Lesson 11: Study design

Victoria Blanes-Vidal
Manuella Lech Cantuaria
The Maersk Mc-Kinney Møller Institute
Applied AI and Data Science

Lesson	Week	Date	TOPICS	Teacher
1	35	1/Sep	Introduction to the course Descriptive statistics –Part I	MLC
2	36	8/sep	Descriptive statistics –Part II	MLC
3	37	15/Sep	Probability distributions	MLC
4	38	22/Sep	Hypothesis testing (one sample)	VBV
5	39	29/Sep	Hypothesis testing (two samples)	VBV
6	40	6/Oct	ANOVA one-way	VBV
7	41	13/Oct	R class (Introduction to R and descriptive statistics) Point giving activity	MLC
-	42	20/Oct	NO CLASS (Autum holidays)	
8	43	27/Oct	R class (hypothesis testing + ANOVA)	MLC
9	44	3/Nov	ANOVA two-way	VBV
-	45	10/Nov	NO CLASS	
10	46	17/Nov	Simple regression analysis	VBV
11	47	24/Nov	Study design Point giving activity	VBV+MLC
12	48	1/Dec	Multiple regression analysis and questions	MLC

VBV = Victoria Blanes-Vidal
MLC = Manuella Lech Cantuaria

Lesson 11

1. **What is a study design?**

2. Types of studies

3. Is this a good study design: In-class activities

Study design

- When we perform a research study, one of our main concerns is whether the data was obtained in a correct manner.

- To ensure that, the study should be organized properly in order that the right type of data is available to answer the questions of interest.

- Also, a special attention should be given to the identification and minimization of sources of **errors**.

- This process is called **study design**.

Study design: Process of planning experiments/data collection so that appropriate data can be analyzed by statistical methods that results in valid, objective, and meaningful conclusions from the data.

Lesson 11

1. **What is a study design?**

2. **Types of studies**

3. **Is this a good study design?: In-class activities**

- There are two main types of studies:

EXPERIMENTAL STUDY

The investigator:

1. Controls the input variables.
2. Observes and identifies the reasons for changes in the output variable.

OBSERVATIONAL STUDY

The investigator:

1. Does NOT control the input variables.
2. Observes and identifies the natural relationships between input variables and output variable.

EXPERIMENTAL STUDY

The investigator:

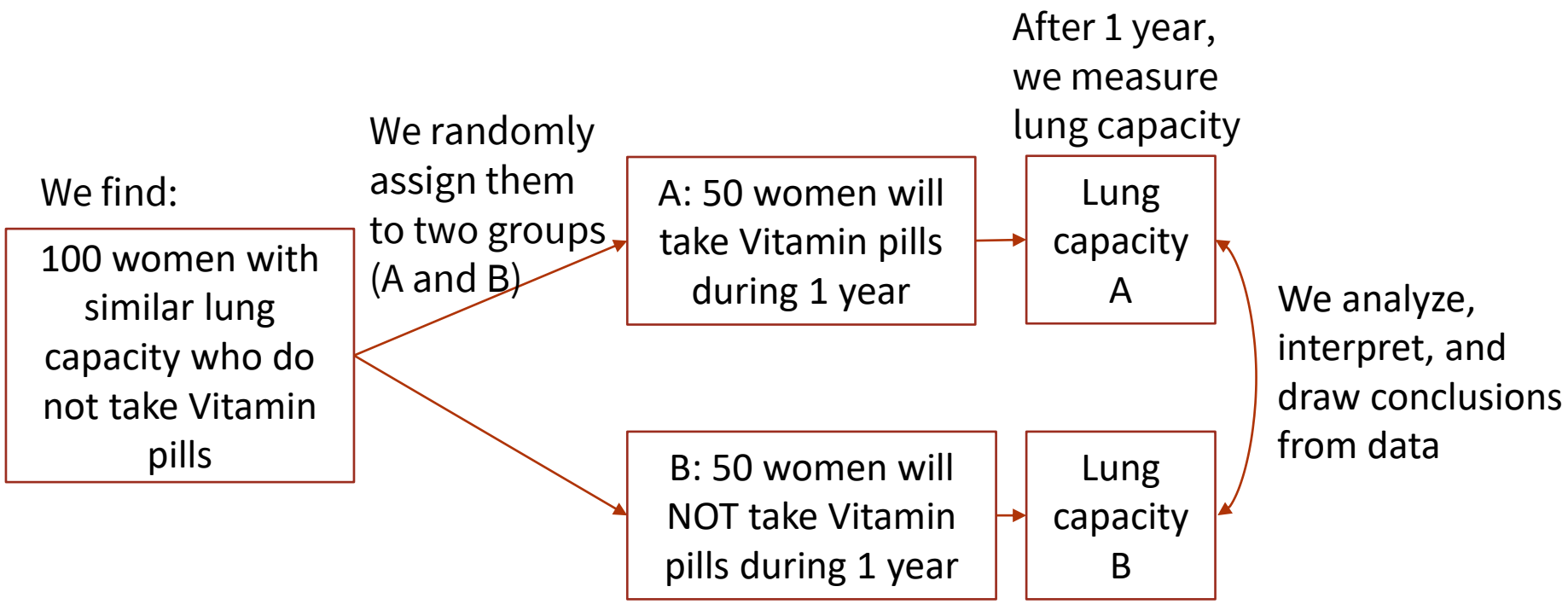
1. Controls the input variables.
2. Observes and identifies the reasons for changes in the output variable.

OBSERVATIONAL STUDY

The investigator:

1. Does NOT control the input variables.
2. Observes and identifies the natural relationships between input variables and output variable.

Suppose we want to study the effect of Vitamin pills on lung capacity in women:



This is an <u>experimental study</u>, because we make a active change (take vitamin pills) in some of the participants: We control the input variable (Vitamin pills).

EXPERIMENTAL STUDY

The investigator:

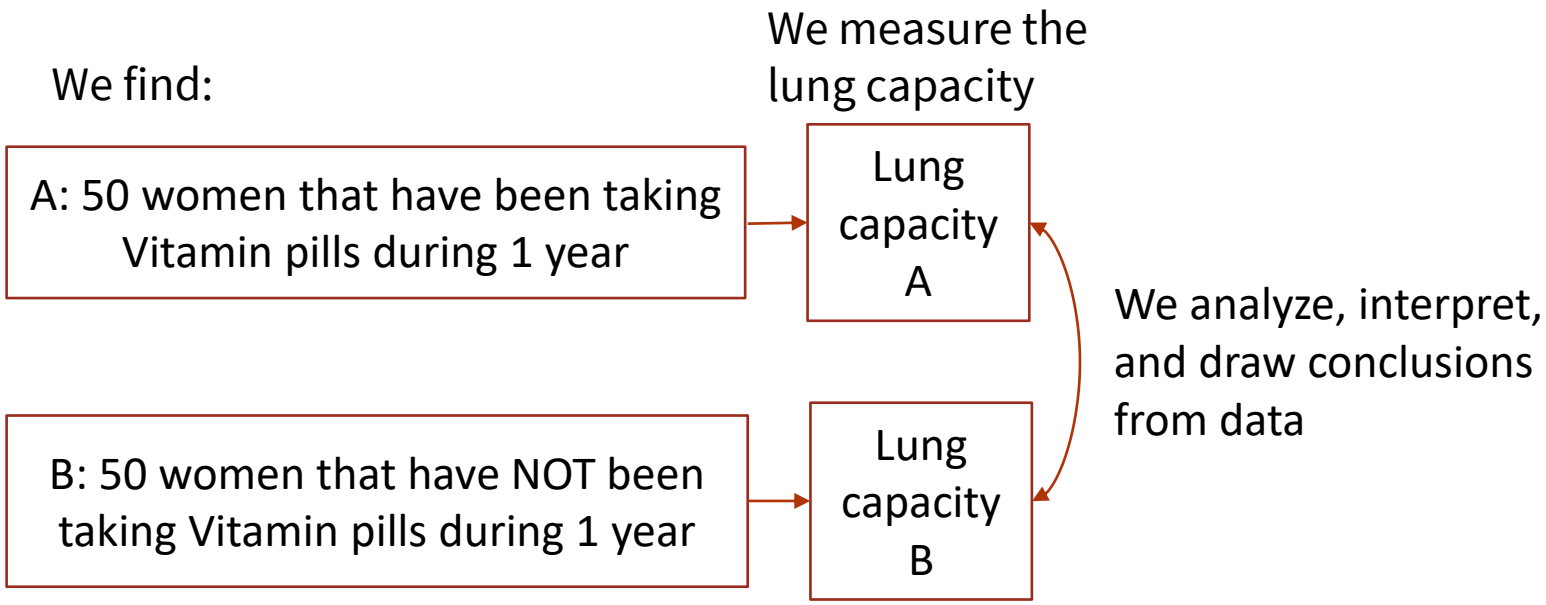
1. Controls the input variables.
2. Observes and identifies the reasons for changes in the output variable.

OBSERVATIONAL STUDY

The investigator:

1. Does NOT control the input variables.
2. Observes and identifies the natural relationships between input variables and output variable.

Suppose we want to study the effect of Vitamin pills on lung capacity in women:



This is an <u>observational study</u>, because we do NOT make a active change in the participants: We do NOT control the input variable (Vitamin pills). We just select people that differ in that input variable.

Lesson 11

1. **What is an study design?**

2. **Types of studies**

3. **Is this a good study design?: In-class activities**

Example 1:

We want to estimate how much money Danish citizens have spent in vacations this year.

We randomly select 5000 residents of Frederiksberg and ask them (in a survey), how much money they spent in vacations this year.

Is this a good study design?

Example 2:

We want to study whether taking a specific medication has an effect on a certain disease.
We know that the medication may work differently in males and in females.
We design the following study:

- We select 12 subjects (6 males and 6 females) with the disease.
- We form two groups: Group 1 (which includes the 6 males) and Group 2 (which includes the 6 females).
- We give the medication to Group 1, and we do not give the medication to Group 2.
- We evaluate the disease in the 12 subjects and compare the results between the two groups.

Is this a good study design?

Example 3:

You want to find out which brand of running shoes is more popular among amateur marathon runners in Denmark (Brand 1 or Brand 2).

You talk to 2 friends of yours, who is are amateur runners, and ask them which shoes do they use. Both of them use Brand 1.

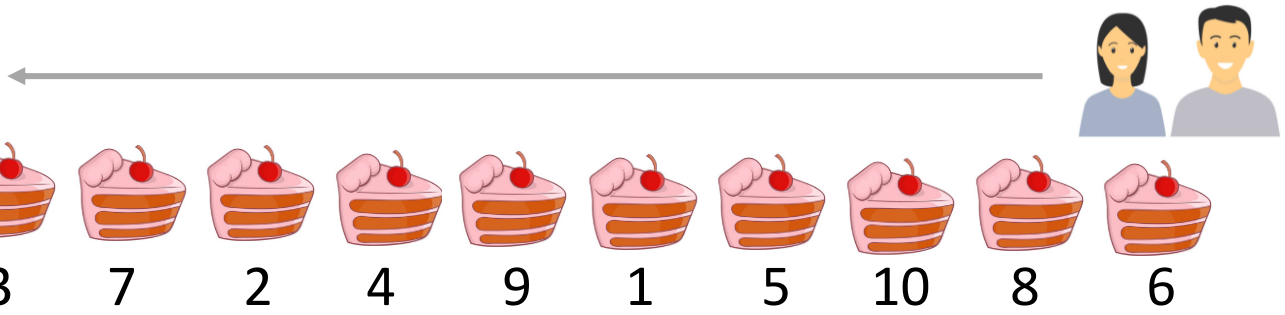
You conclude that Brand 1 is more popular than Brand 2. In fact, you conclude that 100% of the amateur marathon runners in Denmark, use Brand 1.

Is this a good study design?

Example 4: Den store bagedyst (The Great British Bake Off)

There are 10 contestants and 2 judges.
Each contestant prepares a cake.

The 10 cakes are randomly placed on the table, so that the judges cannot see which contestant baked each cake.



The two judges start tasting the cakes, one by one, from right to left.

The judges then choose a "Star Baker" for the week, and a contestant is also eliminated.

Is this a good study design?