

# Introduction to Statistics I

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## Previous Lecture

- ◆ Simple Random Sampling (SRS)
- ◆ Sampling Variability
- ◆ Want **Unbiased/Consistent** sampling method



## Topic 5: Designing Experiments



### How do we gather evidence to support a claim?

Suppose you're serious about becoming a better basketball player.  
Your friend tells you that strength shoes have improved their jumping.

Should you spend \$180 on these shoes?



Strength Shoe

**Anecdotal Evidence:** type of evidence based on personal experiences or accounts.

Anecdotal evidence can help start a scientific inquiry, but can't be used to answer it.

**RQ:** Does wearing strength shoes improve jumping ability?

We take SRS of students. Ask each whether they wear strength shoes and test how high they can jump.



Two vars:

Do they wear strength shoes?    How high can they jump?

### Study Design

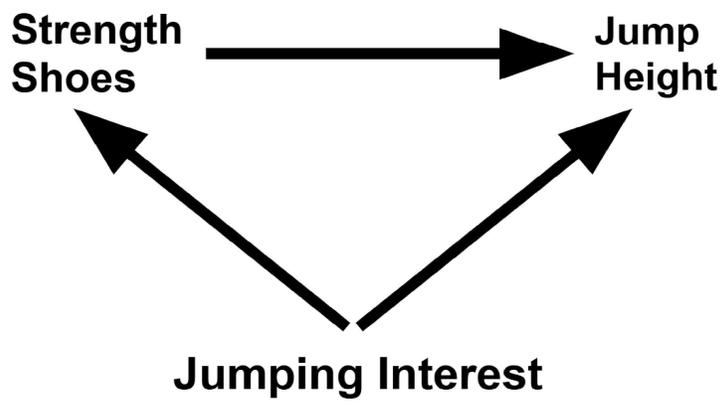
**Strength Shoes**



**Jump Height**

Type of study?

This is an observational study. What's a potential confounding var?



## Random Assignment

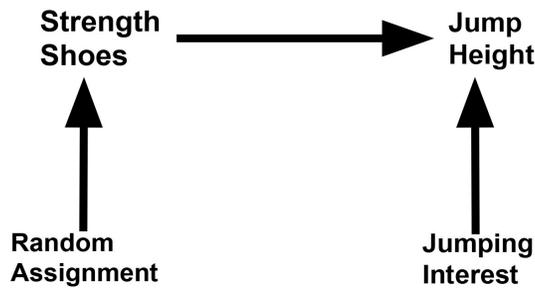
To prevent confounding vars, we need to control the explanatory var.

We do this through **random assignment**.

**Randomly assign** people to wear strength shoes or not.

Then measure their jump height.

What's affecting the explanatory var now? Our random assignment!



## What about other things that affect jumping?

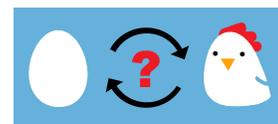
Random assignment will cause any factor affecting jumping (like person's height), on average, to be split between the two groups and so won't affect comparison of the groups.



An **experiment** is a study that uses random assignment to create groups.

Because random assignment is the only thing affecting the treatment, there can be no confounding vars.

! Therefore, **experiments allow us to make cause and effect conclusions.**



## Botox for Back Pain

Does botox relieve back pain?



**Botox** → **Back Pain Relief**

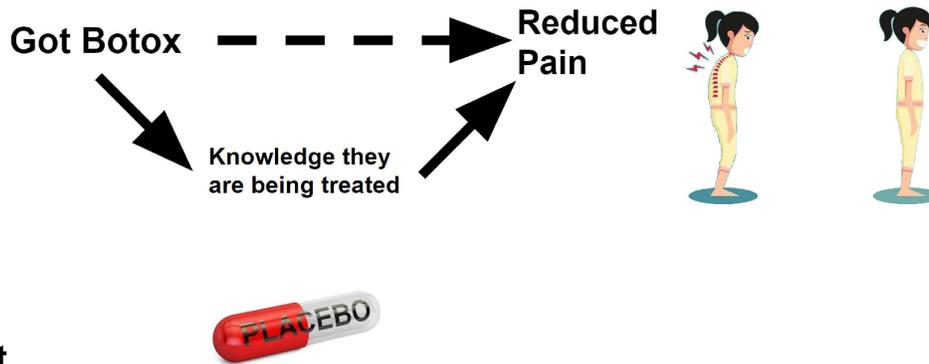
**Study 1:** Thirty patients with severe back pain were given botox injections.  
Twenty reported improvement. Can we conclude Botox reduces back pain?

**Study 2:**

- ◆ 15 patients randomly assigned to receive Botox treatment. (**treatment group**)
- ◆ 15 patients randomly assigned to receive no treatment. (**comparison group**)

Questions:

- ◆ Name two ways in which study 2 is an improvement over study 1.
- ◆ Can you think of a flaw with study 2?  
(How are medical studies *usually* designed?)



## Placebo Treatment

Sometimes, knowing that you're receiving treatment is enough to improve your condition.

To prevent the **placebo effect**, those in the comparison group will receive a non-effective treatment, called a **placebo**.

## Blindness

When subjects don't know which treatment group they belong to, the study is called **blind**.

We make studies blind by using a placebo, or by obfuscating the goals of the study.

If the researcher performing the experiment also doesn't know which group a subject belongs to, it's called **double-blind**.



Double blind studies are the gold standard, though it can't always be achieved.

Typically, an experiment has a **treatment group** (or groups) and a **control group** (no treatment or placebo treatment).

A **comparison group** refers to either a control group or a group receiving a different treatment than the one primarily being studied.

Memorizing Letters: You have 20 secs (used in 5-5).

## Activity: 5-5

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### What did we learn?

- ◆ Anecdotal Evidence
- ◆ Study design: Random assignment
- ◆ Placebo/Blindness
- ◆ Control/Treatment group

