Penelitian IKM/Epidemiologi

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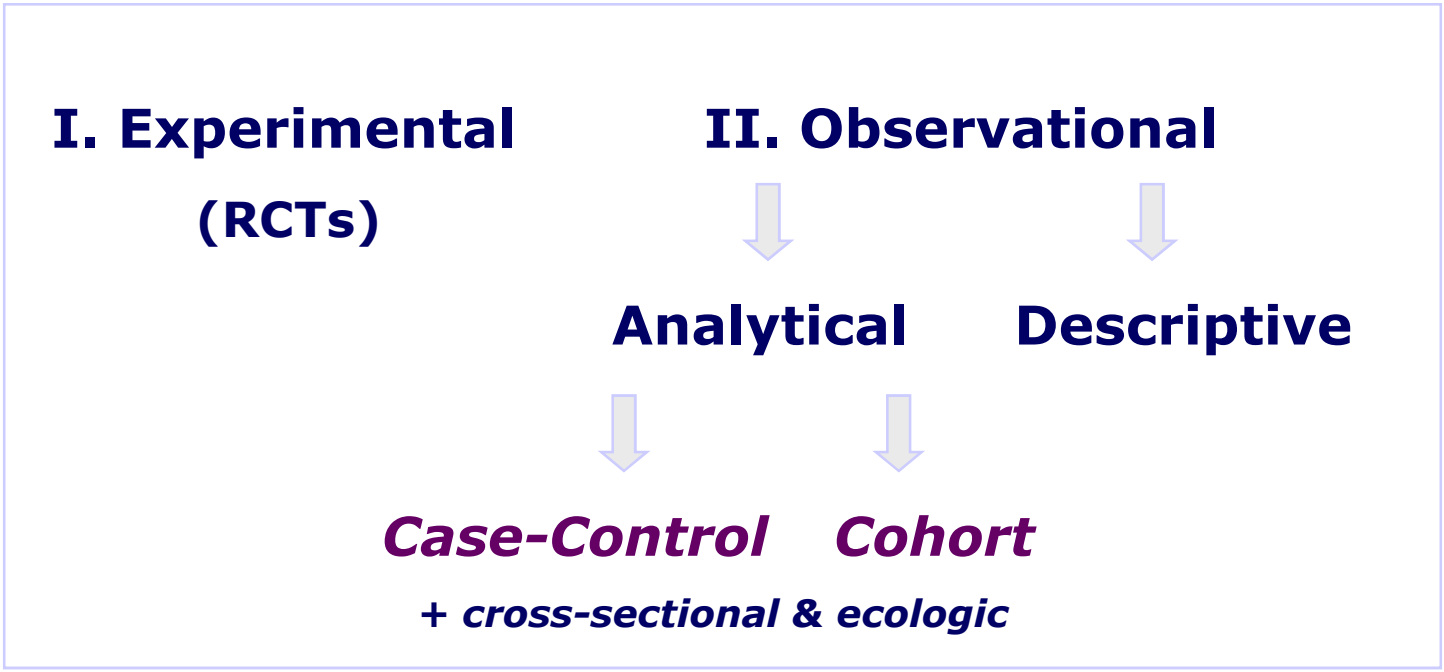
Epidemiologic Study Designs



Epidemiologic Study Designs

Descriptive studies

Examine patterns of disease

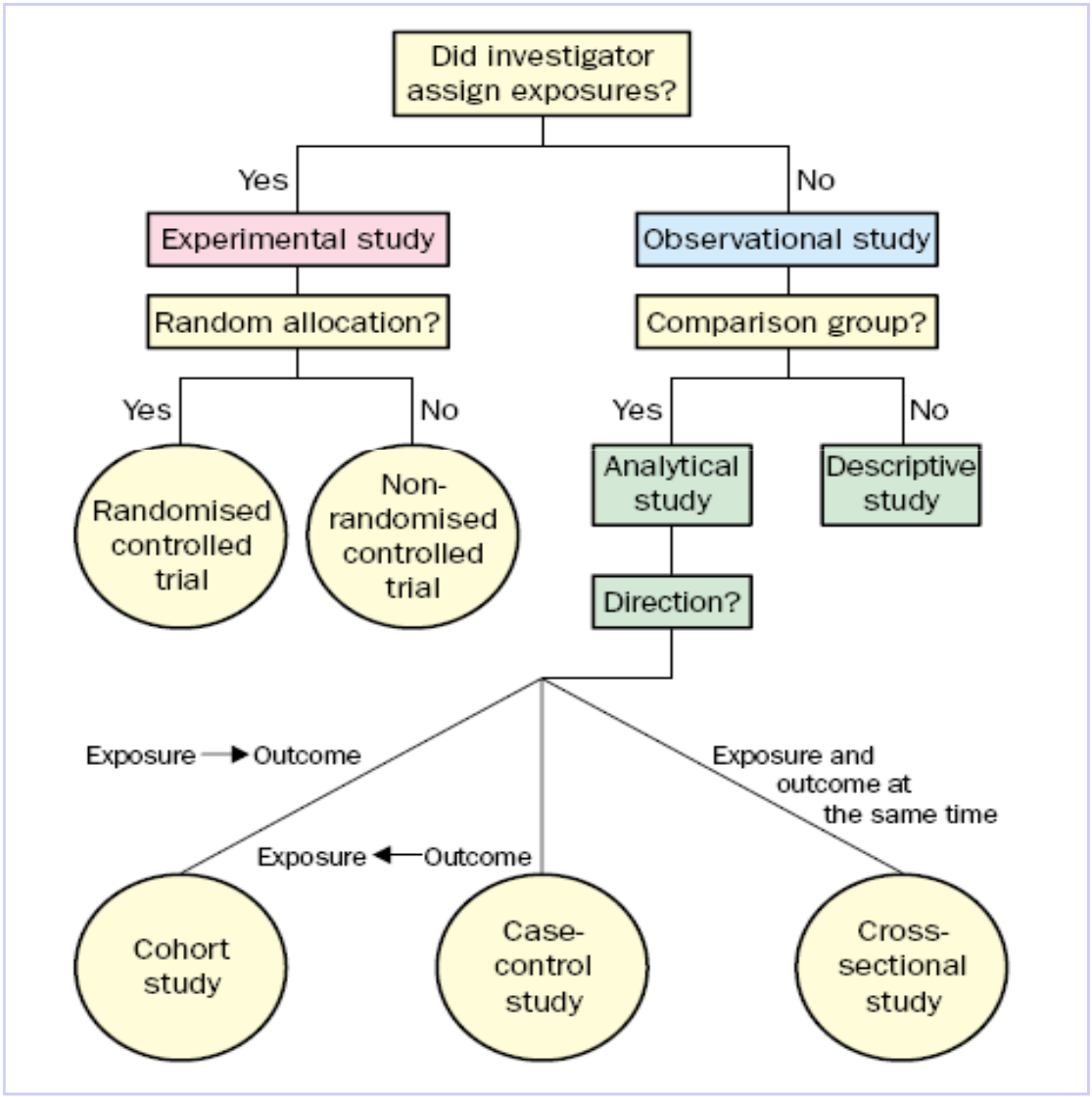
Analytical studies

Studies of suspected causes of diseases

Experimental studies

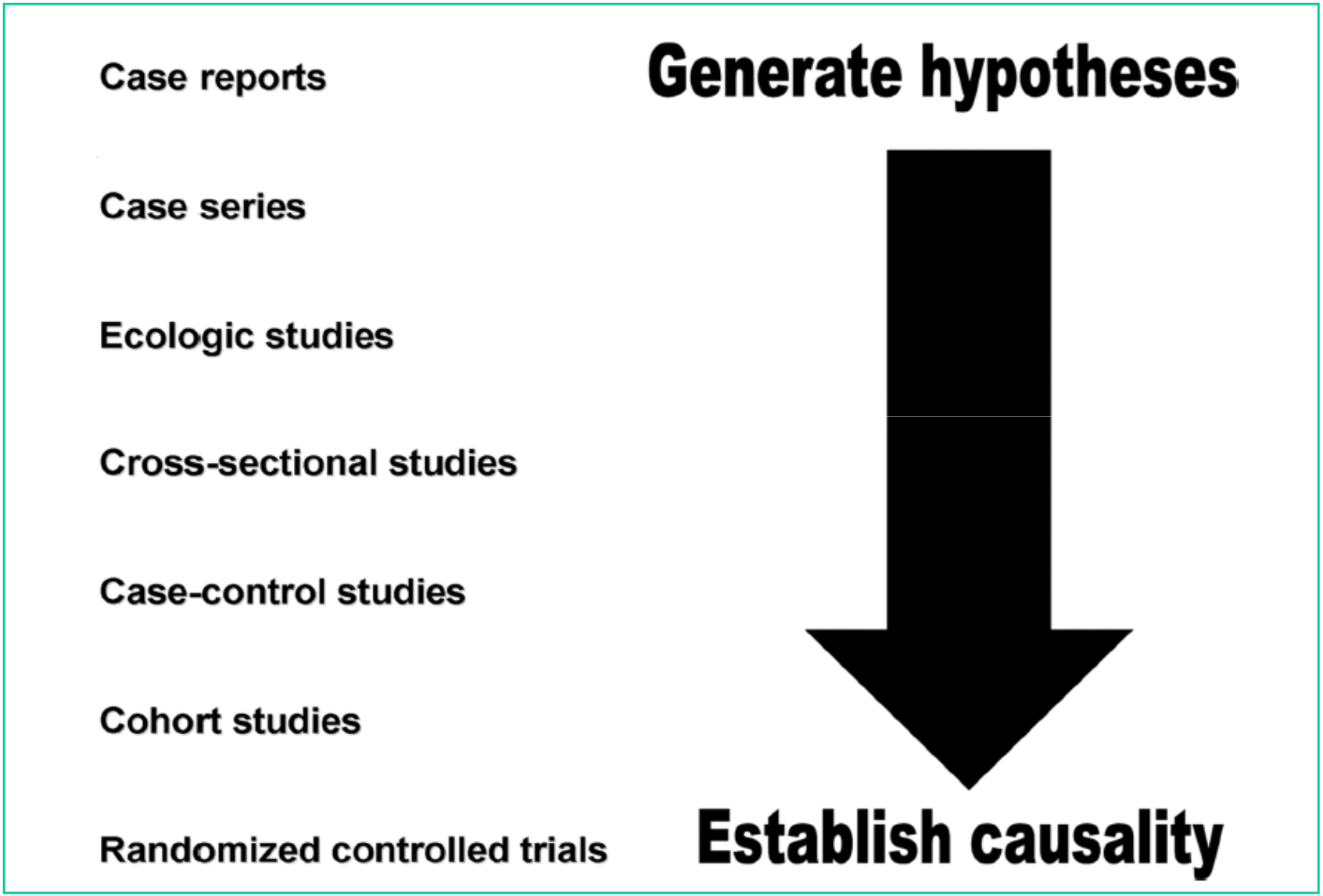
Compare treatment modalities

Epidemiologic Study Designs



Grimes & Schulz, 2002 (www)

Hierarchy of Epidemiologic Study Design



Tower & Spector, 2007 (www)

Observational Studies

(no control over the circumstances)

- Descriptive: Most basic demographic studies
- Analytical: Comparative studies testing an hypothesis
    * cross-sectional

      (a snapshot; no idea on cause-and-effect relationship)
    * cohort

      (prospective; cause-and-effect relationship can be inferred)
    * case-control

      (retrospective; cause-and-effect relationship can be inferred)

Epidemiologic Study Designs

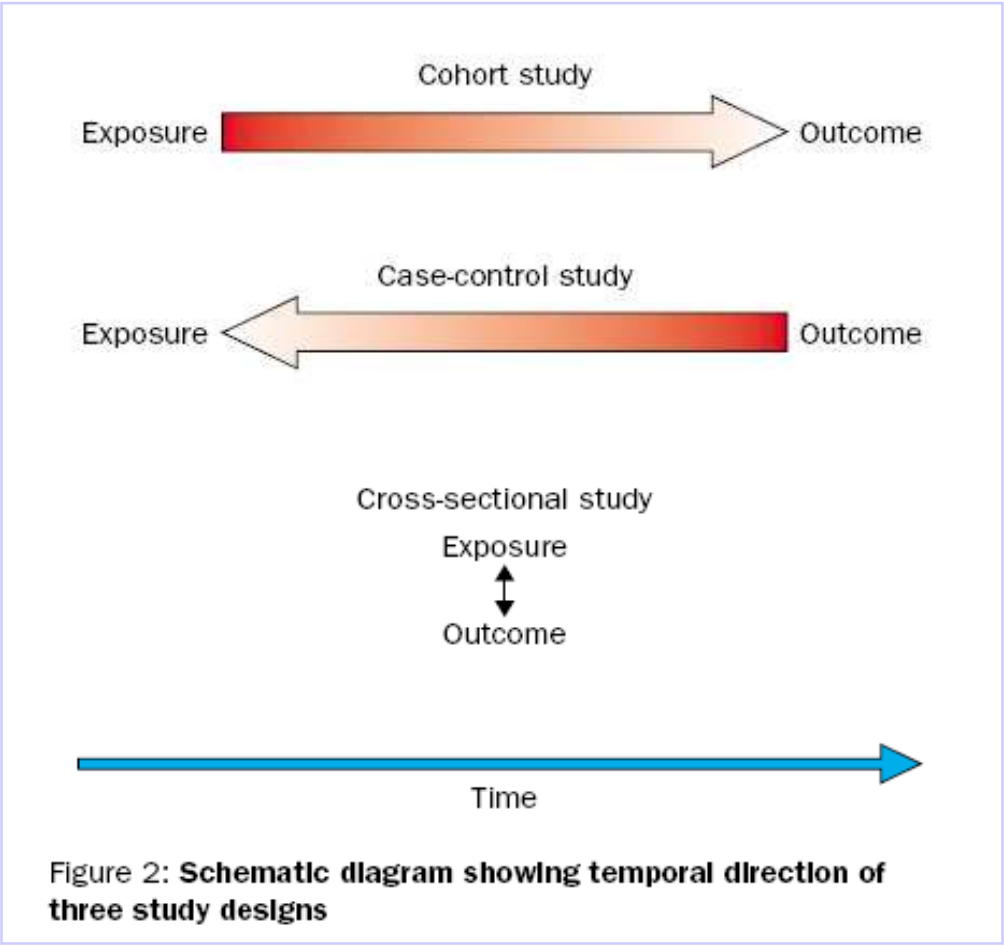


Figure 2: **Schematic diagram showing temporal direction of three study designs**

Grimes & Schulz, 2002 (www)

Analytical Studies

(comparative studies testing an hypothesis)

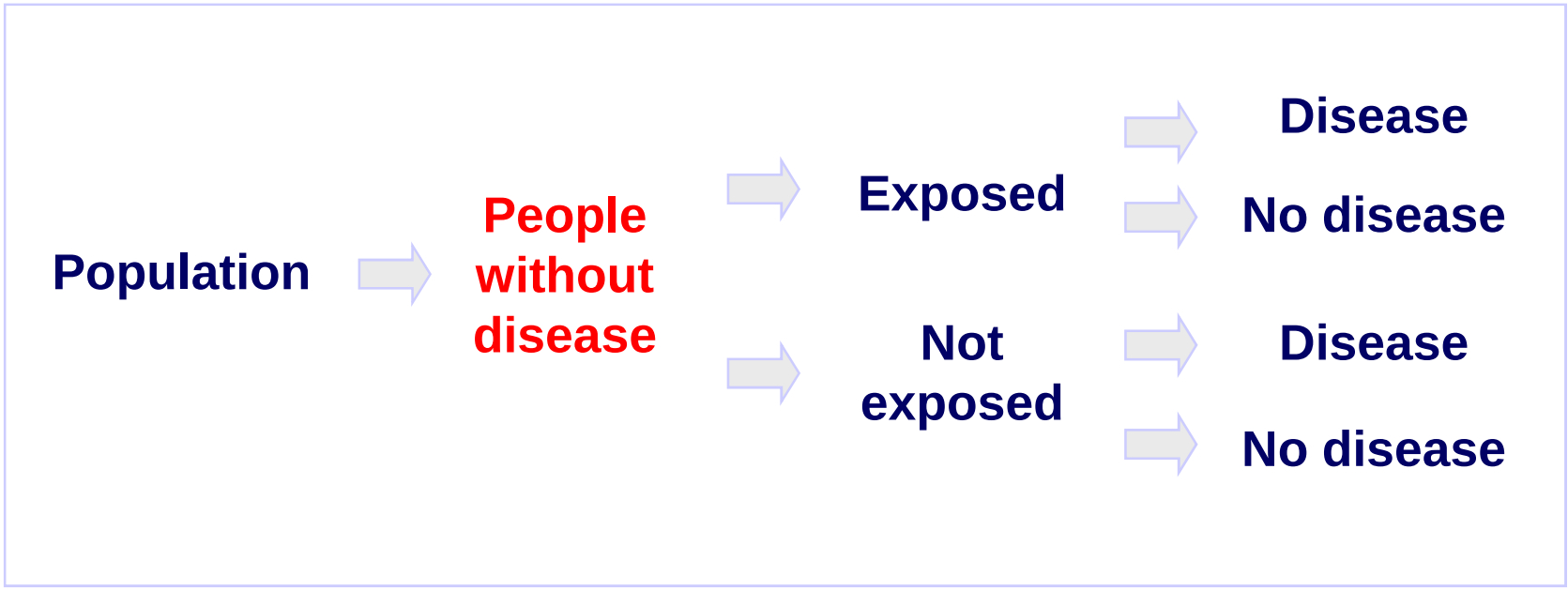
* **cohort** (prospective)

  Begins with an exposure (smokers and non-smokers)

* **case-control** (retrospective - trohoc)

  Begins with outcome (cancer cases and healthy controls)

Cohort Studies



Advantages of Cohort Studies

- Can establish population-based incidence
- Accurate relative risk (risk ratio) estimation
- Can examine rare exposures (asbestos > lung cancer)
- Temporal relationship can be inferred (prospective design)
- Time-to-event analysis is possible
- Can be used where randomization is not possible
- Magnitude of a risk factor’s effect can be quantified
- Selection and information biases are decreased
- Multiple outcomes can be studied
  (smoking > lung cancer, COPD, larynx cancer)

Disadvantages of Cohort Studies

- Lengthy and expensive
- May require very large samples
- Not suitable for rare diseases
- Not suitable for diseases with long-latency
- Unexpected environmental changes may influence the association
- Nonresponse, migration and loss-to-follow-up biases
- Sampling, ascertainment and observer biases are still possible

Presentation of cohort data: Population at risk

Does HIV infection increase risk of developing TB among a population of drug users?

	Population (follow up 2 years)	Cases
HIV +	215	8
HIV -	289	1

Source: Selwyn et al., New York, 1989

Does HIV infection increase risk of developing TB among drug users?

Exposure	Population (f/u 2 years)	Cases	Incidence (%)	Relative Risk
HIV +	215	8	3.7	11
HIV -	298	1	0.3	

Presentation of cohort data: Person-years at risk

Tobacco smoking and lung cancer, England & Wales, 1951

	Person-years	Cases
Smoke	102,600	133
Do not smoke	42,800	3

Source: Doll & Hill

Presentation of data:
Various exposure levels

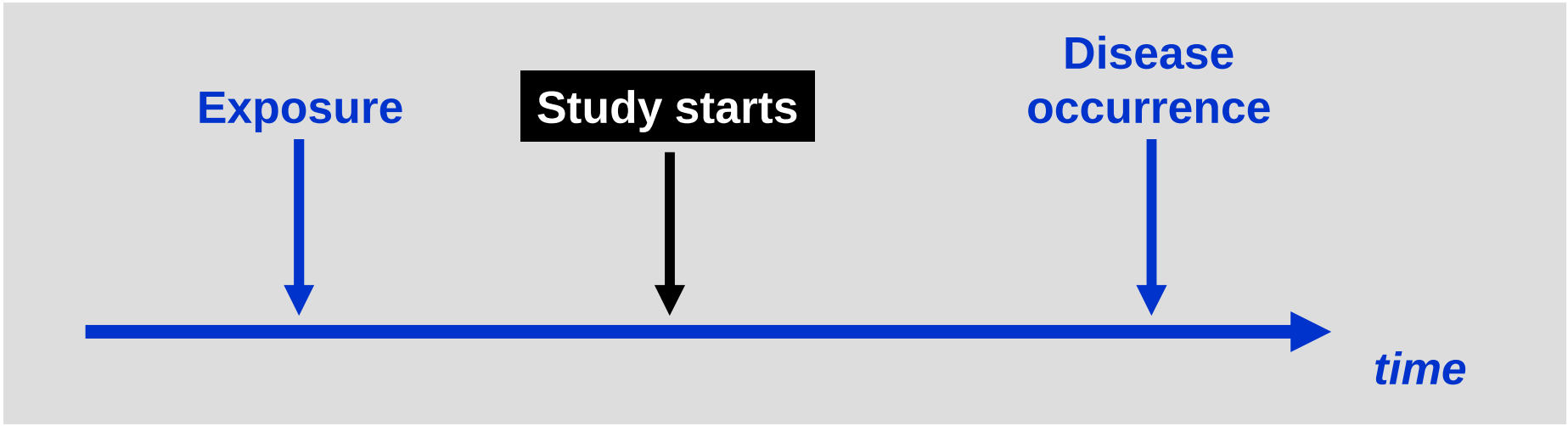
Daily number of cigarettes smoked	Person-years at risk	Lung cancer cases
> 25	25,100	57
15 - 24	38,900	54
1 - 14	38,600	22
none	42,800	3

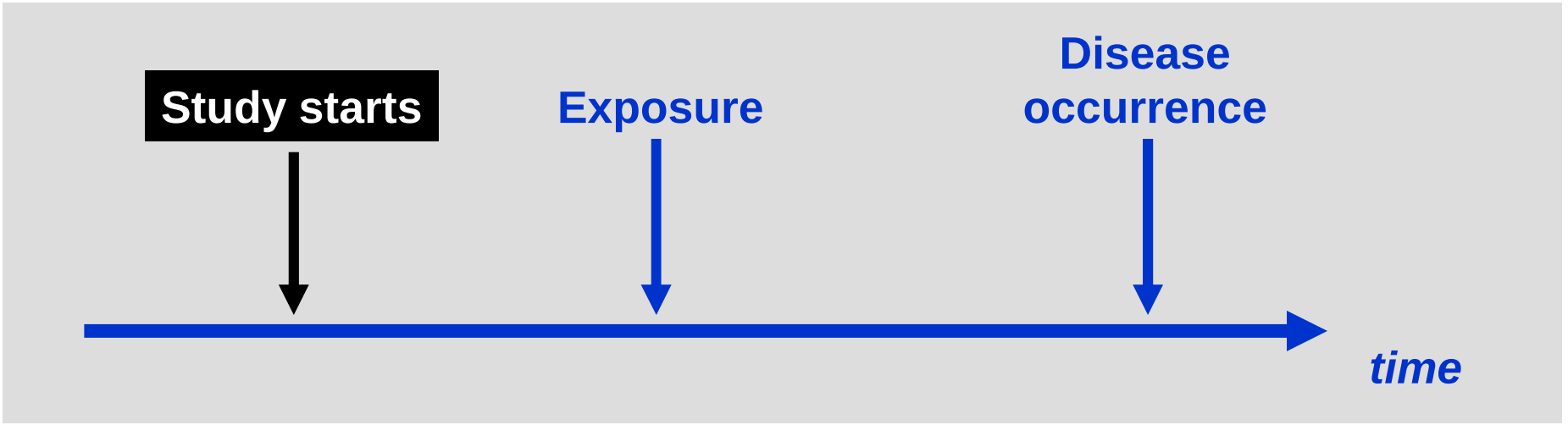
Cohort study: Tobacco smoking and lung cancer, England & Wales, 1951

Cigarettes smoked/d	Person-years at risk	Cases	Rate per 1000 p-y	Rate ratio
> 25	25,100	57	2.27	32.4
15 - 24	38,900	54	1.39	19.8
1 - 14	38,600	22	0.57	8.1
none	42,800	3	0.07	Ref.

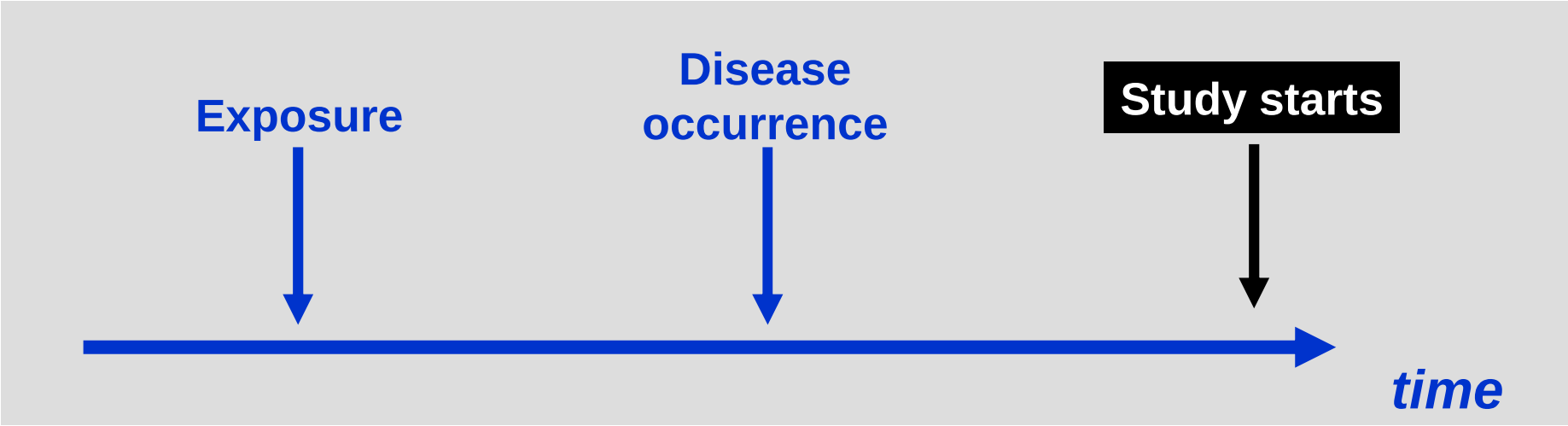
Source: Doll & Hill

Prospective cohort study





Retrospective cohort studies



Cohort Studies

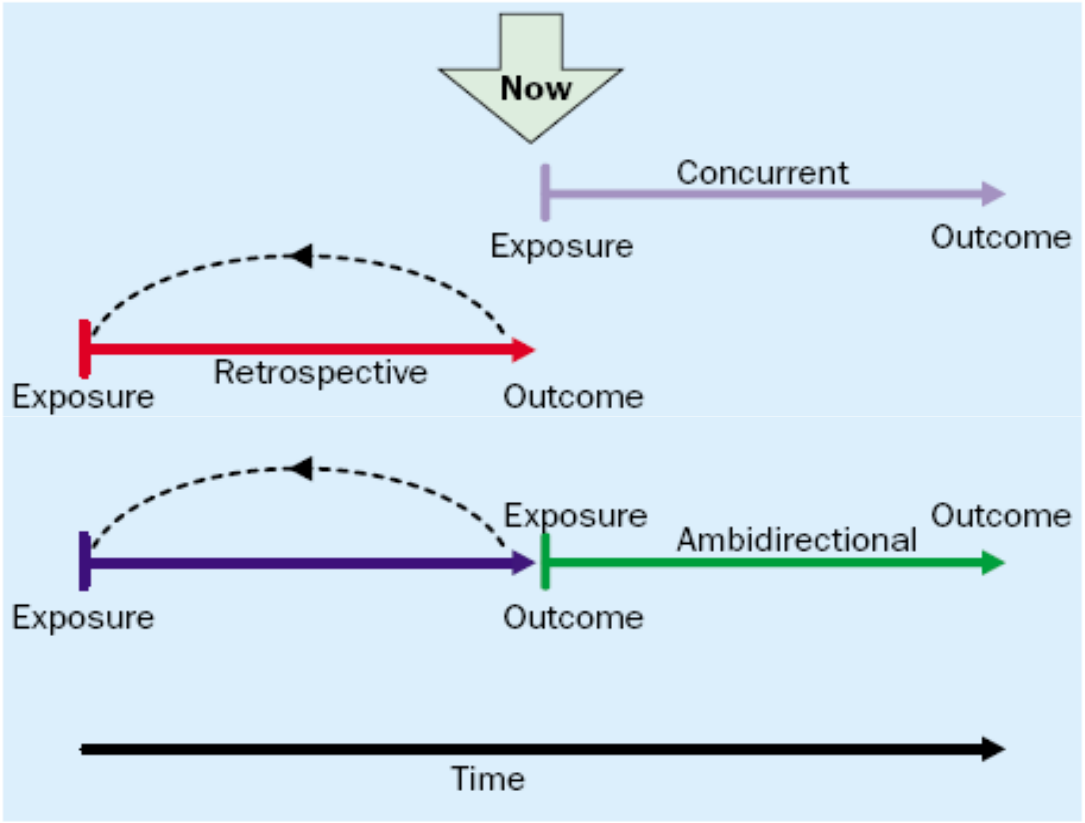


Figure 2: **Schematic diagram of concurrent, retrospective, and ambidirectional cohort studies**

Grimes & Schulz, 2002 (www) (PDF)

Cohort Studies

Panel 2: **Features to look for in a cohort study**

How much selection bias was present?

1 Were only people at risk of the outcome included?
1 Was the exposure clear, specific, and measurable?
1 Were the exposed and unexposed groups similar in all important respects except for the exposure?

What steps were taken to minimise information bias?

1 Was the outcome clear, specific, and measurable?
1 Was the outcome identified in the same way for both groups?
1 Was determination of outcome made by an observer blinded as to treatment?

How complete was the follow-up of both groups?

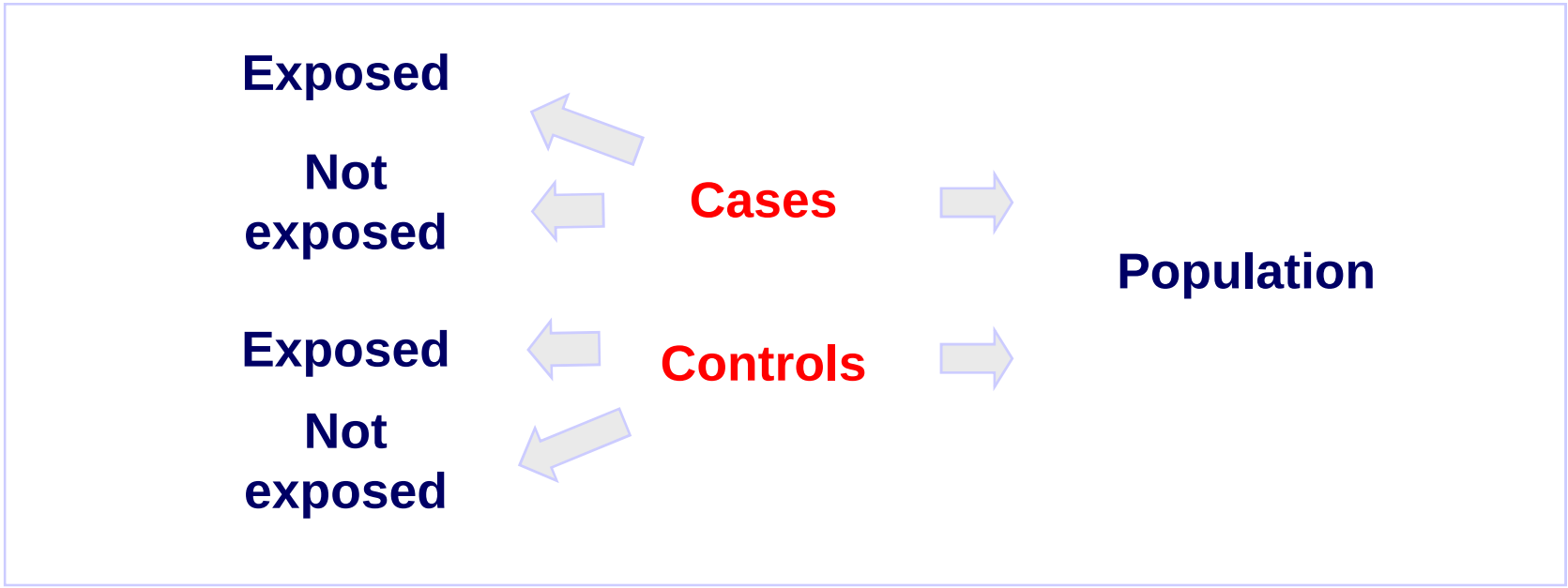
1 What efforts were made to limit loss to follow-up?
1 Was loss to follow-up similar in both groups?

Were potential confounding factors sought and controlled for in the analysis?

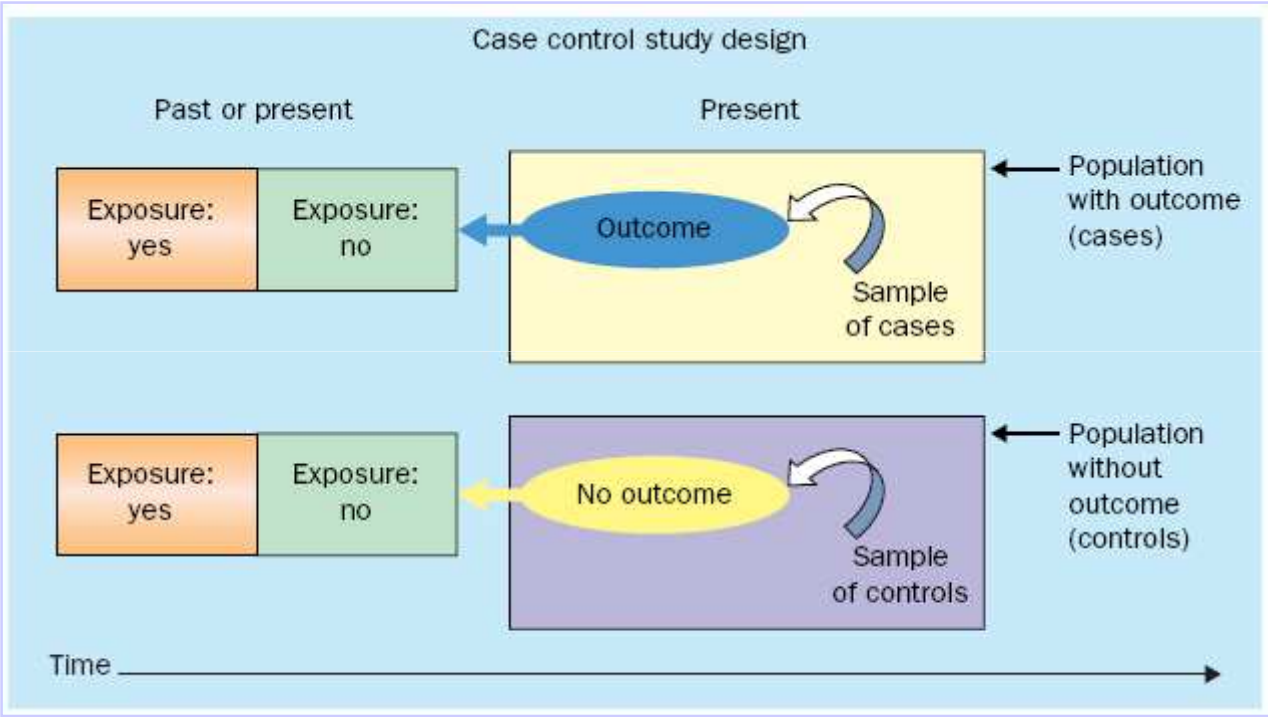
1 Did the investigators anticipate and gather information on potential confounding factors?
1 What method(s) were used to assess and control for confounding?

Grimes & Schulz, 2002 (www) (PDF)

Case-Control Studies



Case-Control Studies



Schulz & Grimes, 2002 (www) (PDF)

Advantages of Case-Control Studies

- Cheap, easy and quick studies
- Multiple exposures can be examined
- Rare diseases and diseases with long latency can be studied
- Suitable when randomization is unethical (alcohol and pregnancy outcome)

Disadvantages of Case-Control Studies

- Case and control selection troublesome
- Subject to bias (selection, recall, misclassification)
- Direct incidence estimation is not possible
- Temporal relationship is not clear
- Multiple outcomes cannot be studied
- If the incidence of exposure is high, it is difficult to show the difference between cases and controls
- Not easy to estimate attributable fraction
- Reverse causation is a problem in interpretation - especially in molecular epidemiology studies

Epidemiologic Study Designs

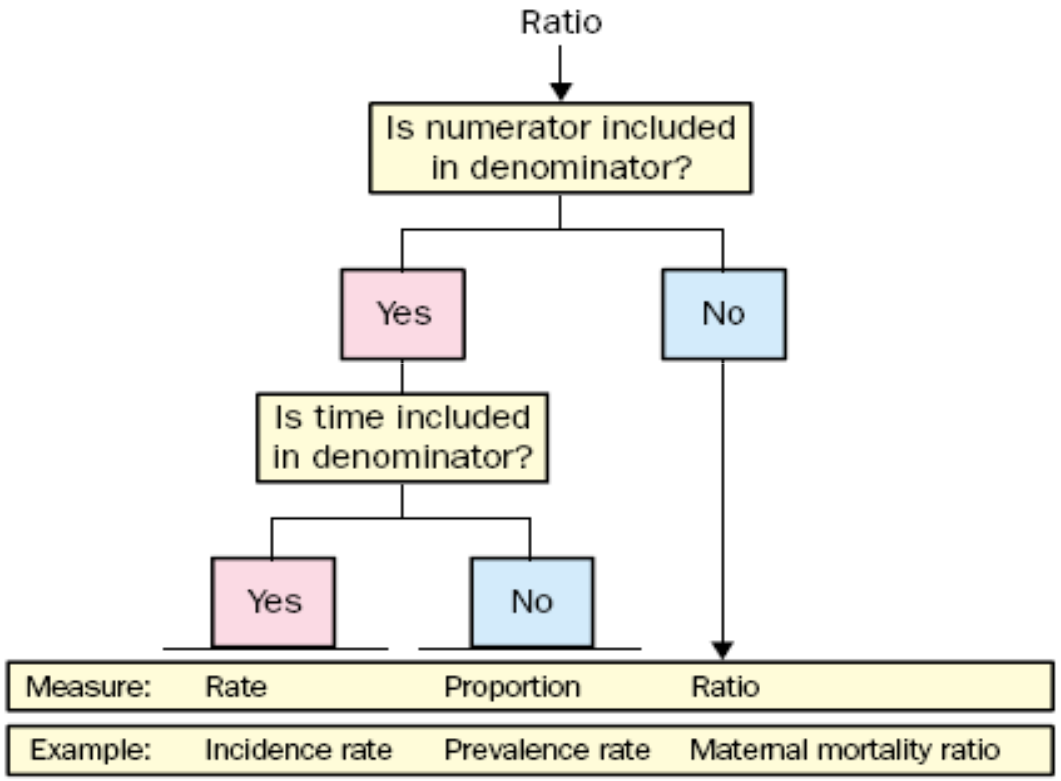


Figure 3: **Algorithm for distinguishing rates, proportions, and ratios**

Grimes & Schulz, 2002 (www)

Sources of Error in Epidemiologic Studies

Random error

Large* sample *size, replication

Bias

Be careful

Confounding

Effect Modification

Reverse Causation

Confounding can be controlled by:

- **Randomization**: assures equal distribution of confounders between study and control groups

- **Restriction**: subjects are restricted by the levels of a known confounder

- **Matching**: potential confounding factors are kept equal between the study groups

- **Stratification** for various levels of potential confounders

- **Multivariable analysis** (does not control for *effect modification*)

Effect modification can be assessed by:

- **Stratification** for various levels of potential confounders
- **Multivariable analysis** (by assessing interaction)

Reverse causation can be assessed by:

- **Mendelian Randomization**