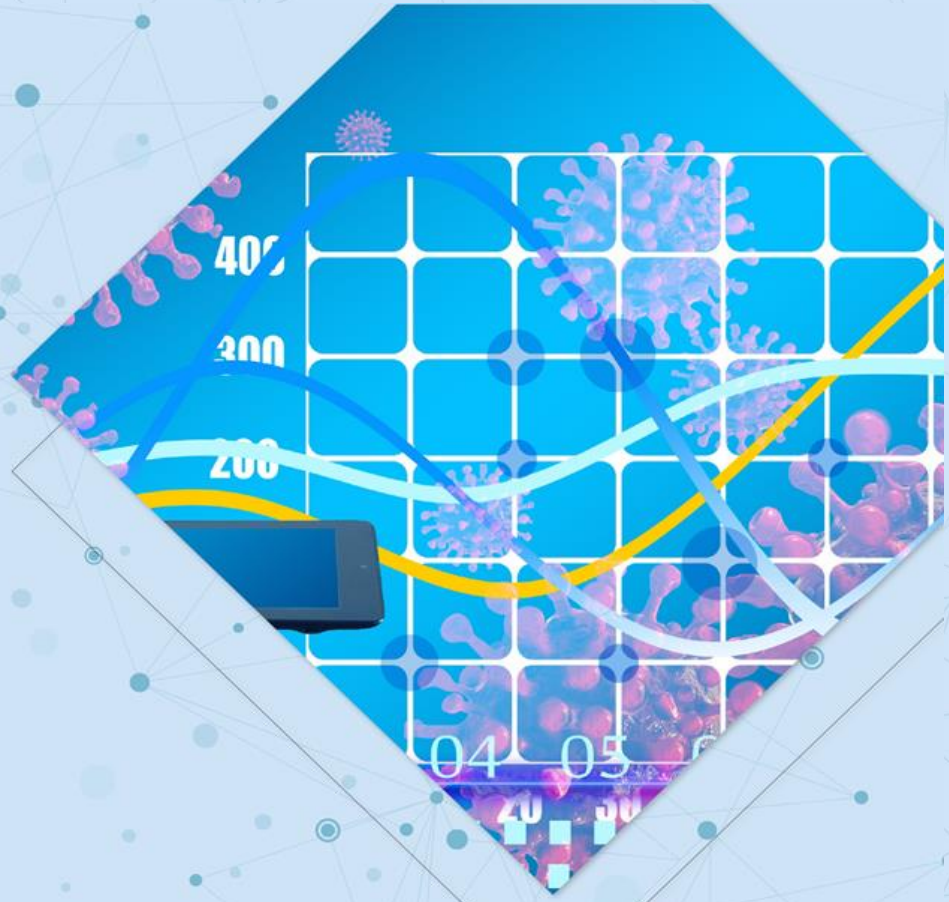
มหาวิทยาลัยราชภัฏนครปฐม
Nakhon Pathom Rajabhat University

CHAPTER 3



Episode 2

Biostatistics

(ชีวสถิติ)

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2.2 Measures of association

The key to epidemiologic analysis is comparison.

A measure of association quantifies the relationship between exposure and disease among the two groups.

Measures of association

The measures of association described in the following section compare disease occurrence among one group with disease occurrence in another group.

- relative risk (risk ratio)
- odds ratio

Relative Risk or Risk Ratio (RR) (ค่าความเสี่ยงสัมพัทธ์)

Relative Risk (RR)

A relative risk (RR), also called risk ratio, compares the risk of a health event (disease, injury, risk factor, or death) among one group with the risk among another group.

The formula for RR is:

$$\text{Relative Risk (RR)} = \frac{Risk\ of\ disease\ (incidence\ proportion, attack\ rate)\ in\ group\ of\ exposed}{Risk\ of\ disease\ (incidence\ proportion, attack\ rate)\ in\ group\ of\ unexposed}$$

Relative Risk or Risk Ratio (RR) (ค่าความเสี่ยงสัมพัทธ์)

Relative Risk or Risk Ratio (RR) Interpretation

- A risk ratio of 1.0 indicates identical risk among the two groups.
- A risk ratio greater than 1.0 indicates an increased risk for the group in the numerator, usually the exposed group.
- A risk ratio less than 1.0 indicates a decreased risk for the exposed group, indicating that perhaps exposure actually protects against disease occurrence.

Source:
https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section2.html

*EXAMPLES: Calculating R*elative Risk (Risk Ratio)

General Format and Notation for a Two-by-Two Table

	Ill (ป่วย)	Well (ไม่ป่วย)	Total
Exposed (ได้รับปัจจัย)	a	b	a + b
Unexposed (ไม่ได้รับปัจจัย)	c	d	c + d
Total	a + c	b + d	N

$$\text{Relative Risk (RR)} = \frac{Risk\ of\ disease\ (incidence\ proportion, attack\ rate)\ in\ group\ of\ exposed}{Risk\ of\ disease\ (incidence\ proportion, attack\ rate)\ in\ group\ of\ unexposed}$$

$Risk\ of\ disease$ among exposed = a / a+b

$Risk\ of\ disease$ among unexposed = c / c+d

Example A: In an outbreak of COVID-19 among community residents in 2022, 28 of 157 older persons who contacted a COVID-19 patient developed COVID-19, compared with 4 of 137 older persons who uncontacted a COVID-19 patient. These data are summarized in the two-by-two table so-called because it has two rows for the exposure and two columns for the outcome. Here is the general format and notation.

	Ill (ป่วย)	Well (ไม่ป่วย)	Total
Exposed (contacted)	28 (a)	129 (b)	157 (a+b)
Unexposed(uncontacted)	4 (c)	133 (d)	137 (c + d)
Total	32 (a + c)	262 (b + d)	294 (N)

For this example:

Risk of COVID-19 among contacted = 28/157 = 0.178 = 17.8%

Risk of COVID-19 among uncontacted = 4/137 = 0.029 = 2.9%

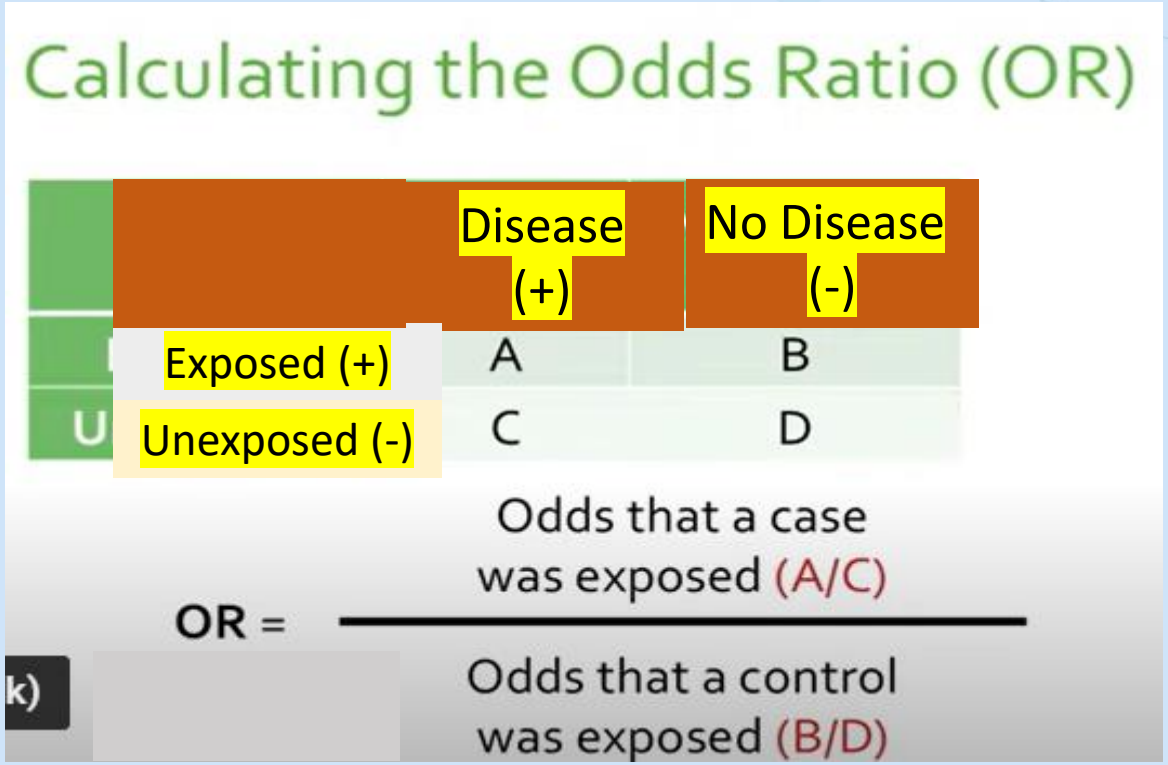
The risk ratio is simply the ratio of these two risks:

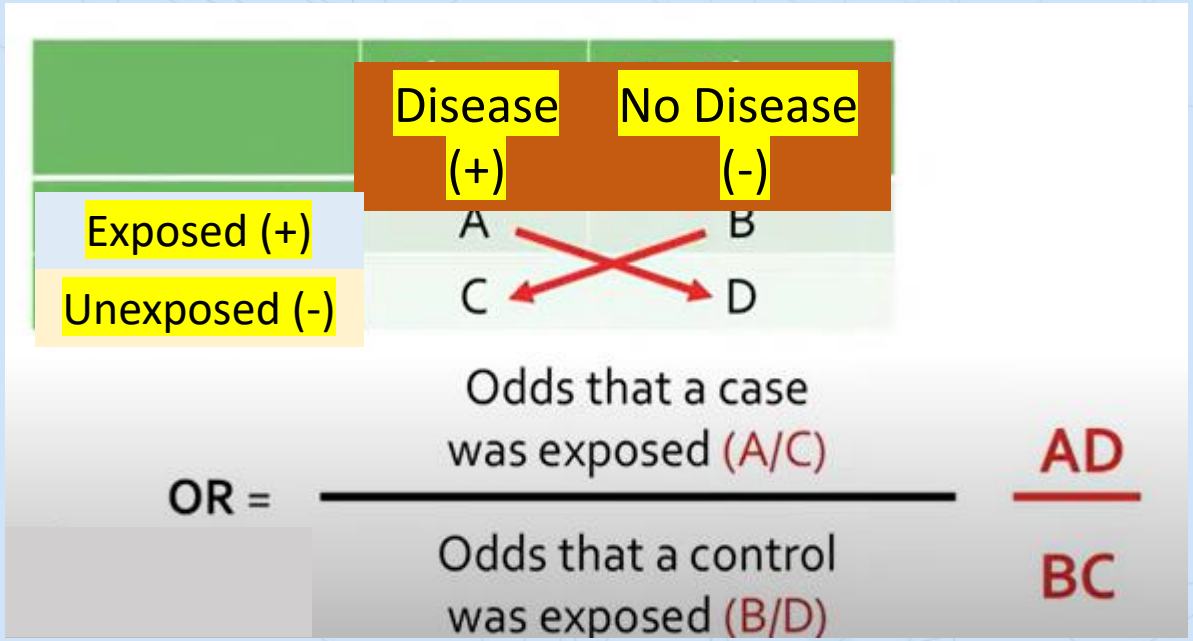
Risk ratio = 17.8/2.9 = 6.1

Thus, older people who contacted a COVID-19 patient were 6.1 times as likely to develop COVID-19 as those who uncontacted a COVID-19 patient.

Odds ratio

- An odds ratio (OR) is another measure of association that quantifies the relationship between exposure with two categories and health outcomes. Referring to the a Two-by-Two Table, the odds ratio is calculated as





$$\text{Risk Ratio} = \frac{\text{Risk (cumulative incidence) in exposed group}}{\text{Risk (cumulative incidence) in unexposed group}}$$

$$\text{Rate Ratio} = \frac{\text{Incidence rate in exposed group}}{\text{Incidence rate in unexposed group}}$$

$$\text{Odds Ratio} = \frac{\text{Odds of disease in exposed group}}{\text{Odds of disease in unexposed group}}$$

Relative Risk or Risk Ratio (RR), Odds ratio (ค่าความเสี่ยงสัมพัทธ์)

Relative Risk or Risk Ratio (RR), Odds ratio Interpretation

- A odds ratio of 1.0 indicates identical risk among the two groups.
- A odds ratio greater than 1.0 indicates an increased risk for the group in the numerator, usually the exposed group.
- A odds ratio less than 1.0 indicates a decreased risk for the exposed group, indicating that perhaps exposure actually protects against disease occurrence.

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2.3 Measures of potential impact

- Attributable Risk (AR),
- Attributable Risk Percent (AR%),

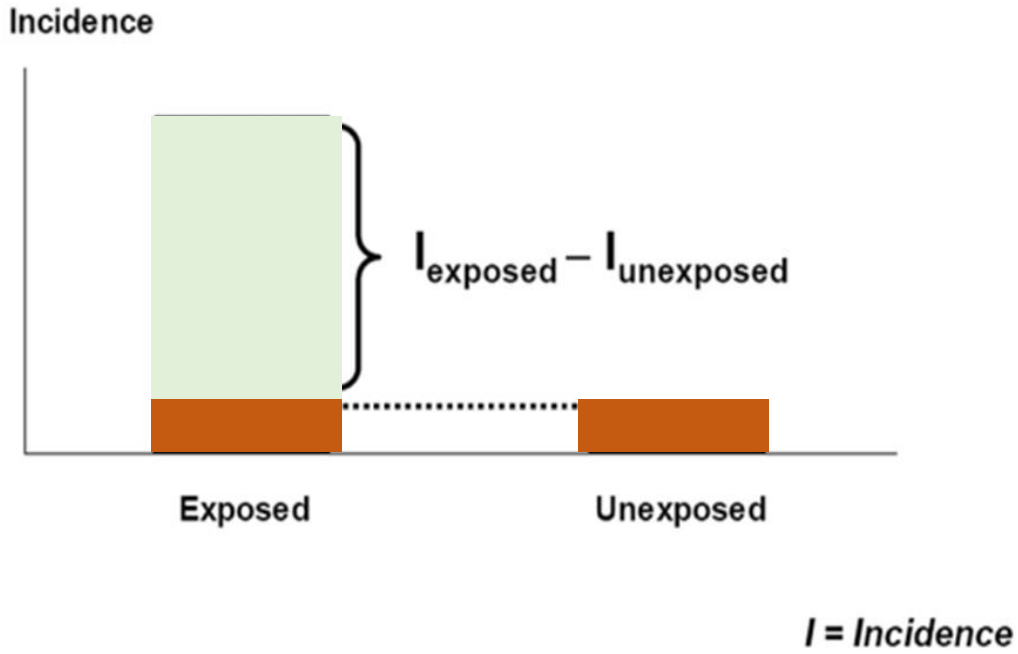
- Population Attributable Risk (PAR),
- Population Attributable Risk Percent (PAR%)

Attributable risk (AR)

- The proportion of the incidence of a disease in the exposed that is due to the exposure

$$AR = I_{exposed} - I_{unexposed}$$

- It is the incidence of a disease in the exposed that would be eliminated if exposure were eliminated



Source:
https://www.rama.mahidol.ac.th/ceb/sites/default/files/public/pdf/ACADEMIC/2016/race612/Handout_Measurement%20in%20Epidemiology2016.pdf

Measures of Public Health Impact (การวัดผลกระทบที่เกิดขึ้นกับชุมชน)

2. Attributable risk percent (AR%) / Attributable fraction

$$AR\% = \frac{I_{exposed} - I_{Unexposed}}{I_{exposed}} \times 100$$

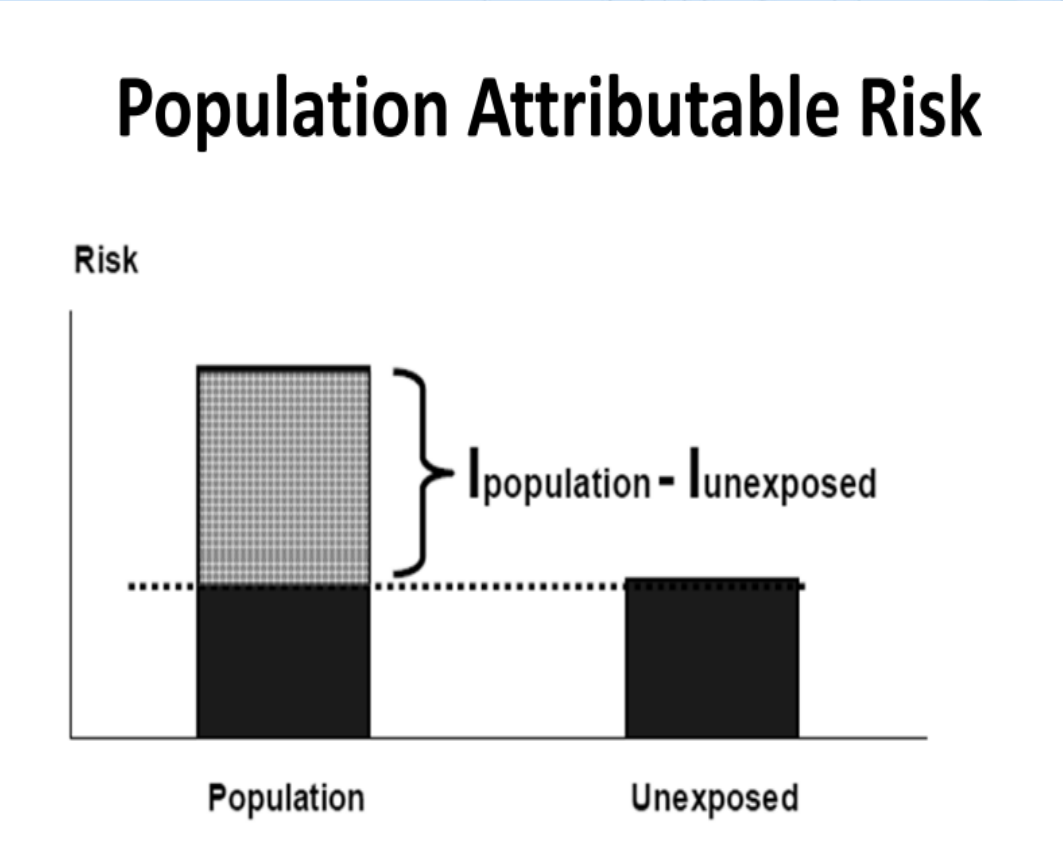
For example, Breast cancer has many causes, including smoking cigarettes and exposure to the hormone Estrogen. One study showed that the AR% for cigarette smoking and breast cancer was 65%.

คือ การคาดคะเนร้อยละของอุบัติการของโรคในกลุ่มสัมผัสสิ่งที่คาดว่าก่อโรค

Source:
https://www.rama.mahidol.ac.th/ceb/sites/default/files/public/pdf/ACADEMIC/2016/race612/Handout_Measurement%20in%20Epidemiology2016.pdf

3. Population Attributable Risk (PAR)

3.



Source:
https://www.rama.mahidol.ac.th/ceb/sites/default/files/public/pdf/ACADEMIC/2016/race612/Handout_Measurement%20in%20Epidemiology2016.pdf

4.

Population Attributable Risk Percent (PAR%)

$$PAR\% = \frac{I_{population} - I_{unexposed}}{I_{population}} \times 100$$

Summary

The epidemiological measurements

- 2.1 Measures of disease frequency
  - Prevalence
  - Incidence
- 2.2 Measures of association
  - RR
  - Risk ratio
  - Odd ratio
- 2.3 Measures of potential impact
  - *Impact of exposure removal on exposed*
    - *AR*
    - *AR%*
  - *Impact of exposure removal on population*
    - *PAR*
    - *PAR%*

Thank you

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