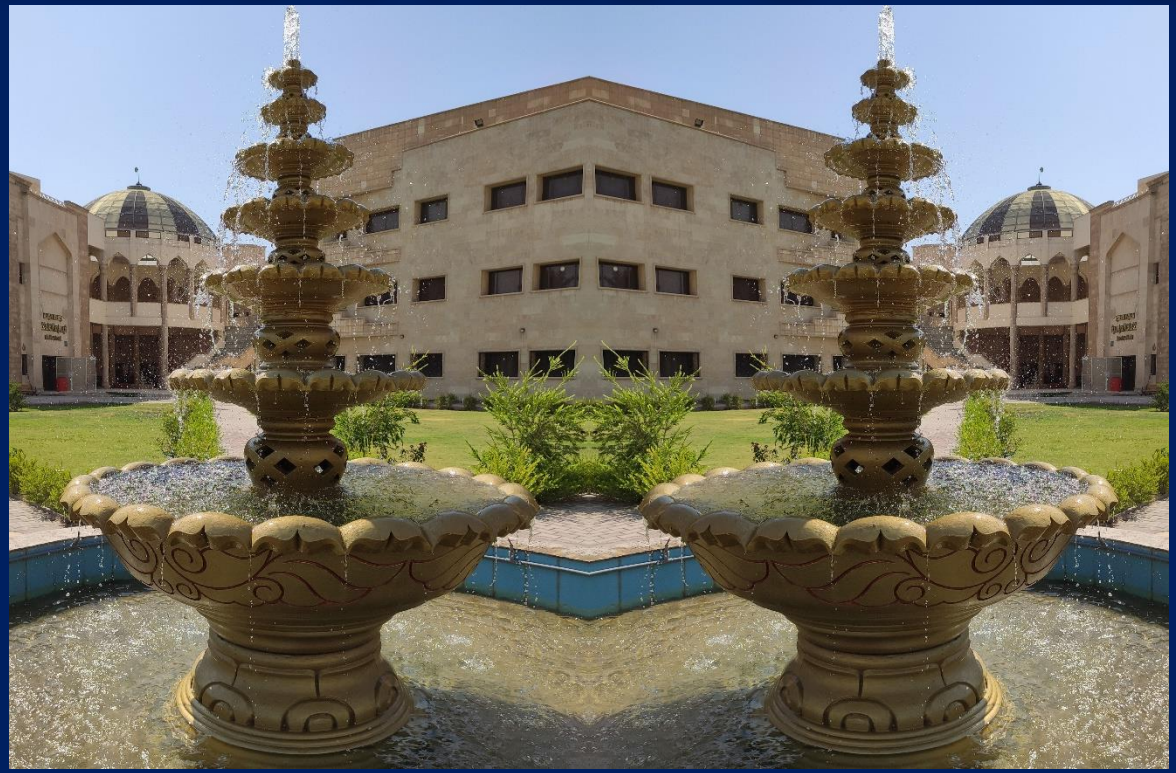
# MEASURES OF RISK



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# By the end of this lecture you will be able to:

- Describe association & risk for disease
- List measures of risk
- Determine if exposure is associated with disease
- Analyze epidemiological studies to find out risk

Lecture link on You tube:
https://youtu.be/_N0MPVCzsds

# DEFINITIONS

## Association

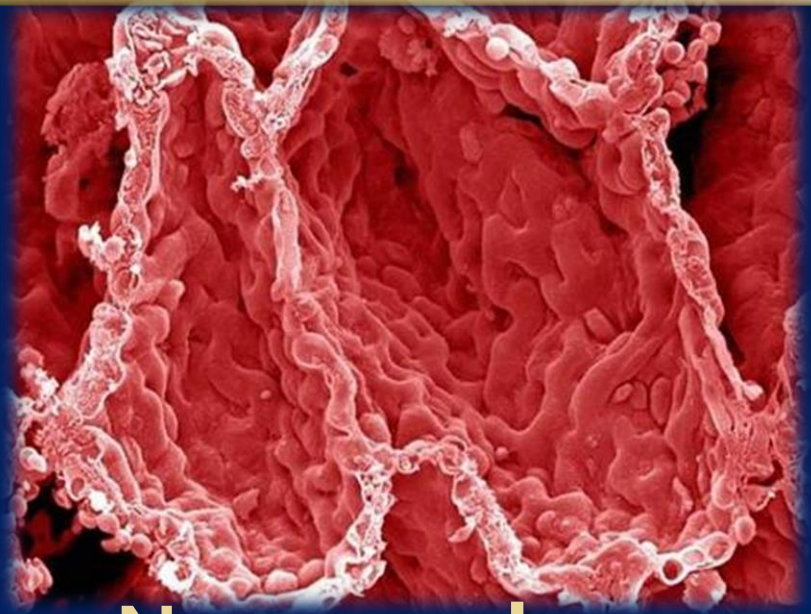
Statistical relationship between two (or more) variables.

## Risk

Probability of occurrence or likelihood to develop disease (health event) in time.

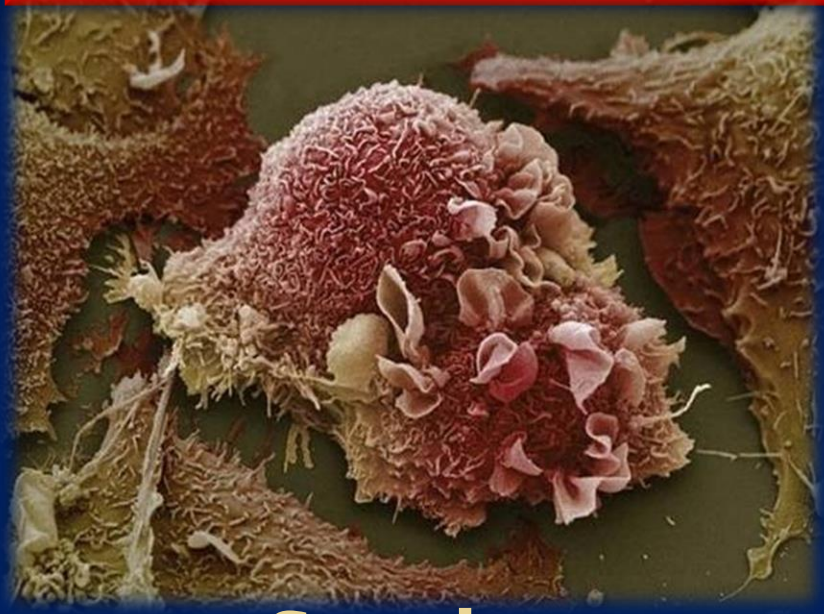
# Is there risk of smoking on lung cancer?

**HEALTHY LUNG**



Non smoker

**LUNG CANCER**



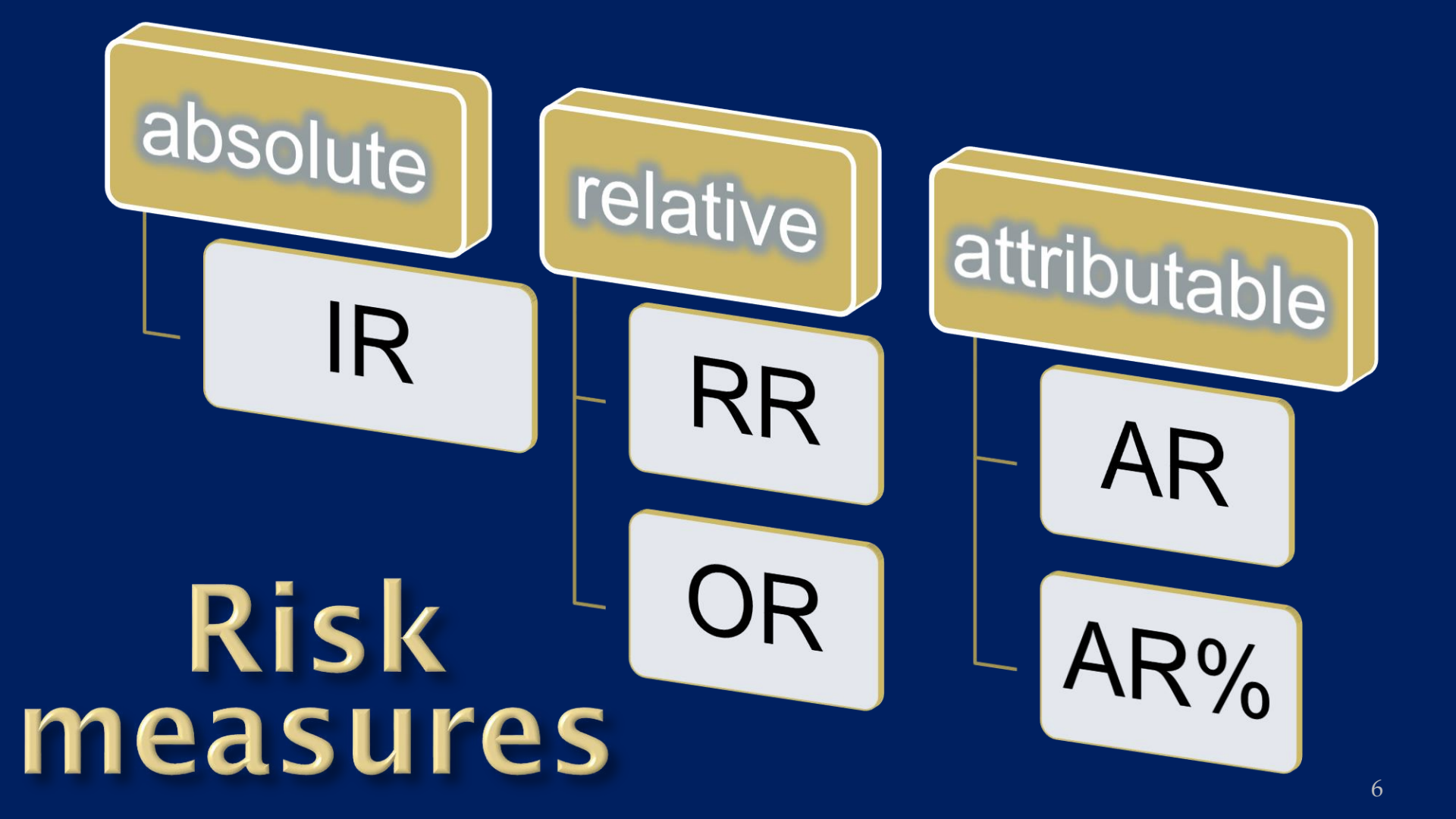
Smoker

# Comparing disease incidence

- Incidence of lung cancer among smokers tells us how much smokers are **at risk** of getting ca.
- This is **absolute** measure of risk, not giving us real idea about risk of smoking itself.
- If we compare it with the incidence among non-smokers:

➔ A study found it to be 9 times more.

➔ smokers are 9 times more likely to get lung cancer than non-smokers.


absolute
IR
relative
RR
OR
attributable
AR
AR%
Risk measures

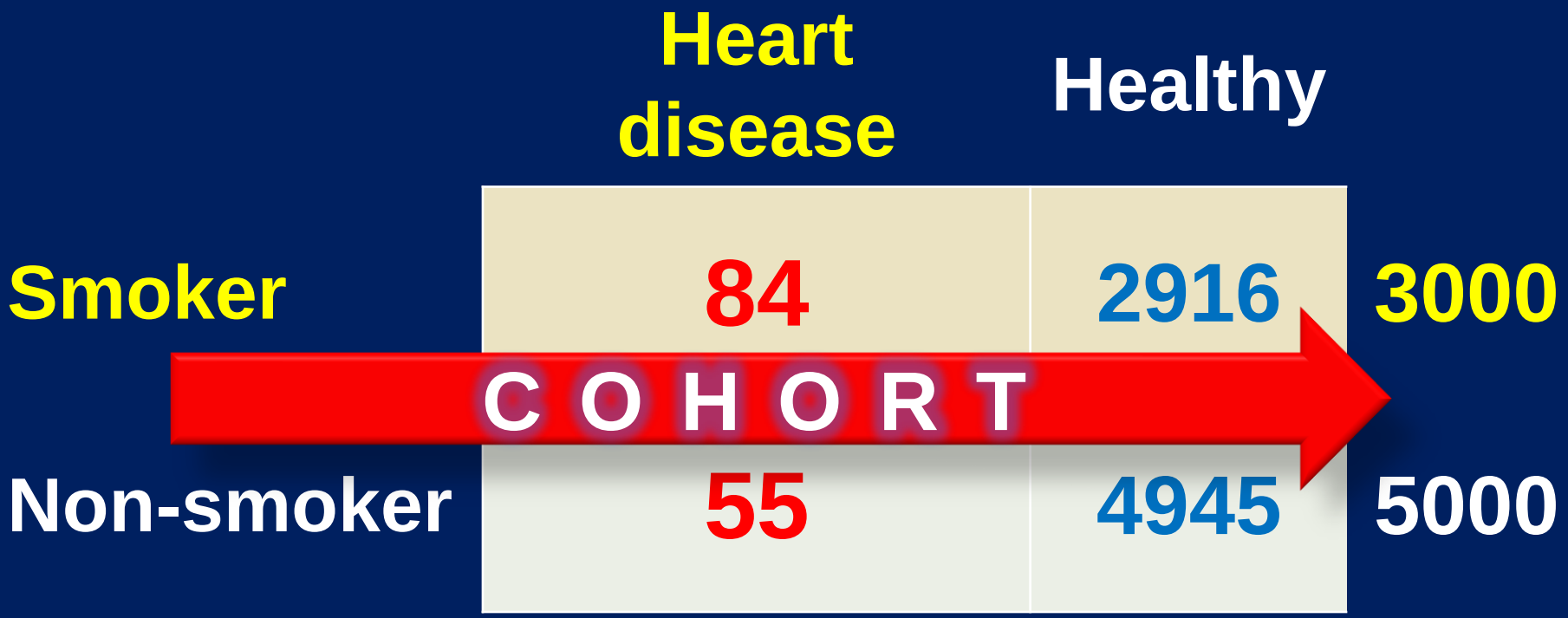
# How to measure risk?

- 8000 healthy government employers were asked about smoking status:

➔ 3000 were smokers

- The sample was medically followed up for 5 years:

➔ 84 smokers & 55 non-smokers developed heart disease.




$I_e = (84/3000)x1000 = 28/10^3$

$I_o = (55/5000)x1000 = 11/10^3$

# Relative risk (risk ratio)

- Indicates **likelihood** of developing disease in exposed group relative to unexposed.
- Measures strength (magnitude) of association, which is important in causation & prevention policy.

RR = IR exposed / IR non-exposed

$RR = I_e / I_o$

| | Heart dis | Healthy | |
|---|---|---|---|
| Smoker | 84 | 2916 | 3000 |
| Non-smoker | 55 | 4945 | 5000 |

$I_e = 28/10^3$ RR= $I_e / I_o$

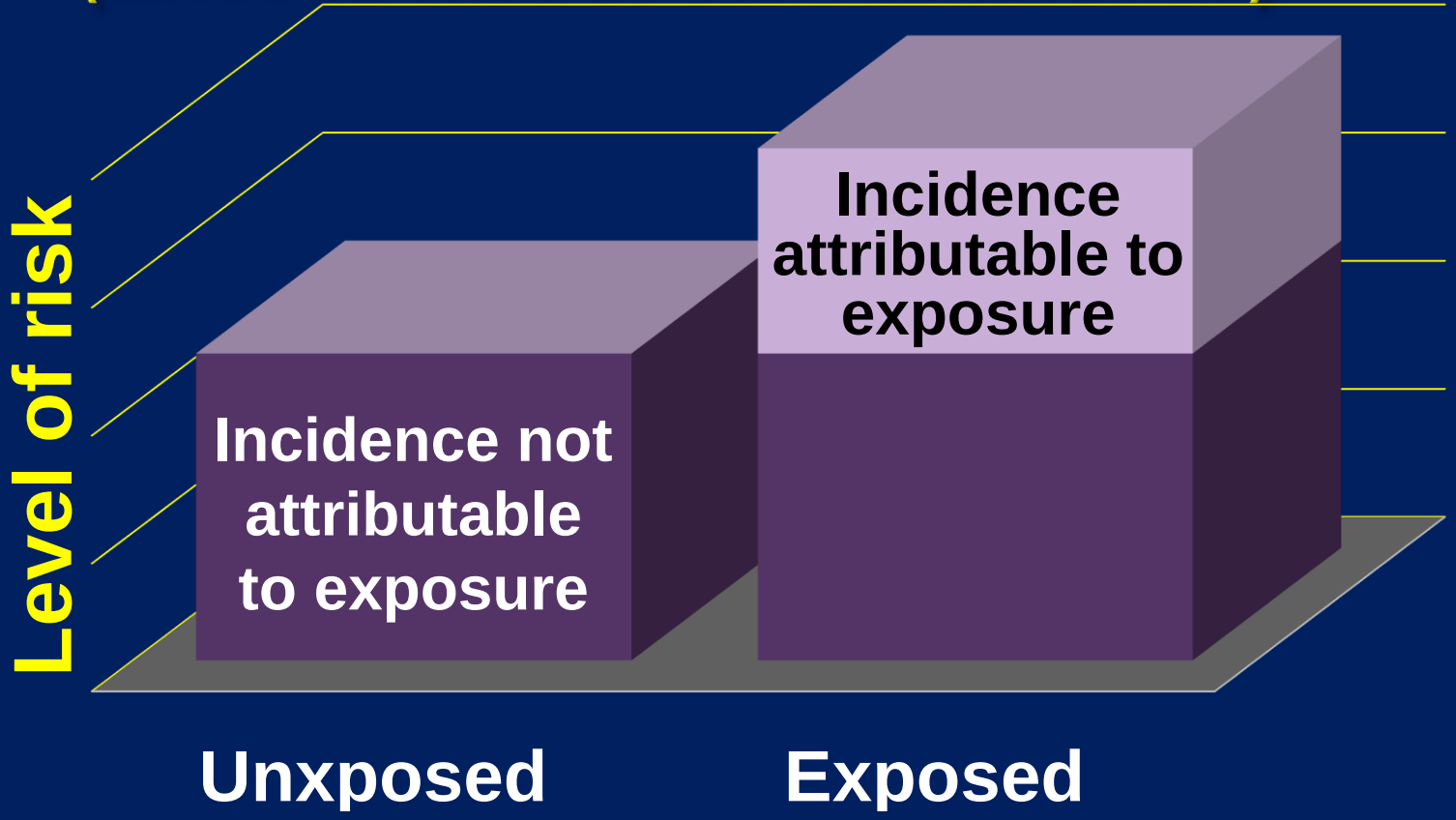
$I_o = 11/10^3$ RR= 28 /11= 2.5

→smokers are 2.5 times more at risk of getting heart disease than non-smokers

# Relative risk

| RR= $I_e$ / $I_o$ | Association with exposure |
|---|---|
| More than One | Positive association (Positive effect of exposure) |
| One | No association (no effect of exposure) |
| Less than one | Negative association (preventive effect of exposure) |

# Attributable risk
## (Excess risk or risk difference)



# Attributable risk

AR = IR exposed – IR non-exposed

$AR = I_e - I_o$

| $AR = I_e - I_o$ | Risk of exposure |
|---|---|
| **Positive** | Exposure increases disease |
| **Zero** | Exposure gives no added disease risk |
| **Negative** | Exposure is protective for disease<br>(Disease prevented by exposure) |

| | Heart dis | Healthy | |
|---|---|---|---|
| Smoker | 84 | 2916 | 3000 |
| Non-smoker | 55 | 4945 | 5000 |

$I_e = 28/10^3$

$I_o = 11/10^3$

$AR = I_e - I_o$

$AR = 28/10^3 - 11/10^3$

$AR = 17/10^3$

➔ $17$ cases/$10^3$ in exposed population is attributed to smoking

# Attributable risk %

Proportion of disease in exposed population that can be prevented if exposure is removed (by application of prevention program)

- **AR% = (AR / IR exposed) %**
- **AR% = (AR / $I_e$ ) x100**
- **AR% = ($I_e$ – $I_o$) / $I_e$ x100**

| | Heart dis | Healthy | |
|---|---|---|---|
| Smoker | 84 | 2916 | 3000 |
| Non-smoker | 55 | 4945 | 5000 |

$I_e = 28/10^3$

$I_o = 11/10^3$

$AR\% = AR / I_e$

$AR\% = (17/10^3) / (28/10^3)$

$AR\% = 60.7\ \%$

➔61% of disease can be prevented by antismoking program

# Odds ratio

In case control study we can't get incidence,

➔ we can not find out RR directly.

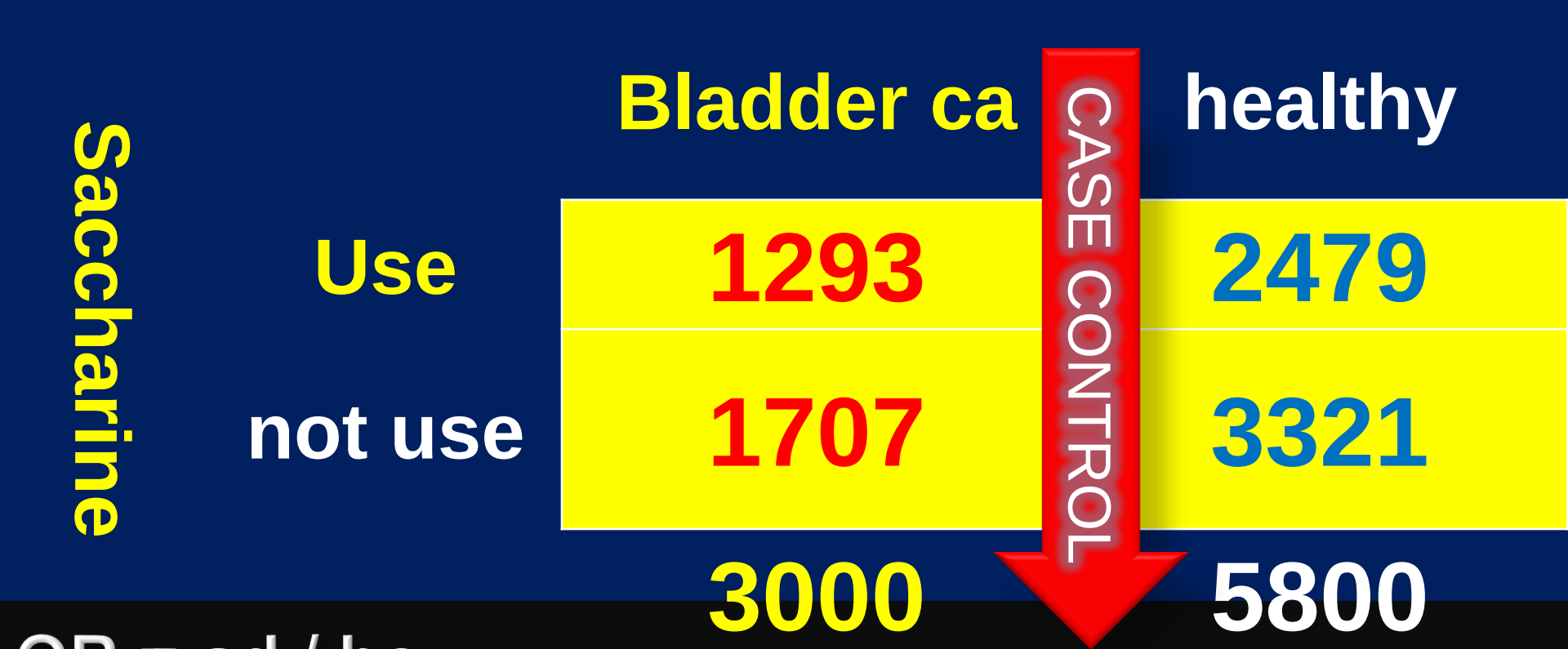
➔ We can measure risk by Odd's Ratio (OR):

**OR= ad / bc**

| | Cases | Control |
|---|---|---|
| Factor present | a | b |
| Factor abscent | c | d |

# Odds ratio

| OR = ad / bc | Exposure risk |
| --- | --- |
| More than One | Exposure increases disease risk (risk factor) |
| One | Particular exposure isn't a risk factor |
| Less than one | Exposure reduces disease risk (protective factor) |




OR = ad / bc

= (1293x3321) / (2479x1707) = 1.0

➔saccharine is not risk factor for bladder ca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