

Water Hygiene



Learning objectives

1. Describe the role of infection prevention and control in water hygiene.
2. Identify different methods to make water safe for health care use.
3. Explain the importance of the safe water in infection prevention and control.

Time involved

- 40 minutes



Key Points

- Protect water sources
- Piped water quality should be regularly verified
- Analyses at point of use should be regularly performed
- Potable water can be rendered microbiologically safe by boiling, filtering, or chlorination
- In health care settings, additional water treatment may be necessary
 - e.g., deionisation
- Prevent infectious risks from bacterial contamination and formation of biofilms



Background

- Minimum daily water requirement - 7.5 litres per person per day
- Diseases may be caused by ingestion, inhalation of droplets from, or contact with, drinking water
- Poor water quality may cause the spread of
 - Cholera
 - Typhoid
 - Dysentery
 - Hepatitis
 - Giardiasis
 - Guinea worm



Illness Related to Water

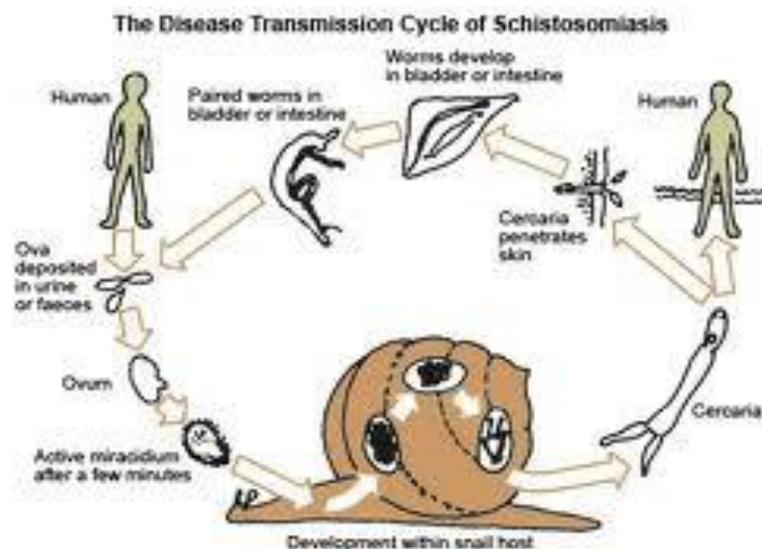
- Water-borne
 - Diseases due to microorganisms in water
 - Transmission caused by
 - Ingestion of contaminated water
 - diarrhoeal diseases, cholera, typhoid, hepatitis A, giardiasis, amoebiasis
 - Inhalation of contaminated droplets or aerosols
 - legionellosis
 - Contact with contaminated water
 - skin diseases, otitis externa

Illness Related to Water

- Water-washed
 - Diseases caused by the lack of water
 - Often associated with poor hygiene
 - Diarrhoeal diseases, eye infections and skin infection

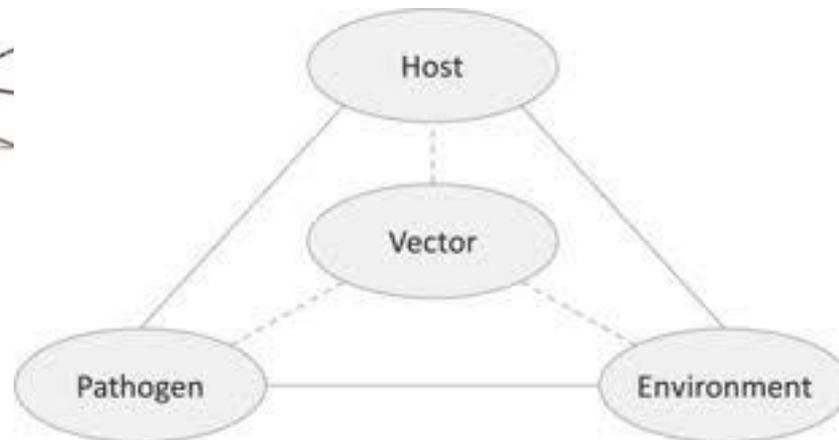
Illness Related to Water

- Water-based
 - Diseases caused by parasites that need an intermediate aquatic host for their life cycle
 - Schistosomiasis (bilharzia)



Illness Related to Water

- Water-related vector
 - Diseases transmitted by water-related insect vectors
 - Malaria, dengue, and yellow fever

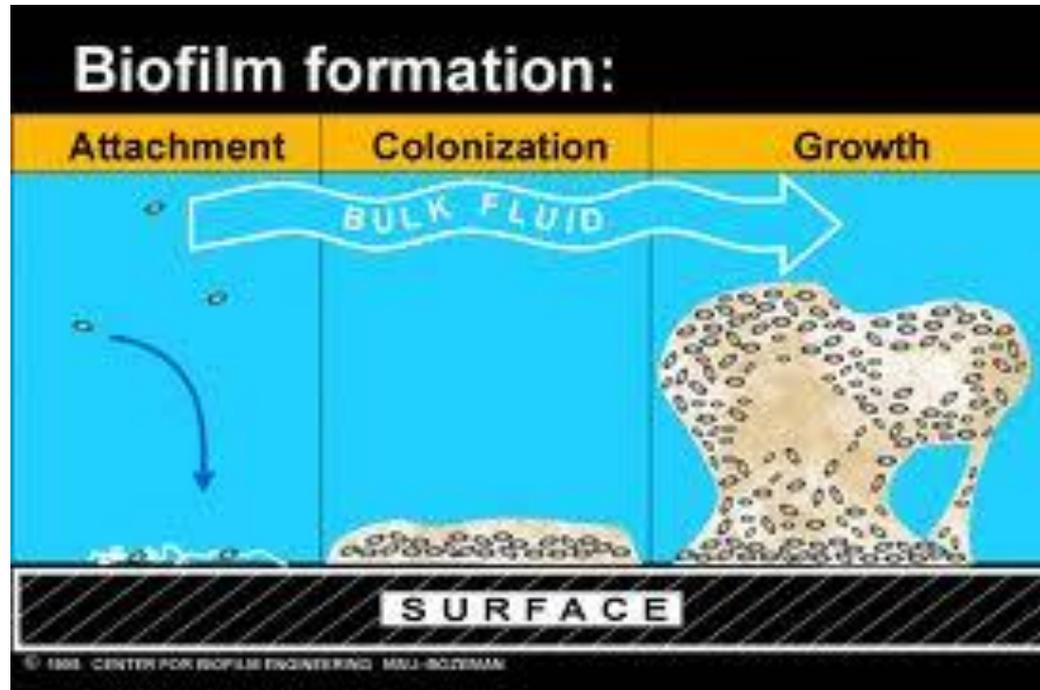


Microorganisms which may multiply in water supplies	Microorganisms which may persist in water supplies between 1 week and 1 month	Microorganisms which may persist in water supplies for more than 1 month
Bacteria		
<i>Legionella spp.</i>	<i>Campylobacter jejuni</i> , <i>Campylobacter coli</i>	<i>Yersinia enterocolitica</i>
Non tuberculous mycobacteria	Pathogenic <i>E. coli</i> , enterohaemorrhagic <i>E. coli</i>	
<i>Pseudomonas aeruginosa</i>	<i>Salmonella typhi</i>	
Viruses		
		Adenoviruses
		Enteroviruses
		Hepatitis A virus
		Noroviruses
		Rotaviruses
Protozoa		
<i>Acanthamoeba spp.</i>	<i>Entamoeba histolytica</i>	<i>Cryptosporidium parvum</i>
<i>Naegleria fowleri</i>	<i>Giardia intestinalis</i>	<i>Cyclospora cayetanensis</i>
		<i>Toxoplasma gondii</i>

Health Care Water

- Facilities have complex plumbing and ambient-temperature water treatment systems
 - Can be colonised by microorganisms
- Bacterial growth promoted by stagnation of water
- *Legionella* spp. mainly colonise warm water distribution systems
- Drains harbour microorganisms like *P. aeruginosa*
 - If the water-jet from a sink impinges directly into the outlet, bacteria-containing droplets can be aerosolised and pose risks

Biofilm



Health Care Uses of Water

- Consumption
- Hygiene
- Sterilisation and disinfection
- Dialysis and dental units
- Pharmacy



Making water safe

- Boiling
- Chemicals
- Ozone
- Filtration

Boiling

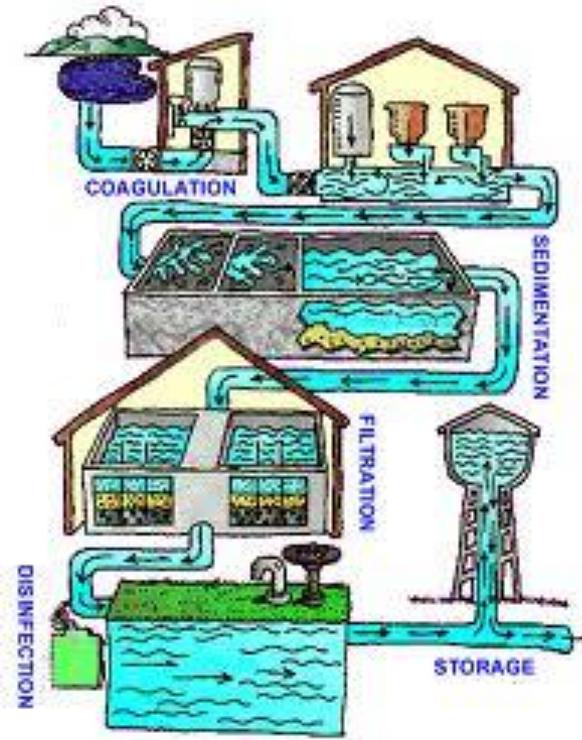
- Raise the temperature so that a “rolling boil” is achieved
 - Large bubbles continuously coming to the surface of the water
 - Maintain for 1 minute before removing water from the heat source
 - Allow it to cool naturally in the same container
 - Water boils at lower temperatures as altitude increases
 - One minute of extra boiling time should be added for every 1000 m above sea level
- Protect water from post-treatment contamination during storage

Chlorination

- Add 2 drops of liquid household chlorine (5-6%) bleach for each litre of clear water and 4 drops for each litre of cloudy water
- Stir well and let stand at least 30 minutes before use
- Bleach solutions are unstable in sunlight and at warm temperatures
 - Store in brown or green glass bottles or opaque plastic bottles in a cool, dark place

Water from non-piped supplies

- Necessitate the use of drinking water treatment plants
- Plants combine coagulation and flocculation, filtration, and disinfection

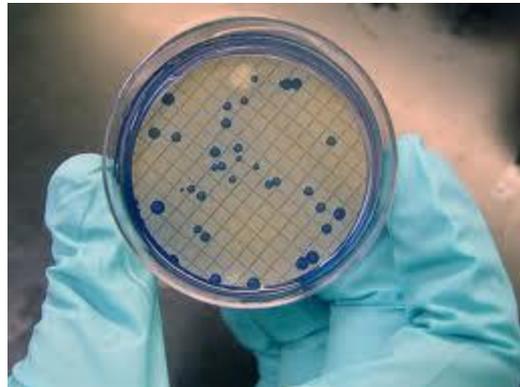


Filtration

- Household filters
 - Candle and stone filters
- Candle filter
 - Allow water to filter slowly through a porous ceramic material
 - Large parasites (ova, cysts) and most bacteria retained by the outer layer of the filter
 - Periodically clean by gently scrubbing it under clean, running water
- Stone filters
 - Carved from porous local stone
 - Disadvantage - difficult to clean

Evaluation

- An evaluation of the outcome of water treatment should be regularly performed by plate count cultures and tests for total coliform bacteria.
- There should be less than 500 cfu (colony forming units) per ml and no coliform bacteria in 100 ml



Storage tanks

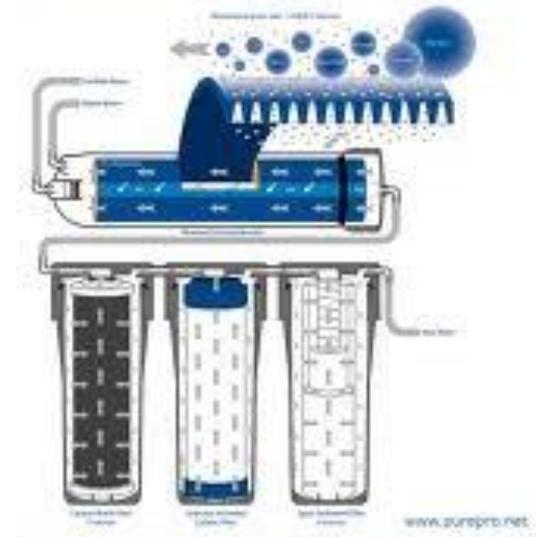
- Should be contaminant free and watertight
- Cover to prevent contamination
- Placed in shadow and be well insulated
- Storage tanks for cold water should maintain temperatures at 20°C or lower; for hot water maintain above 60°C
- Construction of storage tanks should allow for adequate draining
- Inspect, empty, clean, and disinfect at regular intervals due to risk for formation of biofilms inside the tank

Plumbing System

- Construction should avoid stagnation of piped water
- Terminal lines should be as short as possible
- Water pipes which are not used should be removed
- Aerators should be decalcified if necessary
- The temperature of both hot and cold water should be monitored at the faucets

Dialysis water deionisation - 1

- Deionised water is produced by reverse osmosis
- Water must contain less than 0.5 ppm free chlorine or less than 0.1 ppm chloramine
- If necessary, remove chlorine or chloramines with filters containing granular activated carbon
 - Two carbon filters in series
 - Filters should be replaced rather than regenerated



Dialysis water deionisation - 2

- Perform monthly bacteriologic assays of water immediately after the reverse osmosis process
- If bacteria not removed or destroyed by the deionisation unit
 - Use a submicron or endotoxin ultrafilter downstream of the deionisation unit
- If a storage tank is used in the water treatment system, bacteria levels should be evaluated directly from this tank

Prevention

- Water treatment equipment and storage tanks should be regularly cleaned and disinfected
- Newly constructed systems should be filled with water just immediately before bringing them into service in order to prevent biofilm formation
 - Disinfect and rinse prior to use
- A flow-through water treatment system maintained at all times
- Water treatment components which can be thermally or chemically sanitised should be selected



Water Analysis

- Coordinate microbiological and chemical analyses of drinking water, deionised water, bathing water, etc.
- Frequency of analyses assessed according to the results
- May be a need to evaluate for *Legionella* spp. in the hot water system

Legionella - 1

- Establish a surveillance method for detecting healthcare-associated Legionnaires' disease
- One way - perform appropriate laboratory tests for all healthcare-associated pneumonia
- If evidence of healthcare-associated Legionnaire's disease
 - Conduct an environmental assessment to determine the source of *Legionella* spp

Legionella - 2

- If disinfection of the hot water distribution system is necessary, perform high-temperature decontamination or chlorination
 - High-temperature decontamination
 - Flush each outlet for ≥ 5 minutes with water at $71^{\circ}\text{C} - 77^{\circ}\text{C}$
 - Chlorination
 - Add enough chlorine to achieve a free chlorine residual of ≥ 2 mg/l (≥ 2 ppm)
 - preferable sodium hypochlorite - bleach
 - Flush each outlet until chlorine odour is detected
 - Maintain elevated chlorine concentration in the system for ≥ 2 but ≤ 24 hours

Infection Prevention and Control Team (ICT) - 1

- Monitor patients for water-associated diseases
 - such as diarrhoeal illness or Legionnaire's disease
- Assess risks of the plumbing system and of all water treatment equipment

Infection Prevention and Control Team (ICT)

- Should know:
 - Where drinking water comes from
 - How drinking water has been treated
 - Of which materials the plumbing system is constructed
 - Chemicals that may contaminate the drinking water
 - The equipment for water treatment used in the facility
 - If there are persons at increased risk of Legionnaire's disease or if severely immunocompromised patients are present
 - transplant patients, patients with acquired immune deficiency syndrome



References

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Quiz

1. A key role of infection prevention and control in water hygiene involves working with maintenance staff on safe practices. T/F?
2. Potential water-related infection risks are
 - a) An infected patient
 - b) Fecal contamination
 - c) Insect activity
 - d) All of the above
3. Water can be made safe through the following methods:
 - a) Boiling
 - b) Filtration
 - c) Chemicals
 - d) All of the above

International Federation of Infection Control

- IFIC's mission is to facilitate international networking in order to improve the prevention and control of healthcare associated infections worldwide. It is an umbrella organisation of societies and associations of healthcare professionals in infection control and related fields across the globe .
- The goal of IFIC is to minimise the risk of infection within healthcare settings through development of a network of infection control organisations for communication, consensus building, education and sharing expertise.
- For more information go to <http://theific.org/>

