

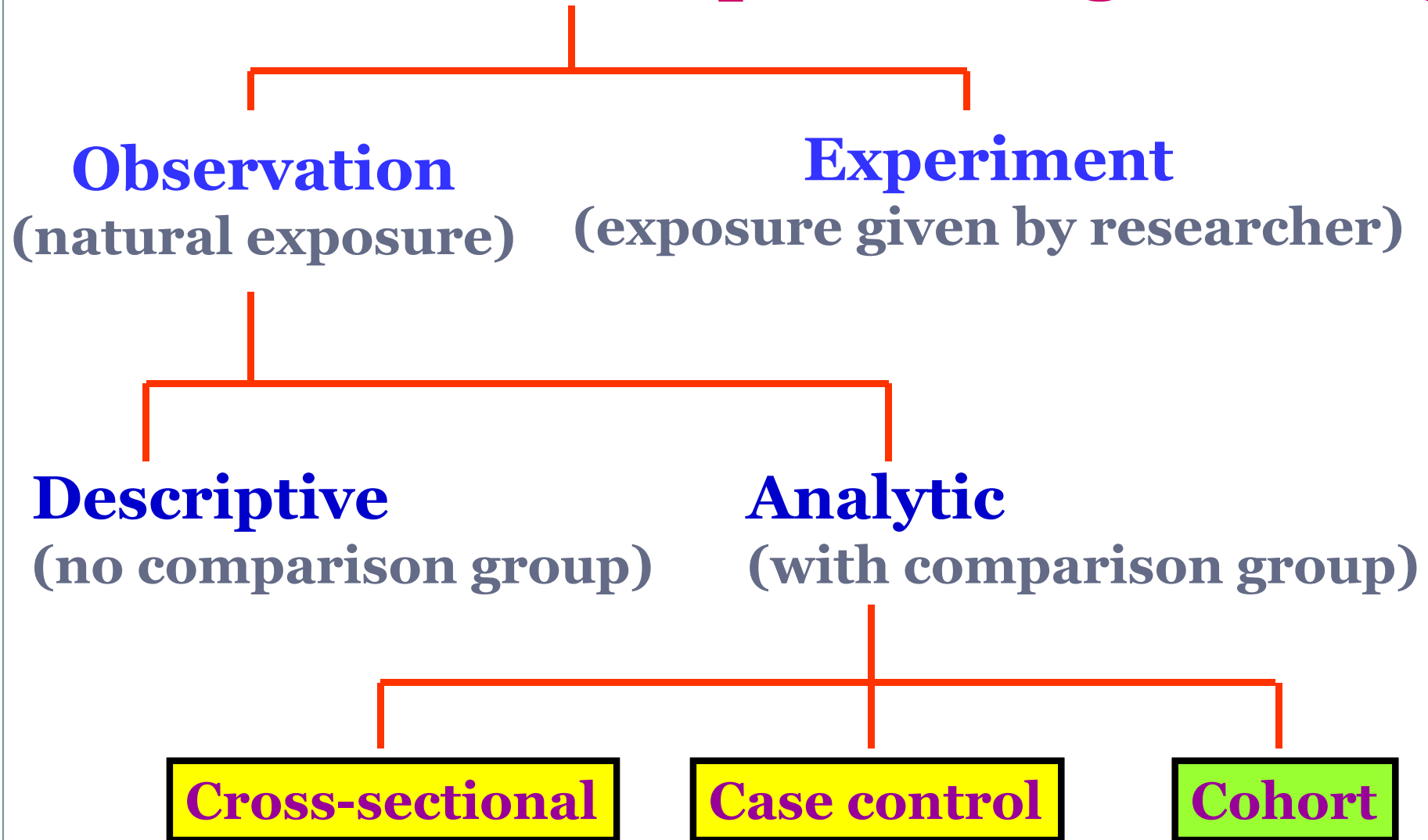
# Cohort Study

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# Classification epidemiological study



# Hierarchy of Epidemiological studies

- **Clinical trial:**

Experiment

- **Cohort study:**

- **Case-control study:**

Analytic

- **Cross-sectional study:**

- **Cross-sectional study:**

- **Case report:**

- **Case series:**

Descriptive

# Basic Question in Analytic Epidemiology



- Are exposure and disease linked?

**E**



**D**

**Exposure**

**Disease**

# **“COHORT” in Epidemiology**

**A group of persons who  
are followed over time**

# Cohort Study

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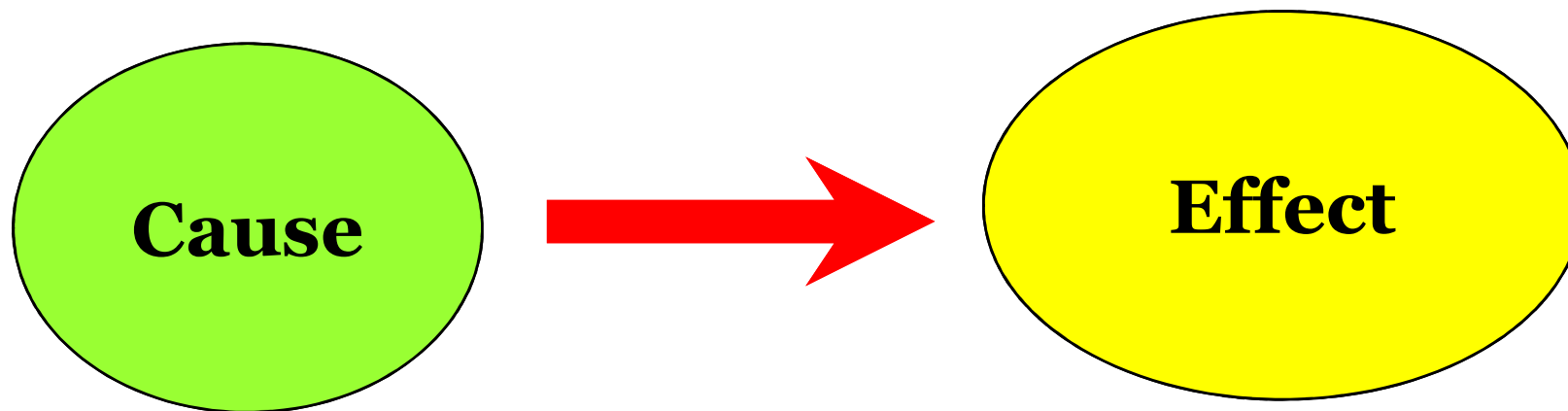
- **most powerful** observational study
- identifying an **association** of risk factors and a disease
- comparing individuals with a known risk factor or exposure with others without the risk factor or exposure
- looking for a difference in the risk (**incidence**) of a disease over time
- data usually collected prospectively (some retrospective)

# Cohort Study

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- **Start** with a group of people **without** the **disease**
- Then divide people on the basis of the **exposure** to a suspected risk factor
- **Follow** the “**whole group**” for a period of time
- Then assess the disease **occurrence outcome**

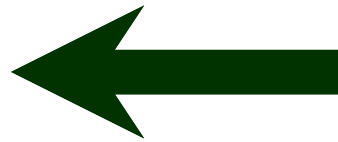
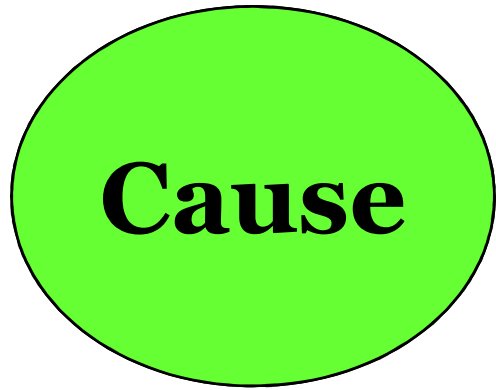
# Using epidemiology to identify the cause of disease



- RISK FACTORS
- Cigarette

- DISEASE
- Lung Cancer





# Cohort Study

**Factors**



**Disease**

**Exposed**

**Not Exposed**

**Develop  
Disease**

**Do Not  
Develop  
Disease**

**Develop  
Disease**

**Do Not  
Develop  
Disease**

# Types of Cohort Studies

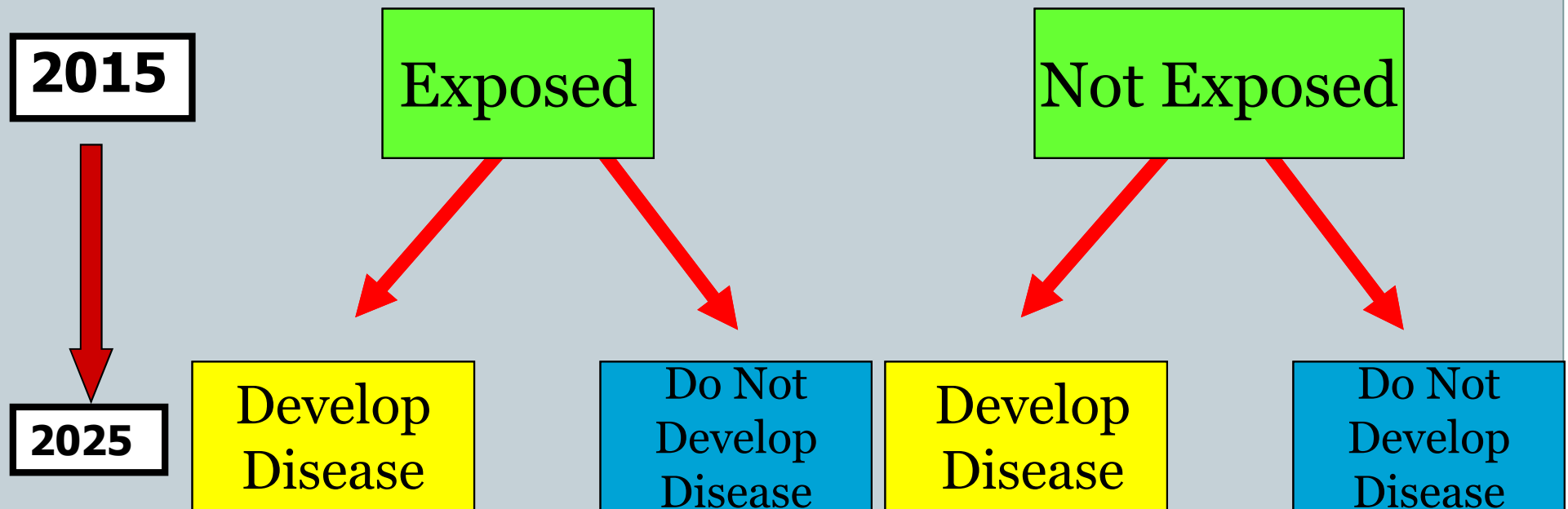


- **Prospective Cohort Study** - looks forward, looks to the future, examines future events, follows a condition, concern or disease into the future
- **Retrospective Cohort Study** - “to look back”, looks back in time to study events that have already occurred

# I. Prospective Cohort Study

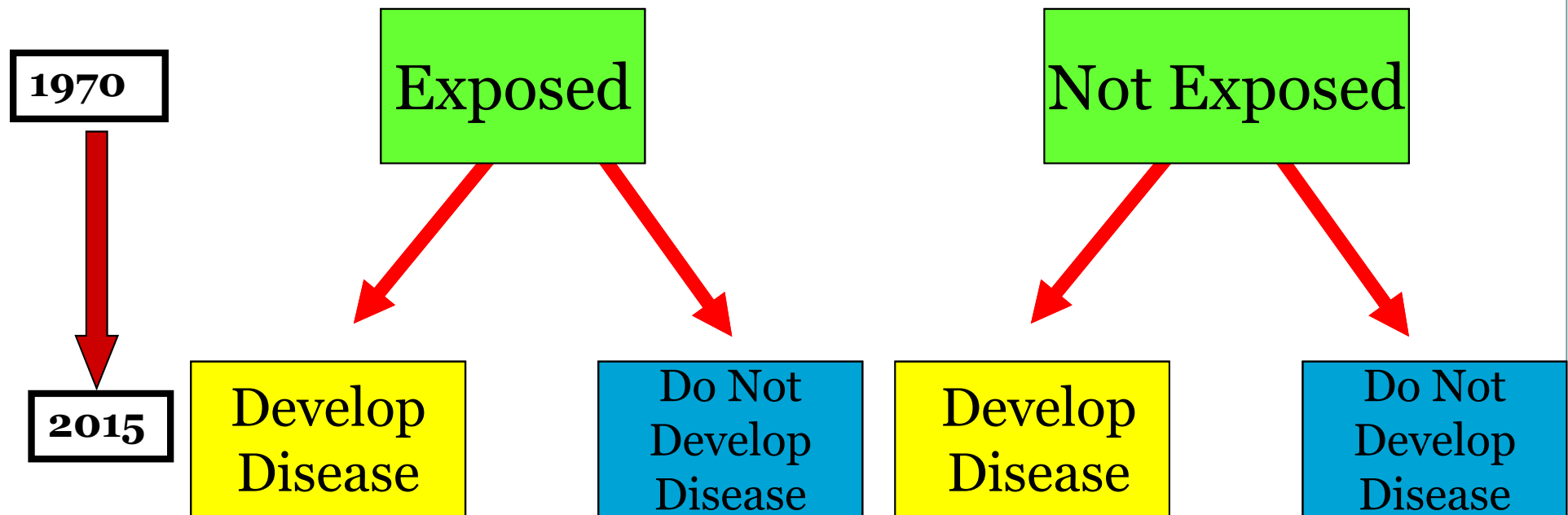
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(Concurrent Cohort Study, forward looking study)



# II. Retrospective Cohort Study

(Historical cohort, Take advantage of records collected)



# Conducting a Cohort Study

- **Selecting a group of people without the disease**
- **Defining the Exposed/Non-exposed group**
- **Follow up**
- **Evaluate the disease outcome among both Exposed and Non-exposed**
- **Calculating Relative Risk**

When we are conducting a cohort study,  
we are dealing with **“INCIDENCE”**

# Measuring the Incidence

There are two ways of measuring

1) Cumulative incidence

$$= \frac{\text{number of } \textit{new case} \text{ in specified time}}{\text{population at risk in specified time}}$$

2) Incidence density or Incidence rate

$$= \frac{\text{Number of } \textit{new case} \text{ in specified time}}{\text{Person-years of observation which is disease free}}$$



# Measurement of Associations

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- Cross-sectional



**Point  
Prevalence Rate  
Ratio**

- Case-Control



**Odds Ratio**

- Cohort



**Relative Risk**

# Data analysis in Cohort study

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- Incidence
  - Cumulative incidence= .../ 100 person
  - Incidence rate(density)= .../ 100 person-year
- Relative Risk or Risk Ratio (RR)
  - The ratio of 2 cumulative incidence
- Rate Ratio
  - The ratio of 2 incidence rate (density)

# Cohort Study

Comparison between

“a group of persons with  
a factor -- Exposed”

VS

“a group of persons without  
the factor -- Non-exposed”

# Relative Risk



	Disease	No disease	
exposed	<b>A</b>	B	<b>A+B</b>
Non-exposed	<b>C</b>	D	<b>C+D</b>

$$\text{Relative Risk} = \frac{\mathbf{A/A+B}}{\mathbf{C/C+D}}$$

# Relative Risk (RR) - Interpretation



- The value of ratio can vary between zero and infinity
- $RR = 1.0$ 
  - indicates the rate (risk) of disease among exposed and non-exposed (= referent category) are identical (= null value)
- $RR > 1$ 
  - Indicates rate (risk) of disease among exposed are higher than non-exposed (exposed= risk factor or hazardous exposure)
- $RR < 1$ 
  - indicate rate (risk) of disease among exposed are lower than non-exposed (exposed= protective factor or beneficial exposure)
- $RR = 2.0$ 
  - rate (risk) is twice as high in exposed versus non-exposed
- $RR = 0.5$ 
  - rate (risk) in exposed is half that in non-exposed

	CA Lung	No CA	
Smoke	45	455	500
Not smoke	1	499	500

- Incidence of Smoker who develop Lung Cancer =  $45 / 500$
- Incidence of Non -Smoker who develop Lung Cancer =  $1 / 500$
- Relative Risk of smoking for Lung Cancer =  $\frac{45/500}{1/500} = 45$
- **Those who smoked were *45 times more likely to get lung cancer***

## Interpretation of Relative Risk (RR)

- **Relative Risk of smoking for CA Lung = 45**
- **Those who smoked were *45 times more likely* to develop lung cancer than those who did not smoke.**

# Summary: Cohort Study

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## Strength:

- ❑ Can measure disease incidence
- ❑ Can study the natural history
- ❑ Provides strong evidence of casual association between Exposure and Disease (time order is known)
- ❑ Can examine multiple diseases outcome of a single exposure
- ❑ Good choice if exposure is rare (assemble special exposure cohort)
- ❑ Generally less susceptible to bias vs. Case Control Study

## Weakness:

- ❑ Takes time, need large samples, expensive
- ❑ Complicated to implement and conduct
- ❑ Not useful for rare diseases/outcomes or diseases with long latency
- ❑ Problems of selection bias
  - ❑ During study = loss to follow-up
- ❑ With prolonged time period:
  - ❑ loss-to-follow up
  - ❑ exposures change (misclassification)
- ❑ Required the availability of adequate records (Retrospective)