**Model five Assignment**

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**Postgraduate Diploma in Public Health**

**Course code: PGD007**

1. **Define the following terms as used in Public Health**
2. **Epidemic**: Epidemic is the increase in the frequency of a disease above the usual and expected rate in a defined population.
3. **Epidemiology**: Epidemiology is the study of distribution and determinants of a disease frequency in a human population.
4. **Chronic diseases:** Chronic diseases are diseases that persist for a long period of time, which developed insidiously and progressive in nature leading to multiple organ failure and eventually death.
5. **Mortality:** mortality is the measure of frequency for diseases that is fetal. It is the number of deaths within a given population in a defined period of time. It can be express in number of deaths per 1,000 or 100,000 individuals per year. (Analytic methods of public health, Epidemiology model six note page 16)
6. **Discuss the five objectives of epidemiology**

The following are the five objectives of epidemiology;

**To identify causes of the diseases and relevant risk factors for the disease.** The epidemiology is to identify the cause of a disease, with desire to prevent or modify the severity of the condition. It normally follows pre-determined procedures in deciding whether to attribute a particular factor as the cause of a disease or a condition. It also formulates, select or rejection and test hypothesis through survey and observational studies.

**To determine the extent of disease found in the community,** this involves asking who, when and where question to understand which part of the community is most affected with particular disease, the distribution of the disease by age, sex, race and ethnicity and to understand if the disease is endemic, epidemic or pandemic in a defined human population.

**To study the natural history and prognosis of the disease.** Epidemiology tries to understand disease by classifying base on the causative agents, prognosis, the natural history and the distribution in the human population.

**To evaluate both existing and newly developed preventive and therapeutic measures and mode of health care delivery**. Testing the validity of rationale of control or intervention programs, such as vaccines and drugs for prevention or treatment of emerging diseases.

**To provide foundation for developing public policy regarding disease prevention and health promotion.** In access need, utilization and effectiveness of public services. In monitoring, evaluating and controlling program, and also in logical planning of services and resources.

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

**Cohort study**

It is an observational study in which a defined group of people (Cohort) is followed overtime and outcomes are compared in the subset of the cohort who were exposed, not exposed or exposed at different levels to an intervention or other factors of interest. Cohort study involves a large number of people, all are healthy at the time study begins are questioned concerning their exposure. They are observed over a period of time to see whether those who are exposed to the factor being studied are more likely to develop the disease than those who are not exposed. In cohort study people choose to belong to the exposed group or the control group. It is usually designed to determine the existence of an association between the exposure and disease as well as the strength of the association. The measure of the strength of an association is called relative risk and it is the ratio of incidence rate for persons exposed to the factor to the incidence rate for person in the unexposed group. Relative ration of 1.0 means not association between the exposure and the disease, valve greater than 1.0 indicates an increased risk while valve less than 1.0 indicates decreased risk.

**Examples of Cohort study include;** Framingham heart study, Smoking/lung cancer studies conducted by Doll and Hill, Hammond and Horn and Nurses’ health study.

**Framingham heart study**

Framingham heart study is an epidemiologic study conducted in Framingham Massachusetts to investigate factors causing heart diseases. The study was conducted in 1948, with more than half middle aged- population of the town, 5000 healthy people were examined, and data were recorded on their weight, blood pressure, smoking habits, the results of various blood tests, and other characteristics. Two years later, the same people were examined again, and these tests have been and continue to be repeated every two years for the rest of their lives. 10 years later, the Framingham Heart Study had revealed a great deal about which of subjects were likely to develop heart disease. study identified three major risk factors: high blood pressure, high blood cholesterol, and smoking. The Framingham Study found that some people maintained their youthful blood pressure and cholesterol values as they got older and that these people remained healthier. Weight gain and lack of exercise were found to be associated with increased blood pressure and cholesterol values and with an increased risk of heart disease. Publicity on the information gained by the study, confirmed and supported by other studies, persuaded some people to change their behavior and formed the basis of public health programs to encourage. By the 1970s, the death rates from heart disease were falling in the United States, this improvement was associated with a decline in risk factors: lower levels of blood cholesterol, blood pressure and smoking was less common.

**Intervention study**

Intervention studies is type of epidemiologic studies in which participants are assigned to a group that receive one or more intervention or treatment or no intervention so that the researcher can evaluate the effects of the interventions in biomedical or health related outcomes. These studies are done in very much the same way as those of laboratory experiments on Animals and usually done to test a new treatment for a disease, such as a chemotherapy for cancer or a preventive measure such as vaccines. In a clinical trial, one group is exposed to the intervention, while control group is not exposed. In a therapeutic clinical trial, both the **experimental group** and the control group are composed of patients who have the disease for which a therapy is being tested. The researchers then watch and wait to see whether response of treatment group is different from that of the control group. The control group may be given a **placebo**—an inactive substance similar in appearance to the drug or vaccine being tested. The drug being tested must show a higher response rate than the placebo if it is to be considered effective. The convincing clinical trials are conducted in a randomized, double-blind manner. **Randomized** means that each subject is assigned to the treatment group or the control group at random. This helps to equalize the groups with respect to unknown and known factors that might affect the results. **Double-blind** means that both the patient and the doctor are blind as to whether the patient is receiving the drug or a placebo. One reason that the doctor should also be blinded is that studies have shown patients to respond more favorably to a treatment that the doctor believes in. Another reason is to prevent the possibility that doctors might interpret the patient’s condition differently if they know how the patient is being treated.

**Example of intervention studies.**

**Field trial of Polio vaccine**

It is a randomized, double-blind clinical trial of a preventive intervention of polio vaccine in 1954. Polio, then a greatly dreaded disease in the United States, killed and paralyzed children and adults. In 1952, 21,269 cases of paralytic polio were reported in the United States. The development of a vaccine by Jonas Salk offered great hope for prevention of this scourge. Preliminary tests had shown the vaccine to be safe and to stimulate disease-fighting antibodies in the blood of people who had been vaccinated. In 1954, some 400,000 school children in 11 states were given the Salk vaccine or a “dummy” vaccine (the placebo); they were then tracked through the end of the year to see whether they became ill with polio. The incidence of polio among the children who had received the vaccine turned out to be less than half that of those given the placebo vaccine. This result demonstrated that polio immunization could reduce the incidence of disease; in fact, the use of the vaccine (or an oral vaccine developed by Albert Sabin in the 1960s) has virtually eliminated polio in the United States.

**The physicians’ health study**

Physicians’ Health Study is a preventive intervention study, in which 22,000 American physicians participated. Two hypotheses were being tested: whether aspirin reduced mortality from heart disease and whether beta carotene decreased the incidence of cancer. The physicians were randomly divided into four groups: those who took aspirin and beta carotene, those who were given one or the other and a placebo, and those who were given placebos only. The trial began in 1983 and was scheduled to run until 1995. The aspirin part of the trial was halted in 1988, however, because it was clear by that time that the physicians taking aspirin had a much-reduced risk of suffering a heart attack. They were only 56 percent as likely to have a heart attack as the group taking the placebo. The beta carotene part of the trial, which continued until 1995, found no significant difference in the incidence of cancer between the group receiving the beta carotene and the placebo group

**Case-control studies**

**case-control studies** are epidemiologic studies which usually start with people who are already ill and look back to determine their exposure. Case-control studies are much more efficient than cohort studies in that they focus on a smaller number of people and can be completed relatively quickly. In a case-control study, cases—people who have the disease—are compared with controls, healthy individuals chosen to match the cases as much as possible in age, sex, and other factors that might be relevant to the disease. The investigator asks all participants the same questions concerning the extent of their exposure to factors hypothesized to have caused the disease. Small case-control studies are commonly done to follow up a hypothesis generated by “shoe leather epidemiology,” as was done in the investigation of EMS and l-tryptophan.

**Example of case-control studies**

**The Reyes’ syndrome study.**

Thiswas conducted in the mid-1980s to sought the cause of Reye’s syndrome, a deadly disease of children that occurred a few weeks after a child had recovered from a viral infection such as chicken pox. The study tested the hypothesis that the development of Reye’s syndrome was linked to medications the child was given during the viral illness. The cases were children who had been diagnosed with Reye’s syndrome and reported a previous respiratory or gastrointestinal illness or chicken pox. Controls were children who did not have Reye’s syndrome but who had recently been diagnosed with chicken pox or a respiratory or gastrointestinal illness. Parents of the children in both groups were asked about what medications their children had received during the viral illness. The study indicates that children who are given aspirin to treat a viral infection are 42.7 times more likely to develop Reye’s syndrome than children who did not take aspirin, a very strong association. As a result of this study, the FDA required drug producers to put warning labels on aspirin containers and told pediatricians to advise parents to give their children acetaminophen (Tylenol) rather than aspirin to treat infections. Case-control studies estimate the strength of the association between exposure and disease by calculating an odds ratio, which is an estimate of what the relative risk would be if a cohort study had been done. The odds ratio is calculated by dividing the ratio of exposed subjects to nonexposed subjects in the case group by the ratio of exposed subjects to nonexposed subjects in the control group. In the Reye’s syndrome study, a link was found with the use of aspirin during the initial viral infection with the odds ratio of 26:1 divided by 53:87, or 42.7. (Analytical method of public health, Epidemiology model six page 9-12 and 22-24)

1. **(a) Identify the problems associated with epidemiologic studies involving humans**

All epidemiologic studies have the advantages of studying humans rather than experimental animals, but all are also limited by the fact that, each type of epidemiologic study has its own strengths and weakness as can be explained below;

**Problems of intervention studies involving humans**, intervention studies are developed through qualitative and quantitative descriptive research, studies to test intervention need to be conducted with meticulous care. The researchers need to attend to maintaining integrity of the study, in all phases. Without serious questioning at every juncture, and without close attention to the detail an erroneous conclusion may be drawn. The problems can arise include, an insufficient operationalized intervention, insufficient power from small sample size or less powerful analytic techniques, too much heterogeneity within each group on the dependent variable, lack of sensitivity of the measurement of outcome variable and incorrect timing of the outcomes.

**Problems of Cohort studies involving humans,** Cohort studies involve a large number of subjects for a long period of time and thus there is likelihood of dropout before the studies can be completed because it is difficult to control human behaviors. It is expensive in term of resources and time required since the subjects are followed-up for a long period and differential loss to follow up can introduce bias. Cohort study is not good for rare and diseases with long latency.

**Problems of case- control studies**. Case-control studies are subject to selection bias which are introduced as a result of poor study design or during collection of exposure and outcome data. This is because the disease and exposure have already occurred at outset of a case control study, there is may differential reporting of exposure information between cases and control based on their disease status. For example, cases and controls may recall past exposure differently (recall bias). Similarly, the recording of exposure information may vary depending on the investigator’s knowledge of individual’s diseases status. Case-control studies are insufficient for studying rare exposure and the information prone to observation bias and it unable to allow calculation of incidence (absolute risk) unless study is population based. Case-control study is limited to examine one outcome and the temporal sequence between the disease and exposure may be difficult to determine. (Epidemiology for practitioners. healthknowledge.org.uk/e-learning/epidemiology/practitioners/introduction-study design-ccs).

**(b) Explain three guiding principles of ethical research involving humans**

All research involving human subjects should be conducted in accordance with three basic ethical principles, namely respect for persons, beneficence/non-maleficence, and justice. It is usually assumed that these principles guide the conscientious preparation of proposals for scientific study. In varying circumstance, they may be expressed differently and given different weight, and their application in good faith, may have different effects and lead to different decision or course of action.

**Respect for persons,** it incorporates at-least two other fundamental ethical principle, namely; autonomy, which requires those who are capable of deliberation about their personal goals should be treated with respect for their capacity for self- determination. Protection of persons with impaired or diminished autonomy which requires that those who are dependent or vulnerable be offered security against harm or abuse.

**Beneficence and non-maleficence,** it is ethical obligation to maximizes possible benefits and minimizes possible harm and wrongs. This gives rise to norms that requires the risks of research be reasonable in the light of expected benefits that the research design be sound, and that the investigators be competent to conduct the research and to assure the well-being of the research subjects. Non-maleficence, ‘’do no harm’’ holds a central position in tradition of medical research, and guards against avoidable harm to research subjects.

**Justice**, it requires that cases considered to be alike be treated like and that cases considered different be treated in ways that acknowledge the difference. When the principle of Justice is applied to dependent or vulnerable subjects, its main concern is with the rules of distributive justice. Studied should be design to obtain knowledge that benefits the class of person of which the subjects are representative; the class of persons bearing the burden should receive an appropriate benefit, and the class primarily intended to benefit should bear a fair proportion of the risk and burden of the study. The rules of distributive justice are applicable within and among the communities. Weaker members of the communities should not bear disproportionate burdens of the study from which all the members of the communities are intended to benefit, and more dependent communities or countries should not bear disproportionate burdens of the studies from which communities or countries are intended to benefit. (international ethical guideline for epidemiologic studies by council for international organizations of medical science in collaboration with Who health organization page 14)

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

Independent comes from the Latin word *inter* meaning ‘’among, between’’ and *dependere meaning ‘*’to hang from, be dependent on’’. Thus, interdependence between factors refer to the state of being dependent upon one another in a mutual relationship. For a disease to occur all the three factors, the pathogen, vector and the host must interact mutually and dependently on one another.

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

A number of environmental factors lead to the spread of communicable diseases that are prone to caused epidemic. The most importance of these include; water, sanitation facilities, food, chemicals and climate.

**Human population dynamic and behaviors.** As more people populate the planet Earth, there is a greater possibility people can encounter infectious pathogen that can spread to others. And as people are travelling greater distances today, this allows pathogen to spread more rapidly over a greater distance as in the case of swan flu. Cultural norms and believes increase the spread of disease as it was the case of 2014-2015 Ebola outbreak in West Africa, in which the cultures encourage the kissing of the dead bodies as last respect to the deaths had made worse to control the Ebola virus disease.

**WASH.** Water, sanitation and hygiene is central to limit the risk of communicable diseases in population in an emergency. WASH risk factors include, Lack of safe drinking water, lack of hygiene and hygiene behaviors, lack of soap and lack of nets, general water scarcity as well as lack of adequate excreta disposal facilities and latrines. These factors considerably increase the risk for diarrheal diseases such as cholera.

**Overcrowding.** Overcrowding is a function of either mass population displacement or entrapment. Overcrowding can be after widespread destruction of homes and infrastructures, it is more prevalent if the population are forced into refugee camps or internal displaced persons are forced into camps. Overcrowding affect both hygiene related diseases such as diarrheal diseases as well as increases the transmission rate of disease like measles and other infectious disease that spread from person to person.

**Living conditions.** Poor living condition are combination of inadequate shelter, overcrowding and individual factors in the immediate surroundings of an individual or group of individuals. This usually leads to increase rate of transmission of communicable diseases as such Measles.

**Mass population displacement.** Most mass population displacement is associated with large number of people moving into camp setting, often associated with overcrowding, inadequate shelters and poor WASH conditions. Additionally, the population is displaced into areas with insufficient resources and services and with potential contact with host population with new disease vectors. Early camp structures such as tents and sitting toilets areas can lead to further complications of situation.

**Nutrition.** Nutritional factors such as malnutrition, food shortage and exposed to contaminated food are main risk factors at individual level, they also posed increased risk to the population as a whole if sufficient percentage of people are exposed. Nutrition factors are related to increased susceptibility to communicable disease with resulting greater shedding and transmission to others. Nutrition factors are exacerbated by insecurity, mass population displacement and inadequate humanitarian response.

**Insecurity**. Insecurity is a multifaceted bundle of risk factors that is one of the main root causes of increase mortality in humanitarian emergency setting. It composed of armed conflict, social disruption and political instability which inhibits the access of the population to health services with potential risk of outbreak of communicable due to poor or lack functioning health services to detect the condition early.

**Health and public health services.** Breakdown of health and public health services is probably the main risk factor for communicable diseases both for individuals and the population. Lack of access to the health and medical care services is a key risk factor for the severe progression of most communicable diseases. It facilitates the further spread of and making detection of cases and outbreak harder. In complex emergency, the public health service including vaccination, communicable prevention, control measures and surveillance are no longer available making disease outbreak more likely, harder to detect and control.

**Economy.** Economic factor such as poverty and lack of resources exacerbate and increase the risk, the spread of communicable disease as a result of overcrowding and poor living condition.

**Climate,** affect the transmission of disease in a variety of ways. The distribution and population size of disease vector can be heavily affected by the climate. Flooding after heavy rains can result into sewage overflow and widespread water contamination. In addition, there is evidence suggest that pathogen can be spread from region to another along air stream or wind spread. (WHO manual on communicable diseases and BMJ global health volume 3, issue 4, risk factors cascade for communicable diseases in complex humanitarian emergency by Charlotte Christiane Hammer, Julii Brainard, Paul R hunter).

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

Incidence rate is the rate of new cases of a disease in a defined population over a defined period of time while prevalence is the total number of cases of a disease existing in defined population at specific time.

Incidence is ascertained by counting the cases reported to local or state health department and divided by the population at risk while prevalence is obtained by conducting a survey.

Incidence measures the probability that a healthy person in a given population will develop the disease while prevalence cannot predict since it done by survey.

Incidence is useful for identification of causes of disease especially acute fatal infectious disease such as cholera while prevalence for identification of chronic disease that are not lethal such as arthritis.

Incidence is useful in epidemiologic studies to ascertained the association between the exposure and developing of the disease while prevalence is used in assessing the societal impact of the disease and healthcare services planning.

Disease with higher incidence would have low prevalence if the people recover from it rapidly or people die from it in short period of time while disease with higher prevalence has low incidence. (Analytic methods of public health, Epidemiology model six notes page 17)

1. **Discuss the importance of data in public health?**

Data is essential to reliable and valid public health research, however, data from studies will only be useful if used, analyzed and applied in timely manner. Data can be used to plan public health program, monitor and evaluate their progress and success, to determine appropriate public health interventions, to determine population targets or at risk for intervention, to determine barriers to health care, prepare government budget and to influence public policy, to detect new public health threats and provide raw materials for epidemiologic research.

**Data for appropriate public health interventions**

Cervical cancer rates vary worldwide, though it is estimated that 85% of the cases occur in low-income or middle-income countries. Similarly, it is estimated that 85% of deaths from cervical cancer occur in developing countries. This variance is largely attributed to developing countries lack of infrastructure and financial resource to establish a cytology screening program. Therefore, a study was implemented to determine if visual inspection with acetic acid, which is more cost effective and appropriate intervention for developing countries, would provide results comparable to advanced technological screening methods. The study determined sensitivity, specificity and positive predictive valve of visual inspection with acetic acid and colposcopy in order to compare the effectiveness and accuracy of the interventions to detect cervical cancer. The study found that visual inspection with acetic acid, a low-tech screening method, had sensitivity of 71% for detecting CIN II or worse condition while specificity was 74%, and the positive predictive valve was 11%. On the other hand, colposcopy, a sensitivity of 81% and specificity of 77% and positive predictive valve of 14% for CIN II or worse. The data for this study were used show how visual inspection with acetic acid and high-tech screening methods have similar abilities to detect cervical cancer and its precancerous stage.

**Data for monitoring and evaluation of program progress**

Data is needed and can be used to monitor progress towards to a goal or target. For example, the millennium development goals, accurate and up to date data is essential in order to record progress and determine which countries are on track to meet the goals. Data from WHO Publication demonstrated the progress that has been made towards achieving millennium development goal 4, which aims to reduce by two third the under 5 mortality rates between 1990 and 2015. The report found that child mortality continues to fall, and in 2008, the total annual number of deaths in children under 5 fell to 8.8 million. This represents a 30% decrease from the 12.4 million estimated in 1990. Though this demonstrated decrease in mortality rate is encouraging, the data also illustrates the need for public health efforts to continue focusing on the combating child mortality since 30% decrease is far from the goal’s target of 66.7% decrease.

**Data to target population-based interventions**

In 1995 National survey of family growth found that the percentage of U.S. women who gave birth before age of 18 years varies by income level and race. Those who made under $20000 /year had a 21% pregnant rate, while those who made between $20000-49000 had a rate of 9%. Those who made above $50000 had a rate of 3%. The data demonstrates that women from lower socioeconomic backgrounds have particularly high rates of birth before the age of 18. The information from this data can be utilized to target new interventions to specific populations. The data is also critical for determining which groups of people have the highest surgical need. Though most of the global burden of surgical disease falls among the world’s poorest, only small percentage of surgical intervention occur in lower income countries. Data can also be used to show where insecticide treated malaria nets for children are most needed. Though great improvement in insecticide- treated malaria nets coverage has been documented, there still specific countries and areas which have a large demonstrated used. In 2000, only 2.3 million (1.8%) African children living in stable malaria conditions were protected by an insecticide-treated nets. The number increased to 20.3 million (18.5%) in 2007, leaving 89.6 million children unprotected. Of these unprotected children, 54% were living in only seven African countries (Nigeria, DRC, Uganda, Sudan, Mozambique, Cote d’lvoire and Cameroon) and 25% were in Nigeria. The data suggest attention should be targeted to increased use of ITNs in these areas of Africa.

**Data to determine barriers to care and reveals patient’s perception**

In order to design interventions that will have the greatest impact, it is important to determine barriers to care and assess patient’s perception. The Indian organization 1298 used data to determine barriers to care. Developed in Bombay, India, 1298 strives to provide high quality ambulance services, and the organization utilizes a sliding scale method to determine fees. Those who elect to be transported to the public hospital for treatment do not have to pay at all. However, the organization realized that India’s poorest people were still not utilizing their services as much as other richer segment of the population. In order to understand why 1298 was not reaching those living below the poverty line, researchers conducted 100 one-on- one interviews in Mumbai slums. They found that 49% of the people interviewed would not call 1298 because it cost too much, 19% do not know the number and 14% said it took too long for an ambulance to arrive. This data shows that in order for 1298 to increase their uptake rates among the poorest, they should focus on making it clear that their services are free for those who can’t afford. In addition, the data revealed that the phone number needed to be advertised.

**Data and public policy**

In U.S. needles sharing directly accounts for more than 25% of AIDS cases. In order to prevent needle sharing, there is proven solution; needle exchange program which provide injectors with clean needles in exchange for their used ones. Data form 99 city study showed that HIV rates among injecting users in the cities with needle exchange programs dropped by 19% per year, while cities without needle exchange had an 8% increase per year. A study by Don Des Jarlais, a researcher at Beth Israel hospital in New York, found that HIV rates in New York city dropped more than 75% after city and community activities expanded clean-needle programs in the early 1990. Despite this evidence, many politicians and policy makers refuse to support these programs. However, data from these aforementioned studies can be used to influence current policy related to needle exchange and demonstrate the need and benefits of these programs.

**Data for evaluating program impact**

Data is critical to evaluate the effect or impact of a program. For instance, a study conducted in Kilimanjaro Christian medical center (KCMC) measured the rates of children attending follow-up appointments after pediatrics 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 43% came for their 10-week follow-up appointment. Cataract surgery alone will have limited valve if follow-up care is poor, the medical center implemented specific changes to improve follow-up. A high-quality counselling services was implemented, and a tracking system was developed which recorded each child’s next scheduled follow-up appointment. If a child did not appear for a scheduled follow-up appointment, the parent or contact person was called. In 2006, 185 children who had cataract surgeries, and intervention data showed that 89% of the children came for their 2-week follow-up, while 83% came for their 10-week follow-up. These data demonstrated how the intervention was successful in improving postoperative follow-up rates of pediatric cataract surgery. (Kilimanjaro Christian medical center study on outcome of cataract surgery and Part 1 health-related millennium development goals access on January 2011).

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