PEPLHLTH 111 – Rote Learning / Summary Notes

Module 1

GATE NOTES

Dis-ease occurrence

- The transition from a non-dis-eased state to a dis-eased event/ state
  - Event = if the transition is easily observable
  - State = if the transition is not easily observable

Groups and populations

- Any group of people who share a common factor (geographic, demographic, time period, dis-ease, behaviour etc.)

Prevalence = Number[1] (or sum)[2] of dis-ease states (Numerator) / Total number of persons (Denominator) at a point in time T

Prevalence in EG (EGO*) = number with dis-ease from EG ÷ number in EG or = a ÷ EG
Prevalence in CG (CGO*) = number with dis-ease from CG ÷ number in CG or = b ÷ CG

[1] If the numerator is a count of a categorical (yes/no) dis-ease states (e.g. diabetes), then prevalence will be a proportion (often expressed as a percentage %)
[2] If the numerator is the sum of the scores for a numerical outcome measured on everyone (e.g. blood pressure), then the mean (or average) is similar to a measure of prevalence.

*As with incidence, in the GATE Notes we use the generic term 'Exposure Group Occurrence' (EGO) to describe the prevalence in the Exposure group and Comparison Group Occurrence (CGO) for prevalence in the comparison group.

Incidence = Number of persons in group who have dis-ease outcomes (Numerator) / Total number of persons in group (Denominator) during study time T

Incidence in EG* (EGO**) = (number of dis-ease events from EG ÷ number in EG) during study time T or = [a ÷ EG] or = [a ÷ (a + c)] during time T

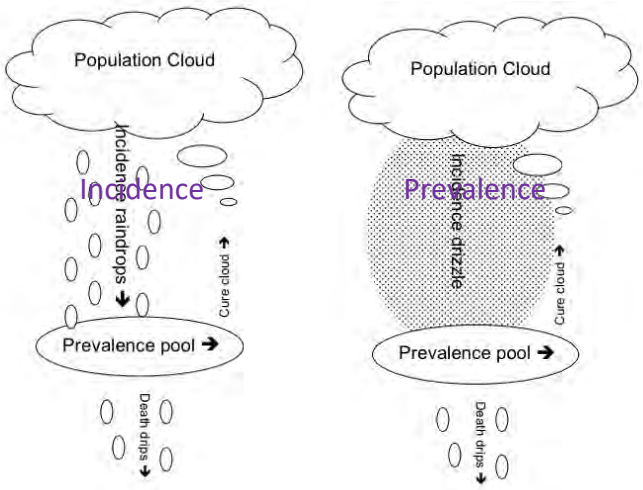
Incidence in CG* (CGO**) = (number of dis-ease events from CG ÷ number in CG) during time T or = [b ÷ CG] or = [b ÷ (b + d)] during time T

* EG is the acronym for the 'Exposure Group' - the people exposed to the factor being studied and CG is the 'Comparison Group' – the people not exposed.
** EGO is the acronym for 'Exposure Group Occurrence' & CGO for 'Comparison Group Occurrence. In this example Incidence is the measure of 'Occurrence.'

Relative Risk* (RR) = Exposure Group Occurrence** [EGO] (or EG Risk) / Comparison Group Occurrence** [CGO] (or CG Risk)

* the terms 'Risk Ratio' and 'Relative Risk' can be used interchangeably.

** if dis-ease occurrence measures are calculated as means or averages (e.g. mean quality of life scores in people taking different anti-depressant drugs), then the relative comparison of two mean scores would yield a "relative mean" (RM)



Risk Difference* (RD) = Exposure Group Occurrence** [EGO] (or EG Risk) MINUS Comparison Group Occurrence** [CGO] (or CG Risk)

* the RD is an **Absolute Risk Reduction (ARR)** if the risk is lower in the exposure group or an **Absolute Risk Increase (ARI)** if the risk is higher in the exposure group.

** If outcome measures are calculated as means (i.e. averages), the difference between two means is a "mean difference" (MD)

Relative risk reduction (RRR) = (1 - RR) x 100%. e.g. if RR= 0.6, RRR= (1- 0.6) x 100= 40%

Relative risk increase (RRI) = (RR - 1) x 100%. e.g. if RR= 1.6, RRI= (1.6-1) x 100= 60%

Measures of counting dis-ease events	Advantages/ Strengths	Disadvantages/ Weaknesses
Incidence (over a period of time)**(Categorical measure)** • Cohort Studies (RCT included) • Ecological Studies • Longitudinal Studies	"Clean" measure of occurrence of dis-ease events. Incidence **studies** are the ideal method for studying dis-ease occurrence because they involve collecting and analysing all the relevant information on the source population, and we can get better information on when exposure and dis-ease occurred	Can be difficult to interpret since data over multiple years must be analysed and followed up with.
Prevalence (at a given point in time) **(Numerical and/or Categorical measure)** • Cross-sectional study • Cohort Studies (RCT included) • Ecological Studies	Relatively easy to measure occurrences since it accounts for data taken at a given point in time. Prevalence studies are ideal methods for studying dis-ease occurrence with the use of substances: Example: alcohol consumption, smoking, heart rate, glucose concentration, cholesterol (any measure of substance)	Provides us with less information relative to incidence. Less "clean" of a measure of dis-ease events.

<u>Cohort Studies</u>

- Cohort studies evaluate a possible association between exposure and comparison groups by following the exposure group participants over a period of time (often years) to see whether they develop the dis-ease.
- *Advantages:*
  - Multiple outcomes can be measured for any one exposure.
  - Minimizes selection bias (in prospective cohort studies) fixed (there or not)
  - Good for measuring rare exposures (rare dis-eases), for example among different populations. (Ecological study)
  - Good for outcomes that occur long after exposure (in retrospective cohort studies).
  - It can measure incidence and prevalence.
- *Disadvantages:*
  - Costly and time-consuming.
  - Prone to bias due to loss to follow-up (Cohort members may die, refuse to continue participation in the study or fail to maintain contact)
  - Being in the study may alter participant behavior.
  - Inefficient for the study of a rare dis-ease outcome (in a prevalence outcome (time)
  - Classification of individuals (exposure or outcome status) can be affected by changes in diagnostic procedures. This means if the researcher knows the prognosis of the patient in the EG, he might alter the classification of the outcome, resulting in a confirmation bias.

Cross-sectional Studies (prevalence)

- Similar to cohort studies but differ by the measure of dis-ease events measured at a given point in time.
- *Advantages:*
  - Relatively quick, cheap and easy to conduct (no long periods of follow-up).
  - Data on all variables is only collected once.
  - Able to measure prevalence for all factors under investigation.
  - The prevalence of dis-ease or other health-related characteristics is important in public health for assessing the issue of dis-ease in a specified population and in planning and allocating health resources.
- *Disadvantages:*
  - Not suitable for studying rare dis-eases or dis-eases with a short duration.
  - As cross-sectional studies measure prevalent rather than incident cases, the data will always reflect the determinants of survival.
  - Unable to measure incidence.
  - Associations identified may be difficult to interpret.
  - Susceptible to biases such as responder bias, recall bias, interviewer bias and social acceptability bias.

Ecological studies (prevalence and/ or incidence)

- Ecological studies is an ideal method to include a large number of people (several populations) and the large number of risk-modifying factors that can be examined. Ecological studies are often used to measure prevalence and incidence of disease, particularly when disease is rare.
- *Advantages:*
  - Ecological studies are generally relatively quick, easy and cheap to conduct.
- *Weaknesses:*
  - Measures of exposure are only a proxy-based on the average in the population. Caution is needed when applying grouped results to the individual level
  - Potential for systematic differences between areas in recording dis-ease frequency. For example, there may be differences in dis-ease coding and classification, diagnosis and completeness of reporting between different countries.
  - Potential for systematic differences between areas in the measurement of exposures.
  - Lack of available data on confounding factors.

Randomized Controlled Trials:

- The aim of randomization is to ensure that any observed differences between the study groups are due to differences in the treatment alone and not due to the effects of confounding or bias.
- Or in other words, in an RCT, study participants are generally randomly assigned to one of two groups, the experimental group who will receive the intervention being tested, and a comparison group (controls) who receive a conventional treatment or placebo. These groups are then followed prospectively to assess the effectiveness of the intervention compared with the standard or placebo treatment.

- *Advantages:*
  - A well-designed RCT provides the strongest epidemiological evidence of any study design about the effectiveness and safety of a given intervention.
  - An RCT is considered to be the best type of epidemiological study from which to draw conclusions about causality. This study design can make causal inferences, i.e. it is the strongest empirical evidence of a treatment's efficacy.
  - Minimises bias:
  - Randomisation minimises allocation bias and selection bias
  - Blinding minimises performance bias
  - Double-blinding minimises assessment bias
  - Allocation concealment minimises both performance and assessment bias\
  - Prospective design minimises recall error and selection bias
  - Minimises confounding factors:
  - Randomisation minimises confounding due to unequal distribution of prognostic factors
  - Randomisation makes groups comparable according both known and unknown factors
  - Blocked randomisation makes groups comparable within known confounding factors
- *Disadvantages:*
  - Ethical constraints.
  - Expensive and time-consuming.
  - Requires complex design and analysis if the unit of allocation is not the individual.
  - Inefficient for rare dis-eases or dis-eases with a delayed outcome. (prevalence)
  - There may be a placebo effect in the non-intervention group, which may result in an underestimation of the true treatment effect.
  - Short follow up periods; not good at assessing long-term outcomes or harms.

Random vs non-random error

- Random: errors that occur by chance
- Non-random: errors that occur due to the design of the study or how the study is conducted (RAMBOMAN)

RAMBOMAN

- Recruitment
- Allocation
- Maintenance
- Blind and Objective Measures
- ANalyses

Recruitment

- External validity error: when participants are not a representative sample from a known population

- The setting must be well described, and the eligible population must be an identifiable and meaningful population in the triangle part of the PECOT system. They should also represent the eligible population.

Allocation

- Allocation of participants to EG and CG can be done by measurement and by random allocation.
- Measurement error: when the EG and CG are measured incorrectly
- Confounding error: when the exposure is mixed with another factor (for instance mixing alcohol consumption with glue sniffing), that is also associated with the outcome i.e. death
- Adjustment analyses deal with confounding by stratifying (dividing) the study into sub-studies so participants with the confounder are all in one sub-study.
- Whether EG and CG were similar or was adjustment needed is also important to establish.
- Randomized control trials' main benefit is that every participant starts off similar and then gets allocated randomly to EG and CG so the chance of confounding greatly reduces

Maintenance

- Questioning whether the participants remain in their allocated groups i.e., did they maintain the initial exposure or comparison exposure? Were lost to follow-up and were more lost from CG or EG or vice versa?
- In a cross-sectional study, there is no loss in follow-up since participants aren't followed up, so maintenance errors are not a problem here.

Blind or Objective Measurements

- Death is an objective measure, cause of death is a subjective measure (bias)
- In randomized controlled trials, measurement error in terms of blind or objective measurements aren't usually a concern since blind studies are involved in most studies. This effect is more appropriate when doctors are also blind to whether participants took the exposure thereby indicating that a double-blind study is highly effective in preventing non-random error.
- Knowledge of a participants exposure status can influence the participants or practitioner's perception or interpretation of signs and symptoms of study outcome

Random Sampling Error

- When samples are never fully representative of the whole population due to chance.
- Inherent in every study because every study population can only be a sample of the total population of interest
- EG and CG will differ due to chance alone, therefore, this type of error fixates more so on recruitment process, where chance makes the participants unrepresentative of the true population
- The smaller the sample, the less likely it will act as a representative of the true population, thus the greater the random sampling error