

Analytic epidemiology 10

Descriptive epidemiology: factors which determine the occurrence of disease regarding **host , agent environment** (Who ,when ,where)

Analytic epidemiology :factors regarding the **cause** of disease (why and how)

Descriptive epidemiology **generates** hypothesis

Analytic studies **investigating** a hypothesis , comparison

Risk denotes incidence rate

Risk factors can be used to predict the future disease

Relative risk : Measure of **strength of association** between an exposure and an outcome

$$\text{Relative risk (RR)} = \frac{\text{Incidence rate among exposed}}{\text{Incidence rate among non exposed}}$$

- a. If the value is 1, then no association exists,
- b. if it is below 1, the factor may be protective,
- c. when it is greater than 1, then the association exists and positive.

لنقرن كانت 100
وتساوي 5
20

له هاد يعني ربح فرمن ال
Exposure was (tobacco)

انه ال IR among smokers

5 times more than non-smokers



Attributable risk ; Fraction of the IR of the disease that can be attributed to the exposure of risk factor , **this gives an idea about the expected gain in health and life or the expected reduction in incidence rate if the risk factor is eliminated**

$$\text{Attributable risk (AR)} = \text{IR among exposed} - \text{IR among non exposed} .$$

لنقرن قيمة ال AR = 38/1000 هاد يعني لو شلنا ال Risk factor ولنقرن Asbestos (2 نزل الحالات بنسبة 38 من كل 1000

هدول ال Population سوار موزن أو غير موزن

لـ RF

(22)

Percentage reduction = $\text{Attributable risk} / \text{IR among exposed} * 100\%$

ولنقرن كان 38% هاد يعني انه بنقرن يعني 38 شخص من كل شخص موزن للخطر

(22)

Prospective study is a type of study in which we screen a group of people for a specific disease **before** they develop the disease **and follow up** for a period of time to estimate the incidence (start with risk factor)

Retrospective : here we start with the **outcome** (people already have the disease) and backward to examine the exposure to the suspected risk -----> **used for chronic diseases**

Association : ($RR > 1$) a quantitative dependence between two or more variables that tend to occur together more frequently

Two types of statistical association non-causal (confounding process) and causal either direct (vit. A deficiency causes night blindness) or indirect (vit. D deficiency causes osteoporosis -----> bone fracture)

Bradford hill criteria;

1- Strength of association :

The larger RR or OR the greater the likelihood that the relationship is causal. (OR, RR > 2 is **moderately** strong, OR, RR > 5 is strong)

2- Time sequence :

lack of temporality rules out causality

3-Dose response relationship (**biological gradient**)

Strengthens the argument for causality

4-Biological plausibility: Maternal caffeine consumption during pregnancy and the risk of miscarriage: a prospective cohort study

biological mechanism to explain the relationship

5- Consistency:

different studies with similar results regarding the association

6- Coherence :

Lack of **laboratory** evidence cannot nullify the **epidemiological** effects on association

7- Experimental evidence, 8- specificity

Health information system(HIS) 11

The ultimate objective of health information system is not to get information but to improve action

Uses of HIS :

Research , measure the health status , identify health problems , comparison , planning , assess user's satisfaction

important indicator for the quality of these services

*Defaulters : people aren't using these programs

Millennium development goals "international goals" which are 8 goals . examples ; eradication of poverty and hunger, concern about the health status of the child and the mother

Source of HIS	General info	strengths	Limitations
Census	<p>Collection of data</p> <p>Interval usually of 10 years</p> <p>Biggest source of comprehensive data</p>	<p>Complete count of country population</p> <p>Equity information</p> <p>data for mortality and fertility</p> <p>Important source for planning programs</p>	<p>Coverage and content error</p> <p>Age misreporting</p> <p>No direct question on deaths</p> <p>Unable to give the demographics estimates</p>
Notification of diseases	<p>The purpose is to affect a prevention and control the disease</p> <p>Source of morbidity data</p>	<p>Valuable information about fluctuations and disease frequency</p> <p>Warning about outbreaks of disease</p> <p>This concept has been extended to many non-communicable diseases</p>	<p>Covers only small part of the total sickness in the community</p> <p>Suffers from under reporting</p> <p>Some atypical and sub-clinical cases escape notification due to non-recognition</p>

Specialized centers

Allow for of patient and provide continuous account of the frequency of the disease

Describe the natural of course of disease especially the chronic diseases

Service management

Basis for the disease surveillance system to detect outbreaks

Measuring performance of facilities and it's monitoring

Generate data in a state specific schemes for local planning and surveillance

Exclude those not accessing the service

Private sector often not included

Incompleteness and data quality

Reporting problems

Irregularity and data duplication and inconsistency

Population survey

Population - based

Representative to the large population

Represents the heterogeneity

Response error

Non-response problem

Information incomplete

Time consuming and costly

Represents temporary situation

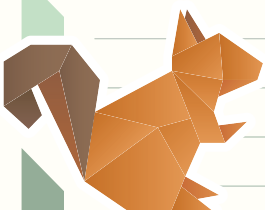
■ Health institutions and organizations constituent the **tip** of the iceberg

■ registration of **vital** events and statistics keeps a continuous check on demographic changes and serve as a reliable source of health information in developed countries if the vital events was complete and accurate it's also important in preparing health indicators

■ **Epidemiological** surveillance set up in case where a disease is **endemic**

■ **Environmental** health data helpful in the identification and quantification of factors **causative** of disease

■ Information quality : accurate,complete,consistent,timely,unique



Types of Epidemiological studies 12+13

Observational studies **no** intervention made

- 1- descriptive studies (cross-sectional, longitudinal)
- 2- Analytical studies (case control, cohort studies)

Experimental or interventional studies (here we made intervention in which investigator allocates and control the exposure)

1- descriptive studies ;

no attempt to analyze the link between exposure and outcome and based mainly on **mortality** statistics

Some advantages of the **cross sectional studies** ; baseline for **prospective** study , identifies **cases** and **controls** for **retrospective** studies

Cross-sectional studies

Single observation over point of time

Frequent conditions , long duration, non-fatal, chronic

Prevalence

Suggest hypothesis

Results are difficult to interrupt

Quick and cheap

Not useful for rare disease

Not Useful to determine seasonal variation

Longitudinal studies

Repeated observations over a **period** of time

Frequent conditions , long duration, non-fatal, chronic

Incidence

Suggest hypo-thesis

Results are easier to interrupt

More expensive and difficult to organize

Not useful for rare disease

Useful to determine seasonal variation

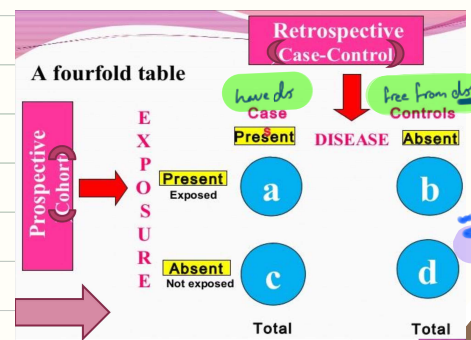
2- Analytical studies:

A-case control studies

↳ **Retrospective**

↳ Cases and controls should match the confounding factors

But avoid over matching



c. Size of the control:

If the number of the cases is >50 cases ,use one control for each case.

If the number of cases is < 50, use 2,3 or even 4 controls.

B- Cohort studies : prospective , retrospective prospective study

Elements of cohort study :

Subjects , data , comparison group (internal ,external ,comparison with general population) , follow up , Analysis)

Case - control

Cohort study

Suitable to study rare disease

Examin multiple exposure factors
for a single disease

Not suitable for rare exposure

Incidence and prevalence cannot calculated

Problem of bias(recall)

Minimal ethical problems

Easy , cheap , rapid

Estimation of risk(OR)

Small number of subjects

Difficult interpretation

Less useful risk measurement

Risk to subjects usually none

Less useful for causal criteria
common

Not Suitable to study rare disease

Examine multiple effects of a
single exposure

suitable for rare exposure

Incidence canbe calculated

No selection bias

ethical problems

Costly , Time consuming

Estimation of RR,AR , Dose response
relationship

Large number of subjects

Easy interpretation

More useful risk measurement

Risk of not removing exposure -

Very useful for causal criteria
More convincing

Equations;

■ The rate of exposure among the **cases** = $a/(a+c) * 100\%$

■ the rate of exposure among the **controls** = $b/(b+d) * 100\%$

■ $OR = ad / bc$

■ $RR = a/(a+b) / c/(c+d)$

■ $AR = a/(a+b) - c/(c+d)$

■ $AR\ reduction = AR / I\ among\ Exp * 100\%$

Experimental studies ;

to modify natural history of disease to decrease morbidity and mortality

Experimental studies produce the most valid results but come at very high cost

It can be viewed as a prospective cohort study

Gold standard of epidemiological research

Small sample size

Uses : evaluation

Advantages and Disadvantages of Experimental Studies

Advantages

- Prospective direction
- Ability to randomize subjects
- Temporal sequence of cause and effect
- Can control extraneous variables
- Best evidence of causality

Disadvantages

- Impossible to control human behavior.
- Ethical Constraints
- Expensive

Potential errors in epidemiological studies 14

Random error :

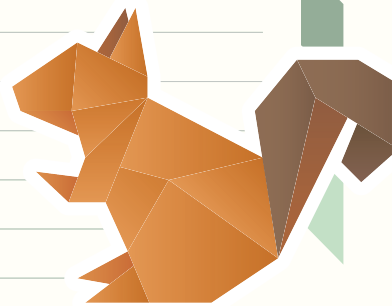
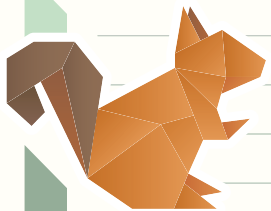
- variability in human population
- Greater random error leads to lower **precision**
- Bigger sample size gives more precise estimates
- Sample measurement diverges due to **chance** alone
- can **never** be completely **eliminated**

■ Sources; biological variation , sampling error(reduced by increasing the size of the study group) , measurement error(reduced by rigid protocols)

Systematic error(bais):

- Results differ in a **systematic** manner from the true values
- Accuracy(validity) is **not** affected by sample size
- **Not** reduced by increasing the sample size

بمراجعة هاي المراجعة هو كثير مهمتها فا هو عارفة ارتب
باقية افكارها ما ازا قرأتها كمان مرة
وفهمتها ينزل الها تخيها تبعوا على التعليقات



Chain of infection 17

Reservoir of clostridium botulinum is **soil** but the **source** of botulism of most botulism infections is improbably **canned food** containing C.botulism spores

Diseases which are transmitted from **person to person** ;
HIV, Measles, mumps , smallpox , polio

There are 4 types of **human** carriers:

1-Asymptomatic carriers; never show symptoms during the time they are infected such as **EBV,CMV,HSV,HIV, measles**

2-Incubatory carriers : **early** stage of disease that a clinical manifestations are not apparent such as; **mumps , measles , chickenpox,hepatitis A,tephoid fever**

3-Convulsant carriers; person who is a clinically **recovered** from an infectious disease but still **capable of transmitting** the infectious agent eg; **salmonella pt.**

4-Chronic carriers : harbor an antigen for a long time eg; **hepatitis B , salmonella typhi**

Animal reservoirs; could be vertebrate animals or insects

Brucellosis (cows, sheep and pigs) Anthrax (sheep,horses)

Plague(rodents) Rabies(bats , racoons,dogs ,etc...) Leishmania(dogs)

malaria (mosquitoes **biological** vector) schistosomiasis(water snails)

Lyme disease is a zoonotic disease of deer transmitted to humans by the deer tick

Environmental reservoirs:

Agent cause **histoplasmosis** live and multiply in the **soil** ,
legionnaire bacillus appears to be pools of **water**

Both of these diseases spread through airborne transmission

Portal of exit;

cholera vibrio , salmonella and hepatitis A excreted in **feces**
 Sacroptes scabiei in scabies **skin** lesions

Genitourinary : syphilis , gonorrhoea , chlamydia , HIV
 Schistosomes through **urine**

Blood born agents exit by crossing the placenta (**rubella , syphilis , toxoplasmosis , HIV, hepatitis-B**) or through the skin (**hepatitis- B**)

Modes of transmission;

Direct (direct contact (**mononucleosis , gonorrhoea**) , droplet spread (**large short-range Aerosoles**))

indirect (**airborne**(1-airborne dust ; particles blown from the soil , 2-droplet nuclei ; residue of dried droplets eg;TB) , **vehicle borne** (contaminated inanimate objectives) , **Vector borne**(**flies** carry shigella , **fleas** carry yersinia pestis that causes plague))

The final link in the chain of infection is a susceptible host

Herd Immunity in **practice** : has **not prevented** outbreaks of measles and rubella in population with immunity levels as high as 85 to 90%

Herd immunity in **theory** : not everyone in community needs to be resistant to prevent disease spread

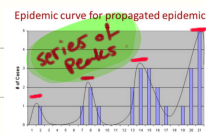
We measure endemic by prevalence while epidemic by incidence

Epidemic patterns

Common source

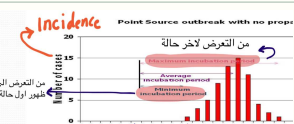
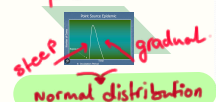
Continuous

Point
 Common source (didn't arise from person-person spread)
 Brief period
 one incubation period



propagated

- * person-person: Control source → Control outbreak
- * No common source
- * More than 1 incubation period.



Person-to-Person Spread
 Index case with limited spread.

Propagated Spread...
 This begins like an infection from an index case but then develops into a full-blown epidemic with secondary cases infecting new people who, in turn, serve as sources for yet other cases.

مهم الفرق



Fatima

