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Introduction of case-control study

開塾　天保9年（1838年）

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  - ✓Overview of study design
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- Major types of case-control studies
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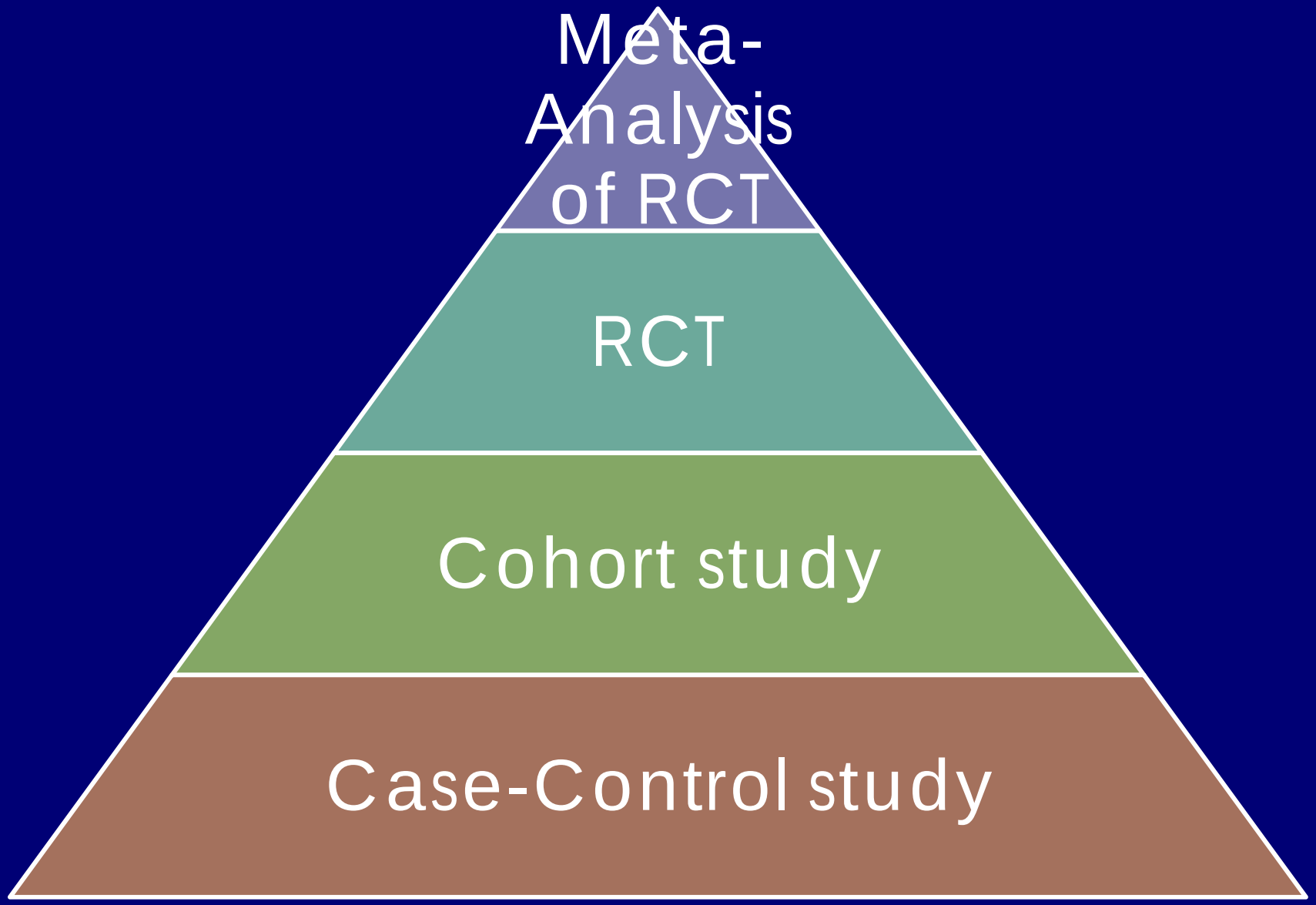
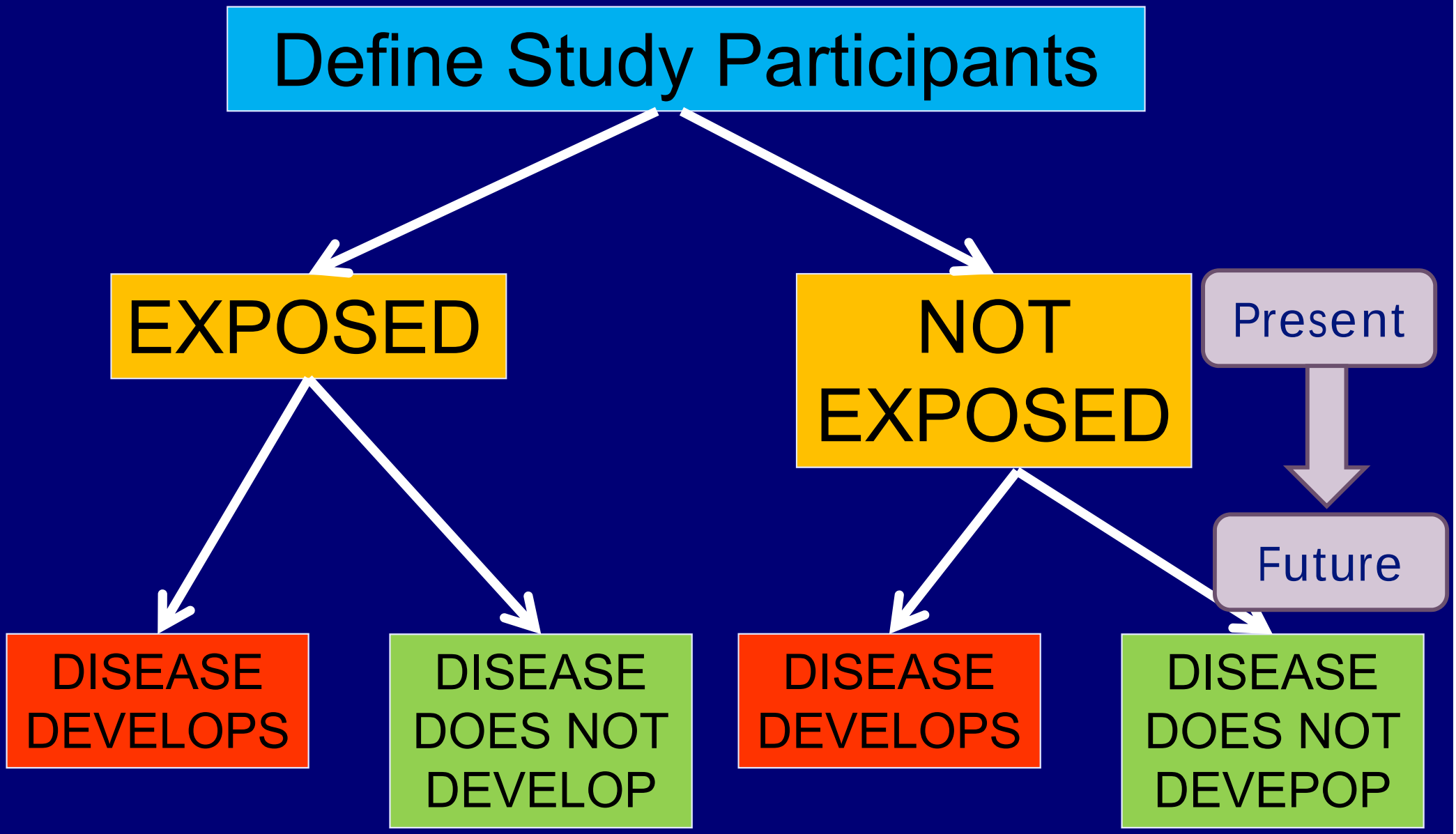
Overview of study designs



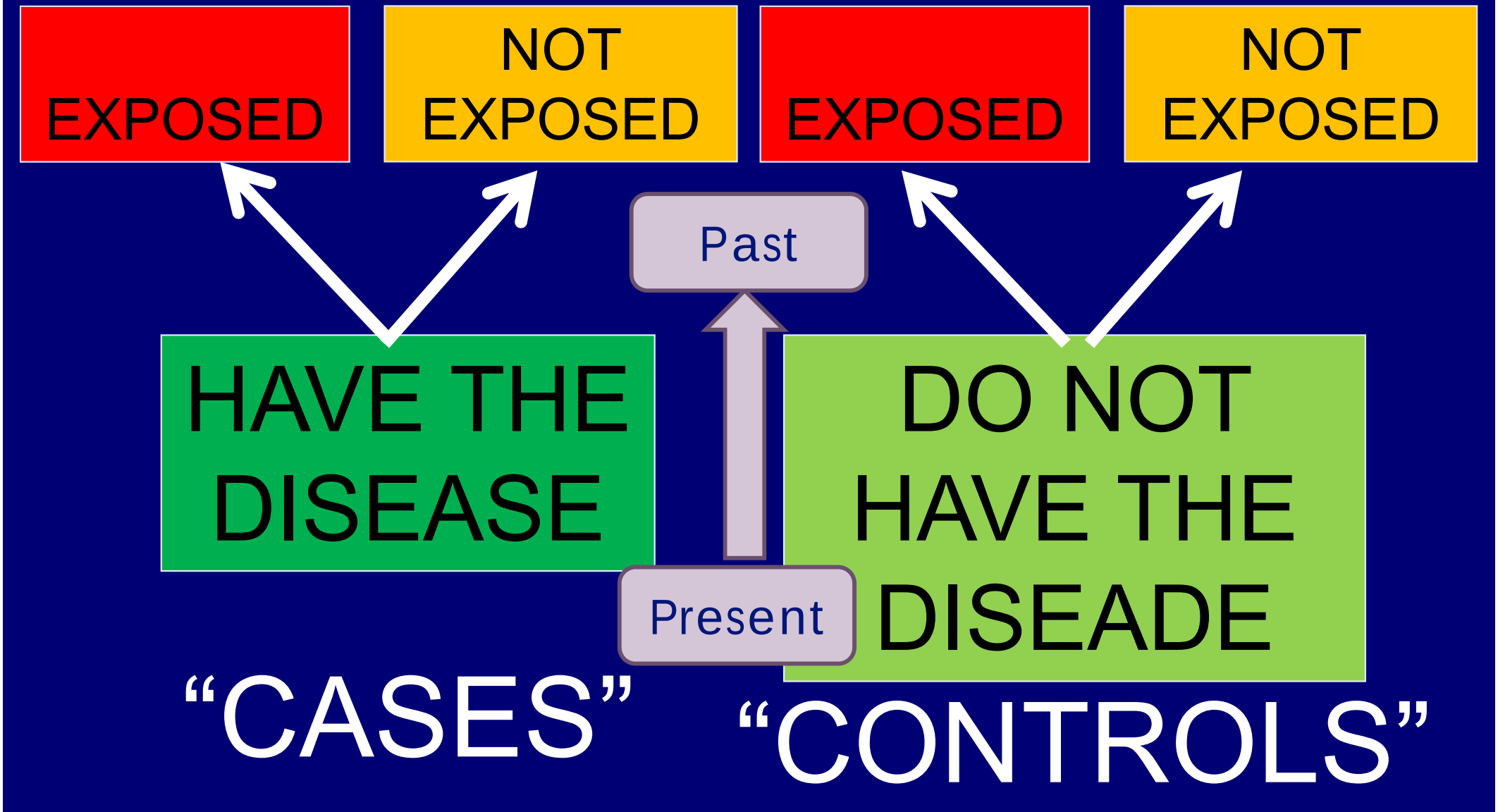
A case-control study is designed to help determine if an exposure is associated with an outcome.

It is always retrospective because it starts with an outcome then traces back to investigate exposures.

Basic design of cohort study



Basic design of case-control study



Why case-control study?

Compared to prospective cohort studies, case-control study tends to be less costly and shorter in duration. In several situations they have greater statistical power than cohort studies, which must often wait for a 'sufficient' number of disease events (target disease) to accrue.

Advantage and Disadvantage of Case-Control Study compared to Cohort study

	Cohort Study	Case-Control Study
Measures	Incidence Rate, Relative Risk(RR)	Odds Ratio (OR) only
Cost	Expensive	Inexpensive
Study term	Long term	Short term
Sample size	Need large sample	Powerful with small sample cases
Exposure	Good for rare exposure	Limited to rare exposure
Disease	Poor potential for rare Possible for several disease	Good for rare disease Only one disease
Causal	Potentially strong	Potentially less strong
Generalization	Possibly generalizable	Probably not generalizable

Which study design do you choose?

A Vietnamese neurologist has a hypothesis that high coffee consumption in youth may be associated with Pick disease in middle or elder age.

Which study design do you choose?

A Vietnamese clinician has a research question whether ratio of LDL and HDL cholesterol (L/H ratio) is associated with cardiovascular events among Vietnamese diabetic patients.

Before deciding a study design

Review feasibility of the planned study considering study question, target disease, exposure, cost, study period , etc.!

Major types of case-control study

Population-based case-control study

⇒Cases and controls are recruited from population.

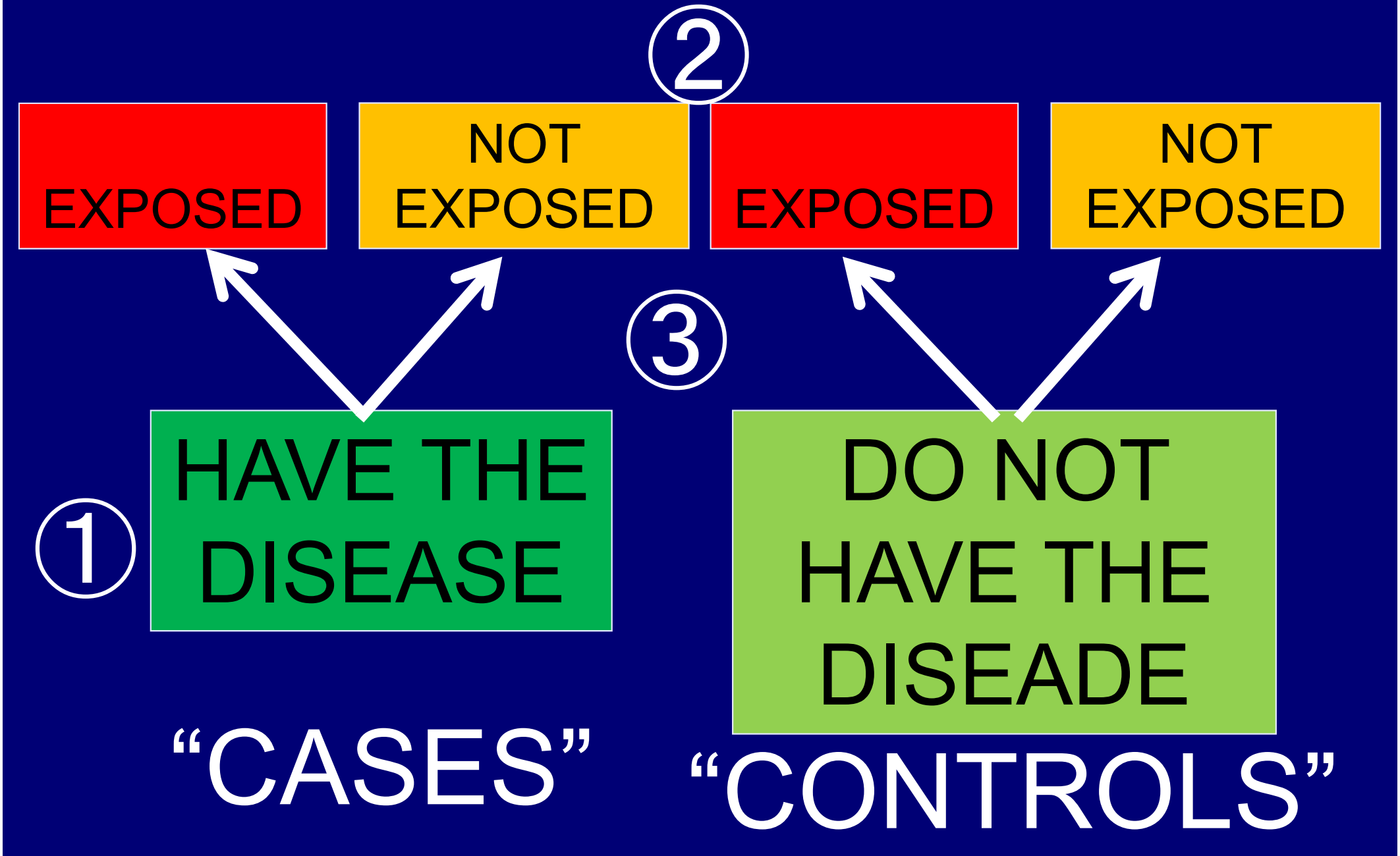
Case-control study nested in cohort study

⇒Cases and controls are registered in a cohort study.

Hospital based case-control study

⇒Cases and controls are patients who are hospitalized or outpatients.

Procedure of case-control study



① Identification of CASEs and CONTROLs (Present).
② Measurement of exposure and determination of EXPOSED or NON-EXPOSED (Past).
③ Expected findings if the exposure is associated with DISEASE

①Identification of cases and controls

Cases; Cases should be identified from patients with your interests systematically.
Controls; Controls should be recruited from appropriate sources.

You are highly recommended to define “Eligible criteria” and “Exclusion criteria” prior to recruiting of cases and controls.

②Measurement of exposure

Exposure history can be collected by the past information using interview, biomarkers or medical records.

NOTICE; Bias and Cofounding

What is Bias ?

"Any systemic error in the design, conduct or analysis of a study that results in a mistaken estimate of an exposure's effect on the risk of disease."

Types of bias

- Selection bias

⇒Results from an unrepresentative sample in sampling.

- Detection bias

⇒Occurs when a phenomenon is more likely to be observed for a particular set of study subjects

- Information bias (Recall bias, Family information bias)

⇒Occurs when we place too much attention on information, even when it is not strictly relevant.

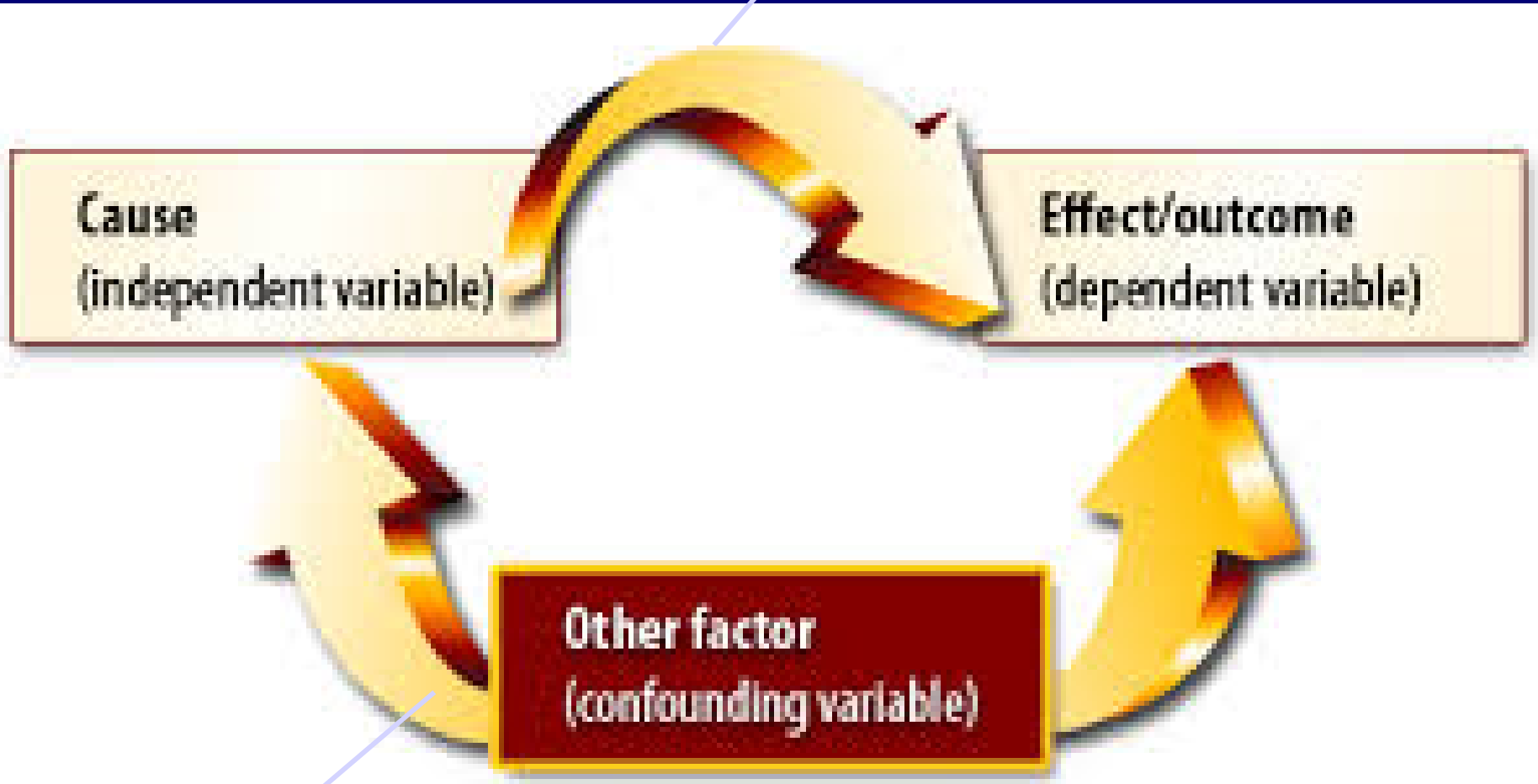
Some types and sources of information bias

- Bias in abstracting
- Bias in interviewing
- Bias from surrogate interviews
- Recall bias
- Reporting bias

Confounding

"A third variable or a mediator variable, can adversely affect the relation between exposure and outcome."

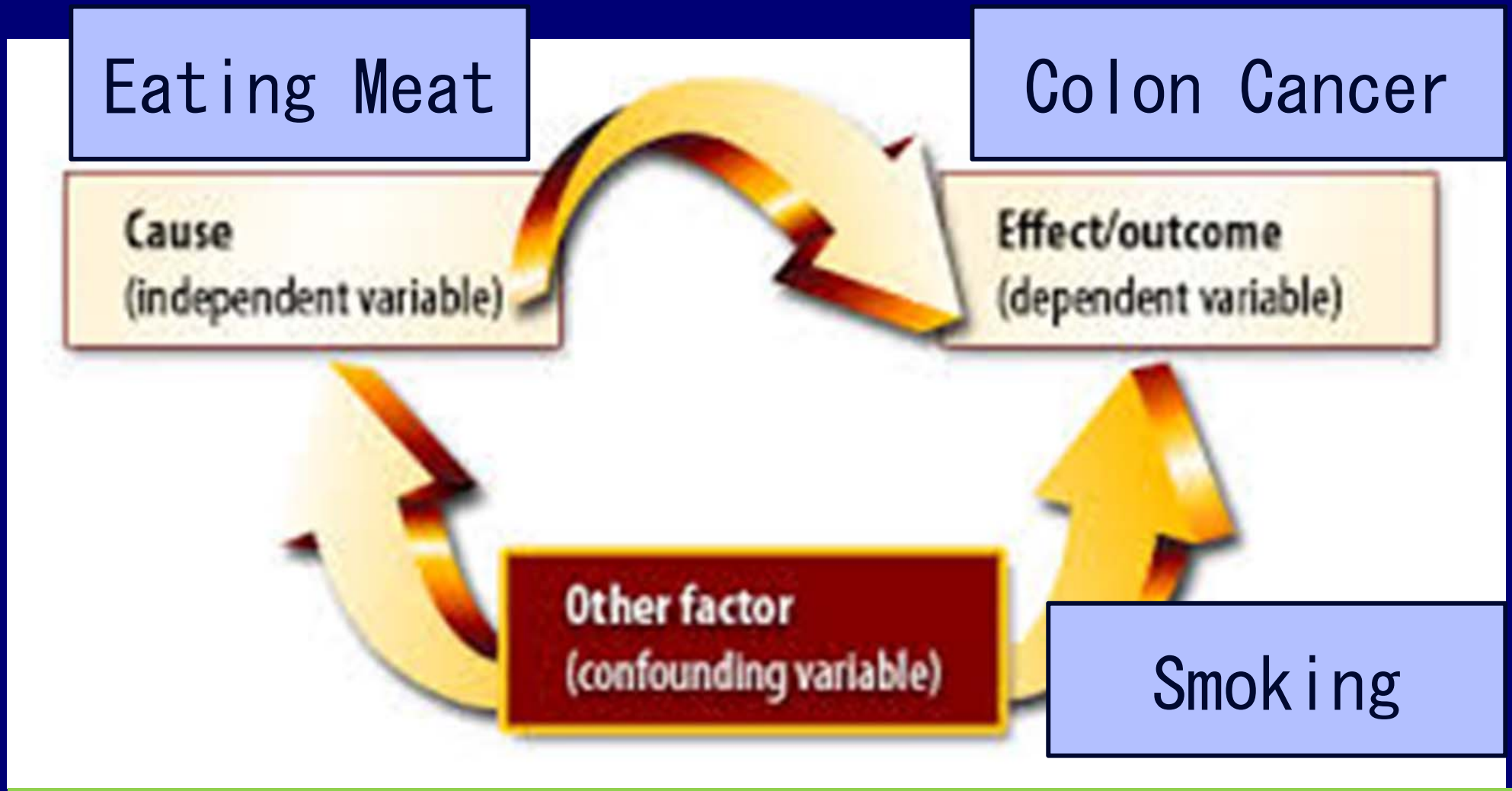
Causal



Due to Confounding

https://explorable.com/confounding-variables

Examples



The observed association between “eating meat” and “colon cancer” may result from confounding by smoking.

Controlling confounding

Before

Study design

- Randomization (Intervention)
- Restriction (Cohort, Case-control)
- Matching (Case-control)

After

Data analysis

- Adjustment
- Stratification
- Multivariate analysis

Restriction

A method that limits participation in the study to individuals who are similar in relation to the confounder

Problems

- Reduces eligible population
- Limits generalizability

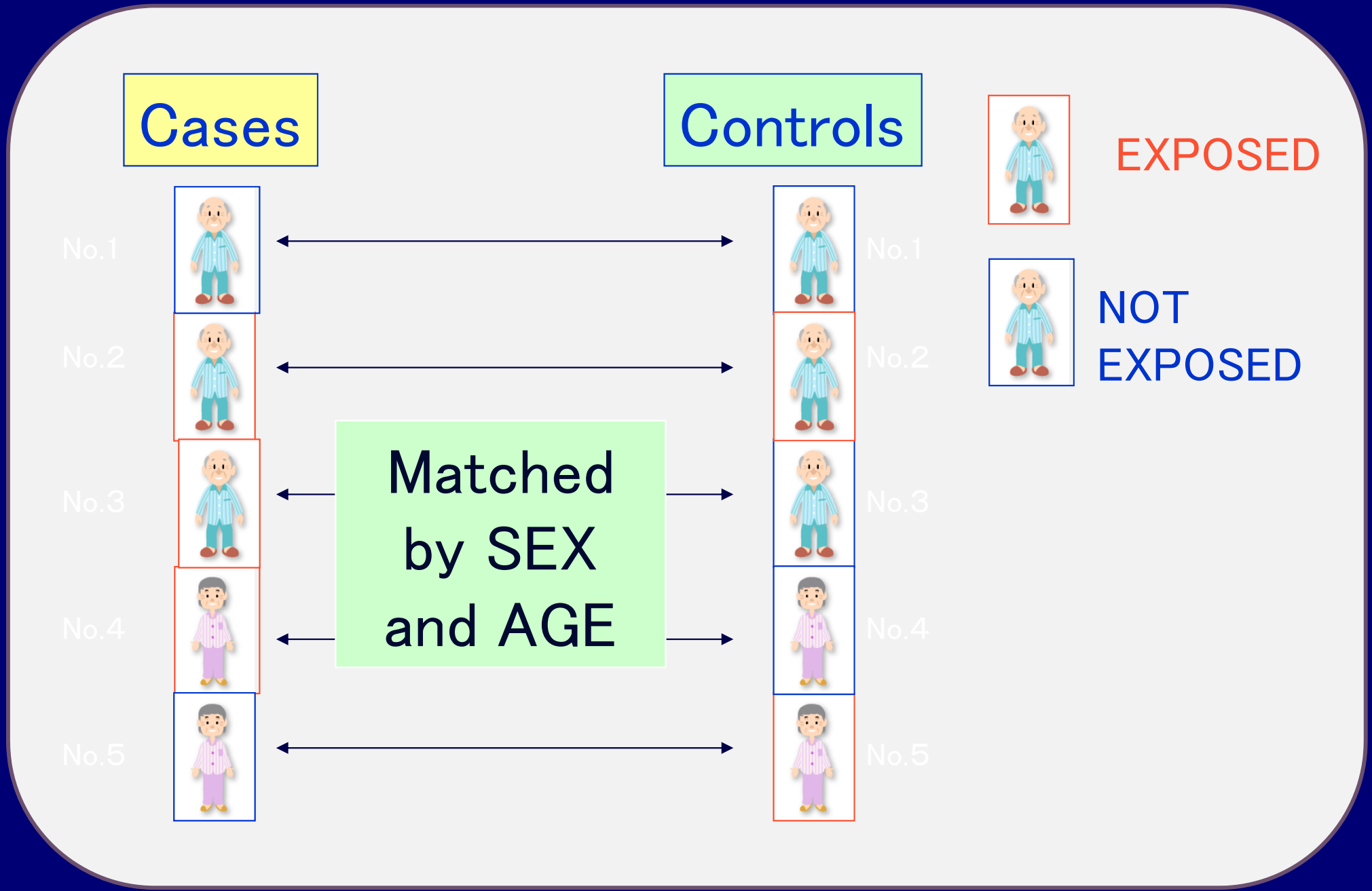
Matching

Controls and cases are similar in variables, which may be related to the topic we are studying BUT are not of interest in themselves.

Problems

- Reduces eligible population
- Limits generalizability

Example of matching



Problems with Matching

- Practical limit on how many you can match on
- Cannot analyze the association for the matched variables
- Sometimes difficult, expensive (Requires large number of cases and controls)
- Over matching (Matched by factors strongly related to the exposure which is your main interest.)

Risk assessment in case-control study

	CASES (with DISEASE)	CONTROLES (Without DISEASE)
EXPOSED	a	b
NON-EXPOSED	c	d

Odds = prevalence / (1 – prevalence)

Odds ratio = (Odds in cases) / (Odds in controls)

= (a/c)/(b/d) = ad/bc

Interpretation of Odds ratio

OR = 1	**No association**
OR≧1	Risk factor
OR≦1	Protective factor

95% confidence interval (CI); A 95% probability which the interval includes the true odds ratio (OR)

If 95% CI range includes “1”, it is not statistically significant since it could be either a risk factor (OR≧1) or a protective factor (OR≦1). If 95 % CI range is greater than 1, the exposure is a significant risk factor (OR≧1) with a probability of higher than 95%.