

Cohort study

Objectives

The aim of this lecture is to illustrate:

1. Definition of cohort and cohort study
2. How to organize a cohort study
3. Selection of the study groups
4. Analysis of results
5. Advantages and disadvantages of cohort study

WHAT IS COHORT?

'*cohors*' (Latin word) = Refers to warriors and gives notion of a group of persons proceeding or banded together in time. Epidemiologically refers to a group of persons with a common statistical characteristic. e.g. age, birth date, smoking ... etc.

Definition & Synonyms

The cohort study is an observational analytic epidemiological study which attempts to study the relationship (association) between a proposed risk factor (exposure) and the subsequent risk of developing disease.

Synonyms

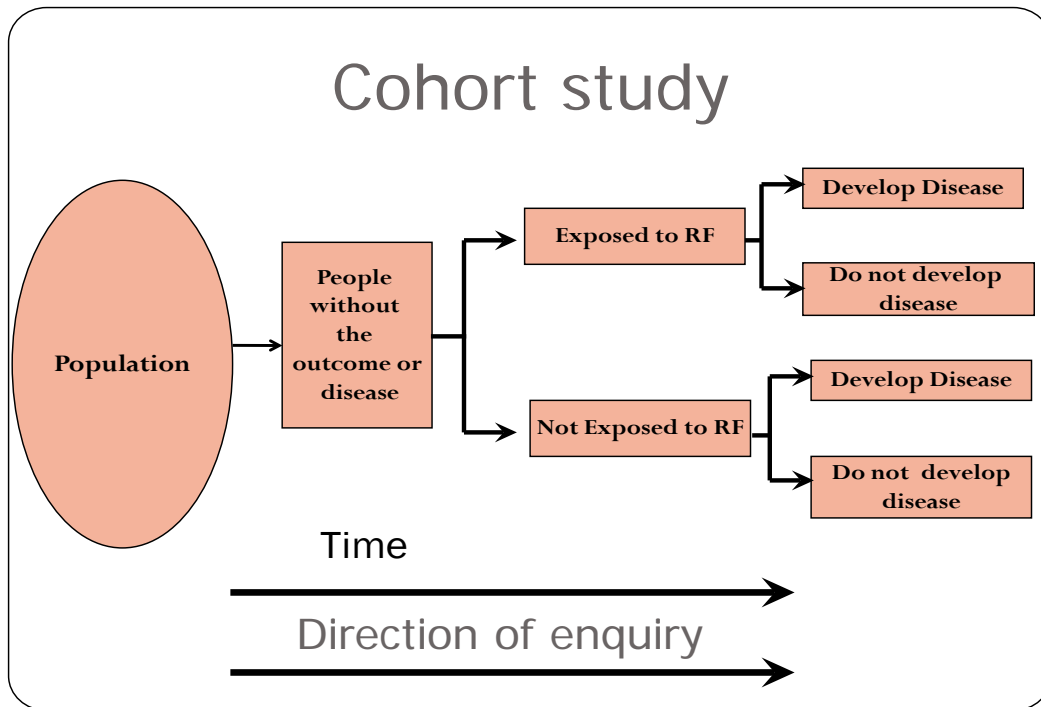
- Follow-up
- Longitudinal
- Prospective
- Incidence study

The cohort design

- Groups are exposure based: The groups of persons to be studied are defined in terms of characteristics manifest prior to the appearance of the disease under investigation

- The study is conceptually longitudinal or follow-up: The defined study groups are observed over a period to determine the frequency of disease among them.

- A definite beginning and end



Indications for a cohort study

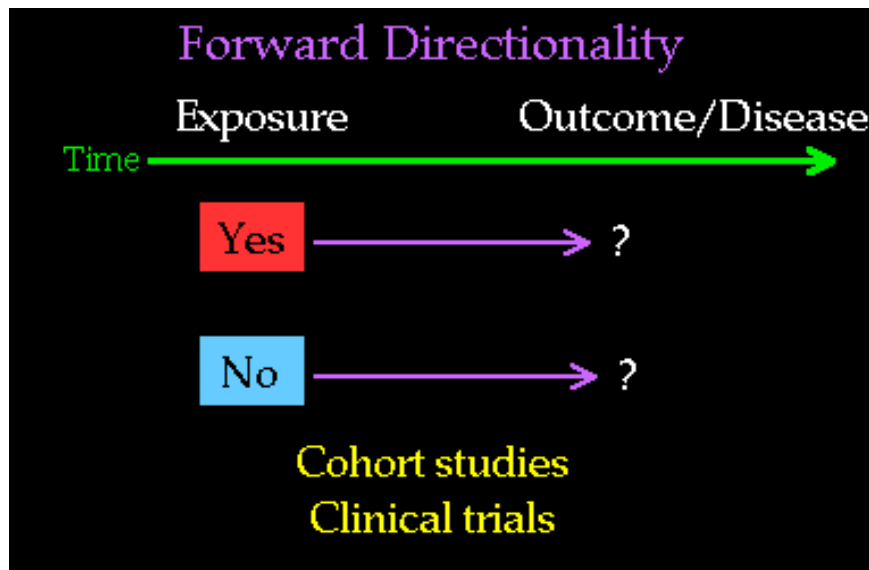
- When there is good evidence of exposure and disease.
- When exposure is rare but incidence of disease is higher among exposed
- When follow-up is easy, and cohort is stable
- When sufficient funds are available

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Prospective Cohort study

Exposure Study starts Disease occurrence

time



Elements of cohort study (Steps in conducting cohort study)

- Selection of study subjects
- Selection of comparison group
- Obtaining data on exposure
- Follow up
- Data analysis

General consideration while selection of cohorts

- Both the cohort study group and controls are free of the disease.
- Both groups should be equally susceptible to disease
- Both groups should be comparable
- Diagnostic criteria for the disease should be defined well in advance

Obtaining data on exposure

- Personal interviews / mailed questionnaire
- Reviews of records: such as dose of drug, radiation, type of surgery ...etc
- Medical examination or special test: e.g. Blood pressure, serum cholesterol
- Environmental survey

By obtaining the data of exposure, we can classify cohorts as:

- Exposed and non exposed, and
- By degree of exposure, we can sub-classify cohorts

Selection of study subjects (cohort group):

The sources of the study subjects

- General population
 - Whole population in an area
 - A representative sample
- Special group of population
 - Selected group such as Occupation group / professional group
 - Exposure groups: such as person having exposure to some physical, chemical or biological agent)(e.g. X-ray exposure (radiologists)

Selection of comparison group

- *Internal comparison*
 - Only one cohort involved in study (e.g. smokers)
 - Sub classified and internal comparison done (Intensity of smoking)
- *External comparison*
 - More than one group in the study for the purpose of comparison (study group and control group)
 - e.g. Cohort of radiologist compared with ophthalmologists
- Comparison with general population rates
 - If no comparison group is available we can compare the rates of study cohort with general population. e.g. we compare Cancer rate in uranium miners with cancer rate in general population.

Follow-up

- To obtain data about outcome to be determined (morbidity or death), we have to use any one way of the following:
 - - Mailed questionnaire, telephone calls, personal interviews
 - - Periodic medical examination
 - - Reviewing records
 - - Surveillance of death records
 - - Follow up is the most critical part of the study
- Some loss to follow up is inevitable due to death change of address, migration, or change of occupation.
- Loss to follow-up is one of the drawbacks of the cohort study.

Analysis of data

- - Arrangement of data in 2x2 table
- - Calculation of incidence rates among exposed and non exposed groups
- - Estimation of risk

1. To arrange a standard 2 x 2 table

		Disease status		
		Exposed	Non-Exposed	
Exposure to risk factor	Exposed	a	b	a + b
	Non-Exposed	c	d	c + d

2. Calculation of Incidence rates

- Incidence rate among exposed =

$$a / a+b \times 1000$$

- Incidence rate among non-exposed =

$$c / c+d \times 1000$$

		Disease status		
		Develop	Do not develop	Total
Exposure to RF	Exposed	a	b	a + b
	Not Exposed	c	d	c + d

3. Estimation of Relative risk

$$RR = \frac{\text{Incidence rate of disease among exposed (a/a+b)}}{\text{Incidence rate of disease among non-exposed (c/c+d)}}$$

$$RR = \frac{a/a+b}{c/c+d}$$

Interpretation of Relative Risk (RR)

When **RR=1**: No association between exposure and disease. The incidence rates are identical between groups

When **RR> 1**: this means a positive association (increased risk) i.e. exposed group has higher incidence than unexposed group

When **RR< 1**: indicate a negative association (protective effect) i.e. unexposed group has higher incidence than exposed group

Guide to the strength of an epidemiological association

Guide to the strength of an epidemiological association

1.0	None
> 1.0 - < 1.5	Weak
1.5–3.	Moderate
3.1–10.0	Strong
> 10	Infinite

4. Estimation of Attributable Risk (AR)

Attributable Risk = IR of disease among exposed – IR disease among non exposed

5. Attributable risk percent [Percentage of reduction]

- It refers to that among exposed, what proportion of the total risk for disease is attributed to or due to the exposure to risk factor.

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Also, we can calculate AR% (Exposed) [Percentage of reduction in risk if the risk factor is removed]

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$$AR\% \text{ (percentage of reduction)} = \frac{[IR \text{ (Exposed)} - IR \text{ (Unexposed)}]}{IR \text{ (Exp)}} \times 100$$

Example of analysis of data

Find out RR and AR for the following data

Smoking	Lung cancer		Total	
	YES	NO		
YES	8	120	200	IR=8/200X1000= 40/1000
NO	4	160	200	IR=4/200X1000= 20/1000
	120	280	400	RR= 40/20= 2
				AR= 40-20=20/1000
				AR% (Percent of reduction)= 40-20/40 x100= 50%

Advantages of cohort study

- Can measure incidence and risks
- An efficient mean for studying rare exposure
- Assesses multiple outcomes of a single exposure
- Establishes temporal relationship between exposure and outcome
(Exposure happened before outcome)
- Low potential for bias [Avoids recall bias].
- Does not require strict random assignments of subjects
- *Cohort study is the best observational design to establish association between risk factor and an outcome*

Disadvantages

- Expensive and time-consuming
- Loss to follow-up
- Bias in ascertainment of exposure
- Measurement errors, multiple interviews, tests
- Complexity of data analysis