MODULE

Water Borne Disease

For the Ethiopian Health Center Team

Ethiopia Public Health
Training Initiative

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UNIT ONE

INTRODUCTION

1.1. Purpose and Use of the Module

The scarcity of relevant teaching or learning materials in the higher training institutions of Ethiopia has been one of the bottlenecks in effecting efficient task oriented and problem solving training. Preparation of teaching materials that will meet the aforementioned mission is an activity that should in no way be postponed or delayed.

Therefore, the purpose of this module is to enable students to develop adequate knowledge, attitudes and practical skills through interactive and participatory learning. This module will help the health center team comprised of Health Officers, (HO), Public Health Nurses (PHN), Medical Laboratory Technicians (MLT) and Environmental Health Technicians (EHT) to correctly identify cases of water borne disease and manage them effectively as team members. For this reason separate satellite modules are prepared for each professional category to the health center team based on the tasks expected of them.

The module can also be used for in-service training of the health center team and for basic training of other health professionals, community health workers and caregivers. However, the module is not intended to replace standard textbooks or other reference materials.

1.2. Direction for Using the Module

Before starting to read this module, please follow the directions given below

- Go through all the contents of the core module by starting with the pre test.
- Use a separate sheet of paper to write your answers and label it “Pre-Test Answers”.
- The pre-test has two portions, Part – I and Part –II.

Part I: Contains common questions to be answered by all categories of the health center team.

Part II: The questions are prepared for the specific categories; Health Officers, Public Health Nurses, Environmental Health Technicians (Sanitarians) and Medical Laboratory Technicians. Select and do the portion indicated by your professional category.

- When you are sure that you are through with the Core Module proceed to read the Satellite Module corresponding to your profession or interest.
- Evaluate yourself using the post-test after you have read the modules completely.
- Go through the task analysis for the health center team members in comparison with that of your own.

Note: You may refer to the list of abbreviations and glossary at the end of the module for terms that are not clear.

UNIT TWO

CORE MODULE

2.1. Pre-test

Answer the following questions on a separate answer sheet.

2.1.1 Part I (Pre-test for All Categories of the Health Center Team)

Define question 1, list for question 2, write "True" or "False" for questions 3 - 6 and the letter of your choice for questions 7 - 12.

1. Define water borne diseases
2. Name three water borne diseases caused by each of the following pathogenic organisms
   A. Bacteria 1._____ 2._____ 3._____
   B. Virus 1._____ 2._____ 3._____
   C. Protozoa & Helminthes 1._____ 2._____ 3._____
3. Water borne diseases are leading causes of morbidity and mortality in all age groups. (T/F)
4. Each year about 3 million deaths occur worldwide due to diarrheal diseases. (T/F)
5. Drancunculiasis (Guinea worm disease) is primarily transmitted by fecal oral rout. (T/F)
6. Giardiasis affects mainly children than adults. (T/F)
7. The age group most affected by water borne diseases in general is:
   A. Children under one year of age
   B. Children under 5 years of age
   C. Children 5 – 10 years of age
   D. Adult above 15 years of age

8. Which of the following water borne diseases is of viral origin.
    A. Typhoid fever
    B. Poliomyelitis
    C. Dracunculiais
    D. Shigellosis
9. In Ethiopia the dracunculiasis (guinea worm) endemic areas identified so far are:
    A. Gambella and Benshangul Gumuz regions
    B. Gambella and South Omo
    C. South Omo and Ogaden area
    D. Gambella, South Omo and Afar regions
10. Which of the following diseases is not under the Ethiopian National Eradication Program?
    A. Cholera
    B. Poliomyelities
    C. Dracunculiasis
    D. A and C
11. The most common cause of severe dehydrating diarrhea in children under 3 years of age is:
    A. Shigellosis
    B. Giardiasis
    C. Rotavirus infection
    D. Amebiasis
12. Construction and appropriate utilization of latrines has no effect in reducing the incidence of:
    A. Amebiasis
    B. Dracunculiasis
    C. Giardiasis
    D. None of the above

2.1.2 Part II (Questions specific to a category of the Health Center team)

A. For Health Officers

Write the letter of your choice for the following questions.

1. Kumsa, a 16 years old male, presents acute onset of bloody, mucoid diarrhea associated with cramps abdominal pain, tenesmus and fever. What is the most likely diagnosis?
    A. Shigellosis
    B. Gardiasis
    C. Cholera
    D. Viral diarrhea
2. Which one of the following water borne diseases can be prevented by vaccination?
    A. Amoebiasis
    B. Dracunculosis
    C. Rota virus infection
    D. Typhoid fever
    E. None
3. Which of the following water borne diseases causes diarrhea due to a toxic substance produced by the specific causative agent?
    A. Cholera
    B. Rota viral infection
    C. Giardiasis
    D. Salmonellosis
4. Which one of the following conditions leads to death in a case of cholera?
    A. Toxic dilation of the colon (toxic mega colon)
    B. Perforation of the colon leading to peritonitis
    C. Rapid dehydration causing shock.
    D. Toxic substance produced by vibrio cholera.

5. Which of the following is true about hepatitis A?
    A. Transmission is mainly parenteral
    B. Transmission is through feco-oral route
    C. Unless treated it is always fatal
    D. All of the above
6. Which of the following signs and symptoms does **not** indicate dehydration in a patient with diarrhea?
    A. Sunken eye balls
    B. Thirst
    C. Vomiting
    D. Oliguria
7. The commonest cause of diarrhea in children under five years of age is:
    A. E. coli
    B. Rota virus
    C. Shigella
    D. Salmonella
8. Which of the following waterborne diseases does not cause diarrhea?
    A. Typhoid fever
    B. Dracunculosis
    C. Giardiasis
    D. Amoebiasis
9. Infection with polio virus always results in paralysis of the lower limb.
    A. True B. False
10. Diarrhoeal disease can cause malabsorption
    A. True B. False

B. For Public Health Nurse

Write the letter of your choice for the following questions.

1. Which of the following is not a water borne disease
    A. Ameobiasis
    B. Shigellosis
    C. Poliomyelitis
    D. Hepatitis B
2. The group most at risk of water borne diseases are:
    A. Elderly
    B. Adolescents
    C. Children under five years of age
    D. Adults
3. Which of the following disease appears frequently in epidemic form in Ethiopia?
    A. Giardiasis
    B. Shigellosis
    C. Dracunculiasis
    D. Typhoid fever
4. Which of the following measures is used in the prevention and control of water borne disease?
    A. Proper or sanitary disposal of human waste
    B. Keeping water safe during storage at home until it is consumed.
    C. Treatment of known carriers.
    D. All of the above
5. The drug of choice in the treatment of ameobiasis is
    A. Ampicillin
    B. Tetracycline
    C. Metronidazole
    D. Mebendazole

6. The management of a patient with diarrhea include the following
    A. Maintenance of fluids and electrolytes
    B. Prevention of spread of infection
    C. Providing comfort and information to both the patient and family
    D. All of the above
7. Signs of dehydration include
    A. Decreased skin turgor
    B. Decrease in heart rate
    C. Decrease in urine out put
    D. A and C
8. The primary concern in the management of apatient with cholera is
    A. Administration of medication
    B. Prompt replacement of fluid and electrolyte
    C. Bed rest
    D. Client teaching

C. For Environmental Health Technicians

Write the letter of your choice for questions 1-5 and write short answers for questions 6-8

1. Which one of the following is considered as large scale water treatment?
    A. Boiling
    B. Home made sand filter
    C. Municipal treatment using sand filter
    D. Storage
2. In the prevention of water - borne diseases, due attention should be given to:
    A. Protecting water sources
    B. Cleanliness of water containers
    C. Hygienic behavior of users
    D. All of the above

3. Which one of the following disinfectant is most commonly used for water treatment?
    A. Ozone
    B. Iodine
    C. Chlorine
    D. All of the above
4. Which strategy is considered to be the best in the prevention and control of water - borne diseases?
    A. An integrated approach to providing safe water supply, improved sanitation and health education.
    B. Provision of sanitary facilities
    C. Health information dissemination
    D. None of the above
5. Which one of the following is the right time to undertake a sanitary survey?
    A. When developing a new source of water
    B. During an out - break
    C. On aregular basis
    D. All of the above
6. Where should a latrine be located relative to water sources?
7. Mention the common methods of water treatment at household level.
8. State different locations where water could possibly get contaminated with disease causing organisms.

D. For Medical Laboratory Technicians

Write the letter of your choice for the following questions

1. The diagnosis of intestinal amoebiasis can be made by identifying the
    A. Cyst stage
    B. Trophozoite stage
    C. Larvae
    D. Only A and B

2. Which of the following specimens is not used for the diagnosis of Giardiasis
    A. Stool
    B. Duodenal content
    C. Serum
    D. None

3. The ‘gold standard’ for the diagnosis of Giardiasis is:
    A. Microscopic examination of stool
    B. Serological analysis test
    C. Culture
    D. Bio chemical tests

4. D. medinensis (Guinea worm) can be diagnosed by identifying.
    A. Cyst stage
    B. Trophozite stage
    C. Larvae stage
    D. Ova

5. In the diagnosis of intestinal amoebiasis, it is recommended to examine _____ before excluding the diagnosis.
    A. A single stool specimen
    B. At least two separate specimens
    C. At least three separate specimens
    D. At least 10 separate specimens

6. Shigellae are
    A. Gram positive rods
    B. Gram negative spirochetes
    C. Protozoan
    D. None

2.2. Significance and Brief Description of Water Borne Diseases

Water borne diseases are among one of the major public health problems in developing countries like Ethiopia. They are the leading causes of morbidity and mortality in all age groups particularly in children under 5 years of age. According to the World Health Organization (WHO) 3 million deaths occur every year from diarrheal diseases world wide (5).

The problem of water borne diseases is especially prevalent where general hygiene and environmental sanitation are poor and where there is a shortage of protected water supply (1, 5). It is believed that 80% of all diseases in the world are caused by inadequate sanitation, polluted water or unavailability of water (WHO Monica II). Poverty, illiteracy, overcrowding and low health services are contributing factors that directly or indirectly affect the prevalence of water born diseases. Therefore an integrated prevention and curative approach with community participation is required in order to tackle this prevalent public health problem.

2.3. Learning Objectives

Upon completion of the module, the reader will be able to:

1. Define water borne diseases.
2. Describe the magnitude of the problem of water borne diseases at national and global level.
3. List the different causative agents and describe pathogenesis of the common water borne diseases.
4. Describe the clinical features and diagnostic methods of the common water borne diseases.
5. Describe the general management of the common water borne diseases.
6. State the different preventive and control measures of water borne diseases.

2.4. Learning Activity 1

2.4.1 Case Study

Ibsa is a 16 year old teenager who lives in Alemaya town located 17km from Harar. He lives in a single room together with his family. The family depends on growing and selling 'chat' for their living. They do not have a latrine and use the open field. They get their water supply from a lake situated a few hundred meters away from their home. Everybody in the surrounding area uses water from the lake for drinking, washing and other purposes. It is also widely used by domestic animals.

Ibsa spent much of his time at his father's 'chat' farm after returning from school. One day while he was working at the farm he started to have malaise and nausea. After returning back home in the evening, he started to have watery diarrhea which was shortly followed by profuse vomiting. Since he was not feeling well, he went to bed early without having his dinner. But he could not have a peaceful sleep because of the markedly increased frequency and amount of diarrhea.

The next morning Ibsa went to Alemaya Health Center. He had to be supported by his family as he was very weak. Upon arrival to the health center they saw many patients being treated with IV fluids on the corridor. The health officer in the health center asked Ibsa about his illness and other related things. On physical examination the health officer found out that he was very weak with sunken eyeballs, dry buccal mucosa and low blood pressure. His heart rate was fast and thready. This was the 12th case with similar complaints that the health officer saw in the same morning.

2.4.2. Questions Related to the Case Study

Based on the above case study attempt the following questions

1. What is your most likely diagnosis?
2. List laboratory investigations you think would be important.

3. What preventive and control measures would you suggest for the family?
4. What is your role in the control of such outbreaks?

2.5. Definition

Water borne diseases are viral, bacterial and parasitic diseases which use water as a common means of transmission. In this module we will discuss those water borne diseases in which the mode of entry of their etiologic agents into a susceptible host is oral...

2.6. Epidemiology

Water borne diseases are major causes of morbidity and mortality world wide.

In Ethiopia, since a large majority of the rural population obtain their water supplies from unprotected sources such as streams, ponds wells, etc, water borne diseases are one of the most significant public health problems.

A person's health may be affected by ingestion of contaminated water directly or through food. One's health may also be affected by the use of contaminated water for the purposes of personal hygiene and recreation. The problem is especially acute where general hygiene and environmental sanitation are poor and where there is inadequate supply of safe water.

Developing countries carry a heavy burden of the water borne disease, the heaviest being the diarrheal diseases. Diarrheal episodes occur in all countries, but they are 5 to 6 times more common in developing countries (WHO, 1987a). The total number of diarrheal episodes each year worldwide may be as high as 4000 million (WHO, 1990a) and each year over 3 million deaths may occur due to diarrheal diseases.

Diarrhoeal diseases are the leading cause of mortality and morbidity of children under five years of age. Estimated occurrence of diarrhea in developing countries accounts for 5 episodes per child each year in children under 5 years of age.

These young children are most at risk of water borne diseases because their immune systems are not fully developed. In addition their resistance may be further impaired by malnutrition.

In 1968 a shigella epidemic in Central America affected half a million people and killed 20,000. In India (West Bengal) some years ago shigella caused morbidity and mortality in 350,000 and 3800 people, respectively. Shigella, still causes endless human suffering in Bangladesh and other Asian, Latin American and African countries.

Ethiopia, as a tropical and developing country, is frequently subjected to outbreaks of shigellosis. Outbreaks of shigellosis were recorded in Hararghe in 1978, Omo Region in 1979, Gondar in 1980 and Illubabor in 1981.

Diarrheal disease out breaks account for 30.1% of out patient visits and 27.2% of hospital admissions (3). [Editorial note: Is this about shigellosis?]

Typhoid fever occurs in all parts of the world where water supply and sanitation are sub-standard. It affects 17 million people world wide with more than 600,000 deaths. Almost 80% of these cases and deaths are in developing countries. (14)

Among 6 months to 12 year old children admitted to the children's hospital in Addis Ababa between 1984 and 1996 with typhoid, 25% developed intestinal perforations and 37% of those died (27).

Giardiasis occurrence is world wide affecting more children than adults. According to surveys conducted in Ethiopia, it accounts for a prevalence of between 2 and 11 percent as recorded in some highland communities and nomadic pastoralists. Urban areas like Addis Ababa are equally affected with a prevalence of 9% recorded in some children (1, 13).

In tropical and subtropical areas of the world, there are an estimated 400 million infections of amebiasis and 30,000 deaths annually. About 80,000 new cases of amebiasis were reported by the Ethiopian Ministry of Health in 1988 – 89, based on out patient reports. The highest prevalence of amebiasis in Ethiopia was found in hospital food handlers in a hospital in Addis Ababa (82%) (1, 12)

Dracunculosis (guinea worm infection) occurs in India, Africa and Middle East. About 20 million people are estimated to be victims of guinea worm infection world wide, but the global incidence is declining dramatically. In a single year 1994 – 1995, the incidence decreased 21%. Active foci of the disease are now found only in Africa south of the Sahara and in Yemen. Ethiopia is listed among the endemic countries for the disease (8, 10). According to the Ethiopian 2002 Dracunculiasis Eradication Program (EDEP) guinea worm endemic areas are Gambella and South Omo. The number of cases reported were 1252 in 1994, but by 2002 the number of cases fell to only 46.

Cholera, affects all age groups. It is more common among children less than 5 years of age and among adults 25 - 39 years old. Worldwide cholera causes 120,000 deaths a year. It is particularly deadly in Africa where epidemics have become more wide spread and more frequent since the 1970s. About 79 million people are estimated to be currently at risk of cholera infection in Africa (9).

Escherichia Coli is a common cause of diarrhea worldwide. In addition, the morbidity of E.Coli diarrhea is notable for its effects on childhood nutrition and development.

In regard to poliomyelitis, a total of 150 countries reported zero cases. of poliomyelitis, 30 countries reported greater than ten cases, 27 countries from one to ten cases and 7 countries failed to report. [Editorial note: state the year this was reported] WHO estimated that approximately 80,000 cases of paralytic polio occurred in 1995. In 1996, 20,000 cases and about 7000 deaths were reported... Polio virus is still circulating widely in three specific areas:

- Large densely populated areas such as Bangladish, India, Nepal, Pakistan, South Asia.
- The Democratic Republic of Congo and Niger (Central and West Africa).
- Ethiopia, Somalia and Sudan (Horn of Africa) (5,6,7)

Enteroviruses have a worldwide distribution. They are most common in tropical climates and socio- economically disadvantaged areas, especially where there is poor hygiene and over-crowding.

Rota virus occurs worldwide during infancy. It is most common in socio-economically disadvantaged areas, especially in areas with poor hygiene and over-crowding as well as areas with tropical climates. It is the single most important cause of severe dehydrating diarrhea in infants and young children under the age of 3 in both developed and less developed countries. It accounts for 30 to 50% of all cases of diarrhea requiring hospitalization and intensive rehydration therapy.

Hepatitis A is a viral disease transmitted via contaminated water or food. There is a high proportion of asymptomatic cases of Hepatitis A. Thus, it is difficult to estimate the incidence of Hepatitis A. According to WHO, about 10-50 persons per 100,000 are affected annually. It occurs as epidemic world wide with a tendency of cyclic recurrences (1, 11).

Hepatitis A infection is also common in Ethiopia. Infection is acquired early in childhood. Seropositivrty in regions surveyed was 34% at one year, 98% at 10 years and universal at about 15 years of age (28).

The first case of Hepatitis E virus (HEV) was reported in Ethiopia in 1985. In 1988-1989 a water borne outbreak was detected in a military camp where 93% of icteric hospitalized patients were infected with HEV. Its case fatility rate is higher in pregnant women (23%) than in the general population (11%).(28).

2.7. Etiology

The causative agents of water borne diseases are broadly categorized as bacterial, viral, protozoal and helminthes as shown in table 2.1.

Table 2.1: Etiologies of common water borne diseases

Category of causative agent	Diseases	Causative organism	Common transmission route
Bacterial	Shigellosis	Shigella species	Man-feces-(flies) water and food - man
	Typhoid fever	Salmonella typhi and paratyphi	Man-feces-food and water - man
	Cholera	Vibrio cholerae	Man-feces-water and food - man
	Acute Gastroenteritis	E. coli	Man-feces-water-Man
Viral	Infectious hepatitis	Hepatitis A virus Hepatitis E virus	Man-feces-water and food - man
	Poliomyelitis	Polio virus	Man-feces-water -Man
	Acute Gastroenteritis	Rota Virus	Man-feces-water-Man
Protozoal	Amebiasis	Entameoba hystolitica	Man-feces-water and food - man
	Giardiasis	Giardia lamblia	Man-feces-water and food -man
Helminths	Dracunculiasis (Guinea Worm)	Dracunculus medinesis	Man-water-man

2.8. Pathogenesis and Clinical Features

In this section pathogenesis and clinical features of common water borne diseases are discussed.

2.8.1. Shigellosis

Pathogenesis

- Organisms reach the large intestine and invade the tissue causing mucosal ulceration.
- Shigella dysenteriae produces shiga toxin that increases the ability of shegella to invade tissues.

Clinical Features

- Incubation period varies from 1 - 7 days with the average being 2 - 4 days.
- Watery diarrhea that progresses to bloody diarrhea.
- Diarrhea is accompanied by abdominal cramps and tenesmus.
- Fever commonly occurs.
- Systemic manifestation which occurs very rarely is characterized by acute renal failure, hemolytic anemia and thrombocytopenia.

2.8.2. Typhoid Fever

Pathogenesis

- The organism, salmonella typhi, enters the gastro intestinal tract and invades the mucosa of colon and ileum.
- After intracellular multiplication in the mucosal cells bacteremia will occur.
- Tissue invasion causes inflammation in the intestine and gall bladder.
- Hematogenous dissemination occurs to spleen, liver and bone marrow.

Clinical Features

- Incubation period is 3 - 60 days (average 7 - 14 days).
- Headache, malaise and chills.
- High grade fever (step ladder like, daily increase in temperature)
- Intestinal manifestation includes constipation, diarrhea and abdominal tenderness.
- Intestinal perforation occurs but rarely.
- Mild hepatomegaly can occur.
- Skin rash (rose spots) may appear over the chest and abdomen.
- Even after infection resolves, asymptomatic carriers may continue to transmit disease through feces. This is especially true of children.

2.8.3. Cholera

Pathogenesis

- The bacteria colonize the small intestine and produce toxic substance (enterotoxin) that causes diarrhea.

Clinical Features

- Incubation Period: 1 - 3 days with range few hours to 5 days.
- Painless watery diarrhea which is large in volume (rice water in appearance).
- Vomiting
- Signs and symptoms of dehydration like thirst, decreased skin turgor, weak and fast pulse and decreased urine output.

2.8.4. Acute Bacterial Gastro Enterities (Escherchia coli)

Pathogenesis

- Enterotoxic E.coli causes watery diarrhea by the production of bacterial toxin which acts upon the upper small intestine.
- Invasive E.coli causes inflammatory diarrhea by invasion of the colon.

Clinical Features

- Incubation period typically 10 hours to 6 days for most strains of E.coli.
- Acute onset of watery diarrhoea that is usually mild and self limiting.
- Maliase, anorexia and abdominal cramps.

2.8.5. Hepatitis A

Pathogenesis

- The virus replicates in the liver causing degenerative and regenerative changes of the cells.

Clinical Features

- Incubation period 15 - 50 days (average 25 - 30 days).
- Initial symptoms include malaise, weakness, fatigue followed by anorexia, vomiting and nausea and abdominal pain localized to the right upper quadrant.
- Jaundice and dark urine occur after 3 - 10 days
- More symptomatic presentation in older children

2.8.6. Hepatitis E

Pathogenesis

- Pathogenesis not known to be directly cytopathic to hepatocytes.

Clinical features

- Incubation period: 14 - 60 days (average 5 - 6 weeks)
- Constitutional symptoms include: anorexia, headache, photophobia, cough.
- Jaundice occurs after 1 - 2 weeks
- Low grade fever, between 38 – 39^{o}C.
- Complication: fulminant hepatitis (fatal) in 1 - 2% of all cases and up to 20 - 30% in pregnant women.

2.8.7. Poliomyelitis

Pathogenesis

- After ingestion polio virus infects epithieal cells of gastrointestinal tract and then spreads to lymphoid tissue, blood stream and the central nervous system.

Clinical Features

- Incubation period for asymptomatic or mild polio is 3 - 6 days, and for development of paralytic polio is 7 - 21 days.
- Most infections are asymptomatic. Patients present with fever, malaise and sore throat. Occasionally aseptic meningitis, anorexia and headache occur.
- Paralytic poliomyelitis occurs in less than one percent of infected persons.

2.8.8. Acute Viral Gastro- enteritis (Rota Virus)

Pathogenesis

- The virus infects the cells of the small intestine leading to decreased absorption and diarrhea.

Clinical Features

- Incubation period ranges from 2-4 days
- Abrupt onset of vomiting followed by mild to severe diarrhea.
- Mucus commonly found in the stool.
- Frequently associated with severe dehydration.

2.8.9. Amebiasis

Pathogenesis

- Trophozoite attachs to colonic mucosa and epithileal cells and cause ulceration of the mucosa of cecum, sigmoid colon and rectum.
- Rarely, intestinal infection results in the formation of mass lesion or ameboma.
- Sometimes troplozoites invade veins to reach the liver and cause liver abscess.

Clinical Features

- Incubation period is variable - typically 1 - 4 weeks but range is a few days to even years.
- Mostly asymptomatic. Onset of symptoms is generally gradual; with increasingly severe diarrhea.
- Symptoms vary from mild abdominal discomfort to severe dysentery with fever, chills and bloody or mucoid diarrhea (amebic dysentery).
- Non specific abdominal symptoms include colicky, lower abdominal pain and increased frequency of bowel movement.

2.8.10. Giardiasis

Pathogenesis

- Infection may be transient, recurrent or chronic.
- The mechanism by which Giardia causes alteration in small bowel function is largely unknown. Infection is limited to small intestine and biliary tract.

Clinical Features

- Incubation period is 1 - 4 weeks.
- Majority of infections are asymptomatic.
- Symptoms range from mild self limited to chronic and recurrent diarrhea.
- Prominent early symptoms include nausea, often foul-smelling diarrhea, flatulence and abdominal pain.

2.8.11. Dracunculiasis (Guinea Worm Infection)

Pathogenesis

- After ingestion of crustacean, Cyclops (intermediate host) with water, dracunculus larva are released in stomach and intestine. The released larva penetrate the stomach and intestines. Here they mature in the peritonial cavity. After mating, gravid female worms migrate to the different parts of the body, usually the lower extremities. The female worm emerges through a blister that ruptures on exposure to cool water. The site of the worm's emergence provides a portal of entry for secondary infection including gangrene and tetanus.

Clinical Features

- Painful blister on the surface of the body, usually on the legs.
- Immersing the leg in cold water results in release of larva, ulcer formation and emergence of worm.
- Emergence of worm can be multiple and from different sites

2.9. Diagnosis

Diagnosis of water borne diseases can be based on clinical features and through laboratory investigations.

2.9.1. Clinical Diagnosis

Clinical diagnosis can be based on the clinical features discussed earlier.

2.9.2. Laboratory Diagnosis

Laboratory diagnosis of water borne diseases is done in several ways since their methods of detection are different. Macroscopic and microscopic examination and culture and serological tests are the main techniques used..

- Macroscopic Examination
  - Direct identification of the adult pathogenic parasite as well as the physical characteristics of the specimen (stool) are used in the diagnosis.
  - The adult form of D.medinensis can be easily identified by observing the emergence of the worm from the wound.
- Microscopic Examination
  - Bacterial Gram stains of presumed sterile fluids.
- Culture
  - A selective medium is used to isolate the bacterial pathogen. The sample source may be stool, urine or blood according to the distribution of the bacteria in the body. There is a recommended optimum period of time for the specific collection to isolate the pathogen successfully.
- Biochemical Reactions
  - This test is done to separate/identify the specific pathogenic bacteria based on their response for different biochemical reactions.
- Serology
  - Serological diagnosis is used to classify the specific pathogen into its sub groups and serovars (serotypes).

2.10. Case Management

The general management of water borne diseases includes the following major points.

- Identifying the specific organism and instituting specific therapy appropriate for that organism.
- However, with patients presenting severe diarrhea, replacement of lost fluids and electrolytes is mandatory even before identifying the organism.
- Supportive therapy includes monitoring the patient's response to therapy.
- Continually observing for complications and providing health information to both the patient and the family.

2.11. Prevention and Control

Objectives

To interrupt the transmission of water borne diseases and thereby reducing their morbidity and mortality.

The approach to prevention and control

There is abundant evidence that improving only water quality or only latrines will have little or no effect on the incidence of water borne diseases. Thus there has to be a holistic intervention approach to these problems. The prevention and control measures include:

- Sanitary disposal of human waste.
- Protecting public water supplies from fecal contamination.
- Treatment of suspected water supplies, both rural and urban, before consumption.
- Keeping fetched water at home safe during storage.
- Treatment of known carriers.
- Mass treatment during epidemic outbreaks, e.g. at schools, in prisons etc.
- Treatment of surface water supplies.

- Washing hands with soap and water before preparing or eating food and after using the latrine.
- Health Education

Health education ensures community involvement and raises the awareness about the effect and preventive measures of water borne diseases. The provision of health education should not be limited to those visiting health institutions but in all situations for individuals or groups of people in the communities. The following points should be addressed:

- The causative agents
- The mode of transmission
- The preventive and control measures, and
- The importance of early treatment

Now you have successfully completed the core module. Following this you will read the Satellite Module of your professional category. The satellite modules are arranged in the following:

3.1. Satellite Module for Health Officers
3.2. Satellite Module for Public Health Nurses.
3.3. Satellite Module for Environmental Health Technicians
3.4. Satellite Module for Medical laboratory Technicians

N.B: All members of the Health Center Team are also expected to read the Satellite Module prepared for Community Health Workers and the Take Home Message in Sections 3.5 and 3.6 respectively. Directions for using this module:

- Before reading your satellite module be sure that you have completed the pre - test and studied the core module.
- Read your satellite module
- Continue to refer back to the core module if necessary.
- Reread Ibsa's case history and try to answer the questions
- Evaluate yourself by doing the post test.

UNIT THREE

SATELLITE MODULES

3.1. Satellite Module for Health Officers

3.1.1. Directions for using this Module

- Before reading this satellite module be sure that you have completed the pre-test and studied the core module.
- Continue reading this satellite module.

3.1.2. Learning Objective

After completing this module you will be able to:

- Describe the pathogenesis and clinical features of common water borne diseases.
- Mention complications of water borne diseases.
- Identify the appropriate laboratory diagnostic measures for each water borne disease.
- State the specific treatment regimen and supportive management of each water borne disease.

3.1.3. Pathogenesis, Clinical Features, Diagnosis and Treatment of Common Water Borne Diseases.

Shigelloses

- Pathogenesis

  The organisms are ingested and pass to the large intestine where invasion and intracellular multiplication causes cell damage resulting in mucosal ulceration. Shigella dysenterae produces shiga toxin that increases the severity of the illness by increasing the ability of shigella to penetrate mucosal cells.

- Clinical features
  - There is wide spectrum manifestation that ranges from mild to dehydrating watery diarrhea which can progress to bloody diarrhea and dysentery.
  - Diarrhea is accompanied by abdominal cramp and tenesmus.
  - Fever occurs commonly.
  - Hemolytic uremic syndrome can occur, but very rarely, that is manifested by acute renal failure, hemolytic anaemia and thrombocytopenia
  - Rarely severe shigellosis can lead to toxic dilatation encephalopathy and colonic perforation which may be fatal (Ekiri syndrome).
  - Hemolytic uremic syndrome can occur, again very rarely, that is manifested by acute renal failure, hemolytic anemia and thrombocytopenia.
- Diagnosis
  - Presumptive diagnosis can be made from clinical features
  - Specific diagnosis is based on culture of shigella from stool.
  - Differentiation from amebiasis is made by microscopic examination of stool.
- Treatment

  Treatment with effective antimicrobial agents and support include:
  - Ampicillin and trimethoprim- sulfamethoxazol are effective agents
  - Naldixic acid for resistant strains to the above drugs.
  - Ciprofloxacin can be used for multiple drug resistant strains.
  - Rehydration therapy and nutritional support including vitamin A supplementation should not be neglected.
  - Antibiotic treatment is not necessary for mild shigellosis (watery diarrhea and no dehydration).

Typhoid fever

- Pathogensis

  After ingestion from contaminated food or polluted water supply, the organisms penetrate the mucosal barrier at the colon and distal ileum where intracellular multiplication occur. Then persistent bacteremia results in persistent fever while invasion of the gall bladder and intestine induce inflammatory responses.

- Clinical feature
  - Prolonged and persistent fever and classically step like daily increase in temperature up to 40-41^{o} C, associated with headache, malaise and chills.
  - Intestinal manifestation includes constipation and diarrhea with abdominal tenderness.
  - Mild hepatomegaly can occur.
  - Relative bradycardia, epistaxis and Rose spots (small, red blanching spots seen over the chest and abdomen), can be seen in some patients.
  - Occasionally disseminated intravascular coagulation and CNS involvement results in death.
  - In other instances necrotizing cholecystitis and intestinal perforation can occur.

- Diagnosis
  - Widal test anti - O titer of > 1: 160 is consistent with acute typhoid fever.
  - Definitive diagnosis can be made from culture of blood, stool and bone marrow.

- Treatment

  Chloramphenicol is the drug of choice (dose, 50 - 60mg/kg/day in four divided doses for 14 days).

- If there is drug resistance then trimethoprin - sulfamethoxazole, amoxicillin with probenecid, ampicillin or ceftriaxone can be used.
- For chronic carriers - ampicillin for 4 to 6 weeks is given.

Cholera

- Pathgenesis

  Vibrio cholera colonizes the small intestine and secretes enterotoxion which results in massive outpouring of isotonic fluid from the intestinal wall.

- Clinical features
  - After 24 - 48 hours of incubation period; the illness begins with sudden onset of painless, watery diarrhea followed by vomiting.
  - Diarrhea becomes large in volume later on.
  - Symptoms and signs of dehydration like thirst, postural hypotension, weakness, tachycardia, sunken eyes, wrinkled skin and oliguria develop fast.
  - If fluids and electrolyte are not replaced, hypovolemic shock and death will follow.

- Diagnosis
  - Dark field microscopy on wet mount of fresh stool.
  - Stool culture on selective medium.

- Treatment
  - Adequate replacement of fluids and electrolyte (oral or i.v.) is required
  - Specific treatment with antbiotic.
    - ✓ Tetracyclin 500mg QID for 2 - 3 day
    - ✓ Doxycycline 100 mg BID for 3 days
    - ✓ Erythromycin 40mg/kg daily in 3 divided doses for 3 days for pregnant mothers and children under 8 years of age.

Escherichia-coli

- Pathogenesis

  Organisms are ingested through the fecal - oral route and start to manifest after an incubation period of 1 - 12 days. Different species of E-coli cause diarrhea by different mechanisms. Shiga toxin producing E.coli causes adherence to and effacement of intestine resulting in bloody diarrhea.

  - Enterotoxigenic E-coli cause watery diarrhea by the production of bacterial toxin which act upon the upper small intestine.
  - Entero invasive E-coli cause inflammatory response by invasion of the colon resulting in bloody diarrhea.
  - Enteropathogenic E-coli cause watery diarrhea by unknown mechanisms.

- Clinical features

  The clinical features of E.coli infection include:

  - Malaise, anorexia and abdominal cramps.
  - Acute onset of watery diarrhea that is usually mild and self limiting.
  - Some species can result in bloody diarrhea as well as produce a cytotoxin which is responsible for hemolytic uremic syndrome (HUS) and post diarrhial thrombotic thrombcytopenic purpura (TTP) in adults.

- Diagnosis
  - Diagnosis can be made from the clinical features.
  - Stool examination shows fecal leukocytes; definitive diagnosis rests on isolation of specific organisms in stool specimen.

- Treatment
  - Rehydration commonly done by Oral Rehydration Salt (ORS)
  - Antibiotic treatment usually shortens the duration of the illness
    - Trimethoprim - sulfamethoxazole, Azithromycin
    - Ciprofloxacin for resistant strains

Hepatitis A

- Pathogenesis
  - Transmitted exclusively by fecal oral route.
  - Poor personal hygiene and over crowding contribute to its transmission.
  - Viral replication is limited to the liver but virus is present in the liver, bile, stool and blood after the late incubation period.
- Clinical Features
  - The clinical features usually occur in three phases.
  - Asymptomatic cases: - common, especially in children.
  - Prodromal symptoms: constitutional symptoms like anorexia, myalgia, headache, cough, vomiting, arthralgias, low grade fever photophobia, etc.
  - Clinical jaundice: occurs 1 - 2 weeks after the prodromal symptoms
    - ✓ Urine becomes dark and stool becomes clay colored 1 to 5 days prior to onset of clinical jaundice.
    - ✓ Hepatomegaly, splenomegaly and cervical adenopathy are present in some cases.
  - Recovery phase: - constitutional symptoms disappear.
  - No chronic states with hepatitis A.
- Diagnosis

  Diagnosis can be made from
  - Clinical presentation
  - Presence of abnormal liver function tests like AST, ALT, Alkaline phosphates and bilirubin. Specific diagnosis depends on serology.
- Treatment
  - There is no specific therapy for acute viral hepatitis.
  - Supportive care and rest together with high calorie diet are the main modalities of treatment.

Hepatitis E

- Pathogenesis
  - Enterically transmitted (feco - oral)
  - Not known to be directly cytopathic to hepatocytes.
  - Age group 20 - 40 years (young adults) are predominantly affected.
  - No chronic liver disease or carrier state.
- Clinical features
  - Incubation period: 14 - 60 days (average 5 - 6 weeks).
  - Symptoms include; anorexia, headache, photo phobia pharyngitis cough.
  - Low grade fever (38 - 39^{o}C).
  - Jaundice may appear after 1 - 2 weeks.
  - Fulminant fatal cases in 1 - 2% of all cases and 20 - 30% in pregnant women.
- Treatment
  - No specific treatment

Poliomyelitis

- Pathogenesis

After ingestion, poliovirus infects epithelial cells in the intestinal mucosa and spreads in the submucosal lymphoid tissue where it replicates. Then it spreads to the regional lymph node and the blood stream during viremia. It is uncertain how poliovirus reaches CNS, but it is assumed to be during viremia or via peripheral nerves.

- Clinical features
  - Most infections are asymptomatic.
  - Some patients present with minor illness manifested by fever, malaise, sore throat, anorexia, myalgia and headache.
  - Occasionally aseptic meningitis occurs.

- Paralytic disease due to lower motor neuron paralysis, occurs less commonly.
- Rapid or gradual development of paralysis is preceded by severe back, neck and muscle pain.
- Weakness is asymmetric, commonly affects the lower limbs with more proximal involvement.

➢ Diagnosis

- Stool culture is commonly done, but other body fluids can also be cultured.

➢ Treatment

- No specific treatment
- Supportive care for the disabled
- Can be prevented by vaccination (live attenuated oral vaccine)

Rota virus Infection

➢ Pathogenesis

- Rota virus infects and kills mature villus tip cells of the small intestine which will be replaced by immature cells that can not absorb electrolytes and water. And this leads to osmotic diarrhea due to nutrient malabsorption.

➢ Clinical feature

- Clinical manifestation can range from asymptomatic infection to mild or severe diarrhea.
- Majority of children develop vomiting followed by abrupt onset of watery, non - bloody diarrhea.
- Fever is present in some patients.
- Frequently associated with severe dehydration.

- Diagnosis
  - Detection of rota virus antigen in fecal specimen by different immunoassays can be done, but it is not important.
- Treatment
  - Replacement of fluid and electrolytes with standard ORS therapy

Amebiasis

- Pathogenesis

Trophozoites attach to colonic mucosa and epithelial cells and cause ulceration of the mucosa of cecum, sigmoid colon and rectum. Rarely, intestinal infection results in the formation of mass a lesion or ameboma in the bowel lumen. Sometimes trophozoites invade veins to reach liver and cause liver abscess.

- Clinical features
  - Typical incubation period is 2 to 6 weeks.
  - About 90% of infections are asymptomatic while 10% produce a spectrum of clinical symptoms.
  - Lower abdominal pain associated with mild diarrhea or bloody stools that develop gradually.
  - Amoeboma and liver abscess can occur, but rarely.
- Diagnosis
  - Demonstration of trophozoite or cyst in the feces by microscopy
- Treatment
  - Metronidazole 500mg three time a day for 5 – 10 day.
  - Tinidazole 2gm daily for three days.

Giardiasis

- Pathogenesis

Giardia trophozoite adhere to the epithelium but do not cause invasion or destruction. The mechanism by which giardia cause alteration in small bowel function is largely unknown. Infection may be aborted, transient, recurrent or chronic.

- Clinical features
  - Incubation period is 1 to 4 weeks.
  - Most infections are asymptomatic.
  - Prominent early symptoms include diarrhea, abdominal pain, nausea, vomiting, flatulence and foul-smelling stools.
  - Symptoms tend to be intermitted but recurring and gradually debilitating the patient as a result of a combination of decreased nutrient intake (anorexia) and malabsorption.
- Diagnosis
  - By identification of cysts or trophozoites in the feces.
- Treatment

  Antimicrobial agents include:
  - Metronidazole 250mg three times a day for 5 days for adults.
  - For children 15mg/kg/day divided in three doses for 5 - 7 days.
  - Tinidazole 50mg/kg/P.O, single dose (maximum 2gm) more effective than metronidazloe

Dracunculiasis

Pathogenesis and clinical features have been dealt with in the Core Module.

- Diagnosis
  - Clinically, based on the findings developing with emergence of the adult worm through the skin.

- Laboratory - microscopic detection of larvae after rapture of the blisters.

➢ Treatment

- Symptomatic treatment of worms emerging from the skin involves use of analgesic and local wound care.
- Niridazole, thiabendazole and mebendazole are reported to reduce tissue inflammation and may possibly hasten removal of the worm.
- Metronidazole 250mg T.I.D. for 10 days. Pediatric dosing, 25mg/kg/day in 3 doses for 10 days (not to exceed adult dosing).

Now you are through with the Core and Satellite Modules. There are still some activities remaining as stated below.

1. Read the Task Analysis of the different categories of The Health Center Team on Unit 4.
2. Do the questions of pre-test as a post-test.

   N.B. Use a separate answer sheet.
3. Compare your answers of the pre and post- tests with the answer keys given on Annex XI and evaluate your progress.

3.2. Satellite Module for Public Health Nurses

3.2.1. Direction for Using this Module

- ➢ Before reading this satellite module be sure that you have completed the pre - test and studied the Core Module.
- ➢ Read this satellite module
- ➢ Refer to the Core Module if necessary.
- ➢ Read Ibsa's case history again and try to answer the questions.
- ➢ Evaluate yourself by doing post-test in Section___

3.2.2. Learning Objective

General Objective:

This module is prepared to equip the learner with the appropriate knowledge and skills required to effectively identify and manage the patients with water born disease.

Specific objectives:

After reading this module you should be able to:

- Assess a patient with water born disease.
- List at least 3 nursing diagnoses of a patient with water born disease in order of priority.
- List at least three goals or outcome criteria of nursing action for patients with water born disease.
- State 4 nursing interventions for a patient with water born disease.
- Manage patients with water borne disease.

3.2.3. Learning Activity 2

After reading Sections 3.2.4 - 3.2.7 answer the case study questions by referring to the story of Ibsa.

3.2.4. Nursing Assessment

- Health history
- Onset and characteristics of the disease.
- Current drug therapy.
- Daily dietary intakes.
- Recent travel to another geographic area.

While performing a physical examination, the nurse:

- Observes for signs of dehydration.
- Determines degree of dehydration.
- Inspects the stool consistency, color and odor.

- Records weight and intake and output daily.

Based on the assessment data the patient's major nursing diagnosis may include:

- Diarrhea related to ingestion of contaminated water as evidenced by verbal report of the patient.
- High risk for fluid volume deficit related to frequent passage of stools.
- Anxiety related to frequent uncontrolled elimination.
- High risk for impaired skin integrity related to the passage of frequent loose stool.
- Altered nutrition less than body requirement related to diarrhea.
- Knowledge deficit about possible causes of the disease and preventive measures due to lack of information.
- High risk of the infection spreading to others..

3.2.5. Goal

- Maintenance of fluid and electrolyte balance.
- Reduction of anxiety.
- Maintenance of skin integrity.
- Maintenance of adequate nutrition.
- Prevention of spread of infection.
- Provision of health information about cause of the disease and its preventive measures.

3.2.6. Case Management

The key management of a patient who has a water bone infection is identifying the specific organism and instituting specific therapy appropriate for the organism.

- Supportive therapy includes:
  - Monitoring the patient's response to therapy.
  - Ensuring hydration and fluid balance.

- Continually observing for complications and providing information to both the patient and family.

➢ Nursing intervention: The goals of nursing management are to give supportive care and to monitor for complications.

- Encourage high fluid intake.
- During the period of anorexia, the patient should receive frequent small feedings, supplemented, if necessary by IV infusion of glucose containing fluids.
- Encourage the patient to express fears / worries.
- Skin care (perineal care).
- Teach the patient about his or her specific disease and therapeutic regimens. She or he is instructed about personal hygiene and the maintenance of the home environment to prevent the spread of infection to other family member.
- Inform the family about the disease problem and how they can seek additional health care.
- Patient and family need specific guidelines about diet, rest and follow up.
- In case of typhoid fever, delirium is common in its severest form. The patient requires special support during this period. Patient safety must be maintained with the use of side rails and other restraints.
- Tepid water sponges are administered for temperature over 40^0C.
- Observe for bladder distension.
- Monitoring for complications: for example, in typhoid fever a dangerous complication is intestinal hemorrhage and perforation of the bowel with resultant peritonitis.
- Additionally, hepatitis A will rarely progress to fulminate hepatitis terminating in cirrhosis or death.

3.2.7. Prevention and Control

- Early treatment
- Universal precautions
- Prevention of complications and disabilities

For Example: Physical therapy is used to attain maximum function for poliomyelitis

Questions (Case Study)

1. What are the subjective and objective data, which lead you to identify the patient's problem?
2. List the actual and potential nursing diagnoses for Ibsa's case in order of priority.
3. What are the goals of nursing management specific to each problem in Ibsa's case?
4. What do you do for Ibsa? (What nursing managements will be given for Ibsa)?
5. As a public health nurse what is your role in the control of epidemic?

3.2.8. Treatment

Shigellosis

- Ampicillin and cotrimoxazole are effective agents.
- Rehydration therapy and nutritional support.

Typhoid fever

- Chloramphenicol 50 to 60 mg/kg QID until improvement occurs, followed by 30mg/kg to complete a 14 day course.
- When resistance is documented - Trimethoprim - sulfarnethoxzole, - Ampicillin.
- For chronic carriers: Ampicillin for 4 to 6 weeks.

Cholera

- The cornerstone of cholera therapy is prompt complete replacement of fluid and electrolytes intravenously or orally.

Hepatitis A

- No specific therapy. Supportive care and rest are the cornerstones of management.

Hepatitis E

- Some as Hepatitis A

Poliomyelitis

- There is no specific therapy
- Symptomatic treatment include maintenance of respiration and hydration, reduction of pain and muscle spasm.

Rota Virus Infection

- Prompt replacement of fluid and electrolyte losses.

Amebiasis

- Metronidazole 750mg po TID for 7 to 10 days (adult dose).
- Metronidazole 35-50mg/day in 3 doses for 7 – 10 days (pediatric dose).
- Tinidazole 50mg/kg/day in 3 divided doses for 3 days (max 2gms/day).

Giardiasis

- Metronidazole - 250mg TID for 05 days
  - 15mg/kg/day in three divided doses to children for 5-7 days

Dracunculiasis

- Symptomatic treatment of worms emerging from the skin involves use of analgesic and local wound care.
- Niridazole, thiabendazole and mebendazole are reported to reduce tissue inflammation and may possibly hasten removal of the worm.
- Metronidazole 250mg PO, TID for 10 days. Pediatric dosing: 25mg/kg/day divided in 3 doses for 10 days (maximum dose 750mg/day)

E.coli

- Rehydration therapy.
- Bactrim is the treatment of invasive intestinal E.coli.

Now you are through with the Core and Satellite Modules. There are still some activities remaining as stated below.

1. Read the Task Analysis of the different categories of The Health Center Team in Unit 4.
2. Do the questions in the pre-test as a post-test. **(N.B.** Use a separate answer sheet.)
3. Compare your answers from the pre and post- tests with the answer keys given in Annex XI and evaluate your progress.

3.3. Satellite Module for Environmental Health Technicians

3.3.1. Introduction

In Ethiopia the large majority of the rural population obtains water from unprotected sources like streams, ponds, wells etc. Consequently, water-borne diseases are one of the most significant public health problems in the country.

The diseases can be prevented and controlled by providing a safe water supply and by implementing good sanitation and health education programs. These three activities should be implemented simultaneously and continuously.

The main concern of Environmental Health Technicians pertaining to water-born diseases is to undertake primary prevention activities. Hence, their role will be to develop ways to break the chain of disease transmission.

3.3.2. Directions for using the module

- Before reading this satellite module be sure that you have completed the pre test and studied the core module.
- Read this satellite module.

3.3.3. Learning objectives

The general objective of this module is to equip Environmental Health Technicians with knowledge, attitudes and skills required to undertake preventive interventions against water-borne diseases and promote hygiene education to bring about sustainable behavioral change.

Therefore, by the end of reading this module, Environmental Health Technicians are expected to:

- Describe the mode of transmission of water-born diseases.
- List the various environmental health activities, which are essential in the prevention and control of water - born diseases.
- Describe the contribution of hygienic behavior in the prevention and transmission of water-borne diseases

3.3.4. Mode of transmission

Water-borne diseases are transmitted by water that has been contaminated with human waste (excreta) containing the different types of pathogenic organisms. Knowledge of the route of transmission of water-borne diseases is essential to providing preventive and control measures.

The job of Environmental Health Technicians is to design ways to break the chain of water-borne diseases transmission. The chain of transmission of water borne diseases is illustrated by figure 3.3.1.

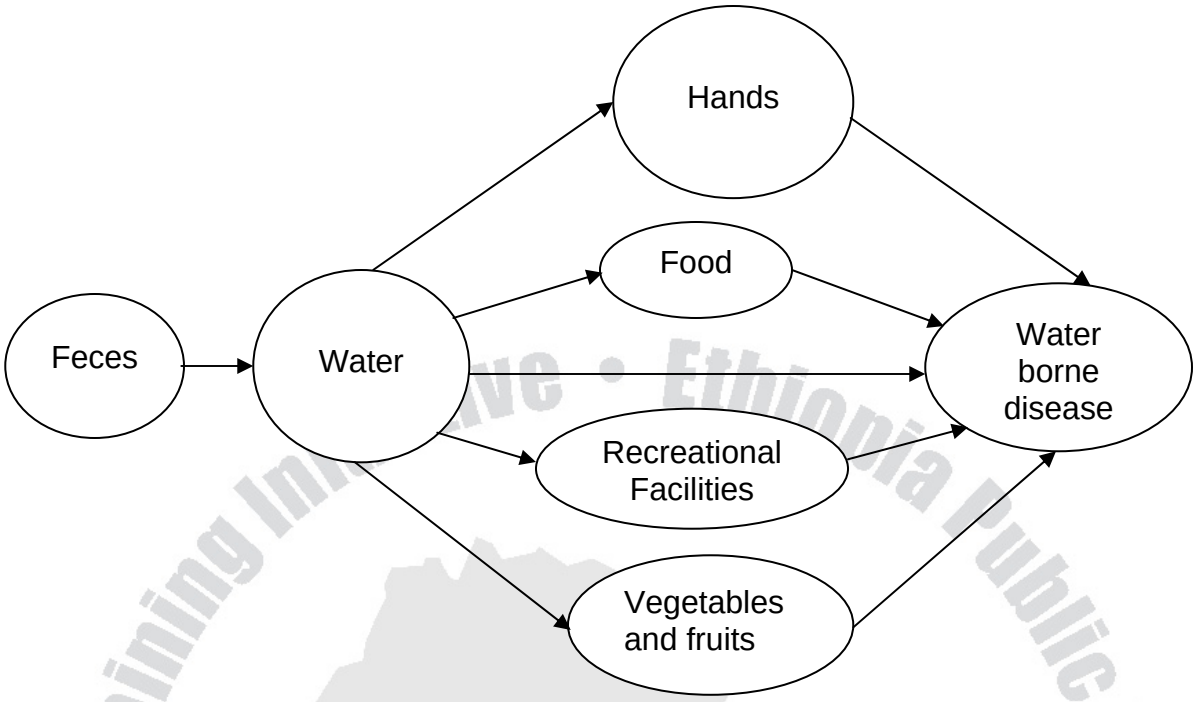

Fig. 3.3.1: Transmission of Water Borne Diseases.

3.3.5. Public health approaches to the prevention and control of water-borne diseases

Water-borne diseases are one of the major public health threats especially in developing countries, where unsafe water, sanitation problems and poor hygienic practices exit. The public health approach to the prevention and control of water-borne diseases should consist of three basic components:

- Provision of safe and adequate water supply.
- Improved sanitation.
- Hygiene education.

1. Provision of a safe and adequate water supply

Provision of an adequate and safe water supply will positively contribute to the health and welfare of individuals, families, and communities. The safeness of the water supply can be ensured through different activities as

described below. Figure 3.3.3 Illustrates protecting a water source as an effective barrier against water borne diseases.

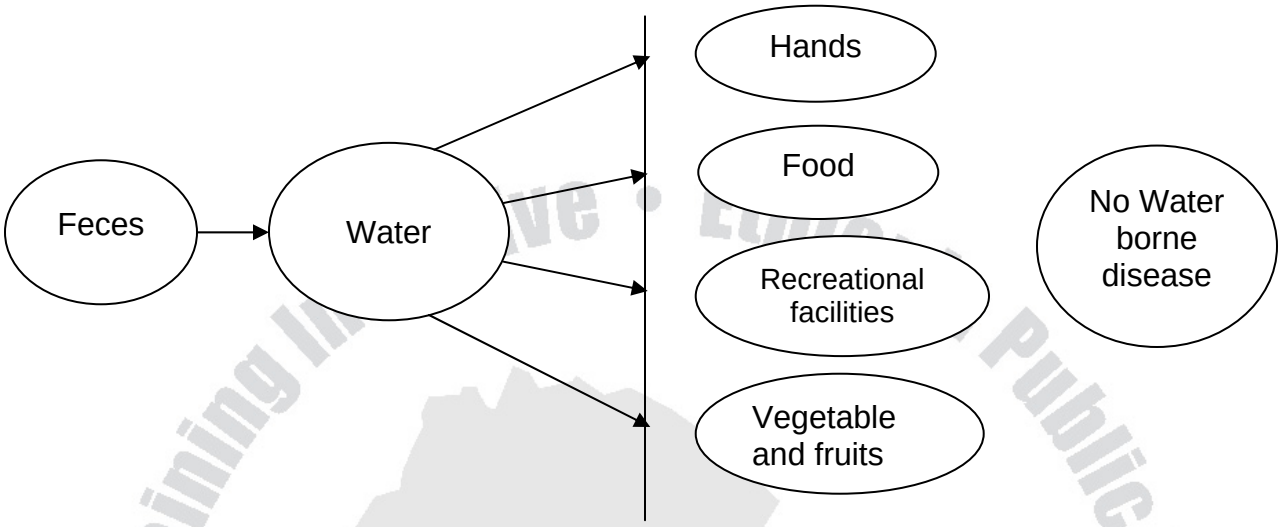

Fig.3.3.3: Protecting source of water supply as a barrier against water borne diseases.

a. Protecting the water at the sources:

Water sources such as springs, streams, and wells should be protected from any contaminants by:

- Proper siting: water sources should be located at a higher elevation and at a convenient distance (at least 30m) from contaminant sources such as latrines, septic tanks etc.
- Constructing waterproof barriers around the sources, for instance protection around a spring.
- Using of pump or sanitary rope and bucket system for drawing water from well: This will help to reduce any contamination arising from unclean containers that may be used to draw water.
- Digging a diversion ditch: diversion ditches should be made around a water source to prevent it from being flooded.
- Fencing: the water source should be fenced to protect gross contamination by animals.

- Zoning: zoning of water sources such as streams and rivers based on the intended use will help to reduce gross contamination.
- Constructing a water tank (cistern) for harvesting rainwater: there should be a properly constructed water tank (cistern) and the collecting surface should be kept clean.

b. Treatment of water supply:

Water for domestic purposes can be treated against contaminants either in small scale or large scale.

- **Small scale treatment of water supply:**

The following treatment methods can be considered as small scale treatment of water supplies for individuals and families.

- Boiling of water:

It is difficult to practice boiling of water due to fuel and time shortages. Nevertheless, boiling water is an important method to prevent water borne diseases at the household level.

- Filtration:

Home made sand filters and candle filters are helpful at the household level.

- Storage of water:

Storing water at the household level for 24-72 hours will help settle suspended impurities including pathogens. It creates an unfavorable environment for pathogenic microorganisms. Most pathogens do not survive long in water.

- Disinfection: disinfection of spring or well with chlorine right after construction or when the need arises.

- **Large scale treatment of water supply**

Large scale water treatment involves the municipal treatment of water for domestic use.

Treatment of surface water involves several stages that include sedimentation assisted with various chemical reagents and the passage of water through sand filters (slow sand filtration or rapid sand filtration processes). Finally the filtered water will be treated with chlorine doses to maintain a residual amount of chlorine throughout the supply lines to avoid any incidental contamination during distribution. Ozone could also be used to treat water supply. However, this is expensive and does not have residual effect like to that of chlorine. Whatever chemical is used, administrating the right dose of the disinfectant is vital in the prevention and control of water - borne diseases.

c. Care during transport and storage:

When water is transported from the source to individual households, care should be given to the cleanliness of the containers. Rather than dipping with a cup or free hand from a storage container,, controlled outlets such as faucets should be used.

d. Monitoring of the water supply:

The Environmental Health Technician should follow the safe supply of water through the following activities:

- **Sanitary survey:**

A sanitary survey is an on site inspection and evaluation of all conditions and practices of the water system to prevent any incident of water-borne illness. Sanitary surveys should be made:

- When developing a new water source.
- When laboratory analysis of a sample taken from the water system indicates a health danger.
- When a water-borne disease outbreak occurs in or near the area served by the water supply.

(N.B. Even though the above surveys are taken once or at irregular intervals, the sanitary survey should also be undertaken on a regular basis.)

- **Water sample:**

Samples are taken from drinking water systems to determine if the water supply system is safe or not. The actual number and frequency of sampling must take the local conditions into account. Indicator organisms are used to interpret the results of laboratory analysis.

2. Improved sanitation

The main water-borne disease causing pathogens are shed in the feces, and, therefore, the hygienic disposal of human waste is of the utmost importance. Each family must have access to a latrine which all members use and keep clean. The latrine must be acceptable and attractive to the users. Figure 3.3.2 illustrates improved sanitation as a barrier against water borne diseases.

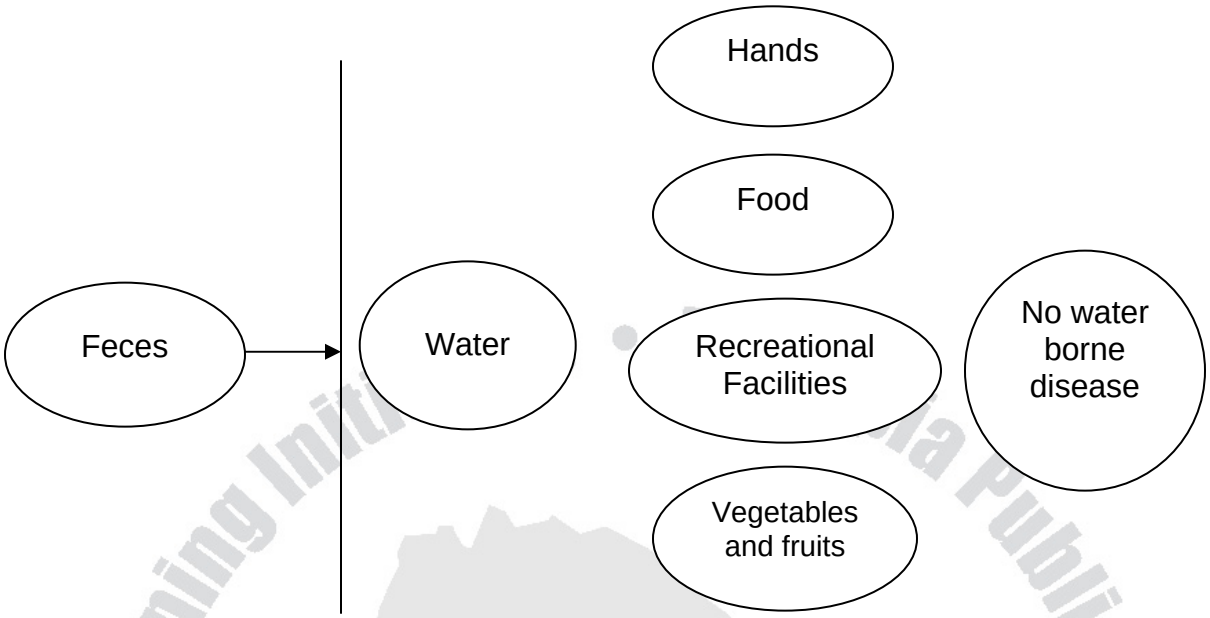

Fig. 3.3.2: Sanitation Barrier for Water Borne Diseases

Therefore, in constructing latrines the following points should be given due attention:

- The latrine should be located at a convenient distance from the water source and at a distance which encourages users to use it.
- The latrine should be sited at a lower elevation than the water source.
- The latrine should be cleanable and have a cover with a handle or a vent pipe to discourage insect reproduction.
- Empowerment of individual families and communities through their active involvement in the construction of the latrine.
- It is advisable to have hand washing facilities nearby a latrine to help people develop hygienic behavior.
- In case of a water carriage system, there should be proper means of final disposal.

3. Hygiene education

Providing safe water supply and encouraging people to build latrines only will not necessarily ensure good health. For instance, evaluation of a water and sanitation program by the Ministry of Health in Botswana (UNICEF) depicted the following results:

- Water that was clean at the source was highly contaminated by the time it was consumed in the home.
- House holds adopting Ventilated Improved Pit (VIP) latrines still had a high incidence of diarrhea.
- Approximately 75% of the people with latrines in their compound did not use them.

It was then discovered that nearly 85% of the households that had built VIP latrines had received no health education either before, during or after their construction. Therefore, health education is vital in raising people's awareness and ultimately bring behavioral change towards hygienic practice. Figure 3.3.4 Illustrates hygiene education as a barrier against water borne diseases

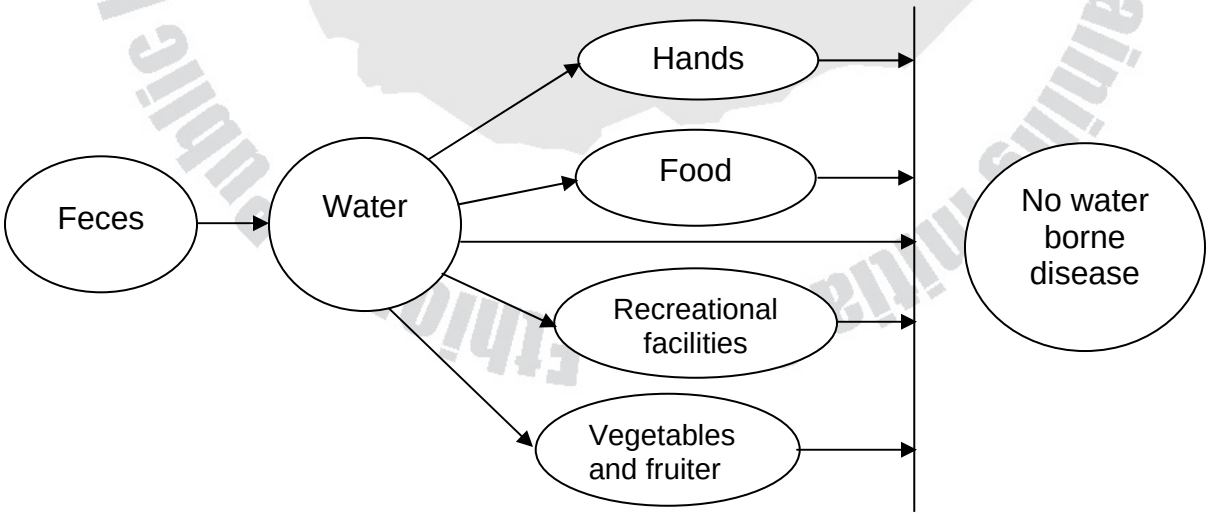

Fig. 3.3.4: Hygiene education as a barrier for water borne diseases

Thus, the Environmental Health Technicians should focus on the following areas with respect to health information:

- The causative agents.
- The mode of transmission.
- Early diagnosis and treatment of cases.
- Prevention and control through the use of different teaching aids such flip charts, posters etc.

An integrated approach to the provision of safe and adequate water supplies, improved sanitation and hygiene education (like washing hands with soap and water) are the keys to successful prevention and control of water-borne diseases.

Now you are through with the Core and Satellite Modules. There are still some activities remaining as stated below:

1. Read the Task Analysis of the different categories of The Health Center Team on Unit 4.
2. Do the questions of pre-test as a post-test.
   (N.B. Use a separate answer sheet.)
3. Compare your answers on the pre and post- tests with the answer keys given in Annex XI and evaluate your progress.

3.4. Satellite Module for Medical Laboratory Technicians

3.4.1. Purpose of the module

This module is designed for laboratory technicians to enable them to actively participate in the team management of water borne diseases by focusing on laboratory investigations. This module should be helpful for both pre-service and in-service training levels.

3.4.2. Direction for using the satellite module

Before you start the Satellite Module, be sure to complete the Core Module and perform the pre-test questions.

3.4.3. Learning Objectives

At the end of this satellite module, the reader is expected to be able to

- Describe the procedure for collecting, handling and processing different specimens in the diagnosis of water-borne diseases.
- Describe the appearance of different specimens during investigation processes in the diagnosis of water-borne diseases.
- List the routine laboratory procedures in the identification of water-borne diseases.
- Illustrate the morphological features of etiologic agents for water-borne diseases.
- Explain the safety procedures that should be taken in the diagnosis of the specimens.
- Demonstrate proper recording and reporting systems for laboratory results used to diagnose diseases.

3.4.4. Learning Activity 2

Refer to Ibsa's story in the Core Module and discuss the following questions:

1. What type of specimen should be collected?
2. How should the specimen be collected?
3. What could be the etiology of the disease?
4. What do you expect to identify on the visual (macroscopic) examination of the specimen?
5. What type of investigation can be done at the Health Center level?
6. What types of materials are needed to perform the investigation at the Health Center level?
7. How would you report the result?

3.4.5. Laboratory Diagnosis

Collection and handling of specimens

Proper specimen collection is essential since the final laboratory results are dependent on the initial quality of the samples taken. Unless the appropriate specimen is properly collected, preserved and processed the detection of organisms is very difficult. Therefore, generation of the test results must begin with focusing on the sample collection process.

Water-borne disease may be detected in the laboratory by examining specimens such as stool and blood (serum): using macroscopic and microscopic techniques to identify morphological criteria, culture and biochemical tests and serological tests for immuno diagnosis.

Appropriate collection techniques are very important to yield the required results for diagnosis.

Collection of stool specimens

The detection of parasites in stool depends on its proper collection.

Procedure

The following procedure should be followed in the collection of stool specimens.

- Provide the patients with specimen containers having tight-fitting lids and appropriately cleaned.
- Collect sufficient quantities of stool. It should contain 4 ml of stool especially in diarrheal cases.
- Examine the stool as soon as possible. The liquid specimens should not wait more than 30 minutes.
- If specimens can not be examined immediately as mentioned above they should be preserved with the appropriate preservative.
- Use the appropriate aseptic technique in the collection for the bacteriological analysis.

Collection of blood specimens

The following care should be taken while collecting blood

- Collect sufficient quantities of blood
- If plasma is required, use the appropriate anticoagulant
- Process the specimen appropriately.

3.4.5.1. Safety procedures (22)

Health care personnel, by virtue of their profession, can acquire certain illnesses beyond those acquired by all others who live and work in our society. Health professionals, specifically the lab. Personnel are at risk of acquiring infections from patients or their specimens which may be viral, bacterial, parasitic or fungal. However this risk can be minimized if they follow universal work precautions.

Much of the contamination in the laboratory occurs as a result of penetrating injuries caused by sharp objects and splashing of specimen materials.

* **Guidelines of basic practices and procedures (22)**

- Prevention of puncture wounds, cuts and abrasions, as well as creating barriers to existing wounds, skin lesions, conjunctiva and mucosal surfaces.
- Application of simple protective measures designed to prevent contamination of the person and his/her clothing.
- Good basic hygiene practices, including regular hand washing with soap.
- Control of surface contamination by contaminant and disinfection procedures.
- Safe disposal of contaminated waste.

Bio-safety Regulations (22)

- Wear gloves when handling infectious materials or where there is a possibility of exposure to blood and other specimens.
- Discard gloves whenever they are thought to have become contaminated or perforated, wash your hands and put on new gloves. Alternatively where there are economic constraints, wash gloved hands whenever they get contaminated with specimens before collecting further samples.

- Do not touch your eyes, nose, or other exposed skin parts with your gloved hands.
- Sterilize non disposable items
- Wherever autoclaving is not possible boiling must be for 30 minutes at least.

3.4.5.2. Laboratory investigation on specific diseases

Salmonellosis

Salmonella are often pathogenic to humans or animals when acquired by the oral route.

- **Morphology and Identification**
  - Salmonella vary in length and most species are motile with peritrichous flagella.
  - Salmonella grow readily on simple media but they almost never ferment lactose or sucrose.
  - They form acid and sometimes gas from glucose and mannose.
  - They usually produce H_2S.
  - They survive freezing in water for long periods.
- **Diagnostic laboratory Tests**

A. Specimens

Blood urine, stool and bone marrow can be used to identify the organisms.

- **Commonly used culture media**

  Eosin Methylin Blue (EMB), MacConkey's and Deoxychocolate medium are some differential media. And Salmonella - Shigella (ss) agar, Hektoen enteric agar and deoxychocolate citrate agar are selective media.
- Biochemical reaction and slide agglutination tests with specific sera are used for the identification of suspect colonies from solid media. (20)

B. Serological methods

- Serological methods include the Rapid Slide Agglutination test and Tube Dilution Agglutination test (Widal test).
- The possible presence of cross-reactive antibodies limits the use of serology in the diagnosis of salmonella infections. (20)

However, almost none of these tests are applicable at the Health Center level.

Shigellosis

The natural habitat of shigellae is limited to the intestinal tracts of humans and other primates, where they produce bacillary dysentery.

- **Morphology and Identification**

Shigellae are slender gram-negative rods; coccobacillary forms occur in young cultures. On culture medium, shigellae are facultative anaerobes but grow best aerobically. They have convex, circular, transparent colonies with intact edges and reach a diameter of about 2mm in 24 hours. All shigellae ferment glucose. They do not ferment lactose with the exception of Shigella sonnei. The inability to ferment lactose distinguishes shigellae on differential media. Shigella form acid from carbohydrates but rarely produce gas. They may also be divided into those that ferment mannitol and those that do not. (20)

- **Diagnostic Laboratory Tests**

A. Specimens:

- Fresh stool, mucus flecks, and rectal swabs for culture. Large numbers of fecal leukocytes and some red blood cells often are seen microscopically.
- Serum specimens, if desired, must be taken 10 days apart to demonstrate a risk in titer of agglutinating antibodies. (20)

B. Culture:

- The specimens are innoculated on differential media (e.g. MacConkey's, EMB agar) and on selective media (Hektoen enteric

agar or Salmonella Shigella agar), which suppress other Enterobacteriaceae and gram-positive organisms.

C. Serology

- Normal persons have agglutinins against several shigella species. However, serial determinations of antibody titers may show a rise in specific antibodies. Serology is not used to diagnose shigella infections.(20)

Cholera

- **Morphology and Identification**

Upon first isolation, V. cholerae is a comma-shaped curved rod 2 - 4 μm long. It is actively motile by means of a polar flagellum. On prolonged cultivation, vibrios may become straight rods that resemble the gram - negative enteric bacteria.

On culture media, V.cholerae produces convex, smooth, round colonies that are opaque and granular in transmitted light. In areas where cholera is endemic, direct cultures of stool on selective media such as TCBS (Thio sulfate - Citrate - Bile-Sucrose), and enrichment cultures in alkaline peptone water are appropriate. However, routine stool cultures on special media such as TCBS generally are not necessary or cost-effective in areas where cholera is rare. (20)

- **Diagnostic Laboratory Tests (20)**

A. Specimens:

Specimens for culture consist of mucus flecks from stools.

B. Smears:

The microscopic appearance of smears made from stool samples is not distinctive. Dark field or phase contrast microscopy may show the rapidly motile vibrios. It can be identified in dark field microscopy by noting its characteristic rapid darting movement and immobilization of the organism with serogroup 1specific antiserum. (21)

C. Culture:

Growth is rapid in peptone agar, on blood agar with a pH near 9.0 or on TCBS agar, and typical colonies can be picked in 18 hours. For enrichment, a few drops of stool can be incubated for 6 - 8 hours in taurocholate-peptone broth (pH 8.0 - 9.0). Organisms from this culture can be stained or subcultured.

D. Specific Tests:

V.cholerae organisms are further identified by slide agglutination tests using anti - O group 1 antiserum and by biochemical reaction patterns.

Amebiasis

A. Microscopic examination

The diagnosis of intestinal amebiasis is made by identifying E.histolytica cysts or trophozoites in the stool. Only one - third of infected patients are identified from a single stool specimen, and it is recommended that at least three separate specimens be evaluated before excluding the diagnosis. (See Annex __for the direct stool examination procedure). (21)

Fresh specimens of stool or scrapings obtained by endoscope can be examined by wet mount preparation within 30 min of collection. Amoebas can be detected by their characteristic morphology and linear motion across the microscopic field. (22).

E.histolytica is identified by their characterstic morphology and ingested red cells, the latter feature seen only in invasive E. histolytica infection and not with other Entamoeba found in the stool. Concentration techniques for stool can also be employed to improve cyst observation.

B. Serological tests

Serological studies can be very useful in diagnosing invasive amebiasis. However, they are not applicable at the Health Center level.

Giardiasis

A. Stool Examination

The gold standard for diagnosis of giardiasis still remains microscopic examination of stool. A saline wet mount of liquid stool in acute disease may demonstrate motile trophozoites. (See Annex ____ for the procedure of direct microcopy). (21)

More often, the stool is semi-formed and trophozoites are not visualized. In these cases, fresh specimens can be examined for cysts, or specimens can be preserved and stained for parasites with trichrome or iron hematoxylin. (21)

Concentration of samples has been shown to increase the diagnostic yield. When these techniques are applied, Giardia will be indentified in 50 to 70 percent of cases after examination of single stole specimen and up to 90 percent when three or more specimens are examined.

B. Duodenal content examination

If stool examination is repeatedly negative and the clinical suspicion for giardiasis remains high, sampling of duodenal contents may be indicated. (21)

C. Serological test

Detecting Giardia by Ag in fecal specimen using mono colonal Abs reagent. The presence of Ag indicates active infection produced as giardia multiplies in the intestine.

Hepatitis

A diagnosis of hepatitis can be made on the basis of the characteristic presentation and the presence of abnormal liver function tests. In the case of hepatitis, the serum aspartate and alanine amino transferees (AST, ALT) levels are markedly elevated (usually >10 times normal) while the level of alkaline phosphates is minimally elevated (usually 1 to 3 times normal).

Other tests like bilirubin determination and leukocyte count can be done in which leukopenia is common in hepatitis cases. Many cases of hepatitis are unicteric with normal levels of serum bilirubin.

But most of these tests (almost all) are not applicable at the Health Center level.

Poliomyelities

Diagnosis of poliovirus infection depends on either viral isolation or serological evidence. Polioviruses may be isolated from throat or rectal swabs cultured on human cell lines. It can also be detected using serological testing by analyzing neutralizing antibodies that are generally detectable early in the course of the disease. However, these tests are not applicable at the Health Center level.

Rota virus

The specific diagnosis of rotavirus infection is generally not required in the management of patients with diarrhea. Rotavirus can be identified by demonstration of the virus in stool; either by electron microscopy or by specific antibody recognition in agglutination or enzyme - linked immuno sorbent assays (ELISAs). Stool ELISA is the preferred method because of its high sensitivity, low cost, and adaptability to multiple samples. These tests are also not applicable at the Health Center level.

Dracunculiasis

A serpiginous worm beneath the skin may be observed in dracunculiasis but it is also seen in loaloa infection and cutaneous larva migrans. However, these latter parasites do not form the characteristic ulcer of dracunculus infection, making the differential diagnosis apparent after a period of observation.

A. Microscopic examination of the larvae:

Materials and Methods used are:

- Wooden application sticks
- Microscope slides

As in dracunculus infection, rupture of an abscess containing a motile larval form may also be seen in cutaneous infestation with cyclops or other insect larvae.

Immersion of the suspect lesion in cold water may induce the release of dracunculus larvae detectable upon microscopic examination. Such intervention is usually not needed to establish the diagnosis. (21)

Procedural Technique for the identification

1. Place a few drops of water on the ulcer to encourage discharge of larvae from the uterus of the worm. Diagnosis is usually made when the blister has ruptured and the anterior end of the female worm can be seen.
2. After a few minutes, collect the larvae rich water in a pipette and transfer a drop of it on a slide
3. Cover with a cover slip and examine with 10 x objective for a motile larvae with the iris diaphragm closed sufficiently to give good contrast.

Now you are through with the Core and Satellite Modules. There are still some activities remaining as stated below.

1. Read the Task Analysis of the different categories of The Health Center Team in Unit 4.
2. Do the pre-test as a post-test.
   (N.B. Use a separate answer sheet.)
3. Compare your answers from the pre and post- tests with the answer keys given on Annex XI and evaluate your progress.

3.5. Satellite Module for Community Health Workers

3.5.1. Introduction

3.5.1.1. Purpose and Uses of The module

The module is intended to be used by Community Health Workers (CHWs) and is believed to provide them with the basic information needed at the grass-roots level to serve the community in the prevention and control of water borne

diseases. It helps them to recognize their role in finding cases and establishing management procedures necessary in the prevention of the diseases.

3.5.1.2. Direction for using this Module

- Start with the pre-test questions. (Use a separate answer sheet).
- Study the text including the task analysis.

3.5.2. Pre-test

Write the letter of your choice in the following questions.

1. All of the following are water borne diseases except
    A. Typhoid fever
    B. Dracunculusis (Guinea worm infection)
    C. Tuberculosis
    D. Poliomylitis
2. Water borne diseases affect mostly
    A. Adolescents
    B. Children under 5 years of age
    C. Adult men
    D. Adult women
3. Dracunculusis (Guinea worm) is transmitted by fecal oral route
    A. True
    B. False
4. Water borne diseases can be transmitted by water contaminating
    A. Hands/ Feeding utensils
    B. Food
    C. Recreational facilities
    D. All of the above

5. Diarrhea is one of the major manifestations of water borne diseases
    A. True
    B. False
6. Dehydration due to diarrhea is identified by
    A. Sunken eyes
    B. Depressed fontanels
    C. Dry lips
    D. All of the above
7. Breast feeding should be interrupted for a child presenting with diarrhea
    A. True
    B. False
8. Immunization is one of the methods of preventing and controlling water borne diseases
    A. True
    B. False

3.5.3. Learning Objective

At the end of this module the CHW will be able to:

1. Define water borne diseases.
2. List the most common water borne diseases.
3. Perceive the problem of water borne diseases in the community.
4. Detect and treat or refer cases of water borne diseases.
5. Advise mothers on the management of diarrhea and the significance of ORT in the treatment of dehydration.
6. Give health education on the causes, modes of transmission and prevention of water borne diseases.
7. Participate in mobilizing communities for integrated environmental sanitation, safe and adequate water supply and immunization program.
8. Identify water sources for the community.
9. Participate in epidemic control of water borne diseases.

3.5.4. Definition

Water borne diseases are diseases that are caused by ingestion of contaminated water either directly by drinking or through the use of contaminated water for preparing food and personal hygiene.

3.5.5. Epidemiology

The most common water borne diseases that produce significant health problems in all parts of Ethiopia include: Typhoid fever, Bacillary dysentery, Cholera, Poliomyelitis, Hepatitis A, Hepatitis E, Viral and bacterial Gastro enteritis, Amebiasis, and Giardiasis. Guinea worm infection is found in Gambella and South Omo only. Although these diseases affect all age groups,, children under 5 years of age are most affected. In Ethiopia, each child under five years of age gets 5 episodes of diarrhea per year on the average. (20)

3.5.6. Causes

Water borne diseases are caused by different germs that get into the body through drinking contaminated water or through food prepared with contaminated water.

3.5.7. Transmission

Water borne diseases are transmitted primarily by drinking water contaminated by feces. (The spread of guinea worm disease is not transmitted through a fecal oral route.)

Feces or urine from an infected person may contaminate water supplies. A healthy person acquires the infection by:

- Directly drinking water from the contaminated source
- Consumption of food prepared by contaminated water.
- Using contaminated water for personal hygiene.
- Using contaminated water for recreation (e.g. swimming)

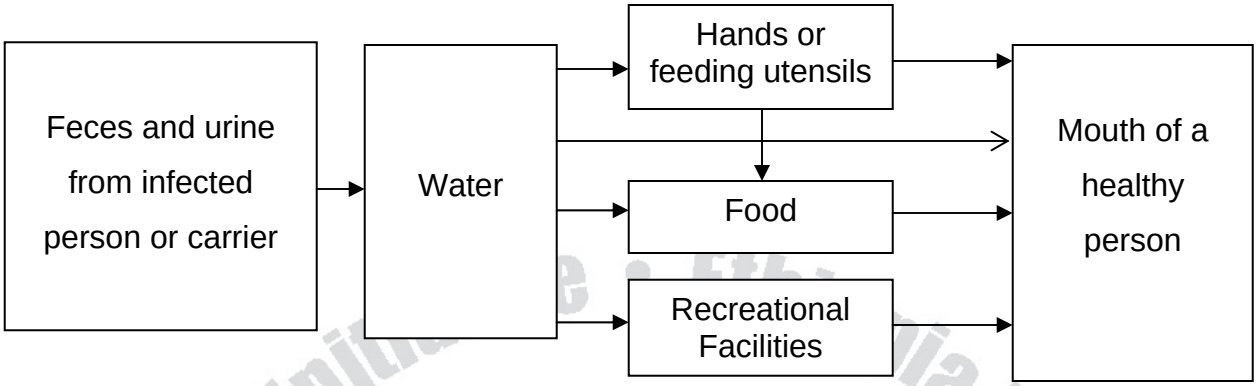

Fig. 3.5.1: Transmission of water borne diseases (except dracunculiasis)

The mode of transmission of Guinea worm disease is different from the other water borne diseases. Source of water supply such as ponds, wells etc. can be contaminated by a larvae of the Guinea worm from a raptured blister found on the body of an infected person. Then the larvae are picked up by Cyclops (crust aceans) which swim in the water. A healthy person acquires infection by drinking water containing infected Cyclopes. The legs are most affected by ulcers.

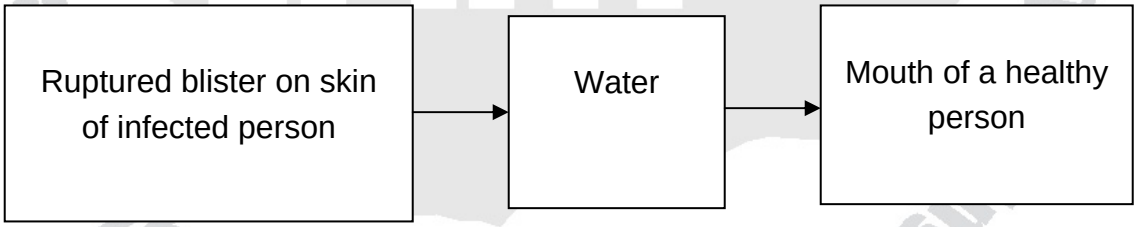

Fig. 3.5.2: Transmission of Dracunculiasis (Guinea Worm)

3.5.8. Clinical Features

The major signs and symptoms in which water borne diseases can be detected include:

- Diarrhea can be watery or loose. It can be large or small in volume. It can be associated with blood or mucus.
- Abdominal pain and tensmus may be present.
- Vomiting.

- Weakness
- Loss of appetite
- Some times fever and chills
- Dehydration (sunken eyes, depressed fonatanel, dry lips etc.)
- Jaundice or dark urine.
- Paralysis of legs (poliomyelitis).
- Ulcer due to ruptured blister on the surface of the body, usually the legs and the adult worm appearing through the lesion in Dracnculiasis.

3.5.9. Management

The Community Health Worker must refer or advise persons presenting with any of the above clinical features to a nearby health care facility.

- Home Management of Diarrhea:
  - Continue feeding including breast feeding
  - Give more fluids.
  - Check for signs of dehydration and refer immediately.
- Oral rehydration therapy (ORT). It can be safely and successfully used in treating many cases presenting with dehydration.

3.5.10. Prevention and Control

Water borne diseases can be prevented by the following methods

1. Safe disposal of human and animal wastes.
   - Construction of appropriate fly proof latrines.
   - Sanitary utilization of latrines.
   - Health education pertaining to behavioral change in improved personal hygiene such as washing hands with soap and water after defecation, and before handling of food, and safe disposal of feces.
2. Provision of safe drinking water.
   - Protecting public sources of water supply such as springs, wells, etc.
   - Installing pipe water from protected sources.

- Health education of the public relating to:
  - Boiling, filtering (sieving) drinking water.
  - Safe collection and storage of domestic water.
  - Protecting source of water from contamination by persons affected by guinea worm.

3. Early detection and treatment of cases.
   - Participation in active case finding.
   - Participation in notification and control of epidemic outbreaks of water borne diseases.
   - Participate in the eradication programs of water borne diseases (such as poliomyelitis and guinea worm).
4. Immunization.
   - Children have to be vaccinated as soon as they are born and then at 6 weeks, 10 weeks, 14 weeks and at 9 months of age according to immunization schedule.

Now you are through with Satellite Module for CHWs. There are still some activities remaining as stated below.

1. Read the Task Analysis for CHWs which follows.
2. Do the pre - test as post - test.
3. Compare your answers of the pre - test and post - test with the answer key following the task analysis.

3.5.11. Task Analysis of Community Health Workers

Table 3.5.1: Knowledge Objectives and Activities

Learning Objectives	Activities
To describe water borne diseases	- Define water borne disease. - List common water borne diseases. - Explain the modes of transmission.
To explain the environmental risk factors for water borne diseases	- List the sources of water contamination. - Describe the contribution of poor waste disposal system to water borne diseases.
To explain the prominent clinical features and management of water borne diseases	- List the signs and symptoms. - State the consequences of diarrhea and the signs and symptoms of dehydration - Explain the treatment for dehydration and the need for immediate referral.
To identify prevention and control measures.	- Describe the need for appropriate waste disposal systems. - Describe the importance of protecting sources of water supply. - Explain the importance of proper handling of water and containers.

Table 3.5.2: Attitude Objectives and activities for CHW

Learning Objectives	Activities
To believe that water borne diseases are major health problems	- Believes that pathogens are the causes of water borne diseases.
To appreciate risk factors and the mode of transmission	- Emphasizes the effect of poor environmental sanitation. - Believes protecting water sources can prevent water borne diseases.
To consider the importance of diagnosis and management of water borne diseases	- Emphasizes early treatment of diarrhea caused by water borne diseases. - Believes in rehydration therapy and other supportive treatment.
To appreciate the prevention and control measures of water borne diseases.	- Stresses the need for sanitary waste disposal systems. - Believes in protecting water sources and appropriate handling. - Believes that behavioral change can be brought about by health education.

Table 3.5.3: Practice Objectives and Activities of CHWs

Learning Objectives	Activities
To identify a case with water borne disease.	- Asks appropriate history and observes signs and symptoms. - Observes for signs of dehydration. - Assess the environmental risk factors.
To conduct appropriate management of water borne diseases	- Carry out appropriate treatment and / or refer to primary health unit, if needed. - Give ORT for diarrheal diseases.
Promote prevention and control of water borne diseases.	- Deliver health education - Identify potential sources of water in the community. - Participate in community mobilization. - Assess sources of contamination of water including drinking water for the community.

Answer key for pre-test / post-test questions of CHWs

1. C
2. B
3. B
4. D
5. A
6. D
7. B
8. A

3.6. Take Home Message for Care Givers

3.6.1. Take Home Message for Care Givers

Definition

Water borne diseases are diseases which are caused as a result of contamination of water used for house hold consumption.

How is water contaminated?

Water which is used for household consumption can be contaminated:

- At the source such as wells, springs, ponds, rivers, by human or animal wastes if latrines are not commonly used.
- During the process of:
    - Fetching water from a protected source when unclean containers are used.
    - Storing and utilizing water at home when the container is not well protected or covered.
    - Hands not clean during food preparation or eating.

Home Management of Diarrhea

Diarrhea is the most common and dangerous manifestation of water borne disease especially in children under five years of age.

A mother who has a child with diarrhea should:

- Give more fluid to a child with diarrhea.
  - Give her/him water, oral dehydration salts (ORS) solution, or locally available drinks or liquids, such as soups, rice water or fruit juices.
  - Give her/him about ¼ to ½ a cup, or 50 - 100 ml, of fluid to drink after each stool.
- Continue feeding including breast feeding
  - If an infant is breast - feeding, breast-feed him normally.
  - If the child is 6 months or older and is no longer being breast-fed, feed him/her normally when he/she has diarrhea.
  - Allow him/her to eat as much as he/she wants.
  - Even after the diarrhea has stooped, give him/her an extra feed a day for one week.
- Watch for signs of dehydration and take the child to the nearest health institution.
  - If the child is losing too much water by passing watery stools too many times or if she/he is getting more and more sick, this is dangerous. Take him/her to the health center or hospital immediately.
- Signs of dehydration
  - Thirst
  - Sunken, fearless eyes
  - Little or no urine
  - The child getting light and lean very fast
  - Dropping in of the “soft spot” (fontanel), the soft part in the centre of the top of an infant’s head

- The skin not stretching when pulled
- Death, if not treated in time.

Prevention of Water Borne Diseases

Water borne diseases can be prevented by:

- Construction and appropriate use of latrines
- Avoiding open field disposal of wastes.
- Using protected sources of water for household consumption.
- Using clean containers with appropriate coverings for fetching and storing water.
- Boiling water especially consumed by children.
- Hand - washing with soap before eating food, before preparing foods, and after visiting latrine.

UNIT FOUR

TASK ANALYSIS FOR THE DIFFERENT HEALTH CENTER TEAM MEMBERS

Table 4.1: Knowledge - Objectives and Activities

Learning Objectives	Learning Activities			
	HO	**PHN**	**EHT**	**MLT**
To define water borne disease	- Define water borne diseases	- Define water borne diseases	- Define waterborne diseases	- Define waterborne diseases
To list water borne diseases	- Lists waterborne diseases	- Lists waterborne diseases	Lists waterborne diseases	- Lists waterborne diseases
To describe the magnitude and severity of waterborne diseases.	- Describe the global and the national incidence, prevalence, and mortality of waterborne diseases.	- Describe the global and national incidence, prevalence and mortality of waterborne diseases	- Describe the global and national incidence, prevalence mortality of waterborne diseases	- Describe the global and national incidence prevalence and mortality of waterborne diseases
To describe the etiology and pathogenesis of water-borne diseases.	- Mention the different causative agents of water-borne diseases. - Explain the pathogenesis of each water-borne disease.	- Mention the different causative agents of water-borne diseases. - Explain the pathogenesis of each water-borne disease.	- Mention the different causative agents of water borne diseases. - Explain the pathogenesis of each water borne-disease.	- Mention the different causative agents of water-borne diseases. - Explain the pathogenesis of water-borne diseases.

Knowledge - Objectives and Activities (Continued)

Learning Objectives	Learning Activities			
	HO	PHN	EHT	MLT
To explain clinical feature and diagnosis of water-borne diseases.	- Explain detailed signs and symptoms of water-borne diseases. - Identify laboratory diagnostic method of each water-borne disease.	- Explain the signs and symptoms of water-borne diseases.	- Explain the common signs and symptoms of water-borne diseases.	- Explain the common signs and symptoms of water-borne diseases. - Identify the detailed laboratory procedures to diagnose each water-borne disease.
To state the preventive and control measures of water-borne diseases.	- Explain the preventive and control measures of water-borne diseases.	- Explain the preventive and control measures of water-borne diseases.	- Explain the preventive and control measures of water-borne diseases.	- Explain the preventive and control measures of water-borne diseases.

Table 4.2: Attitude - Objectives and activities

Learning Objective	Learning Activities			
	HO	**PHN**	**EHT**	**MLT**
To believe that water borne diseases are major public health problems	- Emphasize the . diagnosis and treatment . prevention and control - Believe on the importance of health education	- Believe in the importance of: . Appropriate diagnosis and treatment . Prevention and control . Emphasis on health education	- Believe in: the importance of : . prevention and control . diagnosis and treatment . health education	- Believe in the importance of: . diagnosis and treatment . prevention and control. . health education
To consider the importance of clinical diagnosis and management of water-borne diseases.	- Emphasize the clinical assessment of water borne diseases emphasizing on diarrhea - Initiate appropriate management.	- Emphasize the management of diarrhea.	- Emphasize early diagnosis and treatment of diarrhea.	- Emphasize prompt response to laboratory diagnosis of diarrhea
To appreciate preventive and control measures of water borne diseases	- Stress on: . the risk factors . the mode of transmission . the need of prevention and control of water borne diseases	- Stress on: . the risk factors . the mode of transmission. . the need for prevention and control of water-borne diseases	- Stress on: . the risk factors and the mode of transmission. - Give emphasis on the need of: . protecting and surveying water sources. . sanitary disposal system of feces. . health education	- Stress on: . the risk factors and the mode of transmission . the need for prevention and control of water-borne diseases

Table 4.3: Practice - Objectives and Activities

Learning Objectives	Learning Activities			
	HO	**PHN**	**EHT**	**MLT**
To identify a case with any water-borne disease	- Undertake appropriate history and perform a physical examination. - Request appropriate laboratory test of any water-borne diseases	- Assess signs and symptoms. . assess vital signs . assess existence of dehydration and malnutrition	- Ask signs and symptoms - Assess the environmental risk factors. - Advise cases for early diagnosis and treatment	- Carryout specific laboratory diagnostic procedure and identify the organism
To carry out appropriate management of any water-borne disease	- Prescribe appropriate chemotherapy for specific water-borne diseases. - Advise on the importance of drug compliance	- Carryout the appropriate drug therapy. - Provide supportive care - Advise the need of supportive therapy	- Advise on the importance of taking fluids in case of dehydration. - Advise to visit health institution promptly	
To conduct appropriate prevention and control measures of water-borne diseases	- Deliver health education - Mobilize communities to participate in the prevention and control of water borne diseases. - Coordinate and undertake: . mass treatment campaign . epidemic control	- Deliver health education - Mobilize communities to participate in the prevention and control of water- borne diseases. - Participate in mass treatment and epidemic control	- Identify potential sources of water supply in the community. - Mobilize communities and other sectors for protecting water sources. - Assess sources of contaminants and design appropriate preventive measures. - Deliver health education - Participate in mass treatment campaign and epidemic control	- Conduct health education. - Participate in epidemic control

UNIT FIVE

GLOSSARY

Bradycardia: Abnormally slow pulse rate, less than 60 per minute

Cholecystitis: infection of the gallbladder

Dehydration: Loss of a large amount of water and electrolytes from the body.

Epidemic: The occurrence of a disease with a frequency in excess of the constant (usual) presence of the disease in a specified geographic area.

Epidemiology: The study of the distribution and determinants of disease frequency among a population.

Epistaxis: Nose bleeding

Hepatomagally: Enlargement of the liver

Incubation period: The time between entrance of microorganism into the body and the onset of symptoms of the disease

Mortality: Death

Pathogenesis: The ability of an infectious agent to produce disease.

Prevalence: The number of sick persons existing in a stated population at a particular point or stated period of time.

Shiga toxin: A toxin released by shigella species that initiates secretions of water from the small intestine.

Tenesmus: A sensation of the desire to defecate, which is continuous or recurs frequently, with out the production of significant amount of feces.

UNIT SIX

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UNIT SEVEN

ANNEXES

7.1. Direct Examination of stool specimen

Direct Microscopic Examination of stool specimen with physiological saline and Dabell's Iodine solutions.

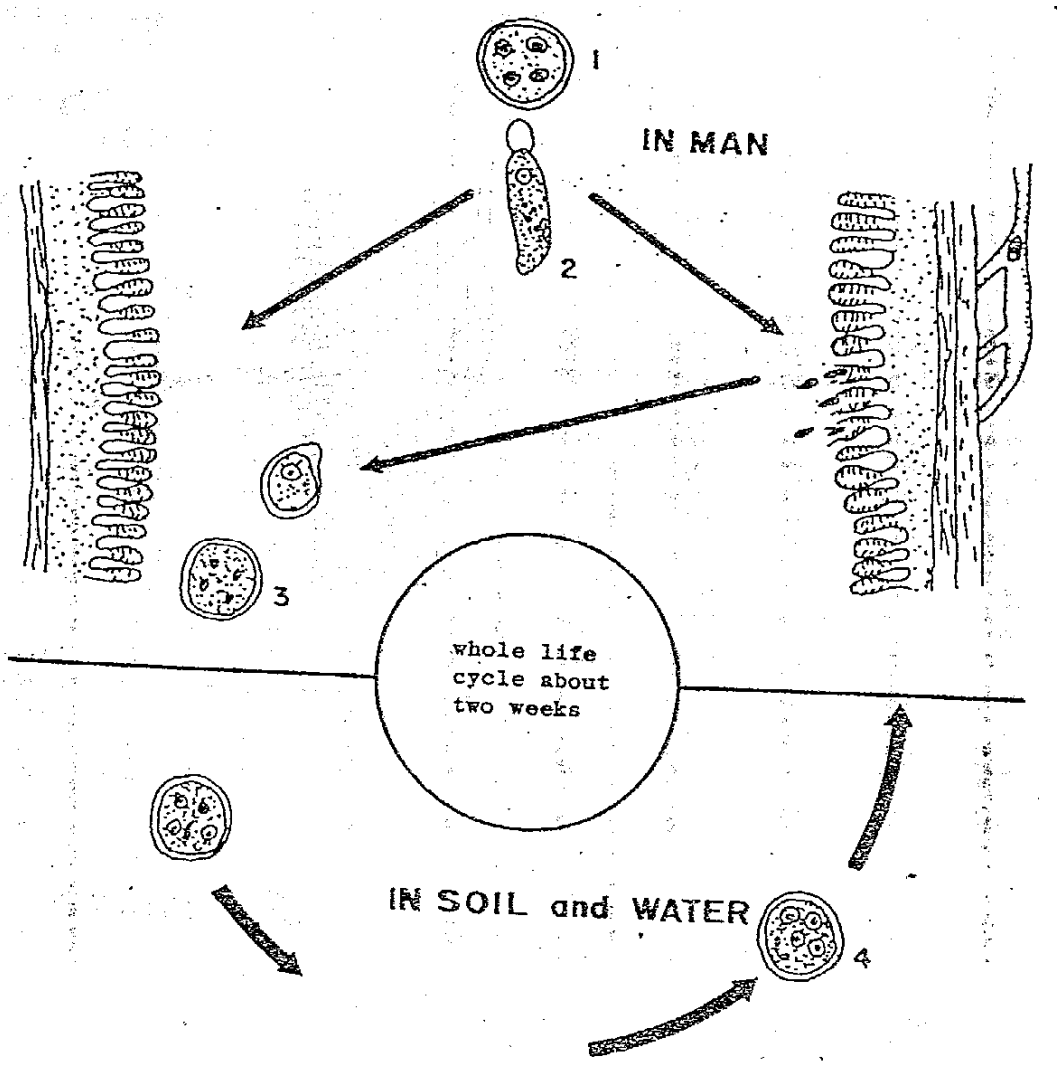
Material and Methods

- Wooden applicator sticks
- Microscopic slides
- Cover slips
- Dropping bottles containing physiological saline (0.85% W/V) and Dobell's Iodine
- Microscope
- Pasteur pipette

Procedure

1. Place a drop of physiological saline in the center of the left half of the slide and place a drop of Dobell's Iodine solution in the center of the right half of the slide.
2. With an applicator stick, pick up a small portion of the feces (about 2 mg which is as much as the size of a match head) and put on the drop of saline. Transfer the same amount of sample to the iodine drop.
3. Mix the feces with the two different drops using the applicator stick to form a homogeneous suspension.
4. Cover each drop with a cover slip. Touch the edge of the drop and gently lower the cover slip onto the slide. Avoid air bubble formation.
5. Examine the saline preparations using the 10x objective for trophozoites (vegetative/motile forms) and cysts as well as oocyst of intestinal protozoa and for any ova or larva of helminthes.
6. Examine the iodine suspension using 40 objective for better identification of the cyst stages of protozoa (Iodine will stain the nuclei and the glycogen mass of the cyst).

7.2. Life Cycle of Entameba hystolicica

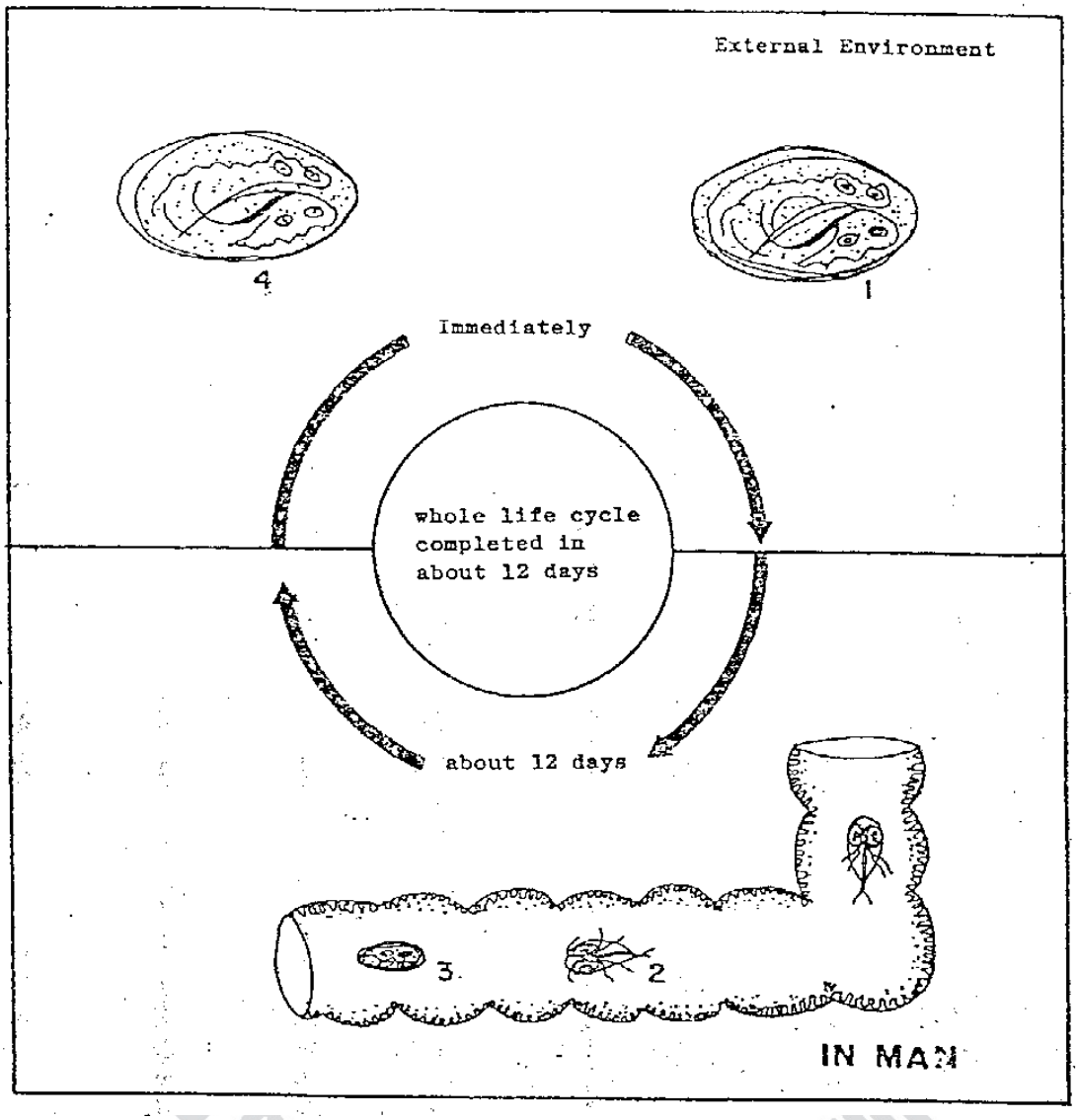


The life cycle of Entamoeba histolytica.

1. Cyst ingested
2. Trophozoite formed
3. Cyst excreted
4. Cyst ingested

Taken form: Shibiru Tedla; Introduction to Parasitology, AAU Press, 1986.

7.3. Life Cycle of Giardia lamblia

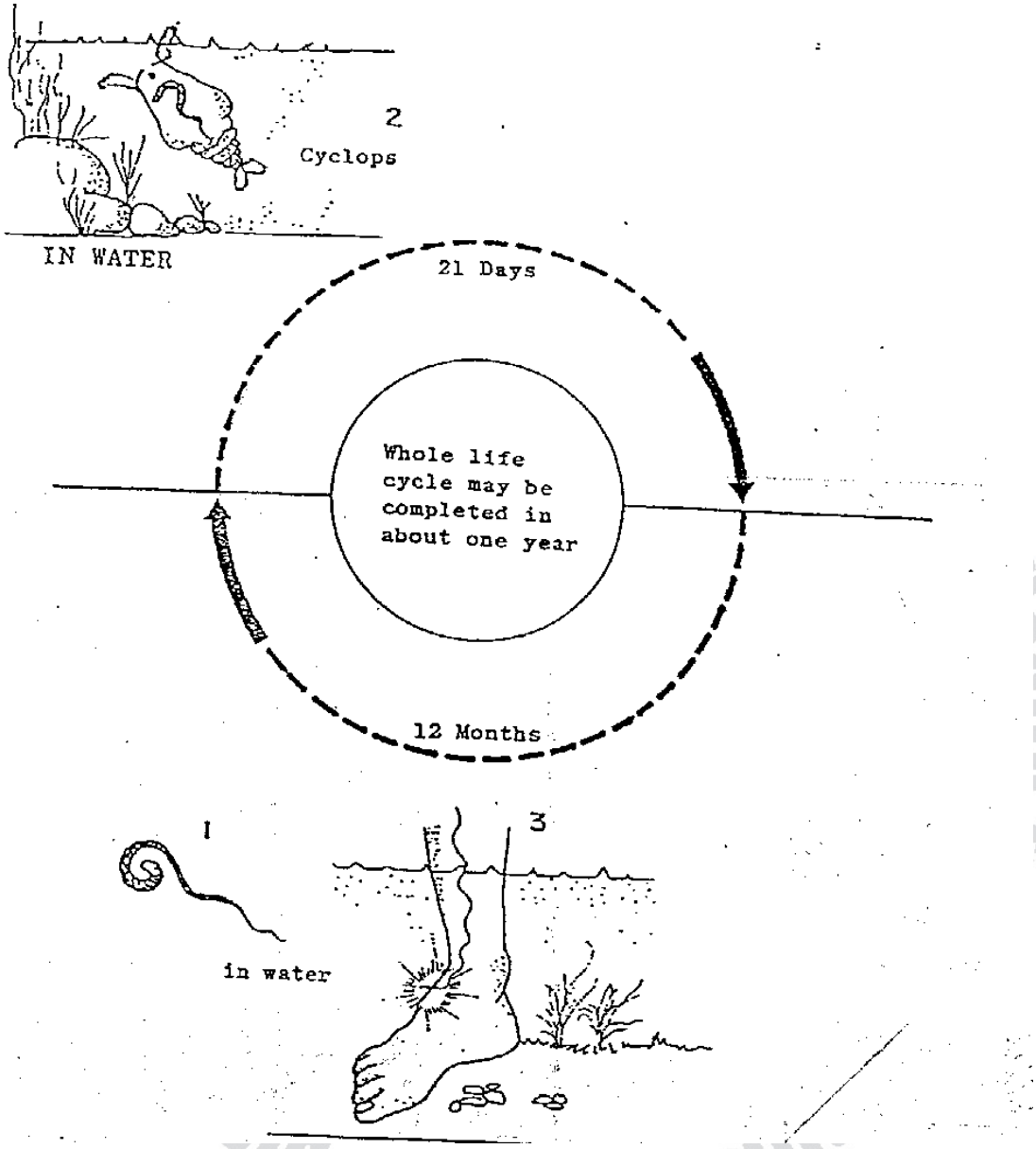


Life cycle of Giardia lamblia.

1. Cyst outside body after passing out with stool.
2. Trophozoite formed in intestine after ingestion of cyst.
3. Cyst formed in intestine.
4. Cyst excreted with stool.

Taken form: Shibiru Tedla; Introduction to Parasitology, AAU Press, 1986.

7.4. Life Cycle of Dracunculus medinesis



Life cycle of Dracunculus medinensis.

1. Larvae released into water by adult females through surface blister in tissues.
2. Larvae develop in Cyclops > infective forms.
3. Adult parasite in man infected by ingesting Cyclops containing infective larvae

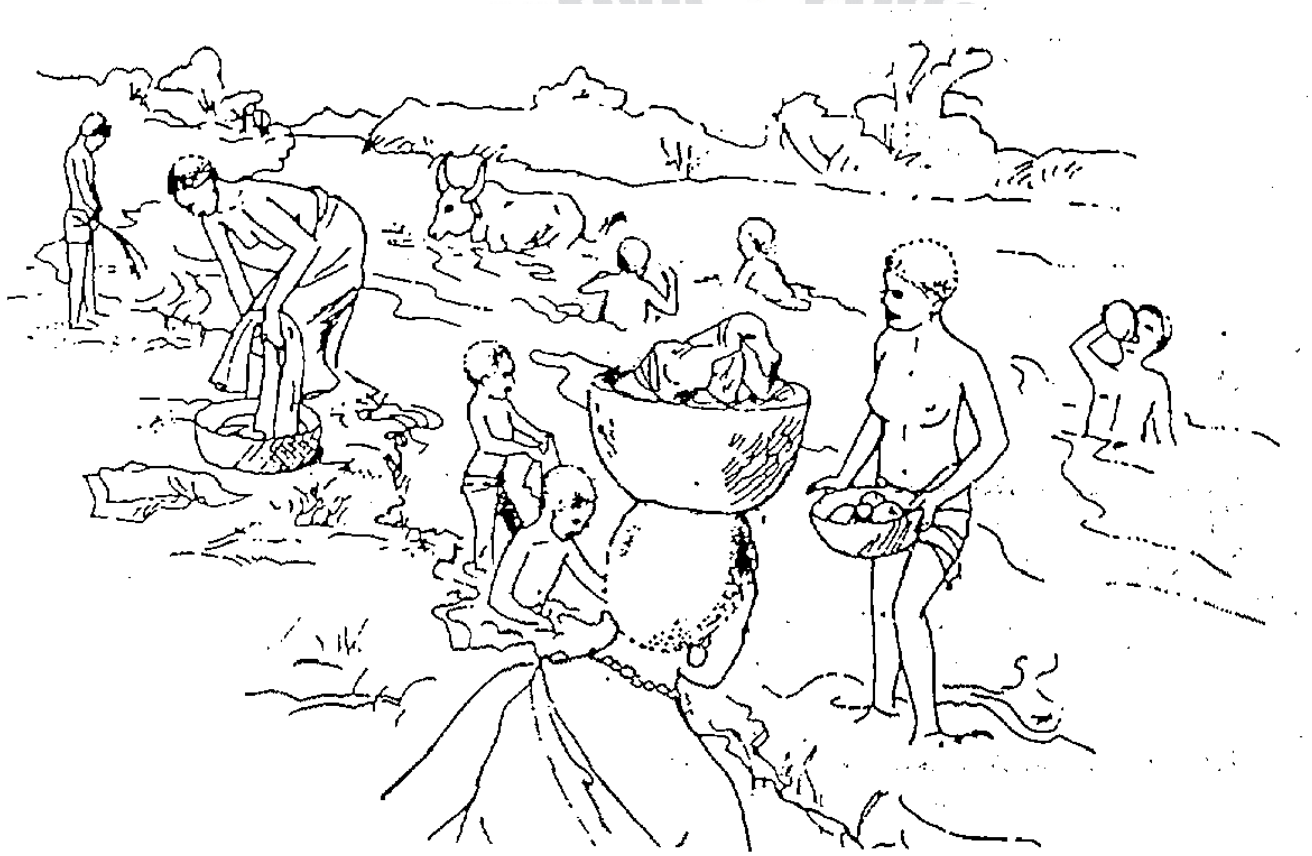
Taken form: Shibiru Tedla; Introduction to parasitology, AAU Press, 1986.

7.5. Figure Collecting of drinking water from protected spring

Collecting and drinking water from a protected spring is a means of promoting health. It is still necessary for the water to be collected in a clean bucket and stored in a clean container.

Taken form: Shibiru Tedla; Introduction to parasitology, AAU Press, 1986.

7.6. Figure of Unhealthy community practice and source of water supply



Sometimes the whole community may have to take action to solve a problem. This is the case when the problem is associated with unhealthy practices that are usual and accepted in the community

Taken form: Shibiru Tedla; Introduction to parasitology, AAU Press, 1986.

7.7. Figure Unhealthy practice of collecting water from a pond

Collecting and drinking water from a pond like this one can help spread disease.

Taken form: Shibiru Tedla; Introduction to parasitology, AAU Press, 1986.

7.8. Tables

Table 7.8.1: Some characteristics of Bacteria that cause Water Borne Diseases

Organism	Shape	Size	Gram Reaction	Atmospheric Requirement	Fermentation Characteristics	Motility
V. Cholera	Curved Rods	3.4 x 0.5 µm	Gram negative	Aerobic	Sucrose fermenting	Highly motile
Shigellae	Rods	2.4 x 0.6 µm	Gram negative	Facultative Anaerobic	Non-lactose fermenter	Non-motile
Salmonella	Rods	2.4 x 0.6 µm	Gram negative	Aerobic and Facultative anaerobic	Non-lactose fermenter	Motile
E.coli	Rods	-	Gram negative	Aerobic and Facultative anaerobic	Lactose fermenter	Motile

Table 7.8.2: Morphological Characteristics of parasites that cause Water Borne Diseases

Organism (parasite)	**Morphology**	
	Trophozoite	**Cyst**
Entamoeba Histolytica	- Average size 25-20 µm - Active amoeboid movement - In dysenteric specimen contain ingested red cell - Has single nucleus	- Round measuring 10-15 µm - Contain 1,2,3 or 4 nuclei with a central karyosome
Giardia Lamblia	- Small pear shaped flagellates with a rapid tumbling and spinning motility. - Size 12-15x 1-9 µm - Has large concave sucking disc. - Has four flagella, two axonemes and a single or two curved median bodies.	- Small and oval - Measuring 8-16x6 µm - Has four nucli grouped at one end. - Has axonemes, median bodies and remains of flagella.
Dracunculus Medinesis	**Larva** - It is large - Measuring 500 – 700 µm in length - Anterior end is round - Tail is long and pointed	**Adult Worm** - Very long - Female 70 to 120cm - Male 12 to 20cm - Elongated cylindrical worm - Has milky white color - Mouth is triangular and papillated

Table 7.8.3: Treatment Options and Dosing for Water Borne Diseases

Condition	Medication	Adult Dosing	Pediatric Dosing	Special Considerations
Typhoid	Chloramphenicol	50mg/kg/day IV divided every 6 hours (max 4gm/day)	50 – 75mg/kg/day IV divided every 6 hours (max 4gm/day)	Avoid if patient has G6PD
	Trimethoprim-Sulfamethoxazole	I double strength tablet PO BID	15-20mg/day TMP/kg/day PO/IV divided every 12 hours	Avoid if patient has G6PD
	Cefrixone	1-2gm IV/IM divided every 12-24 hours (max 4gm/day)	50-100mg/kg/day IV/IM divided every 12-24 hours (max 4gn/day)	
	Amoxicillin	250-500mg PO TID	20-80mg/kg/day PO divided BID or TID (max 2 – 3gm/day)	
	Ciprofloxacin	250-750mg PO/IV every 12 hours	20-30mg/kgday/PO/ IV divided every 12 hours (max 1.5gm/day)	Avoid using in young children
Shigellosis	Amoxicillin	250-500mg TID	20 – 80mg/day PO divided Bid or TID (max 2 – 3gm/day)	
	Nalidixic Acid	1gm PO QID	55mg/kg/day PO divided every 6 hours	Avoid in children under 3mo
	Ciprofloxacin	250-750mg PO/IV every 12 hours	20-30mg/kg/day PO/IV divided every 12 hours (max 1.5gm/day)	Avoid using in young children
E.coli	Trimethoprim-Sulfamethoxazole	I double strength tablet PO BID	15-20mg/kg/day TMP/kg day PO/IV divided every 12 hours	Avoid if patient has G6PD
	Azithromycin	10-12mg/kg/day PO/IV once daily (max 500mg/day)	10-12mg/kg/day PO/IV once daily (max 500 mg/day	

Table 7.8.3 Continued

	Ciprofloxacin	250-750mg PO/IV every 12 hours	20-30mg/kg/day PO/IV divided every 12 hours (max 1.5gm/day)	Avoid using young children
Amebiasis	Metronidazole	750mg PO TID x 7-10 days	35-50mg/kg/day PO divided into 3 doses x 7-10 days max	
	Tindiazole	800mg PO TID x 5 days	50mg/kg/day PO divided into 3 doses x 10 days (max x 750 mg/day)	
Dracunculiasis	Metronidazole	250mg PO TID x 5 – 7days	25mg/kg/day PO divided into 3 doses x 10 days (max 750mg/day	
	Thiabendazole	50-75mg/kg/day PO divided every 12 hours x 3 days	50/75mg/kg/day PO divided every 12 hours x 3 days	
	Mebendazole	100mg PO BID x 3 days	100mg PO BID x 3 days	
Giardiasis	Metronidazole	250gm PO TID x 5 – 7 days	15mg/kg/day PO divided into 3 doses x 5.7 days	
	Tinidazole	2gm PO once	50mg/kg/day once (max 2 gm)	
Cholera	Tetracycline	2gm single dose		Not recommended for children <8 years
	Doxycilline	300mg single dose		Not recommended for children < 8 years
	Ciprofloxacin	300mg/kg single dose (not to exceed/ 1gm) OR 15mg/kg bid for 3 days (not to exceed 1gm)		
	Erythromycin	40mg/kg daily in 3 divided doses for 3 days	30mg/kg/day orally 6 hourly for 3 days	

7.9. Answer Key for Pre-test / Post-test questions

Part I: Answers for questions of all categories of the Health Center Team

1. Water borne diseases are viral bacterial and parasitic diseases, which use water as a common means of transmission.
2. A) 1. Typhoid fever, 2. Shigellosis 3. Cholera
   B) 1. Infectious hepatitis 2. Poliomyelitis 3. Gastro enteritis
   C) 1. Amaebiasis 2. Giardiasis 3. Dracunculiasis
3. True
4. False
5. True
6. True
7. B
8. B
9. B
10. A
11. C
12. B

A. Answers for questions of Health Officers

1. A
2. D
3. A
4. C
5. B
6. C
7. B
8. B
9. B
10. A

B. Answers for questions of Public Health Nurses

1. D
2. C
3. B
4. D
5. C
6. D
7. D
8. B

C. Environmental Health Technicians

1. C
2. D
3. C
4. A
5. D
6. At lower elevation from water source
7. 1. Boiling 2. Disinfections 3. Filtration 4. Storage

D. Answers for questions of Medical laboratory Technicians

1. D
2. D
3. A
4. C
5. C
6. D