**African Centre for Project Management,**

**Nairobi- Kenya**

**Course: Post Graduate Diploma in Public Health**

***Course Unit: Module Six Assignment***

**Student Name: Kei Emmanuel James**

**Adm No: ACPMPGD/115/2019**

**Intake: March 2019**

*1. Define the following terms as used in Public Health*

1. *Epidemic*

According to the definition by Merriam Webster, an epidemic is a disease affecting or tending to affect a disproportionately large number of individuals within a population, community, or region at the same time.

It is an outbreak of disease that spreads quickly and affects many individuals at the same time **such as cholera, and Ebola outbreak which spread widely affecting more individuals in a short time.**

**The center for disease control and prevention defines Epidemic** as an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area or community. For example, when the cases of malaria in an area say Juba are usually around at a prevalence of between 3-5 percent and within a short time a sharp increase happens in a specified short period to say 20-30 percent, then that becomes an epidemic. Outbreaks of infectious diseases such as cholera and the current Ebola in the DRC are examples of epidemics.

CDC therefore, defined epidemic as the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time.

The CDC adjusts its statistical models to alter the definition of what’s truly more than expected since some diseases become more prevalent over time while others are less severe. Taking for example, the flu epidemic of 1990, where the CDC’s threshold was 6.7 percent of total deaths considered to be the what is normally expected in the population or community, which is not what is today as today’s threshold figure is likely higher than that due in part to the emergence of new, less treatable flu strains, as well as the decline in morbidity associated with other diseases (Tsai M.& Brendan, 2009).

1. *Epidemiology*

Epidemiology comes from three Greek words namely;

* epi, meaning on or upon,
* demos, meaning people, and
* logos, meaning the study of.

This therefore means that, the word epidemiology has its roots in the study of what befalls a population.

Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations and the application of it in the control of health problems or health outcomes.

According to Last (2001);

* The Study as mentioned here includes, observation, surveillance, hypothesis‐testing, analytic research methods, and experiments.
* Distribution refers to analysis according to time, place, and classes of persons affected.
* Determinants are the physical, biologic, social, cultural, and behavioral factors influencing health.
* Health‐related states or events include diseases and injuries, causes of death, behavior such as use of tobacco, reactions to preventive or therapeutic regiments, and provision and use of health services.
* Specified populations are those with identifiable characteristics, such as precisely known numbers.
* Application to control makes explicit the purpose of epidemiology – to promote, protect, and preserve good health.

Epidemiology is the study of how often diseases occur in different groups of people and why with the purpose of the Epidemiological information used to plan and evaluate strategies to prevent illness and as a guide to the management of patients in whom disease has already developed (Dr. Fiona G. 2019).

All in all, epidemiology is the study of the distribution of diseases and health determinants in order to use the information to answer the questions of who, where, when, what and why an event or a health outcome is.

1. *Chronic disease*

U.S. National Center for Health Statistics defines a chronic disease as one that persists for a long time lasting about 3 months or more. Chronic diseases generally cannot be prevented by vaccines or cured by medication, nor do they just disappear. Some can be immediately life-threatening, such as heart disease and stroke while others linger over time and need intensive management, such as diabetes and HIV/ AIDS. Other chronic illnesses persist throughout a person’s life, but are not always the cause of death, such as arthritis.

Health damaging behaviors, particularly tobacco use, lack of physical activity and poor eating habits are major contributors to the leading chronic diseases.

Chronic diseases tend to become more common with age and examples include [arthritis](https://www.medicinenet.com/arthritis/article.htm), cardiovascular disease such as heart attacks and [stroke](https://www.medicinenet.com/stroke_symptoms_and_treatment/article.htm), [cancer](https://www.medicinenet.com/cancer/article.htm) such as [breast](https://www.medicinenet.com/breast_anatomy/article.htm) and [colon cancer](https://www.medicinenet.com/colon_cancer/article.htm) and [diabetes](https://www.medicinenet.com/diabetes_mellitus/article.htm).

Physical activity, proper diet and not smoking are known to prevent most of the chronic diseases.

1. *Morbidity*

According to the national cancer institute (NCI) dictionary, Morbidity refers to having a disease or a symptom of disease, or to the amount of disease within a population and it also refers to medical problems caused by a treatment.

Porta (2008) in the dictionary of epidemiology defined morbidity as, any exit, subjective or objective, from a state of physiological or psychological wellbeing.

Morbidity is any physical or psychological state considered to be outside the realm of normal well-being, often used to describe illness, impairment, or degradation of health, especially when discussing chronic and age-related diseases which can worsen over time. The higher your morbidity, the shorter your lifespan may be that if you were healthy. It can also be used to describe the periods of illness that individuals experience, or the duration of illnesses.

There are two basic types of morbidity frequency measures;

* Incidence is a measure of the probability of occurrence of a given medical condition in a population within a specified period of time or the number of new cases of the condition in a given period and is usually expressed as a rate with the denominator being the number of people at risk. This means the incidence rate is expressed as the number of new cases divided by the number of the population at risk at that specified time multiplied by 100%.
* Prevalence is the proportion of cases in the population at a given time rather than rate of occurrence of new cases. Prevalence is the proportion of the total number of cases to the total population and is more a measure of the burden of the disease on society with no regard to time at risk or when subjects may have been exposed to a possible risk factor.

Thus, incidence conveys information about the risk of contracting the disease, whereas prevalence indicates how widespread the disease is.

*2. Discuss the five objectives of epidemiology*

As already mentioned in question one (b) above, Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations and the application of it in the control of health problems or health outcomes.

The five objectives of epidemiology include the following;

**To identify the etiology, cause, of disease**

The purpose or objective of epidemiology is to identify the etiology, cause and risk factors-that is, factors that increase a person's risk for disease. Epidemiologist will trace the cause of a health outcome/disease as was done by the now called father of modern epidemiology John Snow. Epidemiology often provides enough information to support effective action. Examples date from the removal of the handle from the Broad St. pump following John Snow’s investigation of cholera in the Golden Square area of London in 1854 (Snow J, 1936)

Public health surveillance is the ongoing systematic collection, analysis, interpretation and dissemination of health data to help in decision making. It gives the ongoing pattern of disease relating to its etiology and causes.

Much epidemiologic research is devoted to searching for causal factors that influence one’s risk of disease with the goal to identify a cause so that appropriate public health action might be taken with a desire to prevent or modify the severity of the condition or disease.

**To determine the extent of disease found in the community**

Epidemiology’s second objective as stated in its definition that the study of diseases and the distribution of disease and factors relating to the disease, is to determine the distribution of the disease in the community.

Epidemiologists may go to the community to identify the health problem of the community in what is known as community diagnosis where the health issues and the factors responsible for the health problem are diagnosed and its distribution determined in the community according to sex, race, social status, geographical location, age etc. this is vital in the planning of intervention as well as in the governmental planning for the welfare of the community. In this objective the epidemiologist will answer the questions of who, where, how and when.

**To study natural history and prognosis of disease**

According to Pan American Health Organization (PAHO), one of Morris' uses of epidemiology in public health is "completion of the clinical picture" - identification and description of all individuals affected and all expressions of the condition or health event. This is the natural history of a disease. The natural history of a disease refers to the course of a disease in an individual, from onset to resolution, in the absence of intervention.

It can also be the evolution of a disease in a population over time, in the absence of intervention. In this context, "disease" refers to any health outcome.

The natural history of disease is important in public health, because it provides a framework for prevention.

Sound and effective public health practice links specific kinds of prevention to different states or stages of a disease's progress in an individual or a population.

When investigating a disease outbreak, epidemiologists rely on health-care providers and laboratorians to establish the proper diagnosis of individual patients. But epidemiologists also contribute to physicians’ understanding of the clinical picture and natural history of disease.

Epidemiologists help in characterization of illnesses as well as characterizing many non-acute diseases, such as the numerous conditions associated with cigarette smoking including pulmonary and heart disease, lip, throat, and lung cancer. More recently, epidemiologists, clinicians, and researchers around the world have collaborated to characterize SARS, a disease caused by a new type of coronavirus that emerged in China in late 2002 (Kamps BS & Christian H, 2003).

**To evaluate new preventive and therapeutic measures and modes of health care delivery**

Taking for example TB, the only vaccination for TB on the market is the bacille Calmette-Guerin (BCG) vaccine; however, its use is rarely indicated in the United States. Before putting a vaccine on the market in the United States, the Centers for Disease Control and Prevention (CDC) along with the US Food and Drug Administration and other government agencies, must evaluate the vaccines efficacy, safety, contraindications, utility, and cost effectiveness. This is the work of epidemiologists to evaluate each public health intervention.

In a community or group with a high burden of disease, it is the responsibility of public health officials and epidemiologist, knowing its cause and biologic implications, to put in place preventive measures to alleviate the burden which include the primary, secondary and tertiary preventions as were first described by Leavell and Clark (1965) and still continue to provide a range of preventive interventions.

Many individuals may not realize that they use epidemiologic information that are evaluated to make their daily decisions affecting their health. When persons decide to quit smoking, climb the stairs (Physical activity) rather than wait for an elevator, eat a salad rather than a cheeseburger with fries for lunch (good eating habits/Diet), or use a condom, they may be influenced, consciously or unconsciously, by epidemiologists’ assessment of risk. Individual decision making is influenced by the evaluation of the individual health behaviors and interventions to be healthy.

The hundreds of epidemiologic findings about best practices and the exposure and disease association are directly pertinent to the choices people make every day, choices that affect their health over a lifetime.

**To develop Public health policing and regulation**

If we can recall from the definition of epidemiology, the definition ends with “and the application of this study to the control of health problem”, it is from here that epidemiology is essential in making policies that greatly promote, prevent and protect health.

Epidemiology provides foundation for developing public health policies and regulatory decisions relating to environmental problems, genetics issues, disease prevention, and health promotion and protection.

Epidemiologists who understand a problem and the population in which it occurs are often in a uniquely qualified position to recommend appropriate interventions and as a result, they regularly provide input, testimony, and recommendations regarding disease control strategies, reportable disease regulations, and health-care policy.

### **To Coordinate / make Linkages**

Epidemiologists working in public health settings rarely act in isolation. In fact, field epidemiology is often said to be a “team sport” involving several others thus, during an investigation an epidemiologist usually participates as either a member or the leader and/or a coordinator of a multidisciplinary team which members may be laboratorians, sanitarians, infection control personnel, nurses or other clinical staff, and, increasingly, computer information specialists and communication specialists as well as government officers (Politicians).

*3.Using examples explain three types of epidemiologic studies*

Epidemiologic studies are studies on human populations which attempt to link human health effects or outcomes such as disease to a cause which include the causative agent such as infectious agent or exposures such as to chemicals or ionizing rays and behavior such as smoking and diet.

Epidemiologic studies fall into two categories which are **experimental** and **observational.**

### **Experimental studies**

In an experimental study, the investigator determines through a controlled process the exposure for each individual (clinical trial) or community (community trial), and then tracks the individuals or communities over time to detect the effects of the exposure. For example, in a clinical trial of a new vaccine, the investigator may randomly assign some of the participants to receive the new vaccine, while others receive a placebo shot. The investigator then tracks all participants, observes who gets the disease that the new vaccine is intended to prevent, and compares the two groups (new vaccine vs. placebo) to see whether the vaccine group has a lower rate of disease.

Similarly, in a trial to prevent onset of diabetes among high-risk individuals, investigators randomly assigned enrollees to one of three groups, placebo, an anti-diabetes drug, or lifestyle intervention. At the end of the follow-up period, investigators found the lowest incidence of diabetes in the lifestyle intervention group, the next lowest in the anti-diabetic drug group, and the highest in the placebo group.([39](https://www.cdc.gov/csels/dsepd/ss1978/Lesson1/Section7.html#_ref39))

### **Observational studies**

In an observational study, the epidemiologist simply observes the exposure and disease status of each study participant. John Snow’s studies of cholera in London were observational studies.

This type of study is further classified into two most common types namely cohort studies and case-control studies and a third type is the cross-sectional studies.

***Cohort study.***

The cohort study is similar in concept to the experimental study. However, in a cohort study the epidemiologist records whether each study participant is exposed or not, and then tracks the participants to see if they develop the disease of interest. Unlike in an experimental study where the investigator determines the participant’s exposure as mentioned above, in a cohort study, the investigator observes rather than determines the participants’ exposure status and after the intended period of time, the investigator compares the disease rate in the exposed group with the disease rate in the unexposed group. The difference in the rates of the exposed and unexposed will then tell the relationship between the exposure and the outcome. The higher the rate in the exposed group the stronger the relationship of this exposure to the outcome or illness hence an association of the exposure with the illness or the health outcome.

The Framingham study is a well-known prospective cohort study that followed over 5,000 residents of Framingham, Massachusetts, since the early 1950s to establish the rates and risk factors for heart disease. The Study was initiated in 1948 to investigate an epidemic of coronary disease in the USA, using a prospective epidemiological approach. Insights were provided into the prevalence, incidence, full clinical spectrum and predisposing factors (Kennel W.B, 2000).

Another type of the cohort study is a **retrospective** cohort study where both the exposure and the outcomes have already occurred. Just as in a prospective cohort study, the investigator calculates and compares rates of disease in the exposed and unexposed groups through backtracking. Retrospective cohort studies are commonly used in investigations of disease in groups of easily identified people such as workers at a specified factory or attendees at a wedding.

For example, a retrospective cohort study was used to determine the source of infection of cyclosporiasis, a parasitic disease that caused an outbreak among members of a residential facility in Pennsylvania in (CDC, 2004)

During June-July 2004, public health officials in Pennsylvania were notified of cases of the parasitic disease cyclosporiasis among persons associated with a residential facility (e.g., residents, staff, and volunteers). CDC confirmed the diagnosis of Cyclospora cayetanensis infection by examining stool specimens from multiple patients. By early July, local public health officials had been notified of approximately 50 potential cases of cyclosporiasis associated with the facility; onsets of illness were from early June through early July. This report describes the findings of the epidemiologic and traceback investigations, which determined the cases were linked to consumption of raw Guatemalan snow peas at five special events, for which food was prepared by the facility staff, from late May through late June.

***Case-control study.***

In a case-control study, investigators start by enrolling a group of people with disease which at CDC are called case-patients rather than cases, because case refers to occurrence of disease, not a person) and as a comparison group, the investigator then enrolls a group of people without disease called the controls provides an estimate of the baseline or expected amount of exposure in that population. Investigators then compare previous exposures between the two groups. If the amount of exposure among the case group is substantially higher than the amount you would expect based on the control group, then illness is said to be associated with that exposure.

By definition, a case-control study is always retrospective because it starts with an outcome then traces back to investigate exposures. When the subjects are enrolled in their respective groups, the outcome of each subject is already known by the investigator.

An example of a case control study can be a study to determine the association of smoking in patients with cancer in the causation of cancers.

Case control study is relatively quick, inexpensive, and easy. They are particularly appropriate for;

* Investigating outbreaks, and
* Studying rare diseases or outcomes.

There two types of case-control studies which are:

* Non-matched case-control study**:**

This is the simplest form. Find a person with the disease and enroll them in the study. Then enroll a control and determine their exposure status.

* Matched case-control**:**

Find a person with the disease and enroll them in the study. Match the person for some characteristic (e.g. sex, age, weight) with a control. This can eliminate or minimize confounding variables. However, it generally results in a longer study; the more characteristics being “matched”, the longer the study takes.

***Cross-sectional study.***

This is the third type of observational study where a sample of persons from a population is enrolled and their exposures and health outcomes are measured simultaneously assessing the presence (prevalence) of the health outcome/illness at that point of time without regard to duration. For example, in a cross-sectional study of chronic diseases such as Hypertension and diabetes, some of the enrollees or participants with these chronic diseases may have lived with their diseases for many years, while others may have only been recently diagnosed to have the disease making it weaker than the two other types of descriptive studies (Cohort and case control studies).

A cross-sectional study usually cannot separate risk factors for occurrence of disease (incidence) from risk factors for survival with the disease. However, it is a perfectly fine tool for descriptive epidemiology purposes used routinely in the documentation of prevalence in a community of health behaviors such as prevalence of smoking, health states such as prevalence of vaccination against measles and health outcomes, particularly chronic conditions such as hypertension, diabetes.

**Ecological study**

An ecological study which is sometimes referred to as geographic study evaluates the relationship between an exposure and disease in some collective group of individuals such as people living in a country, county or Payam (village) or a community. In this case, instead of the unit of analysis being an individual as is the case with cohort and case control studies, the average measure of exposure and disease frequency are obtained for each aggregate and the analysis focuses on determining whether the aggregates with high levels of exposures also display high disease rates.

For example, the analysis of cancer risks in populations near nuclear facilities in different countries or districts where the country or district average exposures is considered to compare with the other unit of the study. This leads to ecologic fallacy a main limitation to the ecologic type of study. This is because people who developed the outcome might have been exposed more than the considered average leading the unreliable results.

### *4.*

### *a. Identify the problems associated with epidemiologic studies involving humans*

The epidemiologic studies involving humans have problems associated with including the following;

**Impossibility to control human behavior (Randomized controlled trial)**

When looking at the exposure to effect study with humans participating in the study as subjects, it is difficult to determine the amount of exposure. For example, when determining the effect of exposure to say a specific exposure like ionizing radiations, as humans are not restricted in their movements, the amount of exposure will be difficult to control as moving humans may get more exposure or less as they roam in different environments than the rats which could have been controlled and only allowed the required exposure to the specific factor in question. This therefore means that the subjects are exposed to different varying amounts of exposure making it a little bit unrealistic to use it for generalization.

**Individuals may drop out**

With personal reasons or other reasons individuals in the study may drop out leading to unrepresentative results as it will affect the sample size of the study.

**Uncertainty of the exposure**

The difficulty in associating exposure with effect because of the long and variable latency periods for manifestation of chronic illnesses, such as cancers (which are of concern because of their potential relationships to low-dose toxic exposures). Besides, clinical features of chronic illnesses infrequently provide any clues to specific etiology. This is all due to intrinsic characteristics.

**Voluntary change of health behavior or quitting of exposure**

Various beneficial epidemiological studies especially occupational exposure assessments such as exposure to radiations of radiologists are conducted on industrial populations to measurement exposure. These workers, however, are generally relatively young, healthy males whose exposures are limited to working hours and are governed by workplace conditions. The workers are sometimes then able to remove themselves by quitting the job and finding another if they find the exposure disturbing while leaving the less affected, less disturbed, or less sensitive workers to receive the greater exposure. Therefore, when results of occupational exposure studies are used for risk assessment, they may not be entirely appropriate for estimating health risks in the general population exposed under different conditions. The results may be misrepresentative for other groups unlike in the laboratory experimental studies where the animals are subjected to same conditions.

**Health consciousness (Cohort study)/Better health behavior practices**

In the case of a cohort study, the group free of disease who are to be as the control will get into more healthier behaviors such as physical activity. This is because as they become aware that other factors including body inactivity are responsible for diseases under study such as heart disease, they will try to avoid and follow a healthier behavior which will affect the result of the study unlike in the experimental study involving animals where they are controlled, and exposure is maintained.

**Unlikely to remember their past health behavior/Bias (Case control)**

Epidemiological studies are susceptible to certain biases, which must be minimized. Of importance to case-comparison studies is response bias or recall bias. Persons with an illness or with known exposures tend to remember events associated with those illnesses or exposures better than do persons not ill or not aware of the exposure. This means that the already sick will remember the exposure while the not sick will not easily remember or may tend to exaggerate. The greater the uncertainty of exposure or outcome data, the less likely it is that a true association or effect will be correctly identified

**Difficulty in identifying suitable control populations.**

In contrast to laboratory experiments, variables such as nutrition, medication use, or cigarette smoking cannot be easily controlled or matched in populations under epidemiological study. Accurate information on such variables must be collected if they could be potentially confounding elements (Davis et al., 1983). For example, it is inappropriate to try to estimate the risk of lung cancer in a group of smokers in comparison to a general population that includes a substantial number of smokers and former smokers. This is because the control group may tend not to be as the cases because of the variations in these variations unlike the laboratory experimental study where these variables are controlled.

**Shame in telling about their unhealthy behavior**

In the case of case control studies where cases are identified to be part of the study and their past exposure is traced to see the linkage between the disease or illness in question, they may not give the correct information about their past health behavior such as eating foods that are rich in fats or lack of physical activity as in the case of a study to see the causes of chronic diseases such as high blood pressure, diabetes and cancer. As the patient is already with the condition, they feel ashamed after learning they are sick and knowing the best practices that they could have followed to prevent the disease from occurrence. This therefore will lead to unreasonable results and therefore conclusion.

**Confusing health studies**

Studies that emerge with confusing or contradicting reports with existing ones brings dilemma to humans leading to unreliable results of epidemiological studies. For example, when studying on the effectiveness of a known drug in treating a disease, the cases may drop the specific drug under study as many new drugs come up with adverts and research results claiming to be better than the other which is already in the market. Patients will be interested to try the new drug as compared to the one they have previously been taking. This limits the validity of the study.

**Random variation**

In ecological studies, the issue of random variation is a major problem with the studies associated with human beings unlike with the one of laboratory animals. Where the average of the aggregate group is used in comparison will not give the exact measure of the exposure and effect relationship.

**Confounding variables**

Confounding factors such as physical inactivity in the cause of cancer and some chronic diseases may affect the study results of factors thought to directly be linked to these diseases such as smoking.

*b. Explain three guiding principles of ethical research involving humans*

Ethics is defined as the moral principles that govern a person's behavior or the conducting of an activity.

Merriam Webster dictionary also defines ethics as, the discipline dealing with what is good and bad and with moral duty and obligation.

Ethics is often applied to questions of correct behavior within a relatively narrow area of activity.

Therefore, research ethics are the moral principles that govern a person’s behavior during the conduct of a research, and this applies to both the person conducting the research (Researcher) and the participants involved in the research (Subjects).

Ethical research involving humans therefore means that a research using humans as subjects that follows research ethics which is usually guided by guiding principles known as the ethical guiding principles of research.

According to WHO, all researches involving human subjects should be conducted in accordance with four basic ethical principles which include; respect for persons, beneficence, non-maleficence, and justice.

**Respect for persons**

The respect for persons incorporates the two other fundamental ethical principles, namely:

* Autonomy, which requires that those who are capable of negotiation about their personal goals should be treated with respect for their capacity for self-determination. This means that subjects have the right to say out their own minds regarding the subject matter and that their decisions be respected. For example, while conducting a research on a new drug, if the subject chooses not to take the drug being studied or choses to stop taking the drug due to personal reasons, he or she should be let free to do it. The respect of the individual decision is a respect to the individual and hence a fundamental principle in ethical research.
* Protection of persons with impaired or diminished autonomy, which requires that those who are dependent or vulnerable be afforded security against harm or abuse. For example, when conducting a research involving children or the mentally impaired, there is usually need for seeking

**Beneficence**

This is the ethical responsibility to maximize possible benefits and to minimize possible harms and wrongs. This principle gives rise to norms requiring that the risks of research be reasonable in the light of the expected benefits, that the research design be sound, and that the investigators be competent both to conduct the research and to assure the well-being of the research subjects. The research conducted on humans should be more of benefit to the subjects and cause no or just reasonably little negligible harm. In the above example of drug testing, the drug should cause no harm to the people participants in the research and should be able to cure the disease the drug is being tested on such that the participants are cured of the disease to avoid the disease from deteriorating their health.

**Non-maleficence/ Do no harm**

The Do no harm is closely related to the above principle of beneficence. It holds a central position in the tradition of medical ethics, and guards against avoidable harm to research subjects. It looks more into doing no harm to the research subjects.

**Justice**

Justice requires that cases considered to be alike be treated alike, and that cases considered to be different be treated in ways that acknowledge the difference. For example, when using the drug test in a community, the dosage for adults should be different from the dosage for children since there is a difference in dosage between the two different groups of the adults and children. Using two different dosages for the two different groups is being just. It eliminates sampling errors which could otherwise affect the whole results of the research/study. If a study is only conducted in one group, it will not be representative of the community and therefore no justice is done.

Weaker members of communities should not bear disproportionate burdens of studies from which all members of the community are intended to benefit, and more dependent communities and countries should not bear disproportionate burdens of studies from which all communities or countries are intended to benefit according to the distributive justice principle.

*5. what does it mean when an epidemiologist says there is “interdependence’ between factors*

According to the Merriam Webster dictionary, Interdependence means dependence of two or more things on each other or one another.

Another word that is synonymous to interdependence is reliance defined as a logical or natural association between two or more things.

Therefore, interdependence between two factors in epidemiology means that, the two factors depend on one another to produce an effect such as disease or any health state. For factor one to be able to produce effect “C”, there must be factor two that without it factor one will not be able to produce the effect “C”. Also, when factor two is allowed on its own it can’t produce the effect “C” without the factor one.

This means that factor one is dependent on factor two. The two factors one and two are therefore interdependent to produce effect “C”. The interdependence of factors one and two is responsible for the effect “C”.

In epidemiology, every cause is interdependent on other causal factors (Gerstman B. B, 2003) meaning that diseases are caused by the cumulative effect of a number of factors.

Two people exposed identically to the same infectious agent experience different symptoms or sometimes no symptoms at all depending on the various agent, host and environmental contributors which are the so-called interdependent factors.

Most causes of diseases are dependent on the presence of other factors to assert their effects leading to biological interaction or biological interdependence.

*6. Identify factors that can lead to an epidemic*

According to the definition by Merriam Webster, an epidemic is a disease affecting or tending to affect a disproportionately large number of individuals within a population, community, or region at the same time while **CDC defines Epidemic** as an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area or community.

The factors that can lead to an epidemic include the following;

### **Human population dynamics and behavior**

As more people populate the planet, there is a greater possibility someone will encounter a virus that will spread to others. With the growth in population, humans are mad to get to closer proximity with wild animals who are reservoirs for many infectious disease agents such as the Ebola. This leads to humans contracting the disease which spreads fasters in humans leading to epidemics.

As people are traveling greater distances today than before due to globalization and better improved infrastructure and easer and safe means, this allows viruses and bacteria to spread more rapidly over greater distances more quickly leading to epidemics. For example, with the current Ebola outbreak in DRC, travelers have been able to cross it over to Uganda as they move from one place to another and had it not been because of the better well-prepared health team in Uganda it could have caused another epidemic in Uganda. The preparedness of the Ugandan Ebola response team made a great achievement in containing the identified Ebola cases.

As was the case with the 2014-2015 outbreak in west Africa, cultural norms also can cause an infectious disease to propagate resulting to an epidemic. For example, as families in West Africa cared for sick relatives, they unknowingly exposed themselves to the Ebola virus through contact with contaminated body fluids. This practice initially resulted in further spread of the virus in families and in communities. Behavior and norms such as bathing the death was one of the factors that led to the spread of the Ebola in West Africa.

### **Weather and climate changes**

Changes in weather and the climate can drive some animals carrying viruses and bacteria to different areas, where they could spread disease to people. For example, where there has been a case of cholera in one part of a village or say country, when rains rain heavily washing the waste into the rivers which when carried downstream will cause a cholera epidemic in that place. Another example is one here in Juba where people throw their solid wastes in water as it rains so that the solid waste can be carried by the rain. This will later be carried and damped in a down town making it a good habitat for rodents. The rodents will multiply and as their numbers grow competition for food will bring them into contact with humans as they search for food in houses causing diseases to spread such as hantavirus as was the case with the El Nino in 1992 which lead to spread of hantavirus in 1993 in the US.

Climate can affect disease transmission in a variety of ways. Flooding after heavy rains can result in sewage overflow and widespread water contamination which can lead to a disease outbreak as water becomes contaminated.

### **Changes to the Infectious agents (viruses and bacteria) themselves**

Sometimes, a change in a virus itself allows it to become an epidemic. The flu virus is a great example of how mutations can allow viruses to spread widely among populations. The influenza virus changes on a regular basis as small mutational changes happen (called genetic drift). This is the basis for why we need to develop a new flu vaccine for general use each season. Same is also seen with the drug resistant TB strains where the bacteria undergo mutation to gain resistance to the available antibiotic. This leaves them to linger more and more causing epidemic.

### **Technology**

Advancement in technology has led to the development of more virulent infectious agents that are being used in bioterrorism causing epidemic. In the village where I come from, most of the older men believe that all the vaccine preventable diseases were created by people who want to market their vaccines. They therefore develop by the use of high technology these viruses and release to the environment to infect the populations such that they come up with the vaccine for their commercial gain.

### **Changes in insect or reservoir populations**

Infectious agents have as well been able to be transported from one place to another to cause an epidemic through the movement of their reservoir hosts or populations. For example, the bird flu which is terrorizing the world over is believed to be transferred from one place to the other through the movement of its reservoirs the birds. As the birds migrate from one region to another, they go spreading the viruses. Birds are believed to migrate following weather changes.

The distribution and population size of disease vectors can be heavily affected by local climate. For example, the malaria vector, the mosquito population is greatly affected by climate such that during rainy season, the population of mosquitos is high making it more susceptible to transmit malaria. This means that the more the number of the insect vector the more chances of an epidemic outbreak. This is a reason malaria is high during rainy season than during the dry season when the number of the mosquito vectors is lower.

**Water Hygiene and sanitation**

Inadequate or lack of safe drinking water, inadequate or lack of excreta disposal facility, poor hygiene practices such as hand washing after visiting the latrine/toilet or washing of fruits and vegetable salads, poor living conditions and unsafe food lead to epidemic outbreak such as diarrhea.

Unsafe drinking water means waters contaminated with microbes responsible for epidemic diseases such as cholera and others such as shigellosis and typhoid.

Poor waste disposal means contamination of food and water hence spreading the infectious bacteria and viruses excreted in the excreta. Safe disposal of excreta is one way of preventing the occurrence of outbreaks in a community such as cholera and typhoid.

Poor hygiene practices such as eating unwashed raw fruit and vegetable salads and eating without washing hands as well as not washing hands after visiting a toilet or latrine are potential factors that lead to outbreak of epidemic. This is because when one is infected, as the infected person handshakes people or prepares food he or she infects the next person and with repeated cycles an outbreak of epidemic results.

Poor living conduction include overcrowding such as in camps as well as housing with no or poor waste disposal and water systems leading to contamination. Overcrowding is another factor that speeds up spread of disease such as cholera and Tuberculosis that can lead to an epidemic.

Food hygiene is key in preventing food borne diseases. Poor food hygiene practice is another key factor responsible for epidemic outbreaks.

*7. Explain the difference between incidence and prevalence of a disease.*

Incidence and prevalence are terms commonly used in describing disease in epidemiology. The two words are commonly used interchangeably or wrongly used to mean the other. However, they are different from each other and the following differentiate the two words;

**Definitions**

**Incidence**

Incidence is the number of new cases occurring within a period of time (e.g., per month, per year).

It is usually more meaningful when the incidence rate is reported as a fraction of the population at risk of developing the disease also known as the total population (e.g., per 100,000 or per million population).

Incidence is therefore defined as, the number of new cases occurring within a period of time in a specified population or community. It is usually demonstrated as a fraction with the number of new cases as the numerator.

While;

**Prevalence**

Prevalence which is sometimes referred to as **prevalence rate**, is the proportion of persons in a population who have a disease or attribute at a specified point in time or over a specified period of time.

Prevalence is also most meaningfully reported as the total number of cases as a fraction of the total population at risk with the total number of cases (both new and existing) as the numerator.

Prevalence is the actual number of cases alive, with the disease either during a period of time (period prevalence) or at a particular date in time (point prevalence). Period prevalence provides the better measure of the disease load since it includes all new cases and all deaths between two dates, whereas point prevalence only counts those alive on a particular date.

**Differences**

* Prevalence differs from incidence in that prevalence includes all cases, both new and preexisting, in the population at the specified time, whereas incidence is limited to new cases at that time only.
* Prevalence refers to proportion of persons who **have** a condition at or during a time period, whereas incidence refers to the proportion or rate of persons who **develop** a condition during a particular time or period.
* The Numerator of incidence is the number of new cases that occurred during a given time period where as the Numerator of prevalence is the number of all cases present during a given time period
* The numerator of an incidence proportion or rate consists only of persons whose illness began during the specified interval whereas numerator for prevalence includes all persons ill from a specified cause during the specified interval **regardless of when the illness began.**
* Prevalence is based on both incidence and duration of illness. High prevalence of a disease within a population might reflect high incidence or prolonged survival without cure or both. On the contrary, low prevalence might indicate low incidence, a rapidly fatal process, or rapid recovery. Meaning when the disease is a chronic disease with long survival, the prevalence of that particular chronic disease will be high whereas the incidence can be low a reason why prevalence rather than incidence is often measured for chronic diseases such as diabetes or osteoarthritis which have long duration and dates of onset that are difficult to pinpoint.

*8. Discuss the importance of data in Public Health.*

Data is defined as facts and statistics collected together for reference or analysis. It is factual information or numbers collected to be examined, considered and used to help in decision making.

## They include vital statistics such as birth, death, marriage and divorce data, census indicating the total population of an area with the key economic activity performed by the population, levels of income, education etc.

Data is important is so may ways as follows;

## **To Monitor the health of communities**

## Data is used to monitor the health of a community through community diagnosis to identify the health problem of that community as well as monitoring the utilization of health services by the community. The same way as medical professionals monitor the vital signs of every patient, they attend to so does the public health professionals in monitoring the health of a community from what health problem is facing the community to the social services they get.

## **To Evaluating Program Impact**

Data is critical to evaluate the effect or impact of a program. For instance, a study conducted at Kilimanjaro Christian Medical Centre (KCMC) measured the rates of children attending follow-up appointments after pediatric cataract surgery before and after an intervention was implemented. The study found that before the intervention, in 2003-2004, 154 children had cataract surgery at KCMC. Of those children, 67% came for their 2-week postoperative follow-up appointment, while only 43% came for their 10-week follow-up appointment.  Since cataract surgery alone will have limited value if follow-up care is poor, the medical center implemented specific changes to improve follow-up including a high-quality counseling service and a tracking system was developed which recorded each child’s next scheduled follow-up appointment and contact information for tracing such that, if a child did not appear for a scheduled follow-up appointment, then a parent or contact person was called. In 2006, 185 children had cataract surgeries, and post-intervention data showed that 89% of children came for their 2-week follow-up appointment, while 83% came for their 10-week follow-up. Upon comparing the %age of children in 2006 who attended their follow-up appointments to the percentage of children who went in 2004, the data shows a 22% increase for the 2-week follow-up and a 40% increase for the 10-week follow (Kishiki, E et al, 2009). This shows that data was used to evaluate the success or failure of a program. Data is therefore useful in evaluating a program being implemented.

## **To Determines Barriers to Care and Reveals Patient Perceptions**

There is poor uptake of modern family planning methods by South Sudan women which stands only at 1 percent. In South Sudan, 96% of women aged 15-49 years currently married or in union do not use any contraceptive method and of the remaining 4% only 1% use any modern family planning method while the other 3% use any traditional method (SSHHS, 2010). Low usage of modern family planning methods has been widely attributed to the negative attitude towards this form of contraception. Specifically, approval/ disapproval of the modern methods by self and partner (World Bank report, 2009), fear of harmful effects on health and low levels of education have been identified to influence use of modern FP methods in Africa, Asia and other parts around the world (World Bank report, 2009). Data therefore allows the determination of barriers to care and it reveals perceptions about an intervention such as fear of harmful effects and low levels of education which are key determinants of the uptake. This therefore means that the barriers and perceptions need to be handled before implementing an intervention which can only be known using data in public health.

**To select Appropriate Public Health Interventions**

Data can be used to determine the appropriate health intervention required for specific program. For example, when a data shows that, in a particular community, the most preferred intervention such as use of a mosquito net as compared to indoor residual spraying in the prevention of malaria, then any organization which is coming in to implement a malaria control program will have a knowledge of the acceptable and preferred method of malaria prevention in that community. This helps a lot in preventing waste of resources.

Data is also vital in comparison of sensitivities of two interventions in order to go for the most cost effective one other than an expensive intervention.

## **To Monitors program Progress**

Data is also needed and can be used to monitor progress towards a goal or target. For example, when a vaccination program is intended to target say 5000 children in a country or say a state within a specified time frame of say two weeks, data recorded every day can be used to determine the progress of the vaccination program at any time of the implementation of the program. If after five or seven days of implementation we find that 3000 children have been vaccinated it means that the progress of the program is good, and the goal of vaccinating the target 5000 children is possible to achieve. Looking at the data or numbers of the vaccinated children gives a progress report of the program.

## **To develop Public Policy**

Data is vital in policy development and implementation. Data collected during census is vital in the development of policies such as distribution of public services and fund for service delivery. Like is in the case of a political representation of residents in the parliament or the determination of a district / county status the data about the population of that residential area is necessary. Policies are developed after analysis of data.

Data is also important in the development of policies such as monitoring of trend of occurrences of disasters such as the natural disasters including floods. Policies can then be developed to avoid constructions near areas that are prone to floods in order to be safe from the floods that come frequently.

## **To Target Population-Based Interventions**

Data is also critical in determining which groups of people have the highest need for a specific program or intervention. For example, with most of the global burden of malaria among the under five years of age and the pregnant women, this implies that the target population to be looked at in designing an intervention to prevent malaria will be women and children and so came the supply of mosquito net to pregnant women and children during antenatal visits of the pregnant women. Documentation of the data on the drop in the malaria cases among the under five years children and the pregnant women also shows that the intervention has been effective and therefore need for more support to implement this intervention.

Data will show which group is a target group for a health program or intervention. The involvement of women in the sex for money business also let to the introduction of the female condom an intervention used in the prevention of HIV among the women sex worker.

Eases

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