



浙江大学爱丁堡大学联合学院

ZJU-UoE Institute

## Sampling

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Based on slides by Duncan McGregor

**Raise your hand if you love statistics!**



## Is this “study” fair?



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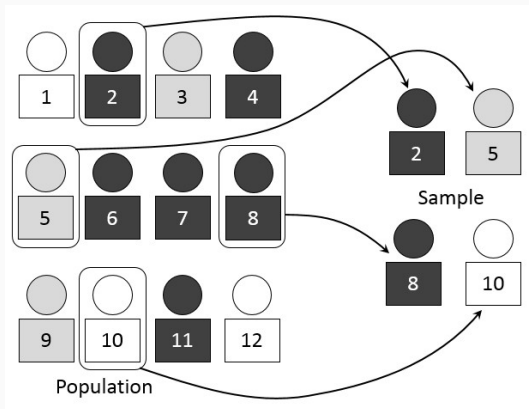


1. Leading question, image, and body language
2. Survey is non-anonymous
3. Power imbalance/conflict of interest
4. Raising hand is more difficult than not raising hand
5. Is this a representative sample?



## This lecture is about...

How to **sample** from a **population** and avoid common types of **sampling bias**.



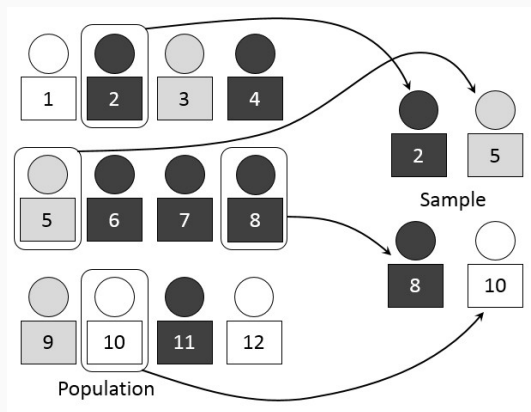
- Explain the relationship between a population and a sample
- Explain the concept of sampling bias
- Give examples of sampling biases that can occur
- Design data collection procedures that avoid sampling bias



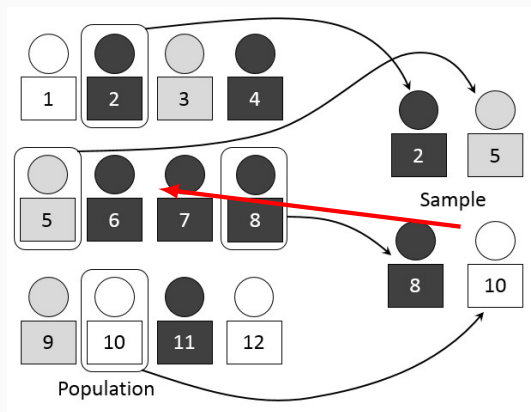
## **Samples and populations**

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## We can only access the population by taking samples...



...but we want to draw conclusions about the population



We need to draw conclusions about the population from knowledge of a sample. We do this using **inferential statistics**.

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Sample estimate	Population parameter
BMI of student volunteers for a study	BMI of all undergraduate students

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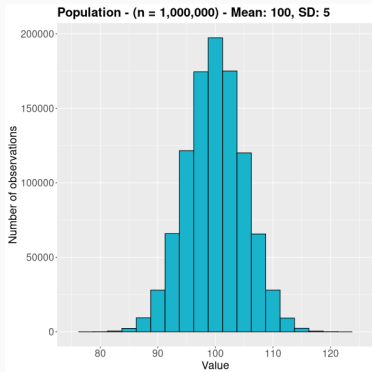
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Response to stroke patients in one clinical trial to medication XYZ	Response of stroke patients to medication XYZ

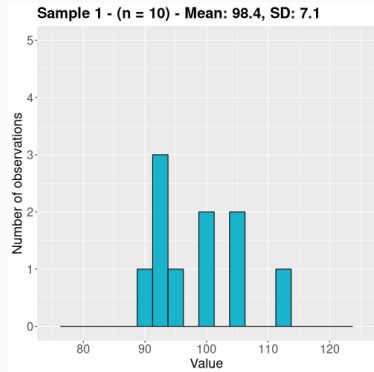
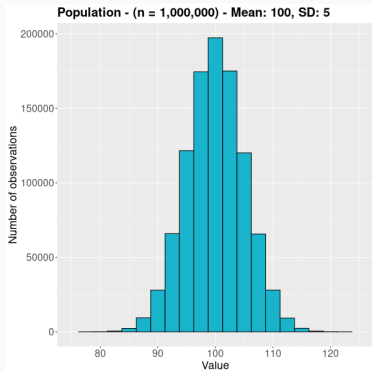
## Sampling example

Let's sample from a population. What features of the sample will be similar/different from the population?



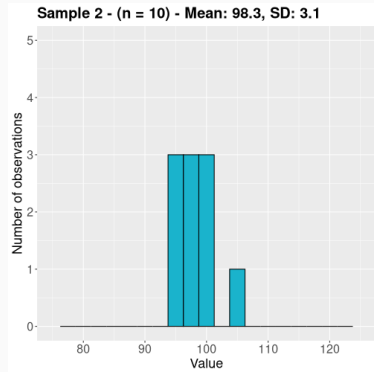
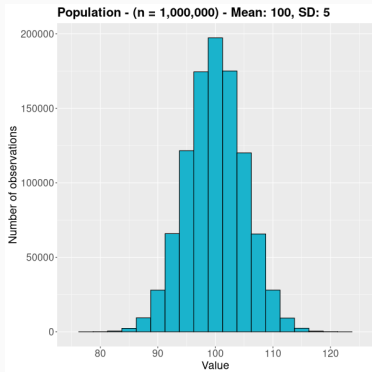
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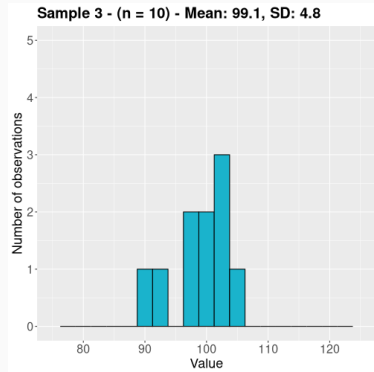
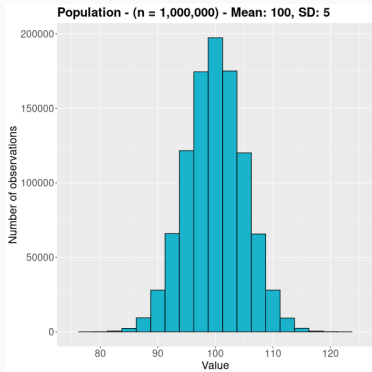
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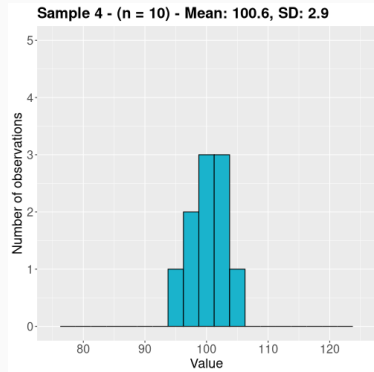
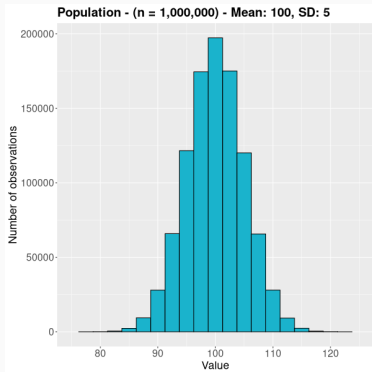
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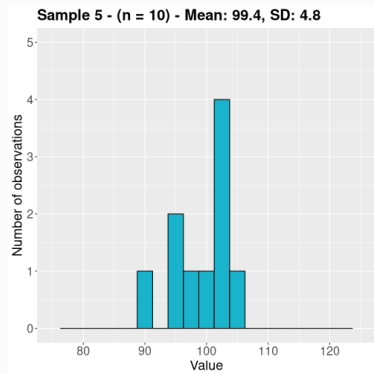
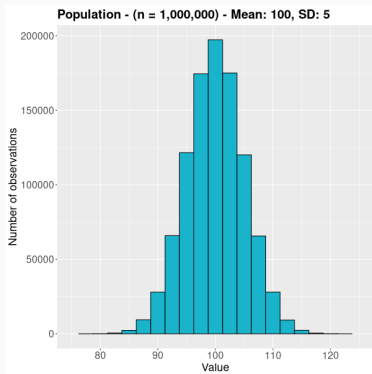
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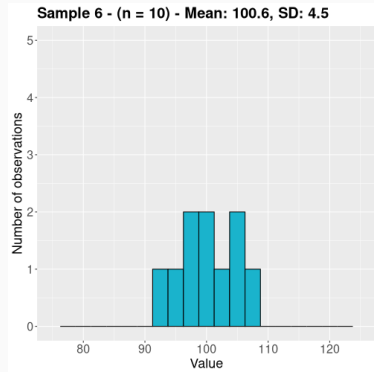
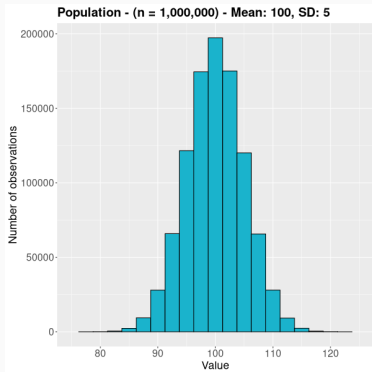
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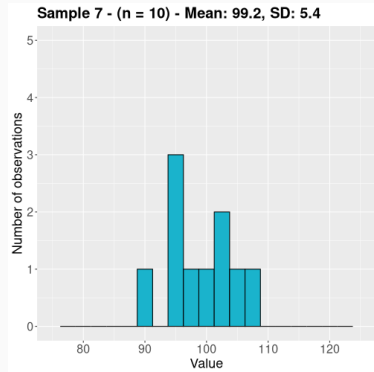
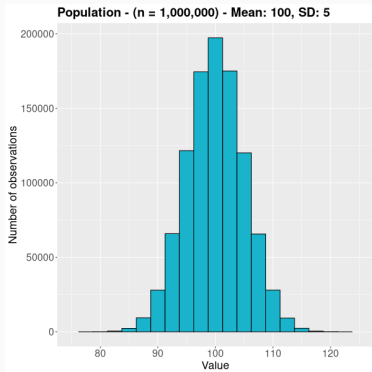
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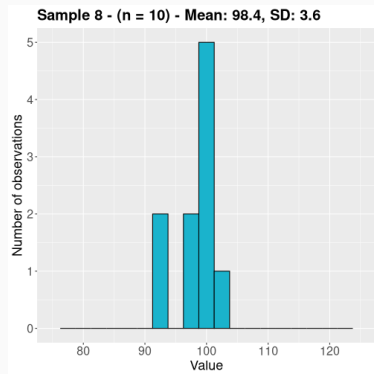
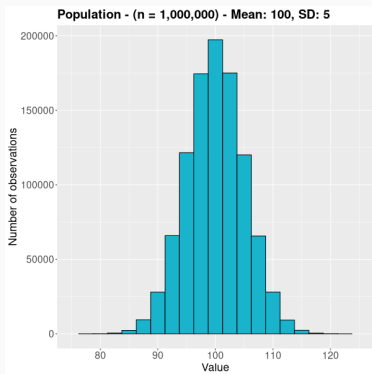
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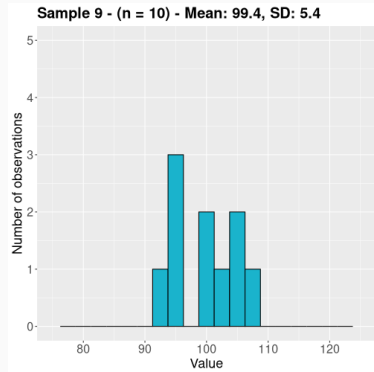
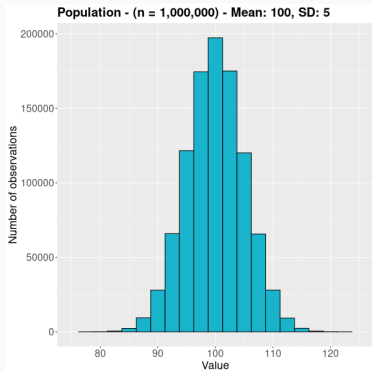
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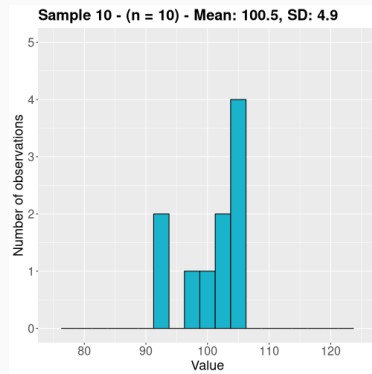
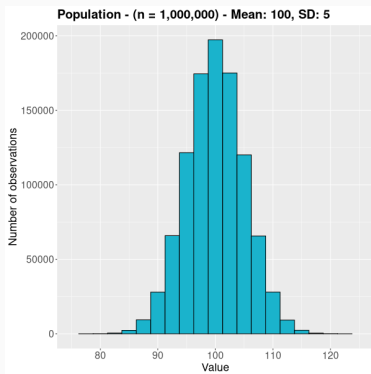
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Try sampling from a population yourself!



## Sampling error

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# Sampling error

1. Even if sampling is perfectly done, the sample will never *exactly* reflect the population.
2. The difference between sample and population is called *sampling error* (“error” here means “difference from the true population”, not “mistake”)
3. How does the *sampling error* depend on *sample size*?





# Sampling error

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3. How does the *sampling error* depend on *sample size*? **More about this next week!**



## Sampling bias

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Ideally, a sample is random and each individual in the population has an equal probability of being sampled. If this is not the case (i.e. if some parts of the population have a higher chance of being sampled than others), there is a **sampling bias**.

### 1948 presidential election



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Thomas E. Dewey against Harry S. Truman

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Telephone poll to find out about voting intentions

## Check your understanding!

What is the difference between sampling error and sampling bias?





## **Recognising and avoiding sampling bias**

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## Questions to ask

- Who is invited to sign up for the study?
- Where are we looking for our sample?
- How is the sample collected?
- Who/what is included, who/what is excluded?
- How are treatment and control group determined?
- Who might drop out, and why?

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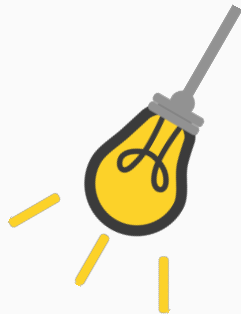
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Which of these methods may result in sampling bias, and why? Which method would you choose?

## Any questions?

You now should be able to:

- Explain the relationship between a population and a sample
- Explain the concept of sampling bias
- Give examples of sampling biases that can occur
- Design data collection procedures that avoid sampling bias





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