

**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE
AND TECHNOLOGY**

2013/2014 UNIVERSITY EXAMINATIONS

**FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE
DEGREE OF MASTER OF PUBLIC HEALTH**

KISII LEARNING CENTRE

COURSE CODE: HES 5121

TITLE: EPIDEMIOLOGICAL METHODS

DATE: AUGUST 2013

TIME: 8.00 – 12.00 NOON

DURATION: 3 HOURS

INSTRUCTIONS

1. Write your University Registration Number on every booklet that you use
2. Do not write your name on any paper you use.
3. This paper consists of **THREE SECTIONS**
4. Read carefully the additional instructions preceding each section

SECTION A: TRUE OR FALSE (20 marks)

For each of the following statements, indicate whether it is either TRUE or FALSE by placing an “X” corresponding to the correct response in the space provided on the right side of the table:

	Statement	True	False
1	Association between exposure and disease always implies that the exposure caused the disease		
2	A confounder is a variable on the causal pathway between exposure and disease		
3	A major strength of the observational study is the investigator’s ability to assign individuals to exposure groups		
4	Attributable fraction is the proportion of potential new cases of a disease that would be prevented by exposure		
5	Bias is a systematic error		
6	Incidence rate is best computed from a dynamic cohort		
7	Force of mortality is the same as prevalence		
8	Blinding is useful for ensuring comparability of information		
9	A case control study has a retrospective directionality		
10	A prospective cohort study is efficient for investigating rare diseases		
11	Matching is used mostly with cohort studies		
12	For causal inference, consistency implies that an exposure causes one disease		
13	The directionality of a retrospective cohort study is backwards		
14	The membership of a closed cohort is defined by a state of health and is transitory		
15	A cross sectional study is efficient for determining the temporal sequence between an exposure and disease		
16	Non-differential misclassification is a form of random error		
17	Retrospective study designs are more prone to selection bias		
18	If stratum-specific estimates of effect are not similar then confounding is present		
19	In a case-control study, controls should be selected based on their exposure status		
20	In differential misclassification the measure of association tends towards the null		

SECTION B: MULTIPLE CHOICE QUESTIONS (25 marks)

For this section, Only ONE response is correct. Circle the correct response.

1. The percentage of disease in a population that can be prevented by eliminating a risk factor is termed?
 - A. Preventable fraction among the exposed
 - B. Population attributable risk percent
 - C. Attributable risk percent
 - D. Population-attributable risk

2. Controls are needed in a case-control study because
 - A. They are matched to the cases for suspected etiological factors
 - B. They provide a comparable estimate of the frequency of exposure in the absence of disease
 - C. They increase sample size, so that statistical significance may be achieved
 - D. They are followed to determine if they develop the disease in question

3. Which of the following is the weakest of the causal criteria?
 - A. Analogy
 - B. Strength of association
 - C. Dose-response
 - D. Temporality

4. The following are sources of systematic error EXCEPT:
 - A. Selection bias
 - B. Confounding
 - C. Information bias
 - D. Sampling bias

5. Select the correct statement:
 - A. The attributable risk is a ratio of the disease risk in the exposed compared to the non-exposed during a defined period of time
 - B. The attributable risk is the excess risk of disease in the exposed compared to the non-exposed during a defined period of time
 - C. The attributable risk is the disease risk in a defined group at a specific point in time
 - D. The attributable risk is the prevalence of disease in the exposed minus the prevalence of disease in the non-exposed

6. The essential difference between experimental and observational studies is that in experimental investigations:
 - A. The study and control groups are equal in size
 - B. The study is prospective
 - C. The investigator determines who shall be exposed to the suspected factor and who shall not
 - D. Controls are used

7. Three ethical principles guide research that involves human participants. These are:
 - A. Respect for persons, beneficence, and justice
 - B. Confidence, compensation, and avoiding harm
 - C. Faith, hope, and love
 - D. Equitable access to benefits of research, moral rightness in action or attitude, minimizing risk

8. A phase I clinical trial:
 - A. The objective is to assess effectiveness
 - B. The study is randomized and double blind
 - C. Is the first step in testing a new drug in human volunteers after animal studies
 - D. Is also called post-marketing surveillance

9. What is the name of the statistical measure of the excess risk of disease among the exposed group attributed to the exposure?
 - A. Rate ratio
 - B. Odds ratio
 - C. Population attributable risk
 - D. Attributable risk

10. Random misclassification will always lead to:
 - A. An overestimation of the true association
 - B. An underestimation of the true association
 - C. Either an under- or overestimation of the true association
 - D. No effect on the true association

11. The following are true about cohort studies EXCEPT:
 - A. Efficient for rare exposures
 - B. Prone to loss to follow up
 - C. Is the strongest experimental design for establishing cause-effect relationship
 - D. Also called incidence study

12. Which of the following is the best for testing a study hypothesis:
 - A. Case control study
 - B. Randomized controlled trial
 - C. Cross sectional survey
 - D. Cohort study

13. Which of the following best defines confounding?
 - A. An association may appear to exist merely because of the luck of the draw
 - B. Confounding is directly influenced by sample size
 - C. Deviation of the results from the truth
 - D. A bias that results when a third factor is associated with the outcome, and independent of that association, is associated with the exposure.

14. Select the correct statement concerning association and causation:
- A. For an exposure and outcome to be causally related, there must be an association between the exposure and outcome
 - B. Effect modification (interaction) is a type of non-causal association
 - C. The relative risk, or odds ratio, must be greater than one for an exposure to be causally related to an outcome
 - D. All the Bradford Hill criteria for causation must be present for an association between an exposure and outcome to be causally related.
15. The major purpose of random assignment in a clinical trial is to:
- A. Help ensure that study subjects are representative of the general population
 - B. Reduce selection bias in the allocation of treatment
 - C. Ensure study participants have comparable baseline characteristics
 - D. Facilitate double blinding
16. A risk ratio less than 1 means:
- A. The exposure factor has caused the disease
 - B. The association between exposure and disease is statistically significant
 - C. The non-exposed group has a higher incidence of disease compared to exposed group
 - D. The exposed group has a higher incidence of disease than the non-exposed group
17. In a case-control study, recall bias is most likely to result in what type of misclassification?
- A. Differential (nonrandom)
 - B. Non differential (random)
 - C. Confounding
 - D. None of the above
18. In 1945, there were 1000 women who worked in a factory painting radium dials on watches. The incidence of bone cancer in these women up to 1975 was compared with that of 1000 women who worked as telephone operators in 1945. Twenty of the radium dial painters and four of the telephone operators developed bone cancer between 1945 and 1975. This study is an example of:
- A. A cohort study
 - B. A case control study
 - C. A clinical trial
 - D. A cross-sectional study
19. Which of the following best defines the causal criteria “specificity”?
- A. The association is consistent with findings of other studies
 - B. An exposure is associated with only one disease
 - C. The exposure must precede the occurrence of disease
 - D. The association between exposure and disease is coherent with the current biological knowledge

20. The following are true about Cumulative incidence EXCEPT:
- A. Is also known as incidence proportion
 - B. Is a measure of individual risk
 - C. Requires a dynamic population
 - D. Requires a closed population
21. The proportion of disease in a population that could have occurred in the absence of the exposure is termed?
- A. Preventable fraction among the exposed
 - B. Population attributable risk percent
 - C. Attributable risk percent
 - D. Population-attributable risk
22. Which of the following designs is best suited if the exposure is extremely rare?
- A. Cross-sectional
 - B. Prospective cohort
 - C. Retrospective cohort
 - D. Case-control
23. Investigators examined data from police records to identify crash factors associated with driver fatality vs. driver non-fatality. The crash factors they considered are driver blood alcohol level, driver age and driver use of the seat belt. This is an example of a:
- A. Prospective cohort study
 - B. Case control study
 - C. Retrospective cohort study
 - D. Clinical trial
24. Select the correct statement concerning retrospective and prospective studies:
- A. Retrospective studies are less subject to misclassification of outcome status compared to prospective studies
 - B. Retrospective studies are less subject to misclassification of exposure status compared to prospective studies
 - C. Retrospective studies are usually less costly to conduct compared to prospective studies
 - D. Relative risks can't be calculated in retrospective studies
25. Random assignment is an effective way to control for confounding in which of the following study designs?
- A. Case-control study
 - B. Cohort study
 - C. Experimental study
 - D. Cross sectional study

SECTION C SHORT ANSWER QUESTIONS (55 marks)

USE a separate sheet of paper. ANSWER ANY THREE QUESTIONS INCLUDING QUESTION 1. QUESTION 1 is compulsory for ALL candidates (35marks).

Choose ANY OTHER TWO Questions from Questions 2 to 5 (10 marks each)

1. A case-control study of the association between smoking and myocardial infarction gave the following results:

	Non-smokers (unexposed)	Smokers (exposed) No. of packs smoked/day		
		½	1	2
Cases	31	9	39	18
Controls	2706	710	1825	605

- Calculate the odds ratio of myocardial infarction, with non-smokers as the reference groups, for those smoking:
 - ½ pack per day (2 marks)
 - 1 pack per day (2 marks)
 - 2 packs per day (2 marks)
- Set up a 2X2 table and re-calculate the odds ratio of smoking on myocardial infarction without considering the number of cigarette packs smoked per day (4 marks)
- What is the meaning of your answer in (b)? (3 marks).
- From the 2X2 table you made in question (b), compute the attributable risk percent of smoking on myocardial infarction (5marks).
- List 2 ways in which confounding can be controlled at the design stage of this study design? (4 marks)
- What do you understand by recall bias? Give an example (5marks)
- List two differences between a case control study design and a retrospective cohort design? (4 marks)
- List two advantages and two limitations of a case-control study design (4 marks)

Choose any TWO Questions from Questions 2 to 5 (10 marks each)

2. Malaria is an important public health problem in Kenya. Both insecticide-treated bed nets (ITNs) and indoor residual spraying (IRS) have been recommended reducing the burden of malaria-endemic areas. However, the combined effect of these interventions is unknown. An intervention study was conducted in Rachuonyo district of western Kenya to determine the protective efficacy of IRS with ITNs (ITN + IRS) compared with ITNs alone (ITN only) in preventing *Plasmodium falciparum* parasitemia. At baseline, all the participants provided blood samples for malaria smears, were presumptively treated for malaria, and received ITNs. Blood smears were made monthly and at sick visits. A total of 1,804 participants were enrolled. From an intention-to treat analysis, the incidence of *P. falciparum* parasitemia in the ITN + IRS and ITN only groups is shown in the table below:

Incidence	ITN+IRS		ITN only	
	Events	Person-years at risk	Events	Person-years at risk
Malaria parasitemia	114	627	251	570
Anaemia	38	633	46	583

- (a) Comparing the participants randomized to the ITN+IRS group and those randomized to the ITN only group, compute the incidence rate ratio for:
- Malaria parasitaemia [1 mark]
 - Anaemia [1 mark]
- (b) From your answer in (a), what is your interpretation of the results relating to malaria parasitaemia? [1 mark]
- (c) Compute the preventive fraction for ITN+IRS compared with ITN only for:
- Malaria parasitaemia [2 marks]
 - Anaemia [2 marks]
- (d) From your answer in (c), what is your interpretation of the results relating to malaria parasitaemia? [1 mark]
- (e) Using your answer to (c) above, what recommendation would you make to the Kenyan Ministry of health with regard to the choice between these two interventions? [2 marks]
3. An epidemiological study was conducted among men in Kenya to find out whether the use of hormones by their mothers during pregnancy influenced the son's risk of developing prostate cancer later in life. The investigators selected 500 men who were hospitalized for prostate cancer (cases) and 1000 control men. The study found that 90 mothers of the cases and 50 mothers of the controls had used hormones during pregnancy.
- (a) What study design was used in this study? [2 marks]

- (b) Set up the 2X2 table for this data [2 marks]
 - (c) Calculate the odds ratio [2 marks].
 - (d) State in your own words your interpretation of the odds ratio [2 marks].
 - (e) List 2 ways of controlling for confounding at the analysis stage of a case-control study [2 marks]
4. The association between low to moderate alcohol consumption and the risk of developing gastric cancer among men of certain ages was investigated. Of 1626 exposed and 1840 unexposed men, 97 and 71, respectively, fell ill during the course of study. Smoking was considered a potential confounder in the study. A subdivision was therefore made into smokers and nonsmokers and the results are shown in the table below:

	Non smokers		Smokers	
	Exposed	Unexposed	Exposed	Unexposed
Disease	19	46	78	25
No disease	609	1478	920	291
Total	628	1524	998	316

Calculate the risk ratio for exposed men (low to moderate alcohol consumption) versus unexposed men (no alcohol consumption):

- (a) Among non-smokers [1 mark]
 - (b) Among smokers [1marks]
 - (c) Set up a 2X2 table and re-calculate the risk ratio of smoking on myocardial infarction without considering smoking as a confounder [2 marks]
 - (d) What was the study design used in this study? [2 marks]
 - (e) LIST 4 limitations of this study design [2 marks]
 - (f) LIST 2 differences between this design and a clinical trial [2marks].
5. A study was conducted among patients visiting at Kericho District Hospital for evaluation of possible Tuberculosis. They were all screened by a sputum smear for TB. Out of 595 patients who had chronic (over 2 weeks) cough, 75 tested positive for TB, compared with 16 out of 712 patients who had coughed for less than 2 weeks.
- (a) Construct a 2X2 table for this data [2 marks].
 - (b) Calculate the:
 - (i) prevalence of TB [1 mark]
 - (ii) sensitivity of a sputum smear [1 mark];
 - (iii) specificity of a sputum smear [1 mark];
 - (iv) positive predictive value of a sputum smear [1 mark], and
 - (v) negative predictive value for a sputum smear [1 mark].
 - (c) List any 3 consequences of a false negative screening result [3 marks]