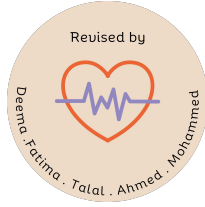# Confounding & effect modification

Tutorial No. 5

Objectives:

~ This lecture was presented by **Dr. Nour Horanieh**
~ It is included in the **Midterm Exam**
~ We highly recommended reading the **Ayah** in the first page

Slides

Color code

Original text
Dr. Notes
Important
Golden note 🎁
Extra

Editing file

Relative Risk (RR)

Contingency (or 2 X 2) Table

	Cases	Controls	Total
Exposed	a	b	a+b
Unexposed	c	d	c+d
Total	a+c	b+d	a+b+c+d

سُورَةُ النَّحْلِ

وَإِنَّ لَكُمْ فِى ٱلْأَنْعَٰمِ لَعِبْرَةً ۖ نُّسْقِيكُم مِّمَّا فِى بُطُونِهِۦ مِنۢ بَيْنِ فَرْثٍ وَدَمٍ لَّبَنًا خَالِصًا سَآئِغًا لِّلشَّٰرِبِينَ ﴿٦٦﴾

المختصر في التفسير

وإن لكم - أيها الناس - في الإبل والبقر والغنم **لعظة** تتعظون بها، حيث نسقيكم من ضروعها لبنًا خارجًا من بين ما يحتويه البطن من **فضلات** وما في الجسم من دم، ومع هذا يخرج لبنًا خالصًا نقيًّا **لذيذًا** يطيب للشاربين.

$$RR = IE/IU = [a/(a+b)] / [c/(c+d)]$$

Incidence rate

$$\text{Incidence among exposed} = \frac{a}{a+b}$$

$$\text{Incidence among non-exposed} = \frac{c}{c+d}$$

Estimation of risk

Relative Risk:

$$RR = \frac{\text{Incidence of disease among exposed}}{\text{Incidence of disease among non-exposed}}$$

$$= \frac{a/a+b}{c/c+d}$$

Odds Ratio (OR)

Contingency (or 2 X 2) Table

	Cases	Controls	Total
Exposed	a	b	a+b
Unexposed	c	d	c+d
Total	a+c	b+d	a+b+c+d

$$OR = \frac{\text{Odds that case was exposed (A/C)}}{\text{Odds that a control was exposed (B/D)}} = \frac{AD}{BC}$$

احفظوها على كلمة ادبس

Confounding

Confounding is a situation in which a measure of the effect of an exposure is distorted because of the association of exposure with other factor or factors that influence the outcome of interest.

Coffee (Exposure) → **Pancreatic Cancer (Disease)**
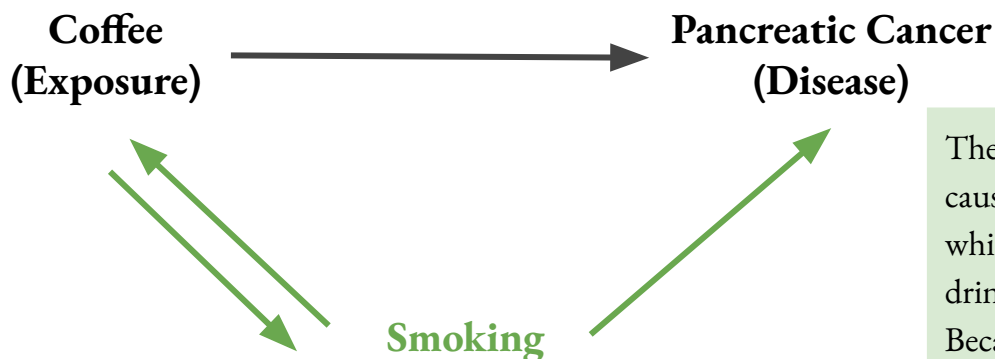
Smoking

There might be a factor that's causing pancreatic cancer which exists among those who drink coffee, which is smoking. Because smokers usually drink coffee when they smoke. Smoking is a confounder because it can cause pancreatic cancer and also it is associated with those who drinks coffee .

Example

3

	CHD (Yes)	CHD (No)	Total
Bald	775	9,225	10,000
Hairy	190	9,810	10,000
	965	19,035	20,000

RR = (775/10,000)/(190/10,000) = **4.08**

So the risk of CHD in bald men is 4.08 times more than in hairy men.

Is it real association or due to confounder?

It is due to a confounder. (Bald men are older, we have to consider the age)

> CHD is Coronary heart diseases

Stratify data and study the effect of age between old and young subjects:

Older subjects (aged greater than 65 years)				RR in the older men:
	CHD (Yes)	CHD (No)		(750/7,500)/(100/1,000)= 1
Bald	750	6750	7500	RR = 1 (No risk and no association)
Hairy	100	900	1000	
	850	7650	8500	

Younger subjects (aged between 40 and 64 years)				RR in the younger men:
	CHD (Yes)	CHD (No)		
Bald	25	2475	2500	(25/2,500)/(90/9,000) = 1
Hairy	90	8910	9000	RR = 1 (No risk and no association)
	115	11385	11500	

RR before stratification (It is the **crude** which means: Before we see who is old and who is young)	**4.08**
RR among older subjects (Stratified)	**1**
RR among younger subjects (Stratified)	**1**

> The stratified values are equal and are different from the crude (4.08). Then it is a confounder. Less than 1 is protective

Thus age is a **confounder** in this study.

This study was carried out in 9400 patients among people aged 60 and above. Records of patients with and without bed sores were examined for outcome.

Calculate the risk and determine whether medical severity (high & low) is a confounder?

	Died (Yes)	Died (No)	
Bed sores (Yes)	79	745	824
Bed sores (No)	286	8290	8576
	365	9035	9400

Answer:

RR = a/(a+b)/c/(c+d) = (79/824)/286/8576 = **2.9** (Crude relative risk)

Thus the probability of death was 2.9 times high in people with bedsores

Risk of bed sores and death in **high** medical severity group

	Died (Yes)	Died (No)	Total
Bed sores (Yes)	55	51	106
Bed sores (No)	5	5	10
	60	56	116

Answer:

RR = Relative risk = A/ (A+B) / C/(C+D)

= (55/106) / (5/10) = **1.04** (RR in **high** medical severity)

Bedsores and death in low medical severity group

	Died (Yes)	Died (No)	Total
Bed sores (Yes)	24	694	718
Bed sores (No)	281	8285	8566
	305	8979	9284

Answer:

RR = Relative risk = A/ (A+B)/C/(C+D)

= (24/718)/ (281/8566) = **1.02** (RR in **low** medical severity)

RR before stratification (Crude)	2.9
RR among high medical severity (Stratified)	1.04 almost 1
RR among low medical severity (Stratified)	1.02 almost 1

Hence we conclude that (medical severity) is a **confounding** variable.

These two (stratified values) are almost 1 which means that there are equal and are different from the crude (2.9).
So this factor is a confounder.
The stratified values are almost equal and are different from the crude so there is a confounder.

Example:
Crude is 6 (Before the stratification)
Stratified is 3
Stratified is 3
So the stratified values are equal and are different from the crude, then it is a confounder.

Another example:
Crude is 2
Stratified is 2
Stratified is 2
All of them are equal so it is NOT a confounder

In a case control study discussing diabetes, CHD and age.
Draw the diagram showing causal association between the variables. With the given data, determine, whether age <40 & ≥ 40 is a confounder ?

Diabetes
(Risk factor A)

CHD
(Disease B)

Age
(X is a confounder here)
Age can be a confounder
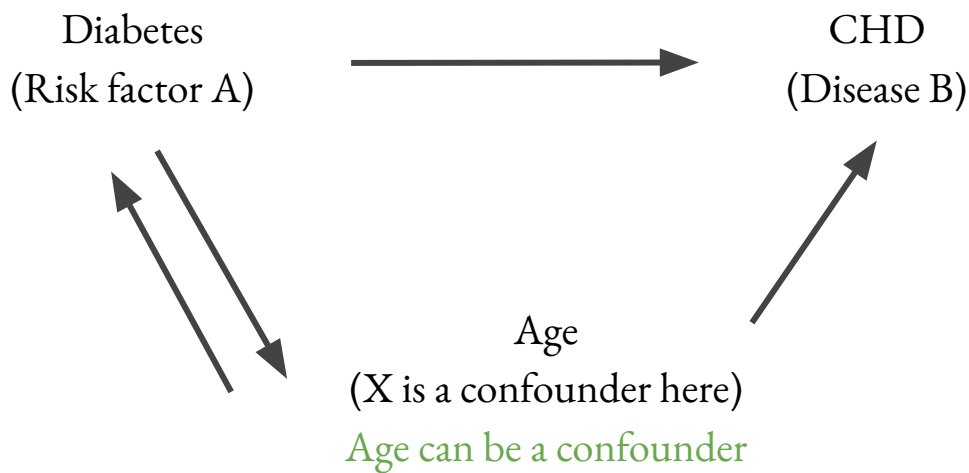
Diabetes Exposure	CHD (Yes) Outcome	CHD (No)
Yes	30	18
No	70	82
	100	100

Answer:

OR = 30* 82/70 *18 = **1.95** (This is the crude odds ratio)

People with diabetes have 1.95 times **higher** risk of CHD than people without diabetes.

Exercise 2, *cont.*

Age	Exposed	Cases Yes	Cases (No)	OR
< 40	Yes	5	8	1.0
	No	45	72	
≥40	Yes	25	10	1.0
	No	25	10	

OR before stratification	**1.95**
OR among older subjects	1
OR among younger subjects	1

Thus, age is a **confounder** in this study.

Those are equal and are different from the crude (1.95). Then it is a confounder

القادة :

نواف التركي

عبدالله الشهري   ريان الغنامي

وهي المتحمي

الأعضاء:

عبدالله التركي   عبدالله الصياح   رغد النظيف

محمد الزير   عبدالله النجرس   ديما الجريبة

عثمان الدريهم   تركي العتيبي   شهد البخاري

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ناصر الغيث   عامر الغامدي   أثير الأحمري

سعد السهلي   سعد الأحمري   وعد ابو نخاع

رائد الماضي   معاذ آل صلام   ثراء الهويش

سعود الشعلان   محمد الحصيني   في الدوسري

منار الزهراني

شذى الشباني

شكر خاص لتاله شاهين على الملاحظات