COMMUNITY MEDICINE

Notes

Done by: لجين العجمي

Cohort studies

The word cohort is derived from the Latin "cohorts" meaning an enclosure, company, or crowd.

In Roman times a cohort was a body of 300–600 infantry.

In epidemiological terms the cohort is a group of people with something in common, usually an exposure or involvement in a defined population group.

Cohort studies includes people who share the same characteristics, like similar age group, similar disease spreading between them, or they work similar job etc

- Cohort study is a type of analytical study which is undertaken to obtain additional evidence to refute or support existence of association between suspected cause and diseases.

- Other names of cohort study are Longitudinal study, Incidence study and forward looking study

n

Cohort study is undertaken to obtain additional evidence

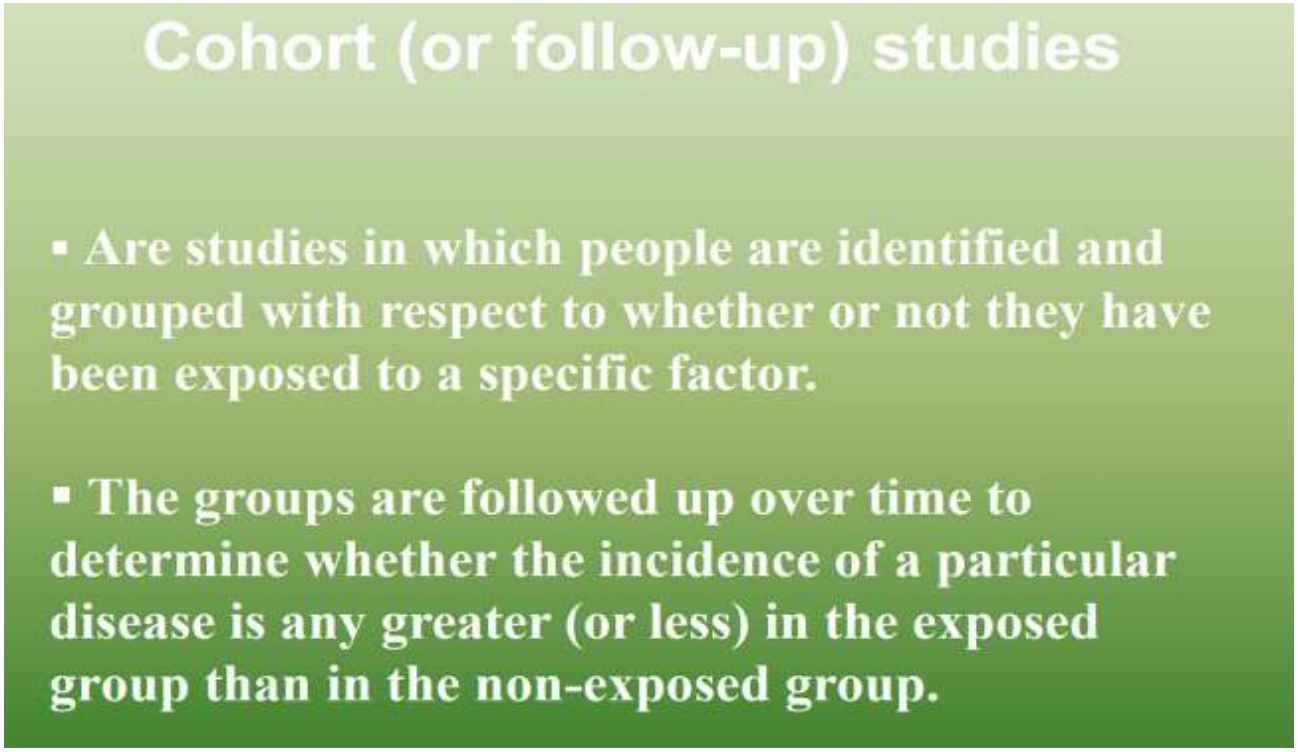
يعني احنا حكينا من قبل انه الcross sectional study هي عباره عن خط البدايه لبحث معين وبعدها الcohort study ممكن نستخدمها عشان نعرف تفاصيل اكثر. يعني مثلا لو عملنا دراسه على أنواع الكانسر ب males of a population

وطلع عندي مجموعه معينه من ال population عندهم اكثر نوع شائع من الكانسر هو الprostate cancer.. بال cohort study بقدر اعرف تفاصيل وأسباب شيوع هذا النوع من السرطان

So cross-sectional study was the first step of initiating the study & then cohort study was used to investigate for further details, we will take the group of highest prevalence of prostate cancer, test them using cohort studies and keep following-up on them to know the cause of this high prevalence rate.

ال cohort study بتساعدنا نعرف لو فعلا في risk factor زي مثلا ال age or certain exposure خلت هالنوع من الكانسر ينتشر عند هالفئه من الmales

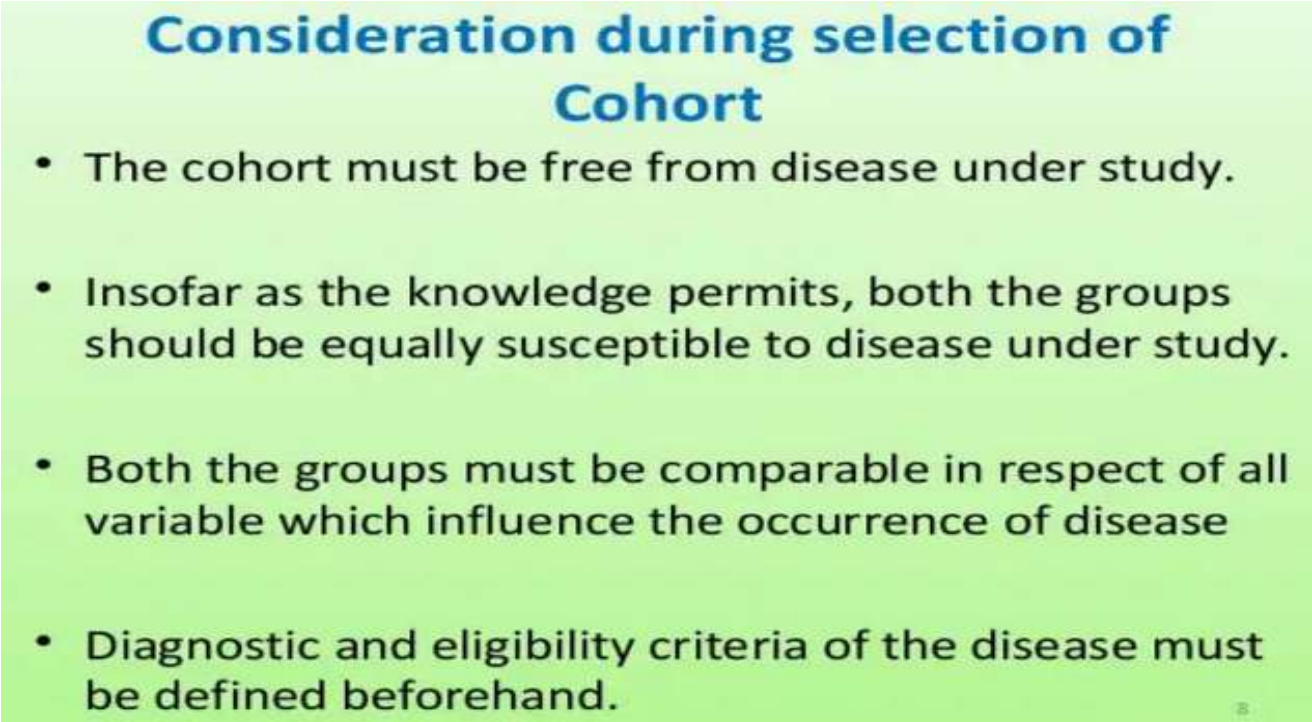
So cohort study helps us find evidence of association between a cause (risk factor) & the disease (outcome) by doing follow-ups



تذكرو انه بل cross-sectional study كنا نبحث عن ال risk factor & disease بنفس الوقت.. يعني مثلا شخص معو سكري بنسألو عن الدايت والحركه واذا كان عندو sedenatry life style with unhealthy diet بنحكي انها ال risk factor that caused diabetes فهيك بندور عال risk factor & disease at the same time

While in cohort study there is follow-up.. we bring two groups of people , group who has been exposed to a risk factor & a group who hasn't been exposed to a risk factor & we will follow-up with them & investigate for appearance of disease, that's why one of the other names of cohort study is "incidence study" because we follow-up cases & see if there's any disease development

n



I will add the doctor's notes under each point:

1) Anyone involved in our cohort study must be free from disease as cohort studies are used to measure incidence rate so we need patients who are free from disease so we can follow-up with them

2) When we take a group of people to perform cohort study on them, we will divide them into two groups.

A group exposed to risk factor & group non-exposed, but you have to keep in mind that the non-exposed are also susceptible to disease, maybe less than the exposed group but they're still vulnerable to disease. However, in some cases, the percentage of disease in exposed & non exposed is equal, and when that happens we conclude that the risk factor is not a cause of the disease

3) I have to check all the possible risk factors that may be the cause of the disease and check on these factors in both groups and compare them.

n

يعني لازم كل ما اسوي خطوة لمجموعه اطبق نفس الخطوه ع المجموعه الثانيه عشان تكون النتائج دقيقه ولازم اختار مجموعات يكونو comparable يعني مثلا لو ابي اسوي دراسه عن مرض ال P.R.O.M وال exposed رح اخذهم من المستشفى مثلا... لازم ال non exposed يكونون من المستشفى بعد عشان اقدر اسوي مقارنه

4) We must investigate for the criteria for disease occurrence, each disease has its own criteria by which we can establish the diagnosis, so before starting the study we have to know the criteria of the disease we're studying.

COHORT STUDY PRIMARY PURPOSES:

♣ Descriptive (measures of frequency) –

To describe the incidence rates of an outcome over time, or to describe the natural history of disease

يساعدنا نعرف معلومات عن المرض خصوصا لو كان جديد..
يساعدنا نعرف incidence rates و ال incubation period للمرض
وال signs and symptoms و نسبه حدوث المرض من risk factor
معين وممكن من خلاله نعرف ال complications لأي مرض ندرسه

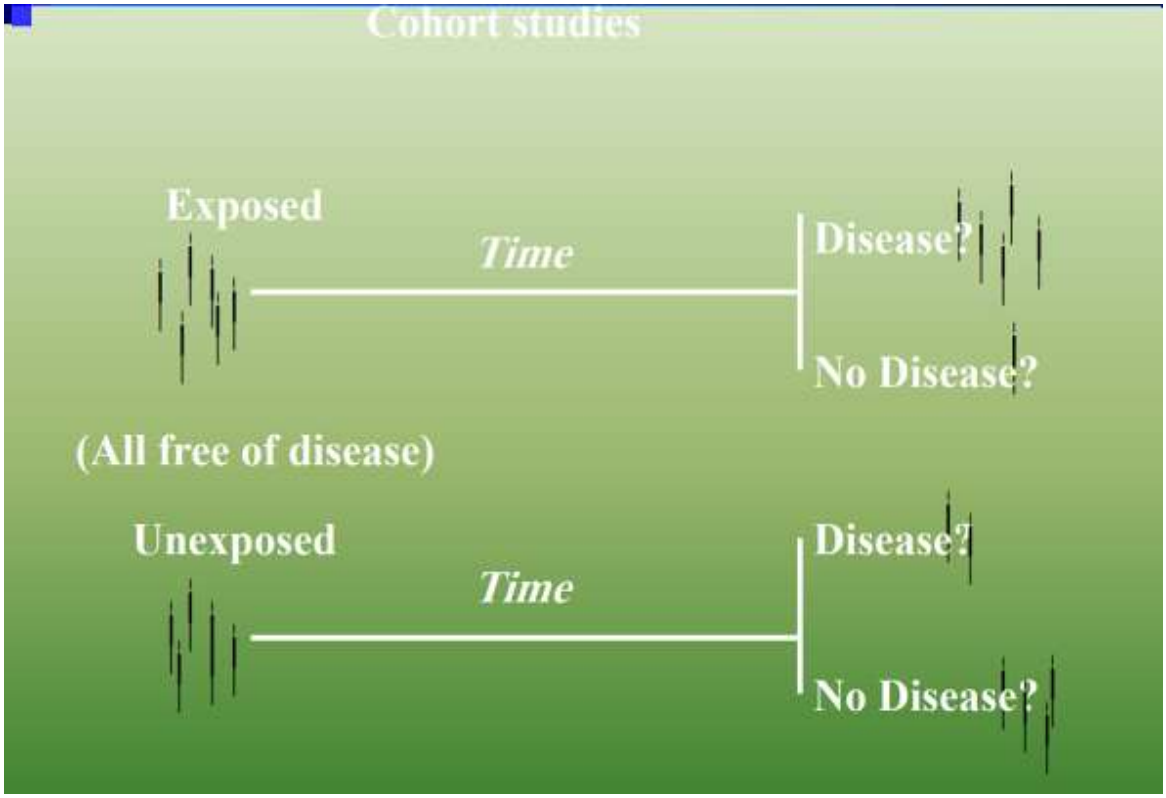
Cohort study is primarily classified as an analytic study, however we can use it to describe characteristics of any disease

♣ Analytic (measures of association) –

To analyse associations between the rates of the outcomes and risk factors or predictive factors

We can analyse by bringing two groups of people (exposed & non exposed) for example to radiation, then follow up and see which group develops cancer at higher

percentage then we can build conclusions that radiation is associated with cancer development



Cohort study design

- Cohort study design is the best observational one for establishing cause–effect relationships (better than case-control studies). Prevention and intervention measures can be tested and affirmed or rejected.
- Cohort studies take into account seasonal variation, fluctuations, or other changes over a longer period.
- Objective measures of exposure, such as biological markers, are preferred over subjective measures

effect of exposure of risk factor ال بنقيس objective measures بال
يعني مثلا لو في risk factor معين بزيد احتماليه حدوث واحد من انوع السرطان بدل ما اقيس level of exposure بقيس level of the effect caused by the exposure

n

وهاد بسموه objective exposure

Ya3ni some cancers cause increase in levels of some tumor markers or biomarkers, so instead of measuring the level of exposure to the risk factor causing cancer development we measure the level of the biomarkers

Objective measure vs subjective measures:

in objective measures we see the effect of the exposure by checking the level of biomarkers for example, while in subjective measures we see the effect of exposure by asking the patients

يعني بال objective بنشوف الeffect بالجسم نفسه من خلال مستوى الbiomarkers مثلا اما بالsubjective بناخذ فيدباك من المرضى ولان الmarkers ادق من ال feedback الobjective exposure احسن من الsubjective

Strengths (advantages) of cohort study design:

- We can measure incidence of disease in exposed and unexposed groups and that's the whole purpose of the study, to know the effect of the risk factor on the development of the disease
- Using cohort study we can get a temporal (time related) sequence between exposure and outcome as all individuals must be free of disease at the beginning of the study. Temporal sequence – **The exposure must precede outcome (to exclude reverse causation)**

يعني القصد انه الcohort study تعطينا تسلسل للاحداث حسب الوقت..
يعني أولا لازم كل رح نطبق عليهم الدرا سه لازم يكونون free from disease بعدها بنشوف الناس اللي صارلهم exposure بعدها بوقت نرجع نفحصهم نشوف لو صار في مرض او لا

So basically this is a time sequence, according to cohort study exposure to risk factor happens first then later on disease develops

- Good for looking at effects of rare exposures.

  In case the risk factor is rare to find, we use cohort study, while if the disease was rare, we use case-control study

  Always keep in mind: We always begin our study with the exposed group in cohort study & the diseased group in case of "case-control" study.

- Allows for examination of multiple effects of a single exposure and that's because a single exposure)single risk factor) can cause several adverse effects and all these effects can be detected via cohort studies

- Not open to bias as much as other types of study

  نسبه حدوث خطأ قليله جدا لان بهاي الدراسه انا رح اضل اراقب المريض واسأله اول بأول ومرح اسأله مثلا عن شي قديم ويكون نسى الجواب ف احتماليه حدوث الخطأ قليله جدا

- Direct calculation of the risk ratio or relative risk is possible because using cohort study we can calculate incidence rate which helps us know any type of risk factor

- Provide information on multiple exposures. We can know from one exposure (risk factor) several adverse effects & we can use these information to compare between several risk factors & know information about them.

Limitations (disadvantages of cohort study):

v Not efficient for rare diseases (we use it if the risk factor is rare, not if the disease is rare) & it's not good for rare diseases because we will keep doing follow-ups for many years with no result

v Can be expensive and time-consuming, some studies need 20 years.

- Large sample as we will take 2 groups and compare between them.
- Drop-out biases If study goes over many years, can get considerable loss to follow up. This can 'dilute' results or lead to bias, and therefore the validity of result can be seriously affected

ممكن لو استمرت الدراسه لسنين طويله رح يصير في خربطه ونبطل قادرين نعمل follow up لبعض الناس وهالشي رح ياثر بشكل كبير ع نتائج الدراسه

- Locating subjects, developing tracking systems, and setting up examination and testing processes can be difficult.

بدايه الدراسه صعبه لانو لازم احدد لو الsubjects اللي رح اعمل عليها الدراسه متوفره ولا لا ولازم ادور عليها ولازم اجهز ال examinations and tests اللي رح استخدمها على المرضى طول فتره الدراسه

- Changes over time in diagnostic methods, exposures, or study population may lead to biased results.

لو طولت الدراس ممكن يصير في تغيير بال exposure او ممكن يصير في تغيير واختلاف بالdiagnosis

Cohort study: Example

Hypertension as a risk factor for spontaneous intracerebral hemorrhage

We will bring 2 groups, first group is group of people with no intracerebral hemorrhage but they have hypertension as a risk factor & second group is people with no hypertension

After follow-ups we can see the differences in incidence rates of hemorrhage between hypertensives & non hypertensives

Selection of subjects for a cohort study :

شنو الشغلات اللي بتأثر عالناس اللي نختارهم عشان نطبق عليهم دراسه الcohort؟

Subjects for cohort study are influenced by a variety of factors including:

1. Type of exposure being investigated

لما اجي اختار ناس بعضهم رح يكونو متعرضين للrisk factor وبعضهم لا

2. The frequency of the exposure in the population

لان تذكرو انه كل ما كان الrisk factor or exposure rare كل ما كان احسن استخدم cohort study.

So case-control is for rare disease while cohort is for rare risk factor

3. The accessibility of subjects, is it easy to reach subjects & the risk factor

4. Exposed and unexposed subjects must be free of the outcome of interest at the start of the study and equally susceptible to developing the outcome during the course of the study.

يعني لازم قبل لا نبلش الدراسه نتاكد ان اللي نفحصهم مافيهم مرض اللي بعمل الدراسه عشانه.

We choose exposed or non exposed, but we don't choose diseased subjects.

5. If some subjects already have the outcome (e.g., disease) at the onset, then the temporal relationship between exposure and outcome becomes obscured

يعني اذا الناس اللي رح اسوي عليهم الدراسه فيهم المرض من اول ما بلشت الدراسه هالشي رح يسبب عائق لي بالبحث

6.Both groups should be accessible and available for follow-up.

7.Multiple comparison groups for exposed subjects chosen indifferent ways may reinforce the validity of findings.

يعني بنقسم الناس اكثر من تقسيمه.. مثلا بنجيب الexposed group وبنقسمهم لاكثر من قسم.. مجموعه نقسمها حسب العمر ومجموعه حسب الoccupational exposure ومجموعه حسب الgeographic area وهيك يعني.. وبحسب ال incidence rate عند كل جروب.. ومثلا ممكن الاقي incidence of disease اعلى شي عند ال occupationally exposed group of people وهالشي رح يقوي البحث تبعي

TYPES OF COHORT:

♣ **Birth cohort :**

all individuals in a certain geographic area born in the same period (usually a year)

♣**Inception cohort:**

all individuals assembled at a given point based on some factor, e.g. where they live or work

مجموعه ناس بشتركو بمكان العيشه والشغل

♣**Exposure cohort:**

individuals assembled as a group based on some common exposure

- e.g. smokers, radiation

مجموعه ناس بشتركو بشي معين مثلا كلهم مدخنين

Example of cohort study:

Study	Source of cases	Source of controls
PROM (premature rupture of membrane)	Hospital patients	Hospital patients
Rheumatoid arthritis	Outpatient clinic	Other outpatient clinic
Cervical screening	GP register	GP register

Note that sources of cases & sources of controls are all similar to each other & that's because we want them to be comparable.

Healthy worker effect:

Phenomenon of workers usually exhibiting overall death rates lower than those of the general population due to the fact that the severely ill and disabled are ordinarily excluded from employment.

هذا الeffect مبني على نظريه انه الناس اللي بشتغلو صحتهم احسن من العاطلين عن العمل و معدلات الوفيات عندهم اقل..هل الكلام هذا صحيح؟ طبعا لا...بس لانه قبل لا يقدم أي شخص لوظيفه بفحصوه واذا كان بصحه كويسه بوظفوه لو صحته سيئه او عنده disability ما بقبلوه فلما نجي نعمل دراسه عالموظفين حنلاقيهم صحيين فهاي الخرافه اسمها healthy worker effect

n

COHORT STUDY DESIGN

v Measurement of exposures should be based on intensity(how intense the exposure is), duration(for how long), regularity(is the patient exposed to it regularly or not), and variability.

v Some exposures are acute, one-time episodes never repeated in a subject's lifetime, for example like explosions that happened in Lebanon, these people have been exposed to the explosion only once so its acute & doesn't happen frequently

v Other exposures are long term, such as cigarette smoking or use of oral contraceptives.

v Exposures may also be intermittent.

Open cohort versus closed cohort:

A cohort may be open, meaning that subjects are allowed to enter the study at various times after it was started

يعني ممكن خلال دراسه مجموعتين مثلا ندخل مجموعه ثالثه عالبحث

It may be closed, meaning that no subjects can be added to the study after it has begun.

Analysis of open cohort data should use person-time units in the calculations.

يعني بنبلش نحسب لاي مجموعه من اول ما تدخل البحث من خلال incidence rateال

n

TYPES OF COHORT STUDY – there's various classification of cohort types don't get confused- :

1)Prospective cohort study (the standard study type)

2)Retrospective cohort study

An example of a retrospective cohort study will be **interviewing a cohort of people who are HIV positive, ask about their lifestyle choices and medical history to study the origins of the disease.**

In the standard prospective cohort study, we check exposed people & follow up for outcomes, while in retrospective cohort we bring diseased people and ask them about history

ببساطه النوع الأول عباره عن تجميع مجموعتين وحده معرضه لrisk factor ووحده لا ونتابعهم اما النوع الثاني بنعمل الدراسه ع ناس فيهم المرض أصلا بس نسال عن history w life styleال

3)Ambi-directional cohort study

يجمع بين الprospective and retrospective.. اول شي بسال ناس فيهم المرض عن الهستوري والlifestyle.. يعني ببلش retrospective بعدين بعمل follow up يعني يكمل prospective

Retrospective cohorts

v Uses information on prior exposure and disease status.

كل المعلومات بتكون موجوده بدايه الدراسه

v All of the events in the study have occurred and conclusions can be drawn more rapidly.

بقدر اطلع الاجوبه اسرع من خلال اني اسأل عن الاعراض اللي بحس فيها الشخص المصاب بالمرض اللي بندرسه

v Costs can be lower

v May be the only feasible one for studying effects from exposures that no longer occur, such as discontinued medical treatments.

يعني لو ابي اسوي دراسه ع تأثير دوا معين ومثلا جبت مجموعتين وحده ما تاخذ الدوا والمجموعه الثانيه كانت تاخذ الدوا ووقفت.. طبعا انا ما اقدر اجبر اللي وقفو الدوا انهم يرجعون ياخذونه بهذي الحاله بمشي معاهم من خلال retrospective study

v The main disadvantage of a retrospective cohort study is that the investigator must rely on existing records or subject recall.

Ambidirectional Cohort

v Data collected both retrospectively and prospectively on the same cohort to study short and long term effect of exposure

يعني رح نجمع الdata من خلال retrospective method اول شي بعدين نكمل prospectively بس لما نكمل prospectively رح تكون مده ال follow up اقل يعني الfollow up بكون تقريبا سنتين بس مش زي ال prospective اللي بياخذ 20 years follow up

Comparison of retrospective and prospective cohort study

Attribute	Retrospective approach	Prospective approach
Information	< complete < accurate	> complete > acurate
Emerging new exposures	Not useful	Useful
Expense	Less costly	More costly
Completion time	Shorter	Longer

Loss during follow-up of cohort study.. a condition were a problem happens causing loss of follow-up in cohort studies:

v Following subjects over a long period of time can lead to a variety of problems.

n

ممكن لو استمر البحث لفتره طويله وضليت اتابع الحالات لفترات طويله تصير مشاكل

v Dropouts and losses of subjects to follow-up are major problems in cohort studies.

ممكن بعض المشاركين بالبحث يتركو الموضوع عشان مثلا حسو في ضرر منه وهيك بقلل عدد المشاركين وبصير خطأ مثلا بالحساب

v Subjects may move away or leave the study for other reasons, including deaths from other causes than the disease under investigation.

v If losses to follow-up are significant during the study, then the validity of the results can be seriously affected.

لو خسرنا عدد كبير من المشاركين رح تتأثر نسبه الfollow up بشكل كبير

Changes in exposure status while performing cohort study:

v It is also possible for exposure status to change during the course of the study.

يعني مثلا لو جبنا مجموعتين مجموعه بتخن ومجموعه غير مدخنه لو في ناس من المجموعه اللي بتدخن وقفو دخان هالشي رح يأثر ع نتائج الدراسه

v The exposure under study may be subject to variation over time.

v For example, cigarette smokers may quit, or employees may change jobs; therefore, their level of exposure to occupational hazards changes.

Analysis:

v Collection and analysis of data on the population subgroups, based on exposure, are divided according to variables of interest, like analysis in a cross-sectional study.

يعني قبل ما احلل الdata رح اقسم الناس لمجموعات حسب بعض الشغلات اللي تجمعهم نفس مثلا العمر او gender

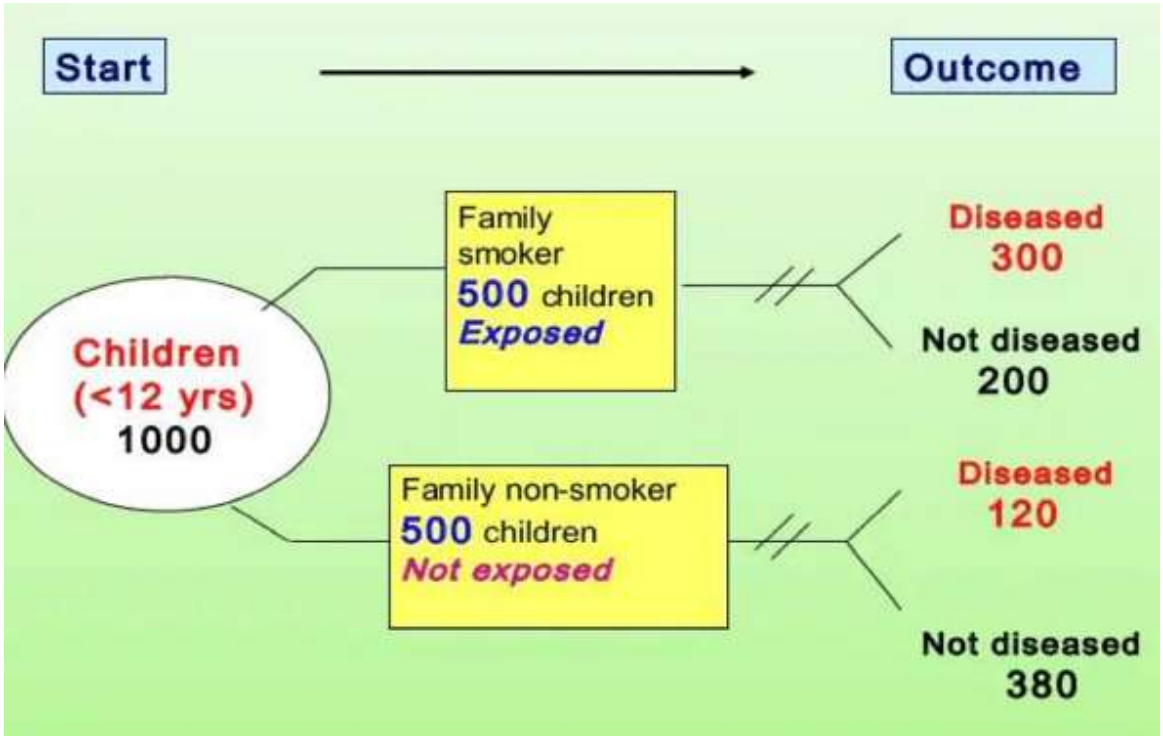
v Rates for subgroups are then calculated and compared (incidence rate).

v Data from cohort studies are analyzed in terms of relative risk and attributable risk fractions.

Midpoint analysis

Occurs when, at a defined point in time in the study, all data collected to that point are analyzed so a decision can be made to stop or continue the study

في مرحله معينه من الanalysis بنوقف عندها وبنشوف ال results لوكنا راضيين عن الشغل رح نكمل ولو لا بنوقف



We will use the chart above for our calculations.

Rate: Incidence rate

- Incidence of Resp. Infection among exposed children: $\frac{300}{500} = 60\%$

- Incidence of Resp. Infect. Among non exposed children: $\frac{120}{500} = 24\%$

Incidence rate is = new cases / all cases x constant

n

Relative Risk: Incidence rate among exposed / Incidence rate in non exposed.

Risk Ratio

$$\frac{60}{24} = 2.5$$

Exposed individuals are 2.5 times more likely to develop disease than non exposed individuals.

If the relative risk was 1 or less than it doesn't matter.

Difference Measures

- Attributable risk
  - No. of cases among the exposed that could be eliminated if the exposure were removed

  = Incidence in exposed - Incidence in unexposed

- Population Attributable Risk percentage:

PAR expressed as a percentage of total risk in population

$$PAR\% = \frac{I_{population} - I_{unexposed}}{I_{population}} \times 100$$

Attributable risk depends on the incidence & removal of exposure factor while PAR doesn't depend on these factors

n

Advantage of Cohort Studies

- Temporality can be established
- Incidence ca be calculated.
- Several possible outcome related to exposure can be studied simultaneously.
- Provide direct estimate of risk.
- Since comparison groups are formed before disease develops certain forms of bias can be minimized like misclassification bias.
- Allows the conclusion of cause effect relationship

1) Temporality (time sequence) can be established because we can perform follow-ups so we know how much time a disease will take before it develops

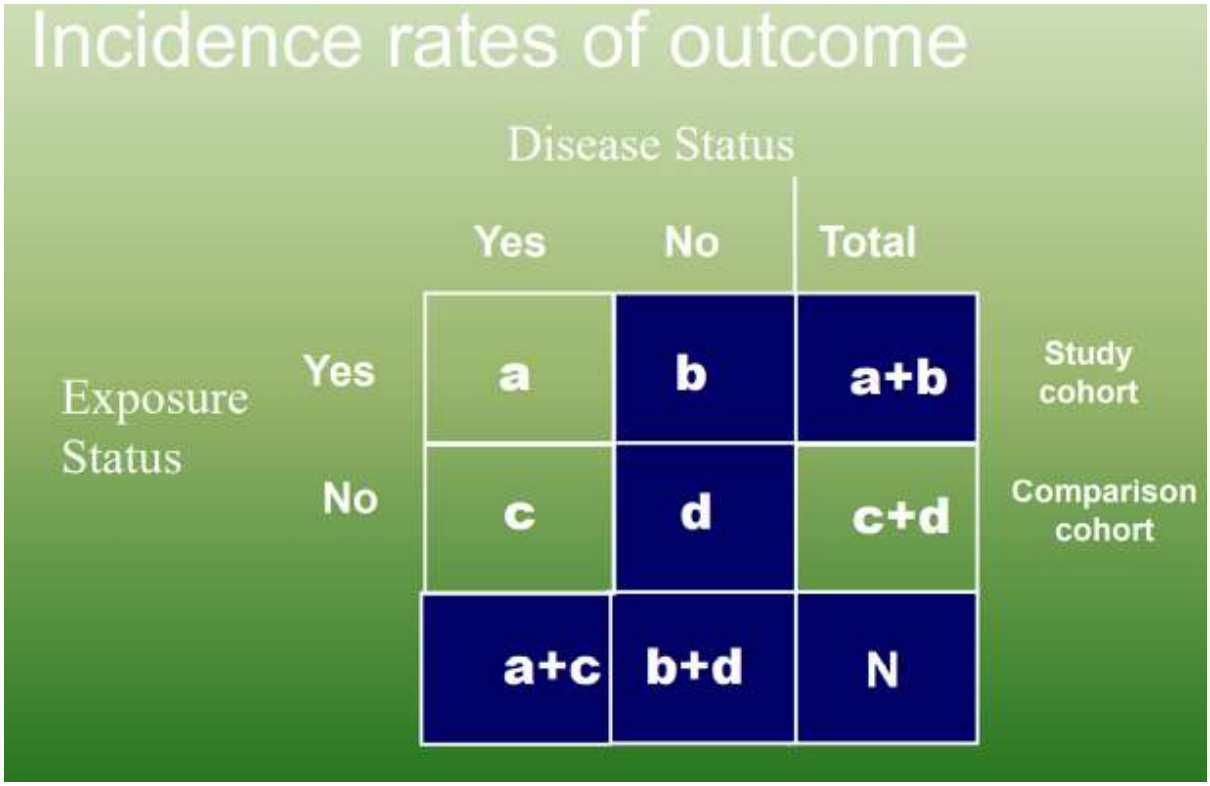
Disadvantage of Cohort Studies

- Large population is needed
- Not suitable for rare diseases.
- It is time consuming and expensive
- Certain administrative problems like loss of staff, loss of funding and extensive record keeping are common.
- Problem of attrition of initial cohort is common
- Study itself may alter people's behavior

n

Point 5, problem of attrition of initial cohort is common.

اذا طولت مده البحث رح يصير في loss of participants لكثير أسباب



a + b = exposed

c + d = not exposed

a + c = diseased patients

b + d= not diseased

Incidence rate:

$$\text{Incidence among exposed} = \frac{a}{a+b}$$

$$\text{Incidence among non-exposed} = \frac{c}{c+d}$$

Estimation of risk:

Relative Risk RR =

n

$$\frac{\text{incidence of disease among exposed}}{\text{Incidence of disease among non-exposed}}$$

$$\frac{\text{a divided by a+b}}{\text{c divided by c+d}} =$$

Cohort is stronger than case-control & cross-sectional studies.

^-^ Goodluck!

n