Health & Social Care
Diploma Level 2

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Unit Information

The Causes and Spread of Infection

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Introduction - IC02 The causes and spread of infection

Unit aim

This unit is to enable the learner to understand the causes of infection and common illnesses that may result as a consequence. To understand the difference between infection and colonisation and pathogenic and non pathogenic organisms, the areas of infection and the types caused by different organisms. In addition the learner will understand the methods of transmission, the conditions needed for organisms to grow, the ways infection enter the body and key factors that may lead to infection occurring.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Understand the causes of infection
2. Understand the transmission of infection

CONTENTS

Bacteria

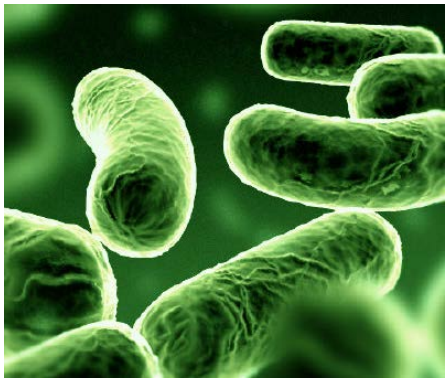

Figure 1 - Bacteria

Bacteria are tiny living beings (single-cell microorganisms) - they are neither plants nor animals - they belong to a group all by themselves, usually a few micrometers in length that normally exist together in millions.

A gram of soil typically contains about 40 million bacterial cells. A milliliter of fresh water usually holds about one million bacterial cells.

Bacteria come in three main shapes:

- Spherical (like a ball)
- Rod shaped
- Spiral

A bacteria does not have a nucleus and often does not even contain organelles. They reproduce only asexually

Bacteria can be beneficila eg. we have bacteria in our intestinal tracts which aid in digestion. Bacteria can be used in wastewater treatment to break down sewage, and bacteria can be used in the food industry for example, in the production of yogurt. Bacteria in the food industry can also be of concern with respect to spoilage. It can affect the odor, taste, and texture of a food product. Bacteria can also be pathogenic, meaning they are capable of causing disease.

Diseases caused by bacteria

Examples of diseases caused by bacteria are:

- **Brain** (bacterial meningitis) - *Streptococcus pneumoniae, Neisseria, meningitides, Haemuphilus influenzae, Streptococcus agalictaiae, Listeria monocytogenes.*
- **Ear** (otitis media) - *Streptococcus pneumoniae*
- **Pneumonia** Commonly acquired - *Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus.*
  Atypical - *Mycoplasma pneumoniae, Chlamydia pneumoniae, Legionella pneumophila*
  Tuberculosis - *Mycobacterium tuberculosis*
- **Upper respiratory tract infection** - *Streptococcus pyogenes, Haemophilus influenzae*
- **Gastritis** (inflammation of the stomach) - *Helicobacter pylori*
- **Food poisoning** - *Campylobacter jejuni, Salmonella, Shigella, Clostridium, Staphylococcus aureus, Escherichia coli*
- **Eye infections** - *Staphylococcus aureus, Neisseria gonorrheae, Chlamydia trachomatis*
- **Sinusitis** - *Streptococcus pneumoniae, Haemophilus influenzae*
- **Urinary tract infections** - *Escherichia coli, other Enterobacteriaceae, Staphylococcus saprophyticus, Pseudomonas aeruginosa*
- **Skin infections** - *Staphylococcus aureus, Streptococcus pyogenes, Pseudomonas aeruginosa*

- **STDs** (sexually transmitted diseases) - *Chlamydia trahomatis, Neisseria gonorrhoeae, treponema pallidum, Ureaplasma urealyticum, Haemophilus ducreyi*

Viruses.

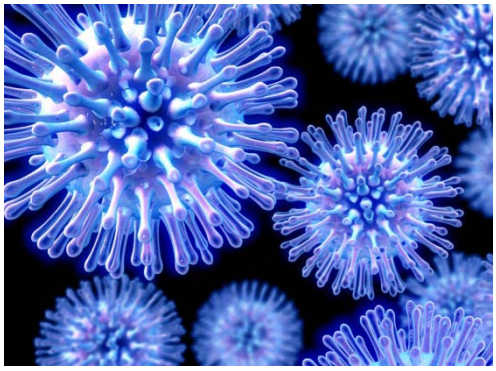

Figure 2 - H1NI Virus (Flu)

A virus is a small infectious agent that can replicate only inside the living cells of organisms. Most viruses are too small to be seen directly even with a light microscope. Viruses infect all types of organisms, from animals and plants to bacteria.

Viruses differ from bacteria in that they do not reproduce in the food, and they need a living host to replicate. They replicate by entering the cell of the host and taking over the genetic material responsible for reproduction. They can infect all types of cells, including bacteria, fungi, plants, animals, and the living cells within human beings. Viruses can be found in

- the environment
- in water
- air.

Viruses target specific cells in the body, such as those in the genitals or upper respiratory tract. Some target certain age groups, such as babies or young children, such as those that cause croup. The rabies virus targets the cells in the host's nervous system. Viruses may target skin cells and cause warts.

However, some viral infections can be systemic - they affect many different parts of the body, causing for example runny nose, sinus congestion, cough, and body aches. A viral infection that causes, for example viral conjunctivitis is local. Viral infections that cause pain, often trigger itching or burning.

Diseases caused by viruses

Examples of diseases caused by viruses are colds, Influenza, Chicken pox, Cold Sores, Herpes, Hepatitis A and Norovirus.

Fungi.

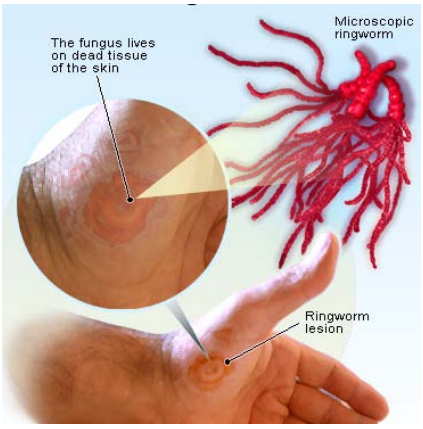

Figure 3 - Ringworm fungi

A fungus is a simple plant like organism, it is a eukaryotic. It reproduces sexually as well as asexually. It is normally found as a single cell.

Fungi reproduce via spores. They can have a variety of shapes and sizes, and they can include yeast and molds. Generally, fungi are a concern in spoilage of food. Fungi can be beneficial. They can cause spoilage. And some fungi are pathogenic, meaning they can cause disease in humans. Eg rarely causes healthcare acquired infections (HCAI)

There are three types of fungal infections of the skin:

- Superficial mycoses - limited to the surface of the skin and hair, such as *Tinea versicolor*, which commonly affects young people. The chest, back, upper arms or legs may be affected (very rarely the face). Light or reddish-brown spots appear on the skin. Sometimes the spots are not visible.

- Cutaneous mycoses - occurs deeper in the skin, in the epidermis. The hair and nails may also be affected. Cutaneous mycoses are limited to the keratinized layers of skin, nails and hair. This type of mycosis is caused by *dermatophytes* (a group of three types of fungus that commonly causes skin disease in animals and humans), which may cause ringworm. Examples of dermatophytes are *Microsporum*, *Trichophyton*, and *Epidermophyton* fungi. Athlete's foot is another example of cutaneous micosis.
- Subcutaneous mycoses - these types of infections go deeper into the skin, including the dermis, subcutaneous tissue, as well as muscle and fascia. The fascia is a band of tissue below the skin that covers underlying tissues - it separates different tissue layers and surrounds muscles. Subcutaneous mycoses tend to be long term (chronic) and are usually caused by skin penetration.

Diseases caused by Fungi

Examples of diseases caused by Fungi are, Athletes Foot, Ringworm, Otomycosis (ear), Thrush.

Parasites.

Figure 4 – Malaria _Parasite

Parasites differ from bacteria in that they need a living host to complete their life cycle. And generally, parasites are host specific. Parasites can be found in:

- Soil
- Water
- Air
- Animals.

Parasites can be acquired through consumption of water, consumption of food, and through contact of a contaminated surface.

Diseases caused by Parasites

Examples of diseases caused by parasites are Malaria, River Blindness, Sleeping Sickness, Lyme Disease, Scabies

Infection

Infection can be defined as:

- Harm caused by a micro-organism.

or

- Invasion of the body by pathogenic organisms

or

- An agent or a contaminated substance responsible for a person becoming infected

or

- The pathological state resulting from having been infected

A human with an **infection** has another organism inside them which gets its sustenance (nourishment) from that person, it colonizes and reproduces inside them. The human with that organism (germ) inside is called the *host*, while the germ or pathogen is referred to as a *parasitic organism*. Another name for an organism that causes infection is an *infectious*

agent.

It is only an infection if the colonization harms the host. It uses the host to feed on and multiply at the expense of the host to such an extent that his/her health is affected. The normal growth of the bacterial flora in the intestine is not an infection, because the bacteria are not harming the host.

Colonisation

Colonisation can be defined as:

- The ability of some microorganisms to live in or on a host without causing disease, eg Staphylococcus Aureus.

or

- The presence and multiplication of microorganisms without tissue invasion or damage. The colonies develop when a bacterial cell begins reproducing.

or

- The development of a bacterial infection on an individual, as demonstrated by a positive culture. The infected person may have no signs or symptoms of infection while still having the potential to infect others.

Colonization occurs when microorganisms inhabit a specific body site (such as the skin) but don't cause signs and symptoms of infection. Colonized pathogens have the potential to cause infection if they spread to a different site on the same patient (for example, from the skin to the urinary tract) or to another person.

Depending on the microorganism, colonized pathogens can be transmitted from person to person and via inanimate objects. Person-to-person transmission is the major route of colonization within health care facilities. Although a person can become infected as soon as a pathogen invades, in many cases, colonization (without signs and symptoms of infection) takes place before infection occurs.

Systemic infection

A systemic infection is one that affects the whole body, probably travelling in lymph or blood.

Or

A systemic infection is one which may involve multiple systems (organs) in the body.

Localised infection

Localised infection describes what occurs when all infected tissue is maintained within the one area, where the infection entered. If infected tissue broke away from original site of infection and travelled to other body parts, it would no longer be localised.

Poor practices

- poor hand hygiene
- inappropriate use of PPE
- inadequate cleaning/decontamination of environment and equipment
- poor waste disposal and storage procedures.

OUTCOME 2 UNDERSTAND THE TRANSMISSION OF INFECTION

Conditions needed for growth of micro-organisms

Moisture - Moisture is required to carry foods in solution into the cell, to carry wastes in solution away from the cell, and to maintain the moisture content of the cytoplasm

Nutrients - Lack of food hinders bacterial growth, and growth is favoured by a sufficient quantity of the proper kind of food

Warmth - Temperature has a profound influence on the growth rate of microorganisms. Microorganisms subjected to adverse temperatures are either destroyed or are not able to multiply. The optimum temperature of a microorganism is the temperature that provides for the most rapid growth of that microorganism.

Time - Time to reproduce.

Routes of Infection

Infection finds way into the body through

1. **Down the respiratory tract (nose, windpipe, lungs) into the lungs**. Coughs, cold, influenza and other common airborne infections are contracted in this fashion.
2. **Breaks in the skin.** One of the many functions of the skin is to act as a barrier against infection. Anything that penetrates the skin, or for that matter the mucous membrane that lines the mouth or nose, provides a route for infection to enter. Typically, bites, scratches, puncture wounds by needles etc increase the risk of infection.
3. **Down the digestive tract (mouth, stomach, intestines).** Food, drink or other infected products can be swallowed and infect the stomach or bowels. Most people have experienced an 'upset stomach', which reveals itself in the form of diarrhea and or vomiting.
4. **Up the urinary (urethra, bladder, kidneys) and reproductive systems.** The infectious agent may remain localized or may enter the blood stream. Sexually transmitted diseases most commonly infect the genitals. HIV, the AIDS virus, is carried in bodily fluids and can be transmitted in saliva, seminal fluid, or blood

Common sources of infection:

- People
- Contaminated food
- Contaminated equipment
- Contaminated laundry
- Clinical waste.
- Dust

Via:

- hands
- equipment
- environment.

Factors that make a person more prone to infection

Infection is more likely to occur in

- babies
- children
- older people
- people with lowered immunity due to other illnesses or conditions