



सत्यमेव जयते

Ministry of Health & Family Welfare
Government of India

Fundamentals of HAIs

Training Session – II



National Center for Disease Control, New Delhi

Outline

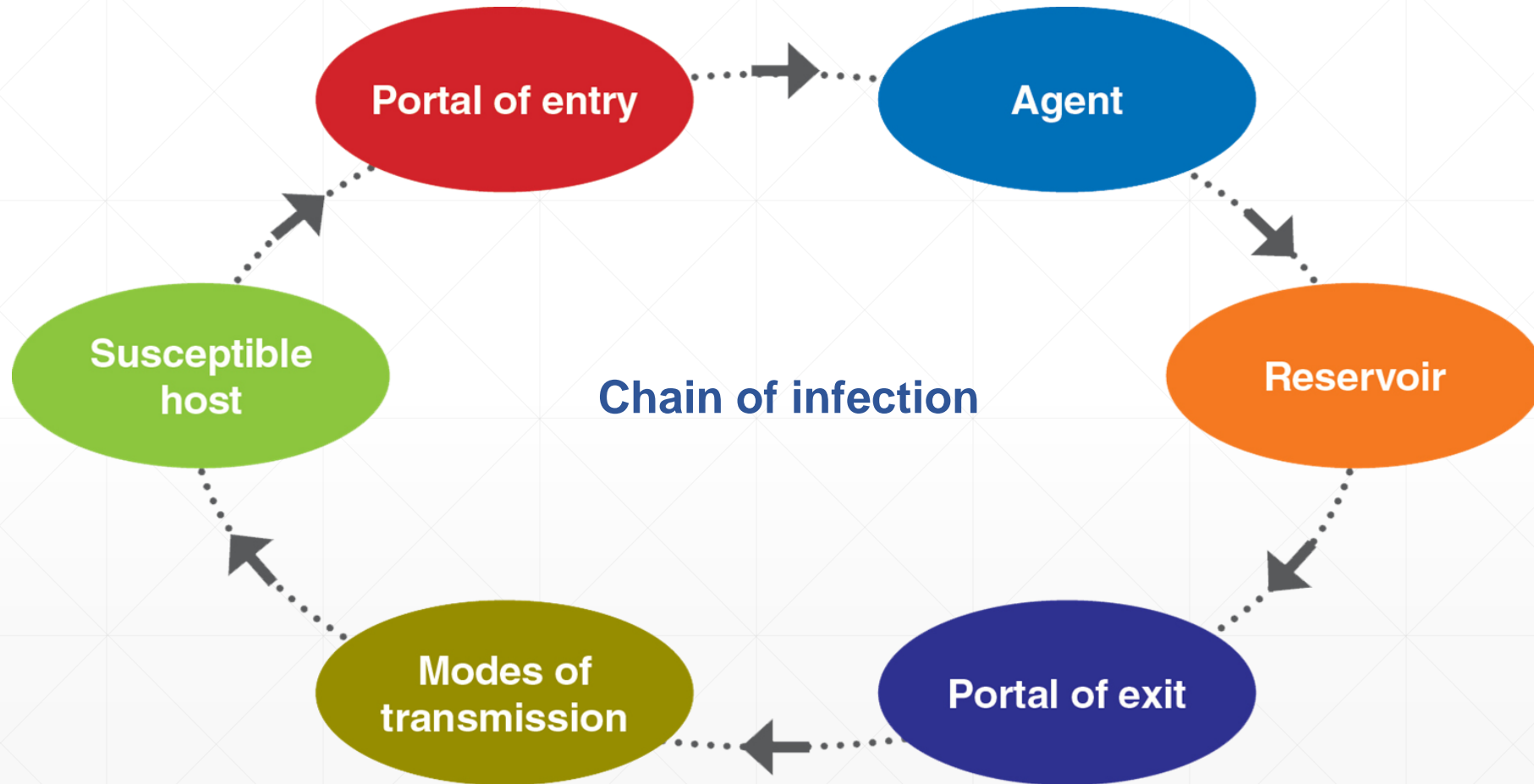
- Definition of HAIs and chain of infection
 - Causes and spread of infection
 - Colonization and infection
 - Types of HAIs
 - Bloodstream infections
 - Surgical-site infection (SSI)
 - Urinary tract infection (UTI)
 - Pneumonia
 - Gastrointestinal infections
 - Modes of transmission
 - Prevention of HAIs – multimodal approach
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Definition of HAIs

- Infection neither present nor incubating at the time of admission of a patient to an HCF
- Majority of HAIs manifest after two days of admission
- HAIs should be identified on the basis of both clinical as well as laboratory criteria
- Infection acquired in the hospital but not evident until after discharge is also an HAI
- Infection in a neonate born in the HCF may also be considered an HAI

It is important to know the mode of transmission of disease to control the spread of infection in HCFs

Causes and spread of infection



Agent

- Infective agent: microorganism capable of causing the infection
 - Include bacteria, viruses, fungi and parasites
- Source of organisms can be the patient's own flora (endogenous infection) or exogenous through the hands of staff or contaminated instruments
- Ability of a microorganism to cause infection depends upon
 - Its ability to invade
 - Proficiency in overcoming the host defense
 - Its pathogenicity
 - Degree of virulence
 - Infectious dose

Critical aspects- agent's capability to survive in the environment and its resistance to antimicrobials

Reservoir

- Source of the infectious agent, where it lives and multiplies
 - Animate (humans, animals)
 - Inanimate (the environment, contaminated food and water)
- Human reservoirs can be
 - Symptomatic
 - Asymptomatic
 - Carriers (presence of organisms for varying periods without signs/symptoms)
- Asymptomatic individuals and carriers are more likely to transmit the disease as precautions may not be taken

**Standard precautions should be taken while dealing with all patients,
even when the diagnosis is not known**

Portal of Exit

- Portals of exit are necessary for the organism to exit the body of one person and be transmitted to another person
- Can be excretions/secretions of
 - Respiratory tract
 - Gastrointestinal tract
 - Genital tract
 - Blood or any other body fluid

Portal of entry

Site of entry of the organism into the body through

- Mucous membranes
- Conjunctiva
- Respiratory tract
- Oral and gastrointestinal tract
- Genitals
- Urinary tract
- Breach in skin

Susceptible host

- A person susceptible to the infection or lacking resistance to the infective organism
- Host factors that influence susceptibility are
 - **Age** – individuals at extremes of age are more susceptible (neonates/old people)
 - **Comorbidities** – diabetes, cancer, etc.
 - **Immunization status** – vaccine preventable diseases
 - **Medications** – immunosuppressive and chemotherapeutic agents
 - **Pregnancy**
 - **Health literacy**
 - **Nutritional status**
 - **Interventions and devices** – surgery, dialysis, intubation, catheterization, etc.

Colonization, Infection and Disease

Colonization is the persistent survival of microorganisms on the surface of the human body; without apparent detriment to the host

Infection involves the growth and multiplication of microorganisms that result in damage to the host; the extent and severity of the damage depends on many factors: microorganism's ability to cause disease, site of infection and general health of the individual infected

Disease results when infection produces notable changes in human physiology associated with damage or loss of function to one or more of the body's organ systems

Colonization

- Colonization with one organism may prevent the establishment of another more virulent organism at that body site
- Colonizing organisms can be a part of the normal flora for a particular body site but may cause infection at another body site
e.g. *E. coli* is a normal flora of the intestinal tract but it can cause infection in the urinary tract
- Removal of the normal flora can cause other organisms to colonize a body site, e.g. antibiotics kill organisms such as drug-sensitive *E. coli* and allow drug-resistant organisms to colonize
- Colonization can precede infection if the host defenses are altered or impaired in some way; this can happen if the patient is on
 - Immunosuppressive drugs
 - Has undergone surgery or interventions (catheterization and intubation)

Common Healthcare associated infections (HAIs)

- Bloodstream infection
- Surgical-site infection
- Urinary tract infection
- Pneumonia
- Gastrointestinal infection

HAI – Bloodstream infections

- Serious infections associated with high mortality (>50% for some microorganisms)
- Often associated with intravascular catheters
- Could be due to contaminated infusions
- Can occur at the entry site of the catheter or along the subcutaneous tract of the catheter line – tunnel infection
- Both central and peripheral lines can be a source of infection

Surgical-site Infection (SSI)

- Infection at the site of surgery (earlier called wound infection)
- Main risk factor is the extent of contamination during the procedure and is largely dependent on
 - Site and type of surgery
 - Surgical technique
 - Duration of surgery
 - Contaminated instruments
 - Patient's general condition
 - Post-surgical wound care

HAI –Pneumonia

- Lower respiratory tract infection that appears during or after hospitalization of a patient who was not incubating the infection on admission
- Ventilator-associated pneumonia (VAP) – most important infection in patients on ventilators – with high case fatality rate, often associated with serious comorbidities
- Acquired by
 - Inhalation of respiratory droplets or aerosols
 - Suction procedures, contaminated devices
 - Aspiration of colonized oro-pharyngeal and gastric secretions

HAI -Urinary tract infection (UTI)

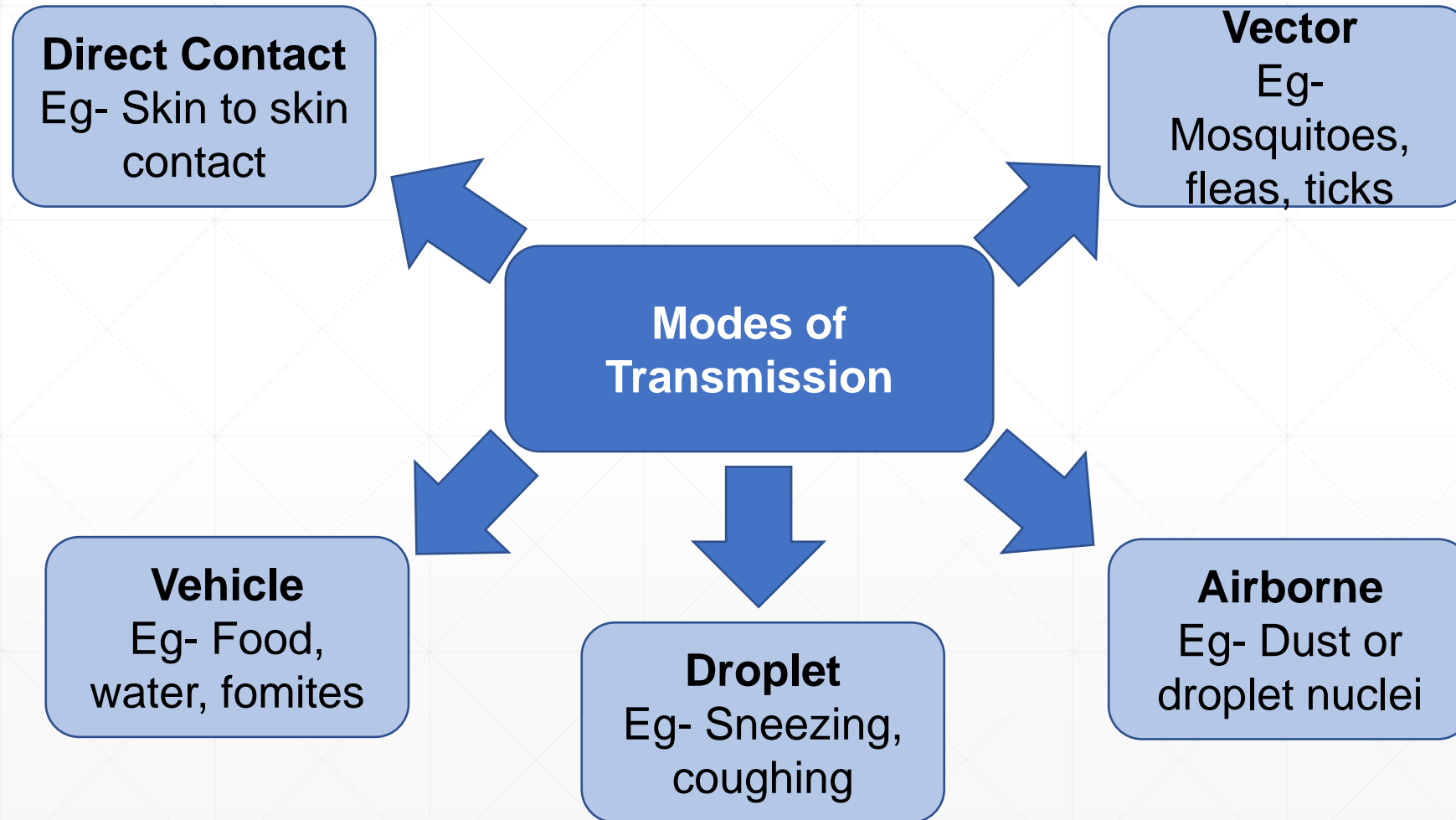
- Majority of UTIs associated with an indwelling urinary catheter
- Indwelling catheter may cause bacteriuria or mild infection or even result in severe infections (pyelonephritis and septicemia)
- Contamination of the drainage bag and retrograde flow of contaminated urine into the bladder can also cause UTI

HAI -Gastrointestinal infections

- GI infections are common in paediatric and geriatric units
- Transmitted through faeco-oral route or contaminated enteral feed
- May be introduced in the hospital through an infected patient or food-handler, such infections can spread rapidly through a contaminated environment, toilets and inadequate hand washing
- May be acquired from contaminated food or water, infected patients or staff, contact with environment contaminated with organisms or instruments entering the alimentary tract such as endoscopes

Diarrhoea may also occur due to non-infectious causes such as medications or certain GI surgeries

Modes of transmission



Prevention of HAIs

- Break the chain of infection e.g. introducing a barrier between susceptible host and infecting organism
- Compliance with recommended IPC guidelines
 - Hand hygiene
 - Appropriate use of personal protective equipment (PPE)
 - Strict implementation of aseptic techniques
 - Use appropriate practices for cleaning and decontamination of soiled instruments, followed by high-level disinfection or sterilization

Prevention of HAIs

- Appropriate disposal of biomedical waste (BMW)
- Appropriate cleaning and disinfection of the environment
- Improving safety in operating rooms and other high-risk areas
- Maintaining a safe working environment and safe work practices

Multimodal strategy to prevent HAI

1. Build it (system change)

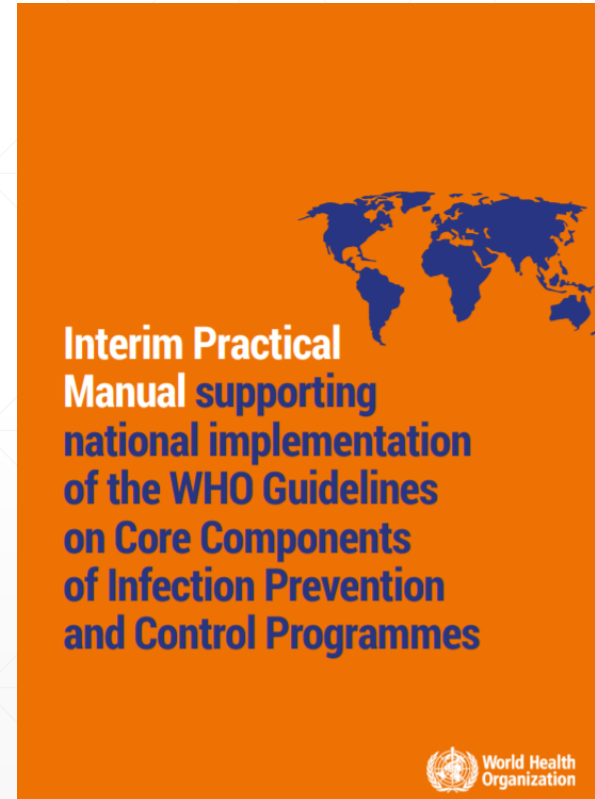


What infrastructures, equipment, supplies and other resources (including human) are required to implement the intervention?

Does the physical environment influence health worker behaviour? How can ergonomics and human factors approaches facilitate adoption of the intervention?

Are certain types of health workers needed to implement the intervention?

Practical example: when implementing hand hygiene interventions, ease of access to handrubs at the point of care and the availability of WASH infrastructures (including water and soap) are important considerations. Are these available, affordable and easily accessible in the workplace? If not, action is needed.



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2. Teach it

(training & education)



Who needs to be trained? What type of training should be used to ensure that the intervention will be implemented in line with evidence-based policies and how frequently?

Does the facility have trainers, training aids, and the necessary equipment?

Practical example: when implementing injection safety interventions, timely training of those responsible for administering safe injections, including carers and community workers, are important considerations, as well as adequate disposal methods.

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3. Check it (monitoring & feedback)



How can you identify the gaps in IPC practices or other indicators in your setting to allow you to prioritize your intervention?

How can you be sure that the intervention is being implemented correctly and safely, including at the bedside? For example, are there methods in place to observe or track practices?

How and when will feedback be given to the target audience and managers? How can patients also be informed?

Practical example: when implementing surgical site infection interventions, the use of key tools are important considerations, such as surveillance data collection forms and the WHO checklist (adapted to local conditions).

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4. Sell it

(reminders & communications)



How are you promoting an intervention to ensure that there are cues to action at the point of care and messages are reinforced to health workers and patients?

Do you have capacity/funding to develop promotional messages and materials?

Practical example: when implementing interventions to reduce catheter-associated bloodstream infection, the use of visual cues to action, promotional/reinforcing messages, and planning for periodic campaigns are important considerations.

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5. Live it
(culture change)

Is there demonstrable support for the intervention at every level of the health system? For example, do senior managers provide funding for equipment and other resources? Are they willing to be champions and role models for IPC improvement? Are teams involved in co-developing or adapting the intervention? Are they empowered and do they feel ownership and the need for accountability?

Practical example: when implementing hand hygiene interventions, the way that a health facility approaches this as part of safety and quality improvement and the value placed on hand hygiene improvement as part of the clinical workflow are important considerations.

Summary

- Chain of infection
- Infection vs disease
- Modes of transmission
- Common HAIs
- Prevention of HAIs by breaking the chain of infection



Questions?