**POST GRADUATE DIPLOMA IN PUBLIC HEALTH**

**FINAL EXAMINATION**

**SUBMITTED TO: AFRICA CENTRE FOR PROJECT MANAGEMENT**

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**Question 1: Types of people who are most vulnerable to waterborne diseases and why and how to overcome diseases**

A communicable or infectious disease is an illness that arises from transmission of infectious agent or its toxic waste products from an infected person, animal or reservoir to a susceptible host, either directly or indirectly through intermediate plant or animal host, vector or environment (Clarke:2016:152). We live in a world of potential infection. The human being and his/her living and non-living environment carry a multitude of infections, depending on circumstances and opportunity. Water is important to human life and health, the most common and widespread health risk associated with drinking water is contamination, either directly or indirectly, by human or animal waste. According to Wikipedia, waterborne diseases are conditions caused by pathogenic micro-organisms that are transmitted in water. Disease can be spread while bathing, washing, drinking water or by eating food exposed to contaminated water. Various forms of waterborne diarrheal disease are the most prominent examples and affect children in developing countries most dramatically. According to World Health Organization (WHO), waterborne diseases account for an estimated 3.6% of total disability-adjusted life year global burden of disease and cause about 1.5 million death annually. WHO estimates that 58% of that burden is attributable to a lack of safe drinking water supply, sanitation and hygiene. WHO further indicates that 884 million people lack access to even basic drinking water service, including 159 million people who are dependent on surface water such as rivers and lakes. Also 423 million people are taking water from unprotected springs and wells. For example, a majority of people in rural areas of Lesotho still get water from unprotected springs. An easy access to safe drinking water and proper sanitation are the basic determinants of a better health.

Waterborne diseases are caused by several pathogenic microorganisms that include bacteria, viruses protozoan and helminths. This usually occurred as result of poorly treated drinking water and waste water or natural disaster like flooding and environmental pollution. In developing countries, accessibility of safe drinking water is still a problem and people are forced to use available unimproved water sources. These water sources are often microbiologically unsafe and a result, the most well-known waterborne diseases such as cholera, amoebic dysentery and typhoid are reported from almost all African countries especially in tropical areas of the region including Uganda.

The primary prevention aims to prevent a disease from occurring by targeting healthy individuals in the community. Primary prevention can reduce both the incidence and prevalence of a disease. On a persona level, hand washing, applying good cough etiquette plus good personal toilet habits, and ensuring that the clothing, environment and person of the individual are hygienic, will contribute to health preservation. The secondary prevention is usually applied after the disease has occurred, to prevent any further spread or complications in the client herself/himself. A registered nurse checking a suspicious skin rash to identify fungal infection during a routine examination. Treatment that is started immediately stops further complications such as systemic disease. The goal of secondary prevention is to find and treat disease early and encourage adherence to treatment and treatment schedules. The goal of tertiary prevention is to handle the symptoms of a well-developed disease and aid the clients’ recovery, returning him/her to a healthy status, able to what he/she used to do previously or to help/her to adjust to changes that cannot be reversed.

Typhoid fever is spread through contaminated food, unsafe water and poor sanitation and it is highly contagious. To overcome typhoid fever that is well-known in extremely poor parts of developing countries, vaccines are recommended for people who are travelling in areas where poor sanitation and unsafe water are common. The vaccine can be injected via a shot or taken orally for a number of days. To prevent it, people are urged to refrain from drinking water that is not bottled and sealed and do not eat from villages or street vendors. Typhoid is treated with antibiotics.

**Question 2: Advice that can be given to inhabitants of a village who obtain water from a spring in terms of the prevention of contaminants entering the spring**

Before the drilling of a well or construction of a spring tapping starts, an appropriate site has to be found. Villagers or landowners are good source of information and mostly point out a suitable location for them as users. However, several other important aspects have to be kept in mind when selecting the optimal site for a water source WAL:2010). In order to protect contaminants from entering the spring, well and the aquifer through the water point itself, several specific measures can be applied:

* Springs cane be protected by installation of a spring tapping, spring box and an adequate drainage system. Additionally, a surface water drainage ditch, dug above and around the spring area diverts surface water run-off from polluting the source. If the area around a spring intake is unstable or exposed to erosion, gabions or dry-stone masonry can be used to stabilize the area (OXFAM:2008).
* Drilled and dug wells need a proper sealing. First, an apron guarantees that no contaminants enter the well from the access point area. Secondly, an impermeable lining (for dug wells) or casing (for drilled wells) makes sure, that no close-to-surface-water laterally enters the well. as for springs, adequate drainage installations keep the immediate surroundings dry. After the completion of the well, a final disinfection with chlorine kills most pathogens that entered during construction.
* The most decent construction of a spring taping, well lining, casing and apron is without a effect, if pollutants are entering the aquifer in the mediate surroundings of the water point. In a fenced, inner protection zone, all activities posing a risk of contamination are restricted. It should only be planted with grass and all trees and bushes should be uprooted. Roots can damage the catchment by cracking the structures or by blocking pipes (Meuli & Wehrle:2001).
* Additionally, an extended protection zone should be put up. Its size depends on the depth and the type of the covering soil. The required radius thus increases if the spring catchment is close to the surface and if the soil is highly permeable. The radius of the extended protection zone should then be extended to more than 150 metres. The area in this zone should be planted with mixed trees and bushes to prevent erosion and heavy run-off. The planting of trees that absorb large amounts of water is not recommended for the protection zone. Examples of more useful trees include cypress and pine. However, local varieties, which do not absorb large quantities of water, should be given priority.
* Fences build around the water source precisely mark the inner protection zone and prevent animals from entering, defecating or destroying installations. Fencing is mainly applied for springs, as they are more susceptible to superficial contamination. However, shallow wells may also need protection zones. It is advisable to fence the inner protection zone with barbed wire and preferable to support the wire by planting a solid hedge bushes around the fence.
* There should also be rules in place for community members to abide by. Such rules can include:

Do not defecate close to the well

Do not let animals graze close to the well

Do not throw any garbage into the well, etc.

**Question 3: Two (2) specific pollutants for:**

1. **A residential area:** Lancaster (1988:314) defines noise as any unwanted sound within the environment. Noise pollution is concentrated in cities, with urban areas becoming increasingly noisier. The sources of noise include construction activity, aerospace vehicles, diesel trucks, power mowers, radio and television sets and people. Noise is particularly difficult to deal with because it is highly subjective. Noise is a health hazard according to its level, frequency, and length of exposure. Depending on these 3 factors, noise reaction falls int the categories of annoyance, disruption of activity, loss of hearing and physical or mental deterioration. Noise can affect a person’s psychological and physical well-being. Annoyance is the most widespread reaction to noise. The noise level, frequency and length of exposure influence how annoying a noise is. Annoying noise can aggravate existing physical disorders, disrupt sleep, lower the body’s resistance to disease or physical stress, interrupt concentration and generally disturb feelings of well-being.

Waste disposal is another pollutant for residential area. The traditional methods of disposing the wastes included the open burning dump or the poorly designed smoking incinerator. Incinerators and dumps violated air pollution regulations and were breeding grounds for rats, flies and other rodents. Other wastes include toxic materials such as poisons, inflammables, infectious contaminants, explosives and radionuclides.

1. **Agricultural activities:** Agricultural activities are the primary cause of water pollution problems. Excessive use of fertilizer results in eutrophication in many aquatic habitats, because the precipitation carries dissolved nutrients into streams and lakes. Smith (2004:366) adds that groundwater may become contaminated with fertilizer and pesticides. The exposure of land to erosion results in increased amounts of sediment being added to water courses. Runoff from animal feedlots carries nutrients, organic matter and bacteria. Water used to flush irrigated land to get rid of excess salt in the soil carries a heavy load of salt that degrades the water body. And the use of agricultural chemicals results in contamination of sediments and aquatic organisms.
2. **Urban surface water run-off:** A wide range of activities, some once thought harmless, have been identified as potential sources of groundwater contamination. Pesticides contribute to the unsafe levels of organic contaminants in groundwater. 73 different pesticides have been detected in the groundwater in Canada and USA. Accidental spills or leaks of pesticides pollute groundwater sources with 10 to 20 additional pesticides. Other agricultural practices contributing to groundwater pollution include animal-feeding operations, fertilizer applications and irrigation practices.

**Question 4: Five (5) reasons why emergencies can put people at greater risk of waterborne disease**

Disaster situations are prime settings for disease outbreaks; limited water tends to go first to drinking and cooking, while hygiene gets short shrift, especially among people who are just being taught the connection between hygiene, sanitation and health.

Refugee camps have been identified as some of the reasons why people are at risk of waterborne disease. Although the refugees can still get water from hand-operated pumps on other boreholes, accessing them requires walking further distances and physical labor to prime the pump. Lack of water for drinking and washing puts people’s lives at risk from waterborne illnesses spread by the fecal-oral route. Fecal-oral diseases can proliferate rapidly, sometimes to epidemic proportions, when people in crowded conditions lack clean water for hygiene and sanitation. Among agents involved are at least 20 viral, bacterial, and protozoan pathogens that cause diseases such as cholera, bacillary dysentery, and the relatively recently discovered hepatitis.

Flooding is also associated with an increased risk of infection; however, this risk is low unless there is a significant population displacement and/or water sources are compromised. Of the 14 major floods which occurred globally between 1970 and 1994, only one led to a major diarrheal disease outbreak in Sudan in 1980. This was probably because the flood was complicated by population displacement. Floods in Mozambique in 2019 lead to an increase in the incidence of diarrhea and in 1998, floods in West Bengal led to a large cholera epidemic. The major risk factor for outbreaks associated with flooding is the contamination of drinking-water facilities, and even when this happens, as in Iowa and Missouri in 1993, the risk of outbreaks can be minimized if the risk is well recognized and disaster-response addresses the provision of clean water as priority. In Tajikistan in 1992, the flooding of sewage treatment plants led to the contamination of river water. Despite this risk factor, no significant increase in incidence of diarrheal diseases was reported.

Emergencies sometimes disrupts water sources and forces people to use many different sources of groundwater that are heavily contaminated with animal feces. As a result, there can be an outbreak of balanitis, an intestinal protozoan. A cyclone and flooding can lead to an outbreak of typhoid fever. There is an increased risk infection of waterborne diseases contracted through direct contact with polluted waters, such as wound infections, dermatitis, conjunctivitis, and ear, nose and throat infections.

According to World Health Organization (WHO:2019) and as of 30th March 2019, more than 500 death have been reported in Mozambique, 172 in Zimbabwe and 59 in Malawi as a result of cyclone Idai. Cholera cases continue to rise: over 1,428 cases and 1 death reported in Mozambique, with 89 people still in treatment centres. United Nations estimates that 1,6 million people have been affected by cyclone Idai in three countries, as thousands of houses have been destroyed or flooded. Heavy rains, floods, the shortage of portable water, disruption of healthcare services and overcrowding are major factors known to increase the risk of waterborne infections such as cholera and typhoid, but also malaria and measles. The areas affected by the cyclone will likely experience infectious disease outbreaks and the number of related deaths is expected to increase.

**Question 5: Public Health and its key elements**

Public Health is the science and art of preventing disease, prolonging life and promoting human health through organized efforts and informed choices of society, organization, public and private communities and individuals (Winslow: 1920). The Oxford Textbook of Public Health defines Public Health as the process of mobilizing and engaging local, state, national and international resources to assure the conditions in which people can be healthy. Public Health aims to improve the quality of life through prevention and treatment of disease including mental health and this is done through the surveillance of case and health indicators and through the promotion of healthy behaviours. Public health practice requires multidisciplinary teams of public health workers and professionals.

Key elements of public health

1. **Monitor health status to identify community health problems**

It is essential for public health organizations to monitor and evaluate health status of populations in order to identify trends and to target health resources. Components of this service include: utilization of appropriate tools to interpret and disseminate data audiences of interest; collaboration in integrating and managing public health; and accurate and periodic assessment of the community’s health status.

Specifically, public health organizations can monitor and evaluate the health status of their populations by creating a disease reporting system; community health profiles ad health surveys. For example, in 2014, Lesotho conducted its third demographic and health survey. The 2014 Lesotho Demographic and Health Survey (LDHS) were designed to provide up-to-date information on key indicators needed to track progress in Lesotho’s population and health programmes. These indicators included fertility and child mortality levels, maternal mortality, fertility preferences and contraceptive use, utilization of maternal and child health services, women’s and children’s nutrition status and knowledge, and attitudes and behaviours relating to HIV/AIDS and other sexually transmitted diseases. This information used in planning for National Strategic and Development Plan for the country and evaluating changes in health over time in Lesotho.

1. **Diagnose and investigate health problems and health hazards in the community**

In order to appropriately allocate health resources, it is essential to diagnose and investigate health problems and hazards in the community. Components in this service include: population-based screening of diseases; access to public health laboratories capable of completing rapid screening and high-volume testing; and epidemiologic investigations of disease outbreaks and patterns of disease. Emergency preparedness is also an essential component of public health organizations. Teams must be available and prepared to combat natural disasters, severe weather, outbreaks, bioterrorism, mass casualties and chemical emergencies.

1. **Inform, educate and empower people about health issues**

Once the public health priorities have been established through monitoring and investigation of health problems in the community, educational activities that promote improved health should be disseminated. Components in this service include: both the availability of health information and educational resources and the presence of health education and health promotion programs. This can be achieved through media advocacy and social marketing. An example to this is the campaign to end malnutrition in Africa where King Letsie III of the Kingdom of Lesotho has been nominated as the African Union (AU) Nutrition Champion as well s Food and Agricultural Organization Nutrition Ambassador. As a result, His Majesty King Letsie III made a commitment to mobilize and engage with African Heads of State and Finance Ministers to rally behind African Leaders for Nutrition initiative in the upcoming African Union Summit in January 2019 (www.afdb.org).

1. **Mobilize community partnerships to identify and solve health problems**

Public health organisations on the local, state and national level can mobilize community partnerships to identify and solve health problems. Components of this service include: building coalitions to utilize the full range of available resources; convening and facilitating partnerships that will undertake defined health improvement projects; and provide assistance to partners and communities to solve health problems. Of particular importance is the identification of potential stakeholders who will contribute to or benefit from public health activities. It is important to note that many of these stakeholders may not be considered to health-related at first glance. For example, community councils involved in urban and rural planning maybe influential in improving the health of residents.

1. **Develop policies and plans that support individual and community health efforts**

Policies can be effective in modifying human behaviour and reducing negative health outcomes. Components in this service include: development of policy to guide health; alignment of resources and strategies for community health efforts; and systematic health planning strategies to guide community health improvement. In addition to policies that can support health efforts, laws can reduce negative health outcomes. For example, Lesotho National Youth Policy drives for more recreational parks for young people across the country and not just in urban cities. It also pushes for establishment of bars or restaurants at least 100 metres away from main roads and churches and monitored operating hours for such facilities.

1. **Enforce laws and regulations that protect and ensure public health and ensure safety**

It is important that individuals and organizations comply with existing laws and regulations in order to ensure the overall health and safety of the general public. Components of this service include: reviewing, evaluating and revising laws and regulations put in place to protect the health and safety of the public; educating persons and organizations about these laws and regulations to improve compliance and encourage enforcement of them; and enforcing actions that protect the health of the public.

1. **Link people to needed personal health services and assure the provision of health care when otherwise unavailable**

Having access to care when it is needed is important in helping prevent and avoid unfavorable health outcomes and medical costs. At the local level, components of this service include: identifying populations that face barriers to accessing health services and addressing their personal health needs, assuring the linkage of these populations to appropriate health services by coordinating provider services, and developing and implementing interventions that address the barriers they face in attempting to access care. At the state and government levels, components of this service include: assessing access to and availability of stat health services; partnering with public, private, and non-profit sectors to provide a coordinated system of health care; assuring access to this coordinated health care system by using outreach efforts that link individuals to the health services as they need; developing and implementing a continuous improvement process to assure the equitable distribution of resources for those in greatest need of these services. Lesotho National HIV/AIDS strategy employs this service idea as one of the action steps for achieving increased access to care and improved health outcomes for people living with HIV.

1. **Assure a competent workforce for public health and personal health care**

Competent workforce is more likely to provide care and other services more effectively and efficiently compared to those who are not. Components of this service include: making sure that the workforce meets the health needs of the population, maintaining public health workforce standards by developing and implementing efficient licensure and credentialing processes and incorporating core public competencies into personal systems, and adopting continuous quality improvement methods and long-term learning opportunities for public health workforce members.

1. **Evaluate effectiveness, accessibility and quality of personal and population-based services**

Given scarce resources, it is important to keep track of whether or not programs or policies end up producing intended outcomes. Components of this service include: assessing the accessibility, quality and effectiveness of services and programs delivered; providing policymakers with the information they need in order to make well-informed decisions regarding the allocation of scarce resources; tracking efficiency, effectiveness and quality of services analyzing data on health status and service utilization; and striving to improve the public health system’s capacity to well serve the population. Cost effectiveness analysis has been proposed as one possible strategy for informing policymakers on how best to allocate health care resources.

1. **Research for new insights and innovative solutions to health problems**

Through research, the health care problems that individuals face can be better understood, and therefore, be better and more appropriately addressed given the evidence provided by such research efforts. Components of this service include: fostering the development of a continuum of innovative solutions for health programming in terms of both practical field-based efforts as well as academic efforts, establishing a consortium of research institutions and other institutions of higher learning to encourage more collaborative and cross cutting efforts, and ensuring the public health system’s capacity to perform timely epidemiological and health policy analyses.

**Question 6: How environmental health and sanitation affect the nutritional status of the vulnerable people**

Proper sanitation and hygiene and safe drinking water can reduce undernutrition and stunting in children by preventing diarrheal and parasitic diseases, and damage to intestinal development. According to World Health Organization, roughly 50% of all malnutrition is associated with repeated diarrhea or intestinal worm infections as a direct result of inadequate water, sanitation and hygiene. When children are undernourished, their resistance to infection is lowered and they are more susceptible and more likely to die from diarrheal disease and other infections. In fact, diarrhea is the second-leading cause of death globally in children under 5 years. Where children regularly suffer from diarrhea, they are also likely to be malnourished as a result. For infants, particularly those under 6 months of age, diarrhea can cause permanent damage to intestinal development, reducing child’s ability to absorb nutrients.

As a result, using toilets and hand washing with soap prevents the transfer of bacteria, viruses and parasites found in human excreta which otherwise contaminate water resources, soil and food. Improving access to sanitation is a critical step towards reducing the impact of these diseases. It also helps create physical environments that enhance safety, dignity and self-esteem. Safety issues are particularly important for women and children, who otherwise risk sexual harassment and assault when defecating at night and in secluded areas. Also, improving sanitation facilities and promoting hygiene in schools benefits both learning and the health of children. Child-friendly schools that offer private and separate toilets for boys and girls, as well as facilities for hand washing with soap are better equipped to attract and retain students, especially girls. Where such facilities are not available, girls are often withdrawn from school when they reach puberty. In healthcare facilities, safe disposal of human waste of patients, staff and visitors is an essential environmental health measure. This intervention can contribute to the reduction of the transmission of health-care associated infections which affect 5% to 30% of patients.

**Question 7: Paul, a resident in my hometown, consults me about building a latrine in the compound of his house. He is an open-minded man who is keen to improve his life for his family. He has a wife and three young children, and his elderly mother also lives with them. He does not have a tap in his house and gets water from a nearby well. The area has heavy soil and the rock below is impermeable.**

1. **The types of latrine that are possible for Paul and his family**

The ventilated improved pit latrine (VIP) with a black vent pipe fitted to the pit and a screen (fly screen) at the top outlet of the pipe is the most suitable latrine for Paul and his family. This is because, the VIP latrines are an improvement to overcome the disadvantages of simple pit latrines. The smell is carried upwards by the chimney effect and flies are prevented from leaving the pit and spreading diseases to his young children. His elderly mother can also use the VIP latrine instead of simple pit latrine where she has to squat in order to help herself. The principal mechanism of ventilation in VIP latrines is tha ction of wind blowing across the top of the vent pipe. The wind creates a strong circulation of air through the superstructure, down through the squat hole, across the pit and up and out of the vent pipe. Unpleasant fecal odors from the pit contents are thus sucked up and exhausted out of the vent pipe, leaving the superstructure odor-free

1. **Recommendation on the type of latrine and why**

The fact that Paul lives with his wife 3 young children and his elderly mother, I will recommend that he constructs a latrine that is at least 3 metres deep for his family. The diameter should be at least a metre. The fact the soil condition is rocky and it is impossible to dig a deep pit, I will recommend that the depth of the pit be extended by building upwards with concrete rings of blocks and care must be taken to ensure the structure remains watertight. The level of water table must also be into consideration, the pit must be entirely above the water table at all times of the year. The other recommendation will be the handwashing station that can be made using jerrycans, tin cans, wooden bowls or pottery as per the culture of our community.

1. **The other advices that I will give to Paul about the location, design and construction of latrine:**

Toilets should be:

* Compatible with current and predicted future water availability for flushing (if required), cleaning and hand hygiene
* The location of the latrine should preferably be in the backyard of the house and away from an alley in the village. It should not be nearer than 6 metres or farther 50 metres from the house
* Compatible with the subsequent containment, conveyance and treatment technologies for safely managing excreta generated through toilet use
* Suitable, private and safe to use for all intended users, taking into consideration their gender, age and physical mobility (e.g. disabled, aged, sick etc.).
* the slab or pedestal should be designed and constructed from a durable material that can be cleaned easily (e.g. concrete, fibreglass, porcelain, stainless steel, durable plastic or smooth wood).

**Question 8: Five (5) ways in which urbanization creates challenges for effective sanitation and solid waste management**

Urbanization is the process of migration of people from rural and peri-urban areas into towns and cities. This process is complex and cannot easily be considered isolation from other social processes such as immigration, changes in industrialization, population growth, societal transformation and population development that happen concurrently and continuously. All these processes impact health and wellness directly. Clarke (2016:574) indicates that urbanization is a normal process that occurs worldwide and is driven by various push-pull factors. Among the factors pushing people away from the rural areas can be drought and population growth, while factors pulling people to migrate to urban areas include access to employment opportunities, education institutions, healthcare, modern shops and the perceived advantages of city lifestyle.

In south Africa during the apartheid era, the natural urbanization process was artificially restricted and organized, in a process of social engineering, through influx control, the Group Areas Act and other oppressive legislation that segregated residential areas by race. When the apartheid laws were rescinded by the new democratic government (since 1994), a deluge of people descended on towns and cities, which were not adequately prepared for the rapid influx of people. The result has been overstretched local government services, such as electricity, water and sanitation, as well as a shortage of proclaimed residential townships. In addition, clinics, schools and public transport have been placed under pressure to service the rapidly increasing urban population.

The outcome has been insufficient job opportunities for the number of employment seekers, and the proliferation of informal settlements and informal housing. People moving to urban areas for the first time are often not skilled for tasks required in industry but have other skills. The demands on local government budgets have grown exponentially while their income remains limited. the political pressure to right the wrongs of apartheid and bring relief to the plight of the disadvantaged resulted in a rush to build houses for the poor, but there is a growing realization that this has entrenched racial and economically segregated residential areas.

Urbanization is not only a geographic relocation. It also may require a change in lifestyle. For instance, when travelling on foot in a remote area it is quite acceptable to urinate in a protected spot along the road; in a city such behaviour is unacceptable, as it impacts on the health of inhabitants. Similarly, in some cultures, animals are ritually slaughtered at homes in rural areas to mark important family events; such practices are illegal in cities or urban areas. An informal settlement can be defined as any settlement that exists where housing has been created in an urban or peri-urban location without the official approval. Clarke continues to assert that, environmental factors which pose a threat to informal settlement are strong winds and freezing temperatures. Fires are also a risk to informal dwellings, as the high level of densification and inflammable building materials contribute to the spread of fires. These disasters lead to loss of life as well as loss of homes and possessions. Informal settlements result in construction of informal and unguided urban planning and these result in absence of formal streets grids, numbered streets, sanitation networks and services including policing, medical services and firefighting.

**Question 9: How do good sanitation and waste management practices bring a positive effect to urban inhabitants.**

The production of waste is natural consequence human activities and the disposal of waste is a very difficult and important task of local government. All humans produce wastes of various types; for example, urine and feces, wastes from washing and cooking, and solid wastes produced at home and in workplaces, schools, hospitals and other public buildings. All these wastes need to be controlled and managed for the benefit of people and the environment that they live in. In urban areas where people live close together and space can be limited, managing these wastes is a difficult problem. The following are examples of how good sanitation and waste management can bring positive effects to urban inhabitants.

1. **Health:** An adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development. That is why, in 2008, the Prime Minister of India quoted Mahatma Gandhi who said in 2013, ‘sanitation is more important than independence’. Improvements in one or more of these three components of good health can substantially reduce numbers of people, particularly children, in developing countries. Scholarly article by Waddington (2009) suggest that improved sanitation and good waste management can reduce rates of diarrheal disease by 32-37%. While many of these studies included in those reviews could not rigorously disaggregate the specific effects of sanitation and good waste management from the overall effects of wider water, sanitation, and hygiene interventions, a longitudinal cohort study in Salvador, Brazil, found that an increase in sewerage coverage from 26%-80% of the target population resulted in a 22% reduction of diarrheal prevalence in children under 3 years of age; in those areas where the baseline diarrheal prevalence had been highest and safe sanitation coverage lowest, the prevalence rate fell by 43%.
2. **Education:** Creating a healthy school environment by provision of safe water and sanitation facilities within schools, to improve children’s health, well-being and dignity, is likely to be most effective where it is supported by other reinforcing strategies. These strategies include policies to provide a non-discriminatory safe and secure environment, skills-based health education, provision of health and other services, effective referral to external health service providers and links with the community. Disease is not only the problem caused by poor sanitation in the school environment. Providing safe and separate sanitation facilities for girls, particularly adolescents, is one of the key factors in promoting greater school attendance for girls, and preventing them from staying away from school, particularly during menstruation. Access to sanitation facilities is a fundamental right that safeguards health and human dignity. Providing those facilities at schools not only helps to meet that right, it also provides the most favorable setting to encourage behaviour change in the school and in the community.
3. **Economic conditions:** Worldwide cities are rapidly expanding, creating visible environmental and social challenges. The generation of waste is one of the central concerns in urban groups, particularly in the global South, where inadequacies, absences and weaknesses shape the local water management system. Uneven geographical development has created obvious spaces of exclusion and neglect. In response, informal and organized waste pickers engage in selective waste collection and recycling, serving their community and the environment. These contributions are still mostly unrecognized and unaccounted for. This dynamic urban growth can generate significant stress on city administrations who need to provide the necessary basic infrastructure and public services to expanding neighborhoods and new settlements. As result of the incapacity to provide these, part of the population lives in extreme poverty and under critically neglected living conditions, often causing health challenges to their families and the surrounding communities. Having developed its industrial base and achieved high economic growth in the last four decades, current day Singapore is highly urbanized and industrialized. This has had major impact on the environment; more pollution and waste generated.

In Singapore more emphasis is placed on judicious land use planning and development and building plan control for housing, commercial, industrial and recreational uses as well as water catchments. Secondly, investments in waste collection and treatment infrastructure are made in tandem with industrial and urban developments to minimize pollution to our land and waters. Thirdly, legislation enacted to control pollution is applied judiciously. This is complemented by close monitoring of ambient air, inland and coastal waters to assess the adequacy and by strict enforcement to ensure that waste collection and treatment facilities are properly operated and maintained and the standards and requirements complied with.

The economic benefits of improved sanitation include lower health system costs, fewer days lost at work or at school through illness or through caring for an ill relative, and convenience time savings.

1. **The environment:** Urban centres are usually surrounded by rural communities and the two areas depend on each other to supply many of their needs. Urban areas depend on the rural areas to supply employment, commercial products, advanced healthcare provision, education and equipment, machinery and other industrial outputs. Most industries in developing countries discharge untreated or partially treated liquid wastes to sewers, where these are available, or to rivers, streams or ditches. Industries also release waste gases that may contain harmful substances and produce solid wastes that may contain hazardous materials such as poisons, strong acids, infectious material etc. increasing urbanization puts pressure on society as a whole as well as on the environment. People who migrate to cities may become unemployed and then need to be provided for. This puts pressure on welfare provision and on the charities that provide assistance to the hungry and the homeless. Even people who have jobs find it difficult to find somewhere to live and may develop illegal unplanned settlements that affect the planning and the service provision of the government sectors. These settlements also add to the city’s sanitation and waste problems.

To address these challenges, some countries have moved swiftly. In Ethiopia, there are several national policies, strategies and programmes that are relevant to improving sanitation and waste management. The policies are:

* The Health Policy (1993) which stresses that environmental health, occupational health and safeguarding the environment are priority issues
* The Environmental (1997) which promotes the use of renewable resources and recycling, includes specific policies for industrial waste
* The Water Resources Management Policy (1999) which describes the conservation, exploitation, use and protection of water resources.

There has been a marked reduction in the practice of open defecation throughout Ethiopia in recent years, particularly in rural areas. This has been accompanied by a rise in the use of latrine facilities, but there is still a long way to go to eliminate open defecation and provide all people with access to improved facilities.

**Question 10: Measures by which success or otherwise of public-private partnership providing water supply services can be assessed**

It is becoming more frequent for the private sector to be involved in the provision of public services such as water and waste water. There is a range of ways in which a dedicated services company from the private sector can be involved in the management and provision of municipal services. These range from a very restricted provision of technical services, through a variety of contracts involving increasing responsibility to full ownership of the supply system. Pickford et al (1995:52) indicate that the following principal stages are to be followed in ensuring the success of the public-private partnership in providing water supply services:

1. The division between the provision of the services through contractual relationship with municipality or a State and the situation where the private sector is the outright owner of the supply company and assets
2. Within the contractual subdivision there is a division between the provision of services only, the provision of services working capital and the provision of all investment and operation

In the case of public-private partnership, the private operator and municipality create an appropriate special purpose company in which they both have a shareholding. This joint venture company undertakes the provision of the full service and charges customers direct. The joint venture can either operate under a contract with municipality or under a license arrangement. Remuneration to the shareholders is through the payment dividends. Often the private sector also provides special management and technical support. In other words, any rural water supply scheme making use of ground water resources, involves two key role players:

* The project sponsor and this may be Government, through one of its departments, or it may be a non-governmental organization
* The community and in this case are the consumers in need of water

The traditional rural water supply programmes were characterized by the initiative being vested in the Project Sponsor. The then Botswana was no exception. Most rural water supply projects involved consultants and contractors. All of these wedged in between the project sponsor and the community. This results in management gaps and limiting the essential lines of communication between various levels of management. To add to the dilemma, there also exists functional gaps between the various working groups in the team. For instance, between the geohydrological and engineering consultants, or between the drilling, testing and equipping contractors. If we superimpose the management gaps on top of the functional gaps, we find that traditional rural water supply teams are made up of small operational islands.

The Botswana rural water supply programme was operational in all 5 regions of the then Bophuthatswana with separate contracts for drilling testing and equipping of boreholes in each region. Allowing for departmental staff and four consulting firms, approximately 200 people were directly involved in the programme daily basis. A further dimension to the problem was the geographical location of the various regions of Botswana.

* Five regions, 14 districts, although only 44,500km2, it was spread over an area ranging between 5 and 600km from the capital, housing a 1993 population of 2,3 million people.

The result of this traditional approach in Botswana were inevitable:

* Hundreds of boreholes
* No database or borehole numbers
* No testing records
* No follow up on equipping and maintenance
* No involvement of the community
* No sense of ownership

It has since been discovered that the success of the rural water supply programme is seated in the strong partnership between the public service, the professional advisors and the communities. All efforts are directed towards satisfying the real needs defined by the people themselves. Pickford et al conclude that the survey conducted in South Africa Department of Water Affairs, the rural communities of North West province are the only areas where availability of water is higher than 15 litres per person per day.

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