**Chapter 3 Epidemiology – answers**

Self assessment

Question 1 of 26

Answer A, B, C. The variation of the pattern of disease in a population over time is the study of time distribution. The affect of the place in which the population lives on the disease is the study of place distribution. The affect of personal characteristics of people in the population on the disease’s pattern is the study of person distribution.

Comparing the cost of an intervention to the benefits of investing in it is the specialist field of health economics.

Question 2 of 26

Answer C

The range of test results beyond which a specific disease is, with known probability, present or absent describes a diagnostic distribution. No additional risk of morbidity or mortality describes a risk factor distribution*.* Variables that lie within a preset percentile of previous diagnostic test results describe a percentile distribution.

Question 3 of 26 Answer D

Number of people in the defined population at the same moment in time is the denominator for point prevalence. Number of people in the defined population over a period of time is the denominator for period prevalence. Number of people in the population at the beginning of the period is the denominator for risk

Question 4 of 26

Answer D – controlled trials. This is an interventional (or experimental) study design. All of the other options are observational study designs.

Question 5 of 26

Answer D – randomised controlled trial. These trials enable all known and unknown factors that could influence the outcome to be distributed equally between the experimental and control groups so that these groups differ only in terms of the factor under investigation.

Question 6 of 26

Answer C. In cohort studies subjects are followed up over time to assess outcome thus enabling prognostic assessment.

Although a randomised controlled trial could assess prognosis, this design is used to test the effectiveness of interventions.

Question 7 of 26

Answer B – cross-sectional study. Both the exposure and outcome were assessed at a single point in time

As there was no follow-up of the subjects this was not a longitudinal study. This was not an experiment, and not a randomised trial as there was no control group.

Question 8 of 26

Answer D – cohort and randomised controlled trial. Relative risk is the ratio of two risks (incidence rates). In both these designs you can calculate incidence.

Question 9 of 26

Answer D – 17. NNT = 1/ARR, ARR = |CER-EER| 0.54-0.48 = 0.06, 1/0.06 = 16.7

Question 10 of 26

Answer C. Two cohorts, i.e. exposed and unexposed, are followed up over a period of time.

This is not a cross-sectional study as the subjects are being followed up*.* This is not a case control study as there are no cases at the start of the study. The figure shows an observational design as there is no randomisation.

Question 11 of 26 Answer B

Follow-up is part of a cohort study. Individuals who currently have the disease form the cases. Individuals who have been exposed in the past are what is being assessed in a case control design. Assessment of exposure and outcome at the same time is a feature of cross- sectional design

Question 12 of 26 Answer E

A randomised controlled study is neither descriptive nor retrospective and is not observational in nature.

Question 13 of 26

Answer D – selection bias. Following randomisation, the subjects in the two groups are identical apart from the intervention under investigation.

Recall bias occurs mainly in case control studies as the subjects recall exposures differently. Ascertainment bias occurs when ascertainment is influenced by a participant knowing their intervention status. This is tackled by blinding. Publication bias happens during dissemination of study findings.

Question 14 of 26 Answer C Question 15 of 26

Answer A, B, C, D, E

The mode is the most frequently observed value in a series of values and is therefore the maximum point on a frequency distribution curve. The median is the central value of a series of observations arranged in order of magnitude.

Question 16 of 26 Answer A, B, D, E

The standard deviation is the square root of the variance. In a normal distribution, approximately 68% of the observations fall within one standard deviation of the mean; and 99% fall within 2.6 standard deviations of the mean.

Question 17 of 26 Answer A, B, C, D, E

The prevalence rate is the number of current cases (old and new) of a specified disease during a specified time period divided by the estimated mid-interval population at risk. Since the prevalence rate includes all cases in the community, it is determined by both the incidence and the duration of the disease process. It can also be used to determine the health needs of the community since it measures the total illness within the community.

Question 18 of 26 Answer B

Although time-consuming, a cohort study allows for determination of a population-based rate of the event under question. A case-control study, on the other hand, is relatively easy and inexpensive to conduct since long-term follow-up is not required. In a cohort study, potential

bias is lessened because exposure can be determined prior to the onset of disease, whereas with a case-control study, there is potential for bias in the selection of subjects since a case-control study is not population-based. The incidence rate of an event or disease for exposed and non-exposed populations can be calculated for a cohort study but not in a case-control or a cohort study.

Question 19 of 26 Answer D Question 20 of 26 Answer A, B, C

Causation is defined by various criteria in addition to risk assessment. These include biological plausibility, appropriate temporal relationships between exposure and disease or event, consistent outcomes, observations across several studies, dose-response relationships, and finally an experimental or animal study confirmation or association.

Question 21 of 26 Answer D Question 22 of 26 Answer C Question 23 of 26 Answer D Question 24 of 26 Answer B Question 25 of 26 Answer B Question 26 of 26 Answer E

Short answer questions

Question 1 of 9

1. Remember association is not equal to causation. Various criteria need to be met before we can establish causation. Refer to the text to find out the list of criteria
2. As there was no control group we cannot conclude the drug led to reduced fatigue. There could be many other explanations including placebo effect where taking an inert substance alleviates symptoms without actual effective treatment. Hence we need a randomised placebo-controlled trial to determine effectiveness.
3. No, this will not be a sensible conclusion. We only have the numerator. The population covered could be very different in size and/or composition. Also reporting and recording of crime could vary across places. We need standardised rates per 1000 population to compare across areas
4. Piano tuners are not the right controls as their exposure the risk factor for deafness will be very different from the general population

Question 2 of 9

Epidemiology is the study of the distribution and determinants of health related states and events in the population and the application of this science to control health problems

Question 3 of 9

An epidemiological variable should

* have an impact on health in individuals and populations
* be measurable
* differentiate populations in their experience of disease and health
* differentiate populations in some underlying characteristics relevant to health, e.g. income or behaviour
* generate testable aetiological hypotheses
* help to develop health policy, plan and deliver health care, prevent and control disease Question 4 of 9

Examples of male/female differences in heart disease:

|  |  |
| --- | --- |
| **Category of underlying difference** | **Example of possible specific differences by sex** |
| Biological | Hormonal, e.g. oestrogen |
| Co-existing diseases | Fewer women than men may have the other diseases which raise the risk of heart disease, e.g. diabetes |
| Behavioural | Women may eat more fruit, vegetables and salad than men, and generally smoke less |
| Social | Women spend more time with friends and family than men |
| Occupational | Their pattern of working, including likelihood of employment, the hours worked and the type of occupation can be substantially different |
| Economic | Women often earn less than men |
| Health care | Women with heart disease may be treated differently to men by healthcare professionals |

Question 5 of 9

This is one of the problems encountered in ecological or correlation studies when exposure and outcome are correlated at a population level. The term ecological fallacy refers to the fact that observations made at population or aggregate levels may not be true at an individual level.

Question 6 of 9

* Solid evidence that each of these risk factors is a component in the causal pathway. Such data come from case control studies, cohort studies or trials
* Knowledge of the frequency of each risk factor in the population
* Precise estimates of the additional risk each factor imposes on the population
* An understanding of the actions that are effective in reducing the prevalence of the risk factor, and their costs
* Assuming success in reducing the prevalence of the risk factor, evidence of improvement in disease outcomes

Question 7 of 9

The major forms of error are selection bias, information bias and confounding. Question 8 of 9

A confidence interval (CI) is an interval we generate from the data which gives a measure of our uncertainty about the effect size. Typically, 95% confidence intervals are used.

If we were to repeatedly sample the population, 95% of the 95% confidence intervals

produced would contain the true value. Confidence intervals indicate the strength of

evidence; where confidence intervals are wide, they indicate more uncertainty, and so

give less-precise estimates of effect. As a study’s sample size increases, we gain more

certainty about the true effect size, and so the confidence interval becomes narrow and

the ‘precision’ of the study’s estimate is increased. In a ‘positive finding’ study, the lower

boundary of the confidence interval, or lower confidence limit, should still remain

important or clinically significant if the results are to be accepted. In a ‘negative finding’

study, the upper boundary of the confidence interval should not be clinically significant

if you are to accept this result confidently.

Question 9 of 9

The criteria for assessing causality of an association between a disease and the hypothesised cause are:

1. Strong
2. Dose-related
3. In the right time sequence
4. Independent of recognised confounding factors
5. Consistent between different studies
6. Plausible
7. Reversible

Interactive exercises:

Question 1 of 2

1. The authors have adopted a case control design
2. Cases were boys with urinary tract infection (UTI) and controls were boys without UTI
3. The exposure under investigation is circumcision
4. The measure of association in a case control study is odds ratio (OR) and in this study it was 0.21
5. Children with UTI are 0.21 times less likely to have had circumcision compared to children without UTI

Question 2 of 2

1. Cohort is a group of people with common characteristics. For e.g. a cohort of smokers i.e. a group of people who smoke.
2. The authors matched the two cohorts by date of birth to ensure that both group have an equal chance of the exposure i.e. undergoing a circumcision.
3. Relative Risk
4. The numerator is incidence (new cases) among exposed and the denominator is incidence among unexposed.
5. The study showed that incidence of UTI requiring hospital admission is significantly lower in the circumcised children compared to children who are not circumcised. Hence circumcision does protect against subsequent urinary tract infection requiring hospital admission. However 195 children have to be circumcised to prevent one admission for UTI in the first year of life.