**POST GRADUATE-DIPLOMA IN PUPLIC HEALTH FINAL EXAMINATIONS**

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**Postgraduate Diploma in Public Health**

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1. **List the types of people who are most vulnerable to waterborne diseases. Explain your answers why and how to overcome the diseases.**

Vulnerable people are individuals who are at greater risk to diseases or injuries or someone who belong to a group within the society that is either oppressed or more susceptible to diseases and harm (Mannan, H., MacLauchlan, M., McVeigh, J.2012). This include the following;

* Refugee or displaced persons living in a crowded camps or settlements
* Weak, malnourished or sick children and infant.
* People living with HIV/AIDS
* Physical and mentally disabled people.
* Individuals with chronic diseases and elderly people.
* Pregnant and lactating mother/women.
* People either separated from or without access to the focus of relief assistance.
* Prison inmates

**Refugee or displaced persons living in a crowded camps or settlements.** Overcrowding is a major problem in emergency situation due to lack enough space for construction of enough shelters for household population and sanitary facilities, hence leading to open defecation and contamination of water sources resulting into spread of waterborne diseases.

**Weak, malnourished or sick children and infant.** Weak, undernourished children infant have weakened immune systems, which make them more susceptible to enteric infections and leads to more severe and prolonged episodes of diarrhea (Caulfield et al., 2004)

**People living with HIV/AIDS-** unsafe drinking water presents additional risks to people living with HIV (PLHIV) who are especially vulnerable to opportunistic infections from water-related pathogens, such as cryptosporidiosis. Diarrheal disease may lead to intestinal malabsorption so that individuals on antiretroviral therapy (ART) are not acquiring essential nutrients and therapeutic dosages of medications (Rachel Pelezt and Thompson Clasen).

**Physical and mentally disabled people**. Globally 700million people live without access to safe water and 2.5 billion lack access to improved sanitation (JMP 2014). Despite the immensity if this problem there is evidence to suggest that individuals living with disability or suffering from chronic illnesses are at a disproportionately greater risk of not having adequate access to water and sanitation facilities increasing risk to waterborne diseases (Human rights of older persons,2011 & world reports on disability, 2011)

**Individuals with chronic diseases and elderly people.** Elderly and people with pre-existing disease such diabetes, may be more vulnerable to waterborne disease because of deterioration of their physiologic, biochemical and immunologic parameters as increased oxidative stress weakens antioxidant defense (University of Haifa 2010).

**Pregnant and lactating mother/women.** Contamination of drinking water by microbial pathogens, chemicals is a major issue affecting health of the population. The problem is of key important if it affects pregnant and lactating women, because it places the well-being of both mother and unborn child under jeopardy (Needham et al, 2011). High mortality of pregnant women from waterborne diseases is associated to hormonal and consequent immunologically changes (Navaneethan, Al Mohajer & Shat,2008). Parasitic infections (malaria) increase risks of miscarriage, intrauterine growth retardation, still birth and birth defects (Roman, Zamir, Rilkis, &Ben-David, 2006).

1. **Suppose that inhabitants of a village obtain water from a spring. What advice would you give to the users about the prevention of contaminants entering the spring?**

Springs water is water found beneath the ground surface held in the space within porous soil and rock (the open university). likely to be polluted by direct contamination through the topsoil unless the surrounding land area is protected. Since the spring are likely to be contaminated by both animals and human being, the following are the advice to the inhabitants drinking from the springs;

Before using a spring, a thorough sanitary survey needs to be carried out at the site to assess the quantity and quality of the water, and the possible contamination. Once the results of the survey are satisfactory, the eye of the spring should be located by digging out the area around down to the impermeable layer. The Spring should be protected from flooding and surface water pollution by constructing a deep diversion ditch above and around the Spring. The ditch should be constructed so it collects surface water running towards the Spring and carries, or delivers it away. The exclusion of animals from the surrounding area by stock proof fence, and any water running off the land after rain should be diverted to a suitable ditch away from the springs. The inhabitants should ensure no open defecation is practice around the Spring, in order to avoid contamination of the Spring by surface run-off water that might carry the faecal matter into the Spring. Avoid construction of latrines in the upstream, in order to prevent contamination of the Spring by the underground water. The inhabitants should ensure proper use of the latrines and practice adequate personal and environmental hygiene. Constructing of protective fence with lockable entrance and exit doors to prevent small animals from entering and easy control of the inhabitants when fetching the water from the Spring. Construction of a concrete waterproof protection box, also known as a Spring box, over the Spring to prevent all actual and potential sources of contamination. The inhabitants should consider building retention wall in the front of the protection box to keep water flowing to the delivery pipe. If the water flow from the Spring is not constant, a collection box may be built in order to ensure adequate water storage.

1. **The following are pollution sources. Give two specific pollutants for each source.**
2. A residential area: Residential pollutants are hazardous materials generated within homes that has potential to negatively affect people health. These include, Tobacco smoke and combustion products such as carbon-monoxides.
3. A metal plating plant: Metal plating plant pollutant are the hazardous materials generated from metal industries and include, heavy metal mercury and lead (Loannis S. Arvanitoyannis, Theodoros H. Varzakas 2008).
4. Agricultural activities: Agricultural pollutants are hazardous chemicals generated as a result of agricultural activities, such as growing and raising of livestock, food crops, animal feeds and biofuel crops and include, chemical pesticides, fertilizers and CAFOs Manures (Courtney Lindwall 31 July 20129).
5. An uncontrolled landfill site: Uncontrolled landfill site pollutants are pollutants produced from opened dumping sites, and include, Methane and Carbon dioxide gases (Antonis M, David Newman).
6. Urban surface water run-off: These are surface run-off pollutants created by urbanization and are usual source of flooding and water pollution in the urban communities worldwide, and include, Roadways and parking lots pollutants (polycyclic aromatic hydrocarbon such as gasoline and motor oil) and Residential lawns (pesticides and fertilizers).
7. **Explain 5 reasons why emergencies can put people at greater risk of waterborne disease.**

**Open defecation** due to lack of sanitary facilities or people do not use the available facilities. This leads to discharged of human excreta into surface water and thus likelihood of outbreak of water-borne diseases.

**Inadequate and unsafe water supplies** to the population due to damage to either the existing water points or due to overpopulation from the host and affected communities leading to water shortage. Poor personal hygiene due to lack of inadequate water supplies or people do not wash their hands after defecation. There is lack of enough clean water containers, for collecting and storage of drinking water leading to contamination of water at the sources, during collecting and at homes, increasing the vulnerability of the population to water-borne diseases.

**Animals access to wells and water points,** springs and surface water as well store water and food, in this emergency setting, there is large number of animals which are uncontrolled, roaming in the population and hence there is likelihood that they get access to water sources and food leading to the contamination, thus spread of water –based diseases in the population. Access of animals to living quarters, during emergency crisis, human beings tend to live with their animals due to lack of shelters and enough grazing land due to fear from the host communities hence the animals are usually kept at home or near home and can easily access the sleeping house, leading to the contamination of the rooms with animals faeces posting health risks.

**Accumulation of stagnant water.** In any emergency areas there is likelihood of accumulation of stagnant wateraround the household, which becomes breeding ground for mosquitoes, Anopheles and Aedes that transmit malaria and dengue fever, leading to outbreak of these vector-borne diseases.

**Overcrowding** is a major problem in emergency situation due to lack enough space for construction of enough shelters for household population and sanitary facilities, hence leading to open defecation and contamination of water sources resulting into spread of waterborne diseases.

1. **In your own words, what is your understanding of public health and what are its key elements?**

Public health is Science and Art that concerns with prevention of diseases, promotion of health and prolongation of life of population at large rather than an individual. The three essential key elements of public health include the following:

**Assessment**

**Assesses** the health needs of the community. To systematically collect, assemble and make available information on public health status of the community in corporation with others including statistics on health status, community health needs, environmental health, epidemiologic and others studies of health problems.

**Investigate the occurrence of health effects and health hazards in the community.** To systematically develop in collaboration with others in the community, more detailed information on the magnitudes of the health problems, duration, trends, location, population risk, and how best to proceed to prevent or control the problems.

**Analyze the determinants of the identified health needs.** This is the processing of examining the etiologic, risk and contributing factors that precede and contribute to specific health problem or reduced health status in the community. Identifying these factors help working with the community for planning intervention efforts for prevention or control.

**Policy development**

**Advocate for public health**, built constituencies and identify the resources needed in the community. This is the process of generating support among constituent group that address the community health needs and issues establishing collaborative relationships between a public health agent and the public it serves, the government body it represents and other health and human- related organization in the community.

**Prioritize among health needs**. To facilitate a community process to rank health needs according to their importance, the magnitude, the seriousness of the consequences, economic impact and community readiness or the ability to prevent or control the problem.

**Plan and develop policies to address priority health needs**. This is the process by which agencies, working with community constituents’ other groups, facilitate the formulated goals and objectives to meet the priority health need of the community, identifies course of action to achieve the goals and the objectives in a way that posters community involvement and ownership and is responsive to local needs.

**Assurance**

**Manage resource and develop organization structures.** To Acquire, allocate influence, resources (people, facilities and equipment) and to encourage or enable them meet priority community health needs in the best possible way.

**Implement program.** Work with other organizations, agencies and individuals to assure the implementation of the programs in the community that fit community priorities. Work with the community to change community policies, practices or morals.

**Evaluate program and provide quality assurance**. This is the process of continuous inquiry to determine the efficiency and effectiveness of efforts so that corrections can be made to improve activities and outcomes.

**Inform and educate for the public**. This is the process of informing the community about health problems, availability of services, gaining the attention of the individuals, high risk groups and constituents concerning public health issues provide health education to help develop beliefs, attitudes and skills conducive to good individual and community health.

1. **Discuss how environmental health and sanitation affect the nutritional status of the vulnerable groups.**

**Malnutrition.** Malnutrition is common among the poor and those with inadequate access to health education, clean water and good sanitation. Civil conflicts and wars, by damaging water infrastructure and contaminating supplies, contributes to increased malnutrition. People are malnourished if they are unable to utilize fully the food they eat, for example due to diarrhea or other illnesses (secondary malnutrition), if they consume too many calories (overnutrition) or if their diet does not provide adequate calories and protein for growth and maintenance (undernutrition or protein-energy malnutrition). Both malnutrition and inadequate water supply and sanitation are linked to poverty (Geneva WHO 2000). Nutritional status is compromised where people are exposed to high level of infection due to unsafe and insufficient waters supply and inadequate sanitation. Individual nutritional status depends on the interaction between food that is eaten, the overall state of health and the physical environment. Combined with poverty, malnutrition contributes to a downward spiral that is fueled by an increased burden of disease, stunted development and reduced ability to work, chronic food deficits affect about 792 million people in the world (FAO 2000).

**Diarrheal diseases.** Diarrhea is a leading cause of mortality and morbidity among children under 5 years of age. Diarrhea and undernutrition form part of vicious cycle. Diarrhea can impair nutritional status through loss of appetite, malabsorption of nutrients and increased metabolism (Caulfield et al., 2004., Petri et al., 2008, Dewey & Meyers, 2011). Frequent episodes of diarrhea in the first 2 years of life increase the risk of stunting and can impair cognitive development (Grantham-McGregor et al., 2007). At the same time, undernourished children have weakened immune systems, which make them more susceptible to enteric infections and leads to more severe and prolonged episodes of diarrhea (Caulfield et al., 2004).

**Intestinal parasitic infections.** Soil-transmitted helminths infections-roundworms, whipworm and hookworm- affect millions of people worldwide (WHO,2013 c). soil-transmitted helminths infections are directly caused by poor sanitation. Helminths eggs and larvae can survive for months in the soil and can infect humans when ingested, by contact with fomites or by direct contact with skin when walking barefoot on contaminated soil (hookworm). Soil-transmitted helminths infections affect nutritional status by causing malabsorption of nutrients, loss of appetite and increased blood loss. Heavy infections with whipworm and roundworm can impair growth (O’Lorcain & Holland,2000). Hookworm infections are a major cause of anaemia in pregnant women and children (Brooker, Hotez & Bundy, 2008), which in turn increase the risk of pre-term delivery and low birth.

**Environmental enteropathy.** Enteric pathogens can impair nutritional status even in the absence of symptoms such as diarrhea. Children living in poor sanitary conditions are exposed to a high load of pathogens, especially between 6 months and 2 years of age, when they start crawling on the floor and putting objects into their mouths (Ngure et al.,2004). Chronic ingestion of pathogens can cause recurring inflammation and damage to the gut, leading to malabsorption of nutrients. This condition is often referred to as environmental enteropathy or environmental enteric dysfunction (Humphrey, 2009). Researchers suggest that environmental enteropathy may be an important cause of poor growth and may compromise the efficacy of nutritional interventions (Humphrey,2009; Korpe & Petri, 2012).

1. **Paul, a resident in the outskirts of your Town, consults you about building a latrine in the compound of his house. He is an open-minded man who is keen to improve life for his family. He has a wife and three young children, and his elderly mother who also lives with them. He doesn’t have a tap in his house and gets water in nearby well. The area has heavy soil and the rocks below is impermeable.**
2. **Which types of latrine are possible choices for him?**

**Simple pit latrine**- it an on-site sanitation system, more widely employed in low in-come and rural areas of the world identified by UN to meet MDG (JMP 2004).

**Raised latrine**-it constructed when the ground water is high or the ground is too rocky to excavate by hand (Scott 2005). Its disadvantages include, lack of privacy afforded to the user of the latrine.

**Slap type**-the slab is to hold the weight of the user over the pit, provide a clean surface for the user feet and drain liquids into the squat hole.

**Ventilated improved pit latrine**-it design to eliminate unpleasant aspects of using simply pit latrine, the flies and smell, hence reducing the transmission of diseases and allow air circulation throughout the system.

**Offset pits latrine**-to improve the operational nature of a latrine, but may increase the cost of construction and increase complexity of the system. The advantages are easier emptying without destroying the superstructure and enable the toilet to be constructed inside the house.

**Single or double pit**-this involves the need to change the direction of flow between pits. It allows the content of one pit gradually decompose overtime while the other pit used become safer to remove (Pickford,1995).

1. **Which types of latrine would you recommend, and why?**

I will recommend Mr. Paul to construct simple pit latrine, because it is simple and understandable, low cost to construct as large part of the work can be done by the householders, allow the use of a range of anal cleansing materials, do not require water to operate since there is not water tap at his home and also controls smell and flies.

1. **What other advice would you give him about the location, design and construction of the latrine? Other advice to Paul may include,**

He should construct the latrine in the downstream to avoid any underground contamination of surrounding wells and the latrine should be 30 or More Metre away from water sources with superstructure.

1. **Explain five ways in which urbanization creates challenges for effective sanitation and solid waste management.**

**Overcrowding and pollution.** Urbanization increases overcrowding and traffic congestion. Inadequate housing and uncontrolled housing development due to weak planning system leads to the development of slums or shanty settlements. In many African countries environmental pollution control measures are weak and pollution arising from industries and chaotic movement of vehicles is high. Associated with dense city population noise pollution, diseases leading to stunted growth amongst. The insufficiency of services results in deterioration of urban environment in the form of air and water pollution and land degradation that pose serious risk to human health and food security ((K. Nsiah-Gyabaah, Oct 2003).

**Inadequate Sanitation.** Urban areas depend on their surrounding regions to act as both official and unplanned repositories of polluted water resources, site for refuse tips, sewage, and disposal of domestic and industrial wastes. This usually result into poor waste disposal and drainage systems and wastewater discharges from industry, agriculture and domestic use cause surface and ground water pollution (K. Nsiah Gyabaah oct 2003).

**Completion for water supply.** Urbanization and population growth contribute to deforestation and changes in land cover that affects water resources. Deforestation alters the hydrological cycle because forests act as water regulator by reducing runoff and soil erosion and by helping to replenish groundwater. Water is life and water shortage impact on the sanitation and hygiene of the population posing risk of waterborne diseases.

**Agriculture, poultry and livestock production.** The environmental problems caused by farming are the huge volumes of waste produced by the animals, which must be disposed of on a relatively limited amount of land. Factory farms, or **concentrated animal feeding operations (CAFOs)**, produce an estimated one million tons of manure every day, three times the total waste produced by the U.S. human population. The farms deal with waste by creating “lagoons”. The Lagoons may break, failed, or overflowed. They emit gases—including ammonia, hydrogen sulfide, and methane—that can be toxic to humans and contribute to global warming. Seepage from the lagoons pollutes groundwater that feeds wells used for drinking water. After heavy rains, lagoons may overflow or burst, spilling thousands of gallons of manure into rivers, lakes, streams, and estuaries (Farm sanctuary, farm animal rescue and protection organization).

**9**. **How do good sanitation and waste management practices bring a positive effect to urban inhabitants? Give examples for effects on:**

1. **Health**

Good hygiene behaviours, especially handwashing with soap at critical times, can significantly reduce health risks, like diarrheal diseases. Good sanitation and waste management help to keep people separate from potential sources of pathogens. It reduces the risk of contaminating water supplies with pathogens and discourages the transmission of disease (health extension and education centre,2007., HEP Ethiopia government 2004).

1. **Education.**

There is also social impact of good sanitation provision in schools. Presence of latrines with separate facilities for girls and boys encourages children to attend school especially girls during their menstrual period. Healthy children have fewer days off school through illness. When they are at school, healthy children learn better than sick children (health extension and education centre,2007, HEP Ethiopia government 2004).

1. **Economic conditions.**

Healthy people spend less money on health care and the loss of work days due to diarrhoea and other related infections is reduced. Illness can affect both the sick person and their family, for example when women have to take time off work to care for sick children. Employment opportunities to the urban inhabitants. The initial stages in recycling process i.e. collecting material from households and business is labour-intensive and provides employment for the poorest people in the society. Giving them an income improves their health, which, in turn, reduces the country’s healthcare expenditure (Health extension and education centre, 2007).

1. **The environment**

Improved sanitation means defecation only takes place in properly constructed latrines, areas of land are not contaminated with faeces and watercourses no longer act as sewers. Good waste management means less litter in the streets and in the neighbourhood of waste disposal sites. It also reduces the smell in the streets from decomposing wastes. Energy production is a major source of greenhouse gases, carbondioxide and methane contributes to human-induced climate change causing global warming. Recycling reduce the emission of these gases. Improving standards of landfills also reduces greenhouse gas emissions and lowers the risk of polluting local watercourses and the surrounding land (Health extension and education centre, 2007).

**10. List and briefly describe the measures by which the success or otherwise of a public–private partnership providing water supply services can be assessed**

**Success of Public Private Partnership in provision of water services**

Exploring PPPs as a way of introducing private sector technology and innovation in providing better public water supply services through improved operational efficiency.

Incentivizing the private sector to deliver projects on time and within budget. Imposing budgetary certainty by setting present and future costs of water infrastructure projects over time

Utilizing PPPs as a way of developing local private sector capabilities through joint ventures with large international firms, as well as sub-contracting opportunities for local firms in areas such as water services, electrical works, facilities management, security services, cleaning services and maintenance.

Using PPPs as a way of gradually exposing state owned enterprises and government to increasing levels of private sector participation and structuring PPPs in a way so as to ensure transfer of skills leading to national champions that can run their own operations professionally and eventually export their competencies by bidding for projects/joint ventures.

Creating persification in the economy by making the country more competitive in terms of its facilitating infrastructure base as well as giving a boost to its business and industry associated with infrastructure development.

Supplementing limited public sector capacities to meet the growing demand for infrastructure development. Extracting long-term valve-for-money through appropriate risk transfer to the private sector over the life of the project from design/construction to operation /maintenance (World Bank, 31-10-2016).

**Risk of Public-Private Partnership in provision of water services**

Development, bidding and ongoing costs in PPP projects are likely to be greater than for traditional government procurement process- the government should therefore determine whether the greater costs involved are justified. A number of PPP and implementation units around the world have developed methods for analyzing these costs and looking at valve for money.

There is cost attached to debt-while private sector can make it easier to get finance will only be available where the operating cashflow of the project company are expected to provide a return on investment.

Some projects may be more politically or socially challenging to introduce and implement than others-particularly if there is an existing public sector workforce that fears being transferred to the private sector, if significant tariff increase are required to make the project viable, if there are significant land settlement issues.

Some projects may be easier to finance than others, if there is proven technology involved and or the extent of the private sector obligations and liability is clearly identified. Some projects will generate revenue in local currency only, e.g. water projects while others such ports and airports will provide currency in dollar.

There are unlimited risk bearing-private firms will be cautious about accepting major risks beyond their control, such as exchange rate risks/risk of existing assets. If they bear this risk then their price for service will reflect this. Private firms will also want to know that the rules of the game are to be respected by government as regards undertakings to increase tariffs/fair regulations. Private sector will also expect a significant level of control over operation if it is to accept significant risks.

Private sector will do what it is said to do and no more than that- therefore incentives and performance requirements need to be clearly set out in the contract. Focus should be on performance requirements that are out-put based and relatively easy to monitor.

Government responsibilities continues-citizens will continue to hold the government accountable for quality of utility services. Government will also need to retain sufficient expertise, whether the implementing agency or via a regulatory body, to be able to understand PPP arrangement, to carry out its own obligations under the PPP agreement and monitor performance of the private sector and enforce obligations (World Bank,31-10-2016).

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