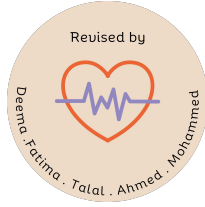


Research  
442



# Confounding & effect modification

Lecture No. 16

## Objectives: **(Important)**

~ No objectives were found as the doctor didn't send the slides, she said that we don't need to study the slides but she gave us some notes that I wrote them down in this file.

~ I took all of the notes from Tala Shaheen's file, she wrote them in Arabic. If you want to study her notes, please click on the attached file that is above the color index.

~ Huge thanks to **Tala Shaheen!**

~ This lecture was presented by **Dr. Leena Baghdadi**

~ It is included in the **Midterm Exam**

~ We highly recommend you to read the **Ayah** in the first page

## Talas' file

### Color code

Original text

Dr. Notes

Important

Golden note 🎁

Extra

## Editing file

## Questions

1- What is **Confounding**?

- A third factor that **affects** the exposure and the outcome.

2- The Relative Risk between smoking and lung cancer is **2.1**

**What is the interpretation?**

- Those who smoke have 2.1 higher risk in developing lung cancer than non-smoker. (Relative risk contributes to the calculations related to the confounding)

**Note: Confounder should be related to both the exposure and the outcome** (Confounder can't be related to the exposure only or the outcome only).

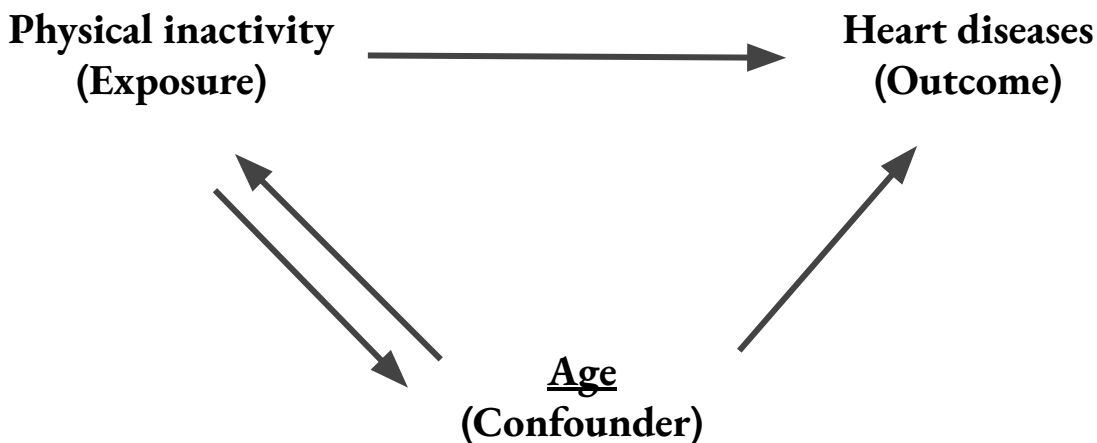
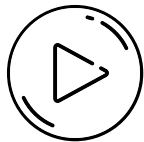
سُورَةُ الرَّحْمٰنِ

أَوْلَمْ يَرَوْا أَنَّا نَأْتِي الْأَرْضَ نَنْقُصُهَا  
مِنْ أَطْرَافِهَا وَاللَّهُ بَخِشٌ لَّامَعْتَبٍ لِحُكْمِهِ وَهُوَ سَرِيعُ  
الْحِسَابِ

المختصر في التفسير

أولم يشاهد هؤلاء الكفار أنا نأتي أرض الكفر نناقصها من أطرافها بنشر الإسلام، وفتح المسلمين لها، والله يحكم ويقضي بما يشاء بين عباده، ولا أحد يتعقب حكمه بنقض أو تغيير أو تبديل، وهو سبحانه سريع الحساب، يحاسب الأولين والآخرين في يوم واحد.

## Example 1

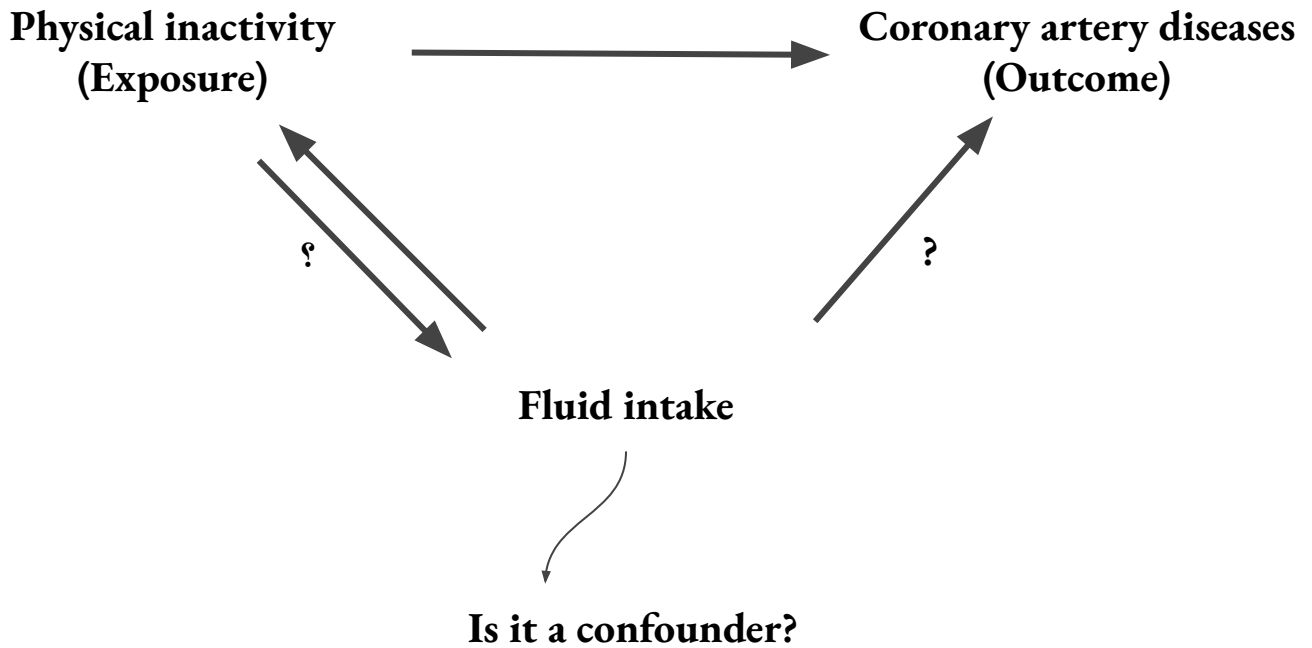
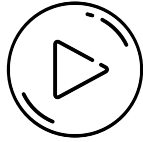


**Interpretation:**

**We can understand from this example the following:**

1. People who are physically inactive are **elderly** (related to the exposure).
2. **Age** is a risk factor of heart diseases because of the physiological changes that come with aging (due to arterial stiffness; Related to the outcome)

## Example 2



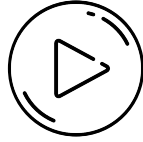
**Is it a confounder?**

**No**, because fluid intake related to physical activity but it is not related to coronary artery diseases.

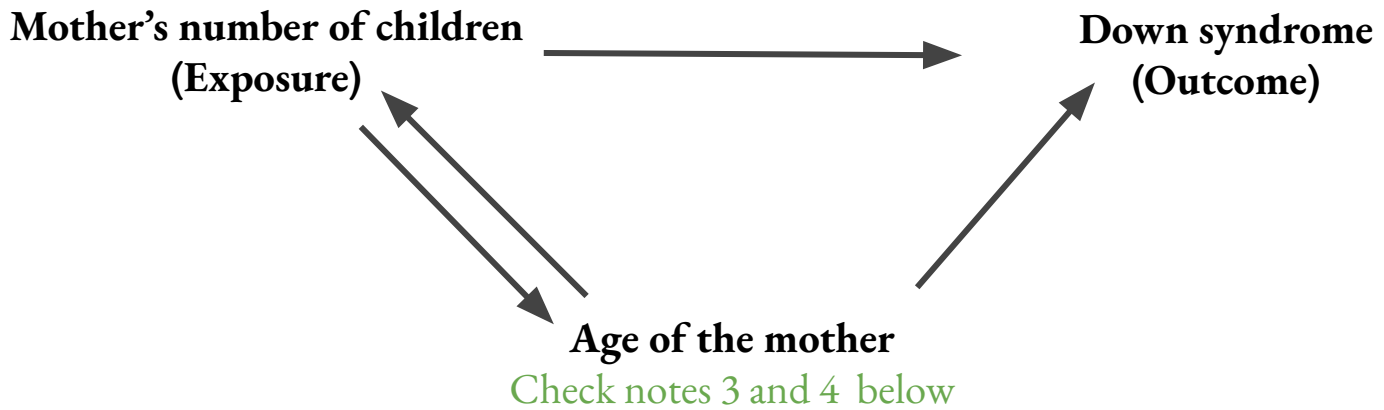
As when someone is more physically active, he/she will drink more fluids and if they are inactive, they will drink less fluids. But **fluid intake is not related to coronary artery diseases.**

Doctor said that it is important to understand these examples.

## Example 3



Check notes 1 and 2 below



1- Doctors before thought that a mother who has a lot of children has more chance to have a baby with down syndrome

Increasing the number of pregnancies → increasing the chance of having a baby with down syndrome  
(They said that women who have **five or more** children have a higher risk of 1.6 of having babies with down)

2- Then they the did the stratification which means that they divide the mothers into groups based on the differences such as the age. They noticed that mothers who are older have the chance of having babies with down syndrome. So they found that age is a confounder (The mothers' age is related of having babies born with down syndrome)

3- Actually, when mothers are having more and more babies that means that they are getting older and older. So that is why they thought that mothers who have lots of children have higher risk of having babies born with down syndrome.  
Ex: a mother who has lots of children that means that she is probably old.

Being pregnant at old age is associated with having a baby with down syndrome NOT the number of children

4- Age of the mother is a confounder because the more the children, the older the mother will be. So it is the age of the mother that is really associated with having a baby with down syndrome and not the number of children.

يعني باختصار هم ظنوا من زمان ان كل ما حملت الام وجابت اطفال اكثر يعني راح احتمالية انها تجيب طفل فيه متلازمة داون عالية. ربطوا عدد الاطفال اللي تجيبهم الام بزيادة احتمالية ان الام تجيب داون. وهذا كلام خطأ، الصحيح ان الام اذا حملت وهي كبيرة بالسن زادت فرصة انها تجيب طفل داون

في السابق: زيادة عدد الاطفال اللي تجيبهم الام تؤدي الى زيادة احتمالية انجاب طفل داون الان: تأخر عمر الام في الحمل تؤدي الى زيادة احتمالية انجاب طفل داون

مثلا لو حملت وهي عمرها ٥٠ ولو افترضنا ان هذا اول حمل لها فاحتمالية انها تجيب داون عالية لانها كبيرة بالسن. اجل ليش من زمان ظنوا ان الام اللي تجيب ١٠ اطفال احتمال انها تجيب داون؟ لان طبيعي اذا جابت ١٠ اطفال ماراح تكون صغيرة بالعمر اكيد الطفل رقم ١١ بتكون الام كبيرة بالسن.

## Very important slide related to the previous example

- Based on this analysis one can conclude that the association between birth order and Down syndrome was **confounded by age**.
- The different **birth order groups** had different age distributions, and **maternal age** is clearly associated with prevalence of Down syndrome.
- As a result, the apparent association between birth order and Down syndrome that was seen in the first figure **was completely due to the confounding effect of age**.
- On the other hand, the association between maternal age and Down syndrome was **NOT** confounded by birth order, because birth order has **no** impact on the prevalence of Down syndrome, and the association between age and Down was not distorted by differences in birth order.

### Example 4 (Liner)



**Alcohol consumption** → **High HDL** → **Heart diseases**



Is there a **confounder**?

- Yes, there is. It is the alcohol consumption.

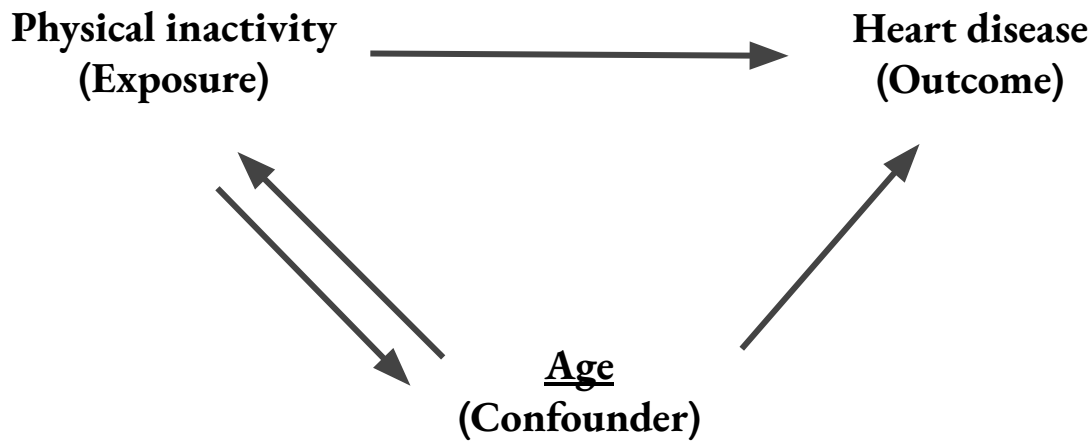
Alcohol consumption can increase the HDL and also it can cause heart diseases. Alcohol consumption can cause heart diseases **alone** without the need to increase the levels of HDL because drinking alcohol in large amounts can affect (damages) the heart. So Alcohol consumption is a confounder.

Notes:

- 1- A little amount of alcohol can be protective to the heart.
- 2- High HDL levels decreases the risk of heart diseases.
- 3- Drinking large amounts of alcohol can cause heart diseases.

So what do we understand from this example?

We should know that the confounder (Alcohol consumption) is associated with **both** High HDL and Heart diseases. Not only one of them.



**How can the stratification be done?**

**Stratification means** (تجزئة العلاقات وبعد التجزئة يجب دراسة كل تجزئة لوحدها)

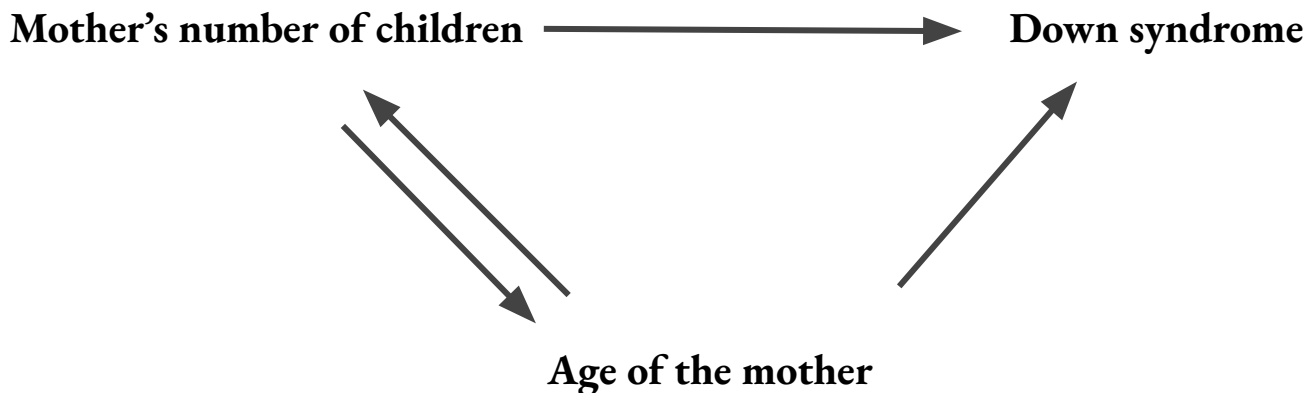
Such as in the example above, with stratification you study:

1. You study the relationship between the **physical inactivity** and **heart diseases** (You study these two together and alone)
2. Then you study the relationship between the **age** and **heart disease** (You study these two together and alone). **Then you compare.**

In simple words: you study the **exposure** with **outcome alone** then you study the **confounder** with **outcome alone** then you compare.

Note: you study the relationships by using the **relative risk** and **odds ratio** (more than 1 is higher risk/odds, less than 1 is protective, equal to 1 means that there is no relation. Discussed more in the tutorial lecture)

## Example 6



**How can the stratification be done?**

With stratification you study the relationship between the **Mother's number of children** and **Down syndrome**.

Then you study the relationship between the **Age of the mother** and **Down syndrome**.

## General notes

### How can we control the confounders?

1. **Multiple regression analysis:** Multiple = you have multiple factors which are the **confounders**. Regression = (linear) you study the relationship between the outcome and the exposure but you consider the confounder.
2. **Stratification (Stratified analysis)**

Confounder is a third factor that is associated with the exposure and the outcome which gives us **inaccurate results** (If it is not controlled).

### Inaccurate results:

1. May cause **no effect** between the exposure and the outcome.
2. Or it can cause an effect such as **hyperinflation or over estimation** (The results are higher than what we expected).
3. Or **underestimation** (There is a relation but we didn't find it because of the underestimation).

**Effects of modification:** Doctor said that we are not supposed to study it but just only for our knowledge please know the following:

What should we do if we have a **confounder** and we couldn't control it?

- We have to do the **effect modification!**

## Restriction

Doctor said that **restriction** is above our level and we only have to know that it has **matching and randomization of clinical trials**.

## Importance of **sociodemographic factors**

### Example of the importance of **sociodemographic factors**:

You are studying polycystic ovary syndrome, what are the **risk factors**?

- Insulin resistance, overweight, hormonal balance, etc.. You should put these factors in your mind when you're doing the **analysis**. Because it could be related to the age, marital status, having children or not, or any physiological changes. You should always put in your mind the **sociodemographic factors** such as age, gender, education, etc.. Because age, gender, education, and income are **confounders** (All of these factors are confounders)

### Exam question example:

How can we control the confounders?

- By **multiple regression analysis and Stratification**



القارة: نواف التركي  
عبدالله الشهري وهي المتحمي

ريان الفنامي

### الأعضاء:

|                    |                 |
|--------------------|-----------------|
| عبدالله التركي     | عبدالله المياح  |
| محمد الزبير        | عبدالله النجريس |
| عثمان الدريهم      | تركي العتيبي    |
| عبدالعزیز القحطاني | عبدالله القرني  |
| ناصر الفيت         | عامر الفامدي    |
| سعد السهائي        | سعد الاحمري     |
| رائد الماضي        | معاذ آل سلام    |
| سعود الشعلان       | محمد الحصيني    |
|                    | رغد النظيف      |
|                    | ريمها الجريية   |
|                    | شهد البخاري     |
|                    | نوف الضلعان     |
|                    | أمير الاحمري    |
|                    | وعد ابونخاع     |
|                    | براء الهويش     |
|                    | في الروسي       |
|                    | نار الزهراني    |
|                    | سدى السباني     |

شكر خاص لتأله شاهين على الملاحظات