Case-Control & Cohort Studies

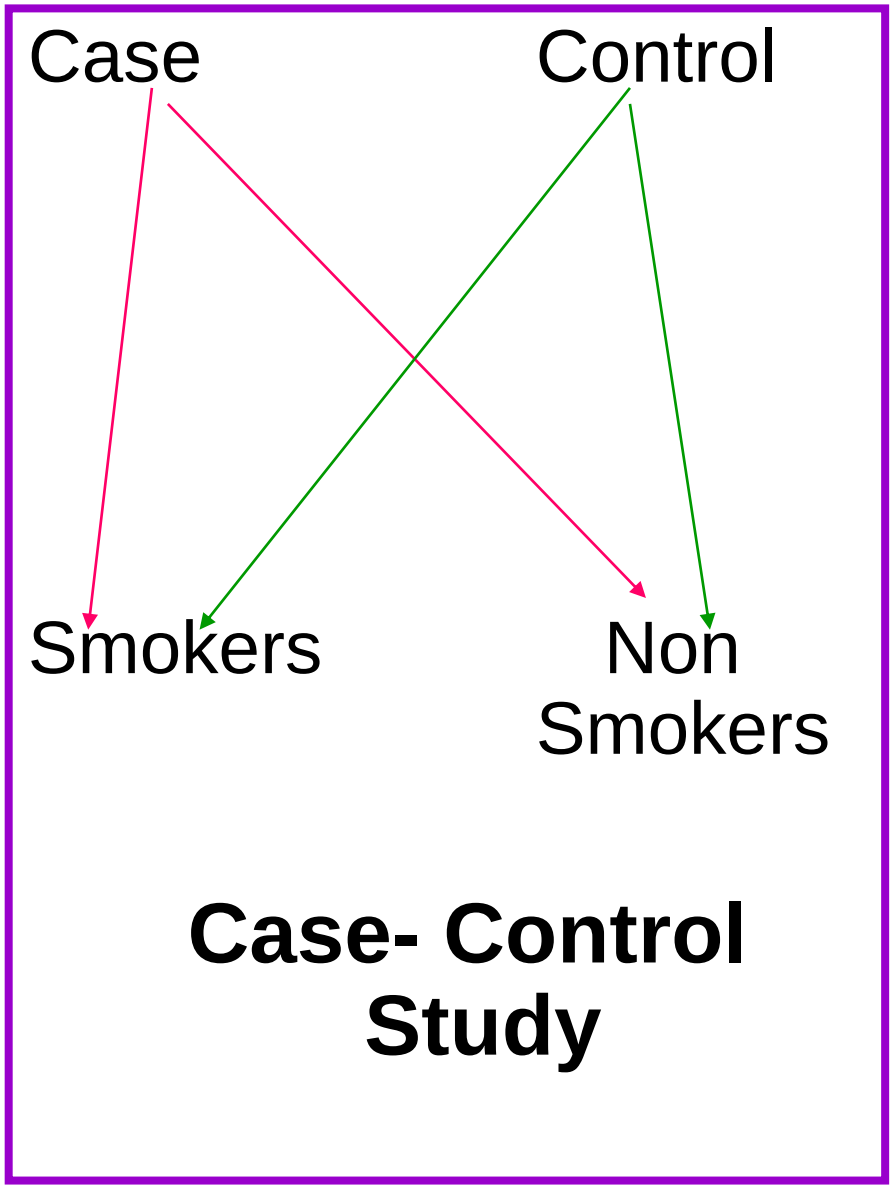
- Whether or not a statistical association exists between a disease and suspected factor
- If it does exist, the Strength of Association

	Types			Alternative Name	Unit of study
I	Observational studies				
	a	Descriptive			
	b	Analytical			
			Ecological	Co-rrelational	population
			Cross Sectional	Prevalence	Individual
			Case- control	Case	Individual
			Cohort	Follow up	Individual
II	Experimental studies			Interventional Studies	
	a	RCT		Clinical Trial	Patients
	b	Field Trials			Healthy Population
	c	Community Trials		Community Interventional	Community
III	Evaluational Epidemiology				
	Coverage Evaluationa Survey				Community & Health system resources

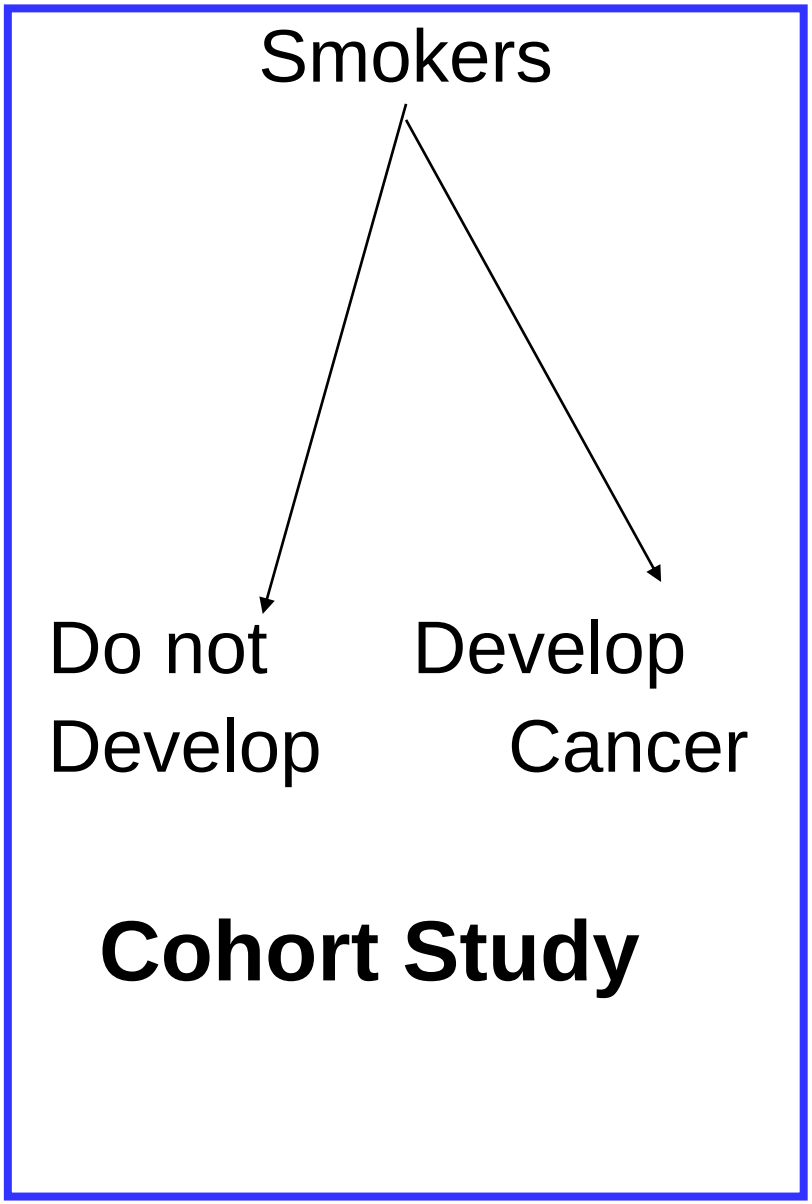
Cohort Study

Alternative names

- Prospective study
- Longitudinal study
- Incidence study
- Forward looking study

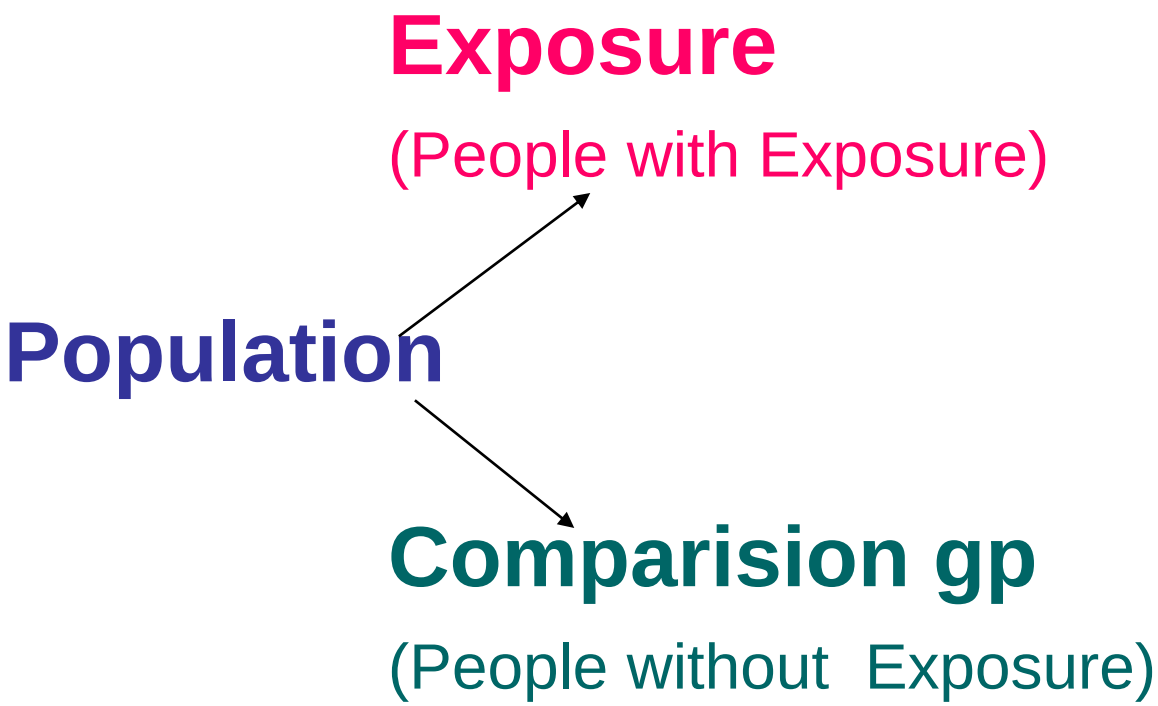


Case- Control Study

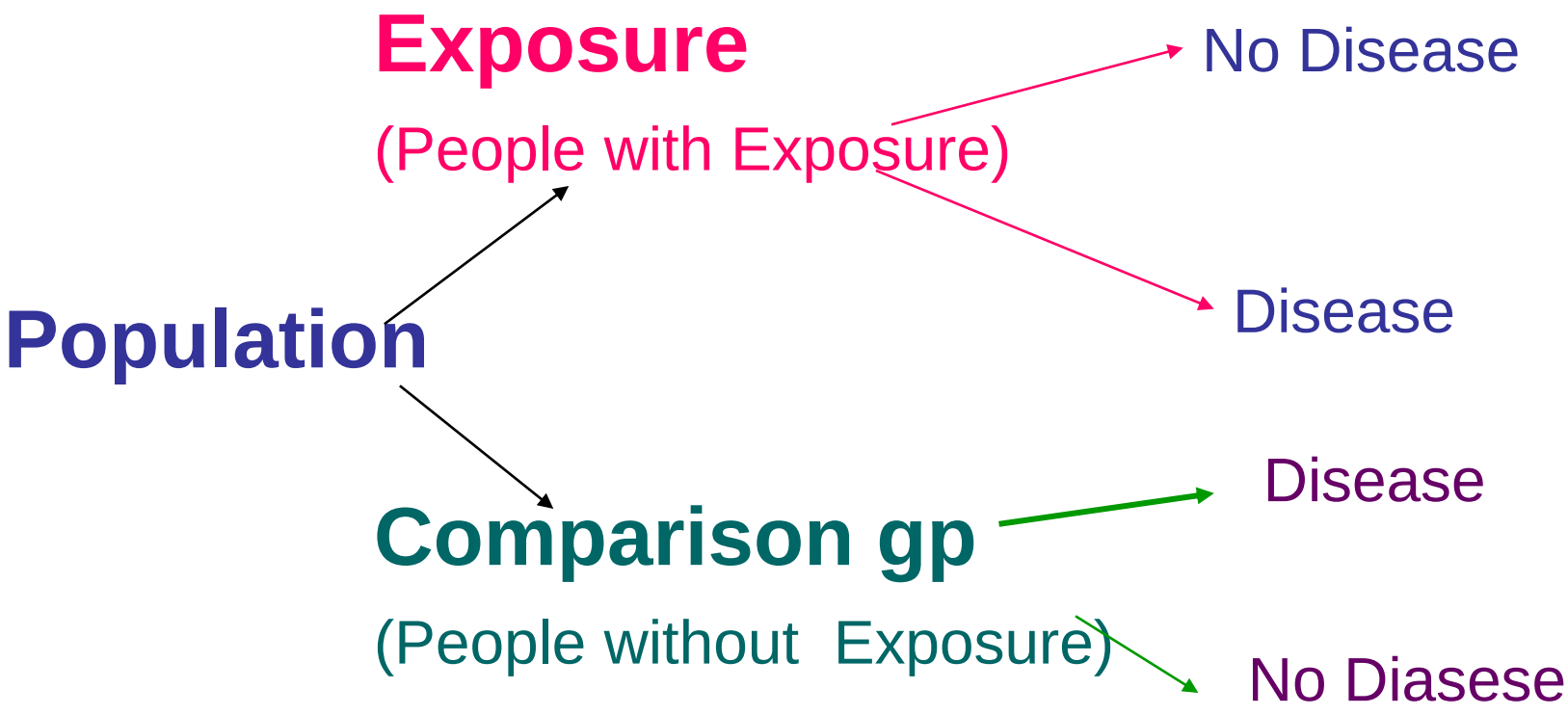


Cohort Study

Design of case control study



Design of case control study



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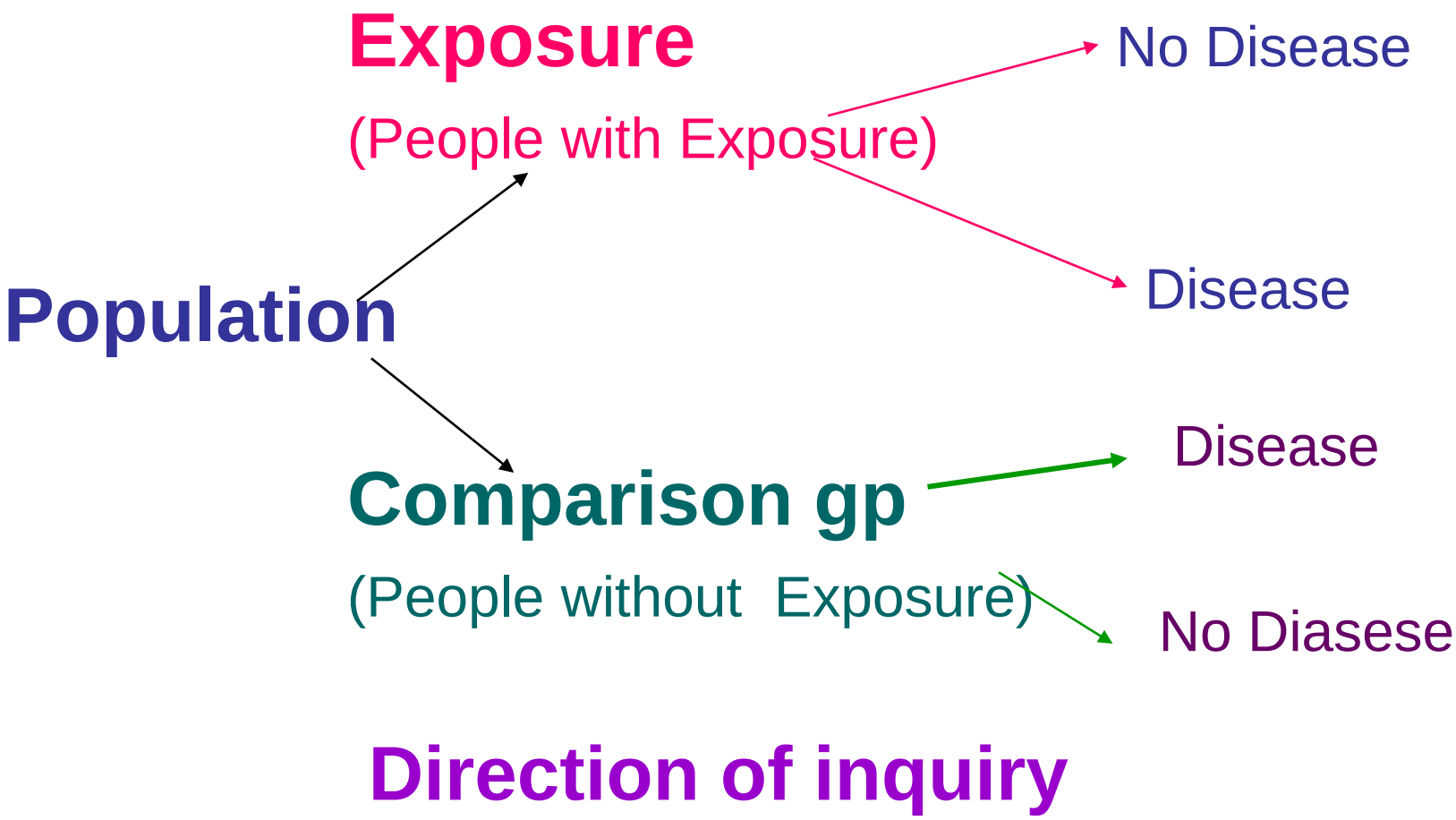
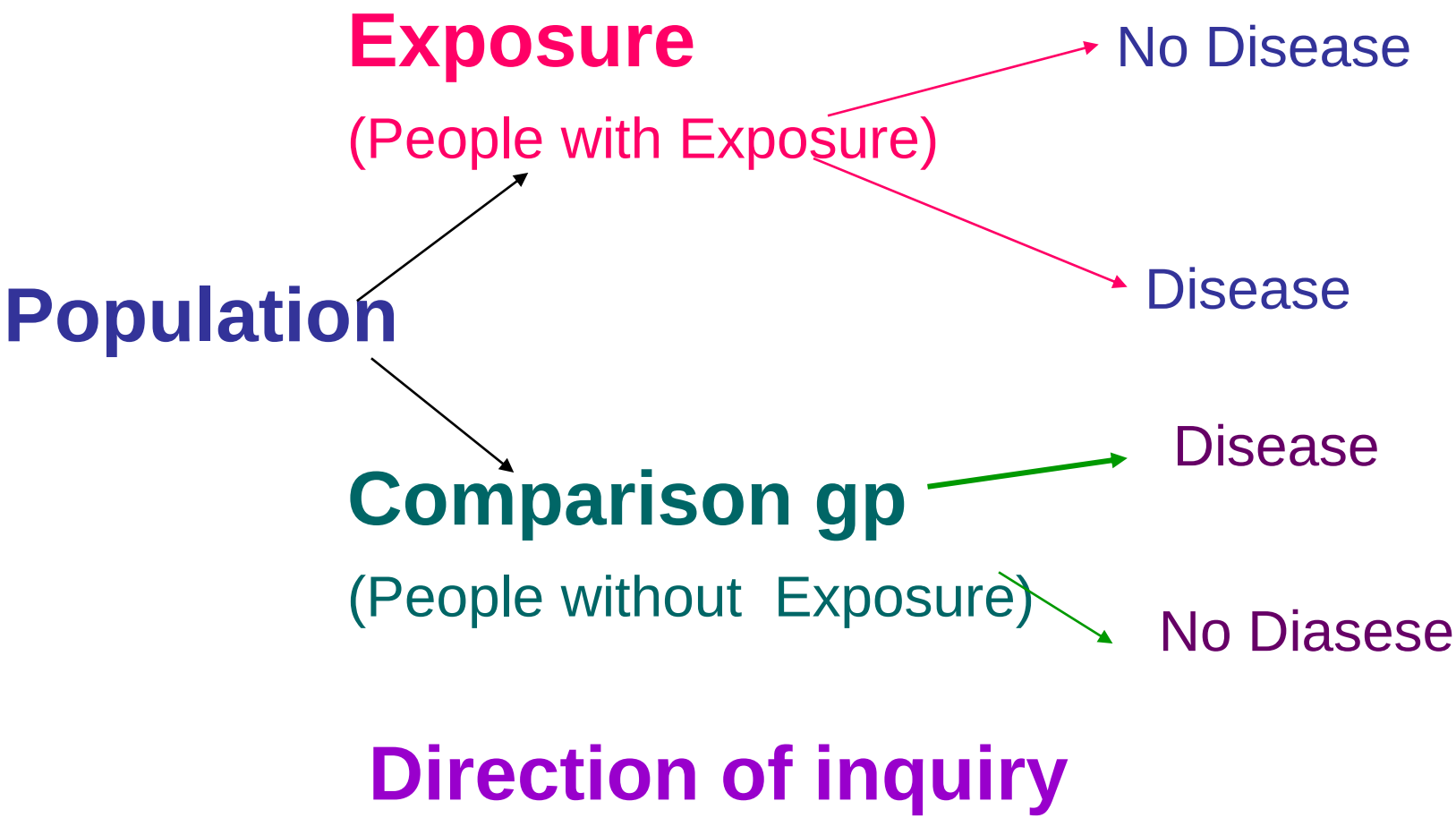


Design of case control study



Characteristics

- The cohorts are identified prior to the appearance of the disease under investigation.
- The study groups are observed over a period of time to determine the frequency of disease among them.
- The study proceeds forward from cause to effect.

Concept of cohort

- The cohort is defined as a group of people who share a common characteristic or experience within a defined time period.
- Marriage cohort,
- Birth cohort,
- Exposure cohort
- Occupation cohort…..

Comparison Group

- It may be general population from which the cohort is drawn,

or

- it may be another cohort of persons thought to have had little or no exposure to the substance in question but otherwise similar

Indication for cohort study

- When there is good evidence of an association between exposure and disease after descriptive & case-control study.
- When exposure is rare, but the incidence of disease is high among exposed
- When attrition of study population is minimized.
- When ample funds are available.

Framework

Case control	Disease yes	Disease no	Total
Smoker	500	100	600
Non smoker	500	900	1400
Total	1000	2000	3000

Framework

Cohort	Disease yes	Disease no	Total
Exposed to etiologic factor	a	b	a+b
Not exposed To etiologic factor	c	d	c+d
Total	a+c	b+d	a+b+c+d

Pre-requisite

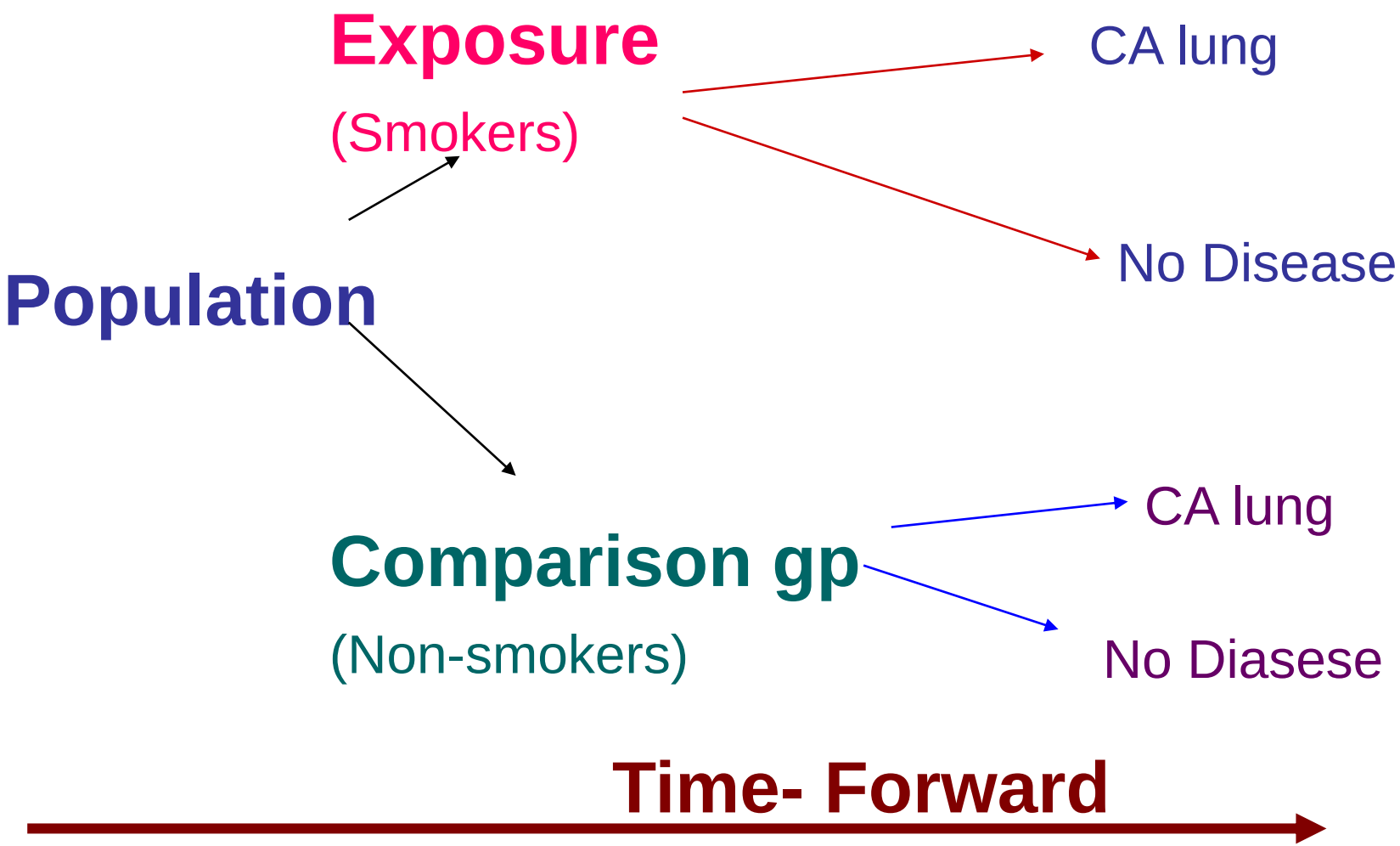
- Cohort must be free from the disease under study
- Both group should equally susceptible to the disease under study.
- Both group should be comparable
- Diagnostic & eligibility criteria of the disease must be defined before hand.

Types of cohort studies

1. Prospective cohort studies - current cohort studies
2. Retrospective cohort studies - historical cohort studies, prospective study in retrospect, non-concurrent prospective study
3. A combination of retrospective and prospective cohort studies.

Prospective cohort studies

Smoking – Lung cancer



Prospective cohort studies

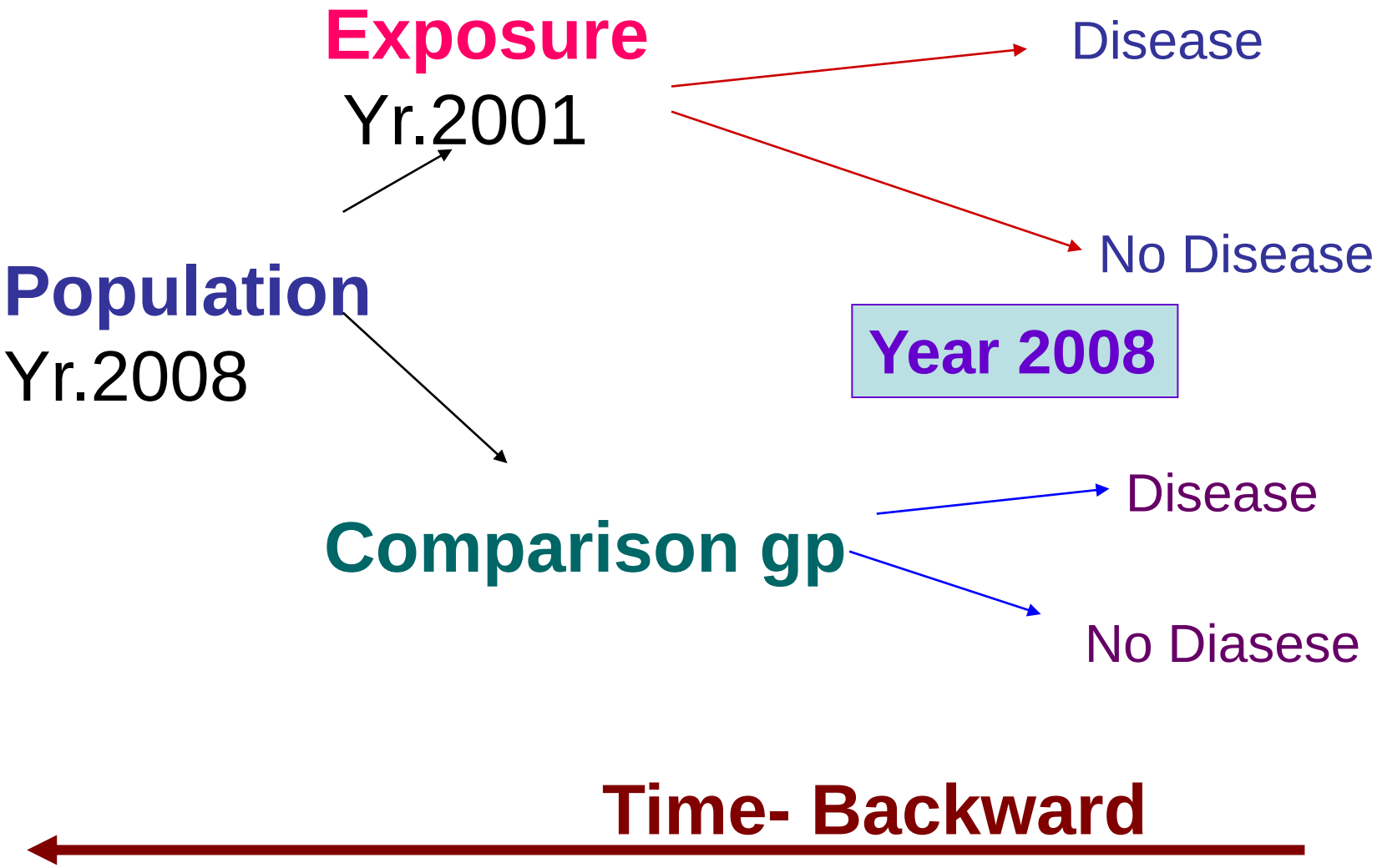
- Study in which the outcome

  (e.g.Disease) has not yet occurred at the time of investigation begins

- This type of study begin in present and continue in future

Retrospective cohort studies

Earthquake- Health effects



Retrospective cohort studies

- Study in which the outcome

  (e.g.Disease)have all occurred before the start of investigation.
- The investigator goes back in time to select the study groups from the existing record of past event.

Combination of retrospective and prospective cohort studies

- Both the retrospective and prospective elements are combined
- The cohort is identified from past records, and is assessed of date for the outcome.
- The same cohort is followed up prospectively into future for further assessment of outcome.

Basic steps

1. **Selection of study objects**
2. **Obtaining data on exposure.**
3. **Selection of comparison group.**
4. **Follow up.**
5. **Analysis**

Selection of study objects

1. General population
2. Special groups

Selection of study objects
General population

- When exposure is fairly frequent in general population
- Results can be generalized to the whole population.
- The exposed and unexposed segments of population to be studied should be representative of the corresponding segments of the general population.

Special groups

a) Select groups e.g. Radiologist..

- This may be professional group.
- These group are homogenous population.
- Easy accessibility and follow up

b) exposure group

When the exposure is rare

Person known to have experienced exposure. E.g.-Earthquake, Radiation

Basic steps

1. **Selection of study objects**
2. **Obtaining data on exposure.**
3. **Selection of comparison group.**
4. **Follow up.**
5. **Analysis**

2. Obtaining data on exposure

Information about exposure may be obtained directly from

- Cohort members
- Review of records
- Medical examination / test
- Environmental surveys.

Information on Exposure Classification

- Exposed or not
- Level of exposure

Basic steps

1. **Selection of study objects**
2. **Obtaining data on exposure.**
3. **Selection of comparison group.**
4. **Follow up.**
5. **Analysis**

3. Selection of comparison groups

- Internal comparison-

  2 cigarettes per day Vs 2 packs/day

- External comparison-

  Cohort of radiologist Vs Ophthalmologist

- Comparison with general population rate-

  Disease rate in general population

Basic steps

1. **Selection of study objects**
2. **Obtaining data on exposure.**
3. **Selection of comparison group.**
4. **Follow up.**
5. **Analysis**

4. Follow up

Procedure required are

- Periodic medical examination of each member of cohort
- Reviewing physician and hospital records
- Routine surveillance of death records
- Mailed questionnaire or telephone calls periodic home visits

Basic steps

1. **Selection of study objects**
2. **Obtaining data on exposure.**
3. **Selection of comparison group.**
4. **Follow up.**
5. **Analysis**

5. Analysis

- Incidence rate of outcome among exposed and non exposed
- Estimation of risk

Estimation of risk

- **Relative Risk**
- **Attributable risk**
- **Population attributable risk**

Relative Risk
Risk ratio

$$\text{Relative Risk} = \frac{\text{Incidence amongst exposed}}{\text{Incidence amongst non-exposed}}$$

Framework

Case control	Lung CA	No CA lung	Total
Smoker	500	500	1000
Non smoker	100	900	1000
Total	600	1400	2000

Incidence amongst exposed =500/1000= 50%

Incidence amongst non exposed =100/1000= 10%

Relative Risk = $\frac{\text{Incidence amongst exposed}}{\text{Incidence amongst non-exposed}}$

= 50/10

=5

Smokers have 5 times higher risk of CA lung as compared to non-smokers

Relative Risk (RR)

- Direct measure of strength of association between the suspected cause & effect.
- RR of one indicates no association
- >1 indicates positive association between exposure & effect.
- RR 0.25- 75% reduction in the incidence in exposed.
- Larger the RR, greater the strength of association.

Attributable risk

- Difference in incidence rates of disease between an exposed group and non exposed group.
- A.R.=

  Incidence of Disease in Exposed (MINUS)-

  Incidence of Disease in NOT Exposed

  Incidence of Disease in Exposed

Population Attributable risk

- Difference in incidence rates of disease between an exposed group and non exposed group.
- A.R.=

  Incidence of Disease in Population (MINUS)-

  Incidence of Disease in NOT Exposed

  Incidence of Disease in Population

R.R. V/s A.R.

- RR important in etiological enquiries
- Larger the RR stronger the association between cause and effect.
- AR gives the impact of successful preventive or public health programme might have in reducing the problem.

Risk assessment
smoker v/s non smoker

Causes of death	RR	AR (%)
Lung cancer	12.9	92.2
CHD	1.15	13.3

The RR and AR of Cardiovascular complication in women taking oral contraceptives

C.V. risk 100,000 patient years	Age 30 - 39	Age 40 - 44
RR	2.8	2.8
AR	3.5	20.0

PROSPECTIVE STUDY: PROS & CONS

PROS	CONS
• Less variability to bias • No recall necessary • (no recall BIAS) • Incidence determined • Relative risk more accurate	• **Consistent disease definitions & symptoms.** • **Longer time** • **Common disease only** • **Expensive** • **Ethical concern** • **A high drop-out rate** • **Volunteers needed** • **A large # of subjects needed** • **The Hawthorne-effect**

Examples

- Smoking and lung cancer. Doll and Hill Hammond and Horn and Dorn were first to report their finding.
- The Framinghan heart study,
- Oral contraceptives and health,