care
  - ❖ It is difficult to treat once it develops, particularly in ICUs.
- These findings call for energetic and sincere efforts for prevention and control of healthcare associated infection
  - ❖ This Requirement is much more in low and middle income countries where these efforts are fragmented and sporadic

# Challenges to Prevention and Control of HAI

## ❖ The Challenges posed by many HAIs

- The HAIs are posing more and more challenges for their prevention and control
- They include:
  - ◇ Controlling antibiotic resistance
  - ◇ Emergence and spread of multidrug resistant organisms
  - ◇ Early detection and control of new emerging organisms, e.g., SARS
  - ◇ Informing public constantly with updated infection prevention and control
  - ◇ Implementing comprehensive surveillance programme with limited resources

# Challenges to Prevention and Control of HAI

- ◇ Safeguarding risks of infectious outcomes for more and more complex medical procedures
- ◇ Dealing with highly immunocompromised patients subjected to complex procedures such as gene therapy, xenotransplantation
- ◇ Maintaining a safe work environment for protecting staff from HAIs
- To meet these challenges a well planned HAI prevention and Control programme and implementing them is necessary
- Rapid identification, investigation and control of outbreak of HAI in a healthcare setting is required
- Creation of awareness about the reality of HAIs along with behavioural changes of healthcare workers are necessary



# Prevention And Control of Healthcare Infection

# Infection Control Programme – Structure and Function

- **HAI Programme**

- ❖ Each institution distinguishes themselves by their unique characteristics
- ❖ Each has their specific needs
- ❖ These aspects need to be considered when developing or reorganising an hospital infection control programme
- ❖ The uniqueness of the hospitals are characterised by their size, case-mix, and types of care provided
- ❖ However, the core functions are similar. They include:

# Infection Control Programme – Structure and Function

- ❖ To obtain and manage critical data and information
  - The method for this is usually the surveillance for infection
- ❖ To develop and recommend duties, responsibilities, policies and procedures
- ❖ To intervene directly to prevent infections
- ❖ To educate and train Health Care Workers (HCW), patients and non-medical care givers

# Infection Control Team

- The team for infection control (IC)<sup>7</sup>
  - ❖ Most often the IC team consists of:
    - Infection Control Practitioner (ICP)
    - The Chair of the IC committee
    - Healthcare epidemiologist
    - Person responsible for employee health or administration
  - ❖ The team is responsible for carrying out all aspects of the IC programme
  - ❖ A person will be designated as the in charge and responsible for the programme

# Infection Control Committee

- Infection Control Committee (ICC)

- ❖ The committee functions as the central decision making and policy-making body for IC
- ❖ The ICC chairperson reports to the administration
- ❖ The ICC (Functions)
  - Acts as the advocate for prevention and control of infection in the healthcare facility
  - Formulates and monitors patient care policies
  - Educates staff, and
  - Provides political support that empowers the team

# Infection Control Committee

- ❖ The ICC is a multidisciplinary committee
  - Representatives from most of the departments are its member
  - For implementation of ICC recommendations necessitates that the administration must be represented
  - Many recommendations of the ICC transgress the boundaries of many departments
  - Therefore, the multidisciplinary composition of the ICC is essential for its effectiveness
- ❖ The ICC meets preferably monthly or quarterly

# Infection Control Team and Committee

- ❖ The composition of the infection Control team and the ICC needs to be tailored to the local need and circumstances
- ❖ In India, as yet, there is no concept of hospital epidemiologist, neither there is any such training programme specifically for hospital epidemiology is available
- ❖ M of H & FW, Government of India Guidelines for infection control has proposed the ICC structure as under:<sup>8</sup>
  - Chairperson: Head of the Institute
  - Member Secretary Infection Control Officer
  - Me

# Infection Control Team and Committee

- **Members:**

- ◇ Representative from management/administration:
- ◇ Dean/Director of hospital
- ◇ Nursing Services
- ◇ Medical services
- ◇ Operations
- ◇ Representation from relevant medical and surgical disciplines
- ◇ Representation from support services, operation theatre, CSSD, pharmacology/pharmacy, stores/materials department
- ◇ Infection Control Nurse (ICN)

# Infection Control Team and Committee

## ❖ Responsibilities of ICC

- Establish the IPC programme in the Healthcare Facility (HCF)

## ❖ Roles

- Develop an action plan for strengthening IPC measures for the facility and individual units within the facility with priorities based on the risk matrix for the unit and appropriate review
- Constitute and Infection Control Team (ICT)
- Review and revise annually infection control guidelines and key components of IPC practices under the programme
  - ◇ The key components are :
    - \* Standard precautions, and
    - \* Hand hygiene

# Infection Control Team and Committee

- Organise training programmes on recommendations of guidelines and IPC practices for staff and other Health Care Workers (HCW)
- Develop an antibiotic Policy and Antibiotic Stewardship Programme
- Conduct surveillance of Anti Microbial Resistance (AMR) and Hospital Associated Infection (HAI)
- ❖ Analyse the surveillance data for HAI
  - This should include:
    - ◇ Identification of Common Sources
    - ◇ Routes of entry of infectious microorganisms
    - ◇ Identification of at risk patients

# Infection Control Team and Committee

- Monitoring the trends of HAI and compare the rates of infections within the HCF and if feasible with other similar facilities
- Monitor and assess regularly compliance with:
  - ◇ Hand hygiene
  - ◇ Cleaning and decontamination
  - ◇ Disinfection and sterilisation
- These should be done through audits and quality control of IPC activities
- Investigation of outbreak investigation
- Evaluation of effectiveness of IPC interventions

# Infection Control Team and Committee

- Participate in the selection of equipment and material and provide advice and focus on IPC measures
- Help control environmental risks for infection by liaising with appropriate departments
  - ◇ Example:
    - \* Housekeeping, CSSD, Provision of safe water, pharmacy, laundry, and kitchen services
- Establish link with related health programmes in the HCF, such as,
  - ◇ Injection safety programme, TB Control Programme and control of HIV/AIDS
- To adopt a multimodal approach for implementation of IPC (next 5 slides)

# Infection Control Team and Committee

## ❖ Multimodal Approach<sup>9</sup>

- A multimodal strategy consists of several of elements or components
  - ◇ The components number from 3 to 5
- These are implemented in an integrated way with the aim of improving an outcome and changing behaviour.

## ❖ The 5 most common components include:

### 1. System change

- ◇ that is, availability of the appropriate infrastructure and supplies to enable IPC good practices

# Infection Control Team and Committee

2. education and training of health care workers and key players (for example, managers);
3. monitoring infrastructures, practices, processes, outcomes and providing data feedback;
4. reminders in the workplace/communications; and
5. culture change with the establishment or strengthening of a safety climate

# Infection Control Team and Committee

## ❖ Bundles:

- A bundle is an implementation tool aiming to improve the care process and patient outcomes in a structured manner.
- Successful multimodal strategies include the involvement of champions or role models in several cases,
  - ❖ The champions are individuals who actively promote the components and
    - their associated evidence-based practices within an institution.

# Infection Control Team and Committee

- The practices

- ◇ Comprise a small, straightforward set of evidence-based functions (generally 3 to 5)
- ◇ Implementation in this manner have been proven to improve patient outcomes when performed collectively and reliably.

- These champions have four main functions:

1. protecting those involved in implementation from organizational rules and systems that may act as barriers;
2. building organizational support for new practices;
3. facilitating the use of organizational resources for implementation; and
4. facilitating the growth of organizational coalitions in support of implementation

# Infection Control Team and Committee

- ❖ It has been noted that
  - patient involvement could be considered as a part of establishing or strengthening the safety climate in the context of multimodal strategies.
- ❖ However, this approach requires local adaptation and careful consideration of the
  - cultural specificities,
  - social dynamics,
  - level of education, and
  - literacy.

# Infection Control Team and Committee

- ❖ The other responsibilities of the ICC include:
  - To introduce
    - ◇ system change (equipment/infrastructure)
    - ◇ Education
    - ◇ Monitoring
    - ◇ Communication, and
    - ◇ Culture changes through champions/leaders
    - ◇ Use of tools such as care bundles and checklists
  - To prepare an annual IPC plan with a detailed budget

# Infection Control Team and Committee

- To organise periodic (monthly/quarterly) meetings of ICC
  - ◇ The minutes of the meeting to include clear action points with allocation of responsibilities
- To appoint an IPC team
  - ◇ The team will be responsible for day-to-day activities
  - ◇ The IPC team shall have the following members:
    - \* Infection Control Officer (ICO)
      - The ICO should be from among clinical microbiologist/clinical epidemiologist/infectious disease physician
      - The ICO will be the team leader
    - \* Infection Control Nurse (ICN) – 1 ICN per 250 beds
    - \* One link nurse from every unit

# Roles and Responsibilities

## ❖ Infection Control Officer (ICO)

- The ICO is usually a clinical microbiologist or a clinical epidemiologist or an infectious disease physician
  - ◇ Any other physician trained in IPC may also be an ICO
- The ICO is the member secretary of the ICC and also the leader of the IPC team
- The ICO is responsible for the day-to-day activity of the IPC programme
- The ICO should have direct access to the head of the Health care facility

# Roles and Responsibilities

## ❖ Responsibilities of the ICO

- Develop policies, guidelines and standard operating procedures (SOPs) on IPC in collaboration with other members of the ICC and the IPC team
- Initiate and maintain activities for HAI surveillance and analyse surveillance data
- Provide trends of HAI to different patient care units
- Advise staff on all aspects of IPC and maintain a safe environment for patients and staff
- Liaise with microbiology department for analysis of antibiograms
- Monitor rational use of antimicrobials

# Roles and Responsibilities

- Oversee sterilisation and disinfection
- Investigate an outbreak, and advise on control measures and isolation procedures
- Coordinate microbiological surveillance as decided by the ICC
  - ◇ Testing of drinking water, dialysis water, biological monitoring of sterilisation and investigation of sources and modes of transmission in outbreak situations
- Organize and conduct regular IPC educational and training activities for HCWs
- Audit infection control procedures, worker safety and antimicrobial usage
- Organize regular ICC meeting

# Roles and Responsibilities

## ❖ Infection Control Nurse

- The SENIC study in 1970s demonstrated that surveillance of infection by trained personnel can substantially reduce HAI
- The staffing level recommended one Infection Control Nurse per 250 beds along with a hospital epidemiologist
- The recommendations were formulated about 50 years ago
- These recommendations were sufficient at that time when the hospital systems were simple
- Presently, a large number of invasive procedures are performed, there is emergence of antimicrobial resistance, shorter length of stay and more acutely ill patients are admitted

# Roles and Responsibilities

- Therefor the SENIC recommendations are clearly obsolete now at least for multidisciplinary tertiary care hospitals
- Many studies now recommend one IPC practitioner for 100 beds<sup>10,11</sup>
- The designation of infection control practitioners in US has now been changed to Infection Preventionist

## ❖ ICN Indian Guidelines

- S/he should be a full time nursing staff trained in IPC
- The duties of ICNs are primarily to ensure that HCWs are following IPC practices
- S/he is a member of the IPC team

# Roles and Responsibilities

- S/he is responsible for liaising between microbiology laboratory, wards, ICUs/OTs, etc to identify problems and find solutions and implement them
- S/he implements through the specially designated link nurses in each ward, ICU,OT or other units of the HCF

## ❖ Responsibilities

- Collects from the microbiology laboratory all culture positive reports
- Visits wards daily and tracks all infected cases and maintain surveillance data
- Monitor implementation of IPC practices and SOPs, including hand hygiene, preventive bundles, sterilization and disinfection and antimicrobial stewardship

# Roles and Responsibilities

- Impart education and training to HCWs under the supervision of infection control officer
- Ensure compliance with hospital's biomedical waste (BMW) management policy
- Ensure data of sharps/needle-stick injuries and post-exposure prophylaxis
- Initiate and facilitate immunization for hepatitis virus as per policy of HCF
- Vaccination of staff in high risk areas
- Facilitate provision of first aid and appropriate consultation in case of suspected exposure of any hospital worker

# Roles and Responsibilities

## ❖ Link Nurse

- A nurse in every patient care area is designated as Infection Control Liaison or Link Nurse.
- S/he is a useful additional help to the ICN to implement infection control practices in the ward
- They assist in surveillance of HAI by informing the ICN about suspected cases
- The link nurse is in addition to and not for replacement of the ICN
- They work only in the patient care areas

# Roles and Responsibilities

## ❖ Responsibilities of the link nurse

- Implement IPC practices in the ward and assist in HAI surveillance by informing the ICN about suspected cases
- Increase awareness about infection control at the unit level
- Implement IPC practice in the ward
- Receive training in basic infection control and be in regular touch with the ICN
- Maintain primary role as a ward nurse in the unit

# Roles and Responsibilities

## ❖ Effectiveness of Link Nurse Programme

- The clinical link nurse programme was introduced in 1980's
- Many studies were conducted to identify their profile, role, effectiveness and barriers to their work
- Earlier studies have shown positive results, but most of these studies had methodological issues
- A recent scoping study conducted concluded that there is no robust evidence to support the effectiveness of the Link Nurses in preventing and controlling HAI
- In some healthcare institutions though the programme had shown positive results but because of the above issues the programme has issues of transferability and generalizability<sup>12</sup>

# Roles and Responsibilities

## ❖ Microbiologist and microbiology department

- Plays a key role in the IPC programme
- Have responsibilities of identification and characterization for the organism causing the infection
- Provides guidance for appropriate antimicrobial treatment with the aim of preventing antimicrobial resistance and improving patient outcome
- Develops guidelines for clinical departments for appropriate selection, collection, handling and transport of specimens
- Ensure safe laboratory practices to prevent infections among laboratory staff

# Roles and Responsibilities

- Communicating promptly to ICC about suspected cases of HAI
- Analysing and reporting the antibiogram of relevant pathogens in different units and in different specimens
- As per ICC policy, to carryout microbiological testing of drinking water, biological testing of sterilizers and also testing of preserved food samples in case of outbreaks of food poisoning
- To carry out environmental sampling of air, water, and environmental surfaces only in certain circumstances and not as a matter of routine<sup>13</sup>
- There are only four recommended circumstances as below:
  - ◇ To support an investigation of an outbreak of disease or infections when environmental reservoirs or fomites are implicated epidemiologically in disease transmission

# Roles and Responsibilities

- ◇ Research – well designed and controlled experimental methods and approaches can provide new information about the spread of health-care associated diseases
- ◇ To monitor a potentially hazardous environmental condition, confirm the presence of a hazardous chemical or biological agent, and validate the successful abatement of the hazard
- ◇ For quality assurance to evaluate the effects of a change in infection-control practice or to ensure that equipment or systems perform according to specifications and expected outcome
- **Storage of isolates of epidemiological importance**
  - ◇ In collaboration with the IPC programme, the laboratory should develop a system of storing epidemiologically important strains of HAI pathogens

# Roles and Responsibilities

## ❖ Physicians

- They provide a leadership role in infection control
- Responsibilities:
  - ◇ Provide quality patient care to minimize infection as per ICC guidelines
  - ◇ Serve in ICC and Support the IPC team
  - ◇ Ensure collection of appropriate microbiological sampling in suspected HAI
  - ◇ Notify infected/HAI cases to the IPC team
  - ◇ Comply with antibiotic policy and antibiotic stewardship programme
  - ◇ Advise patients, visitors and staff on measures to prevent the transmission of infection

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# End of Part 1

(To continue)