

# Studying Social Inequality with Data Science

Soc 114  
Winter 2025

Sampling: Stratified, Clustered, and the Future

# Learning goals for today

By the end of class, you will be able to

- ▶ explain a stratified sample
- ▶ explain a clustered sample
- ▶ connect sampling to the replication crisis
- ▶ discuss the future of sampling

# Baseball salaries

BASEBALL

The New York Times

EDIT THE TIMES

## Channeling the Old Steinbrenner Ways, Yankees Stepped Up for Judge

Aaron Judge, who hit 62 home runs in 2022, agreed to a nine-year, \$360 million contract with the Yankees after meeting with at least two other teams.

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Aaron Judge set career highs in batting average (.311), home runs (62) and R.B.I. (131) in 2022. Chris Denoos for The New York Times

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California dreaming

Dodgers pitchers rising

\$1 billion boom?

DODGERS

## Complete coverage: Shohei Ohtani signs record deal with Dodgers



Shohei Ohtani speaks during his introductory Dodgers news conference at Dodger Stadium on Thursday. (Wally Skalij / Los Angeles Times)

BY LOS ANGELES TIMES STAFF

PUBLISHED DEC. 9, 2023 | UPDATED DEC. 22, 2023 8:54 AM PT

# Baseball salaries

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EDIT THIS TIMES

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# Major League Baseball Minimum: \$720,000

# Baseball salaries

## Major League Baseball Salaries 2023

Major League Baseball salaries based on players on opening day rosters and injured list and restricted list. Figures, compiled by USA TODAY, are based on documents obtained from Major League Baseball, the MLB Players Association, clubs officials and agents, filed with MLB's central office. Deferred payments and incentive clauses are not included. See [more salaries for 2022](#).

Source: USA TODAY Sports

### Quick Search

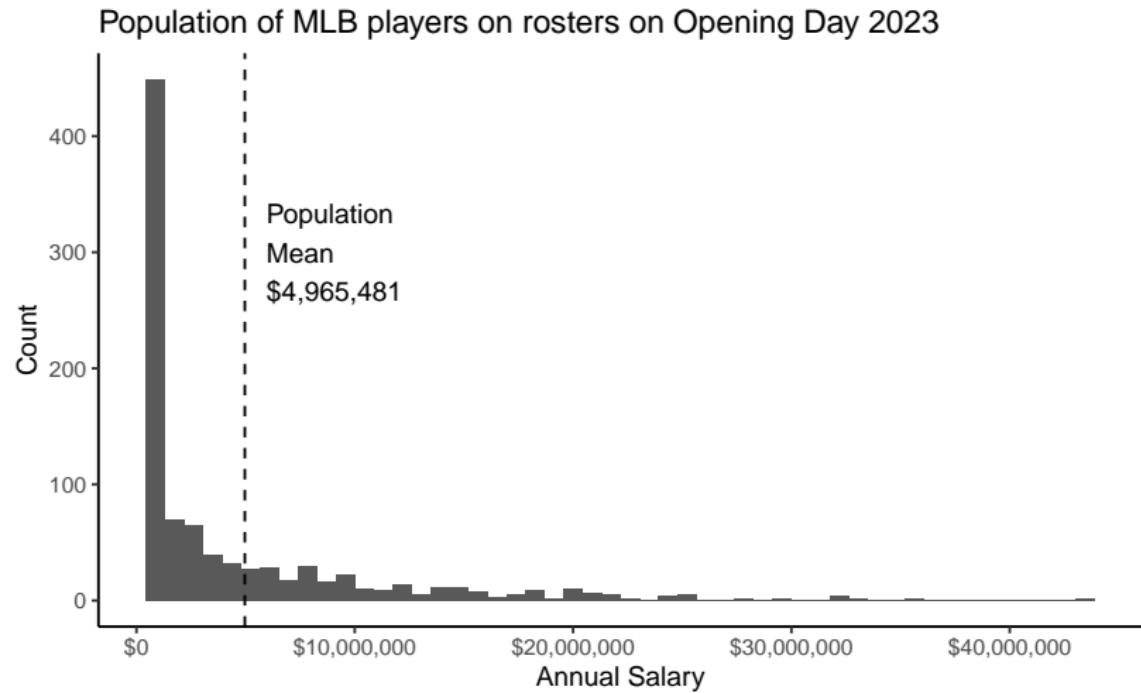
Player  Team  Position

Show/Hide Columns

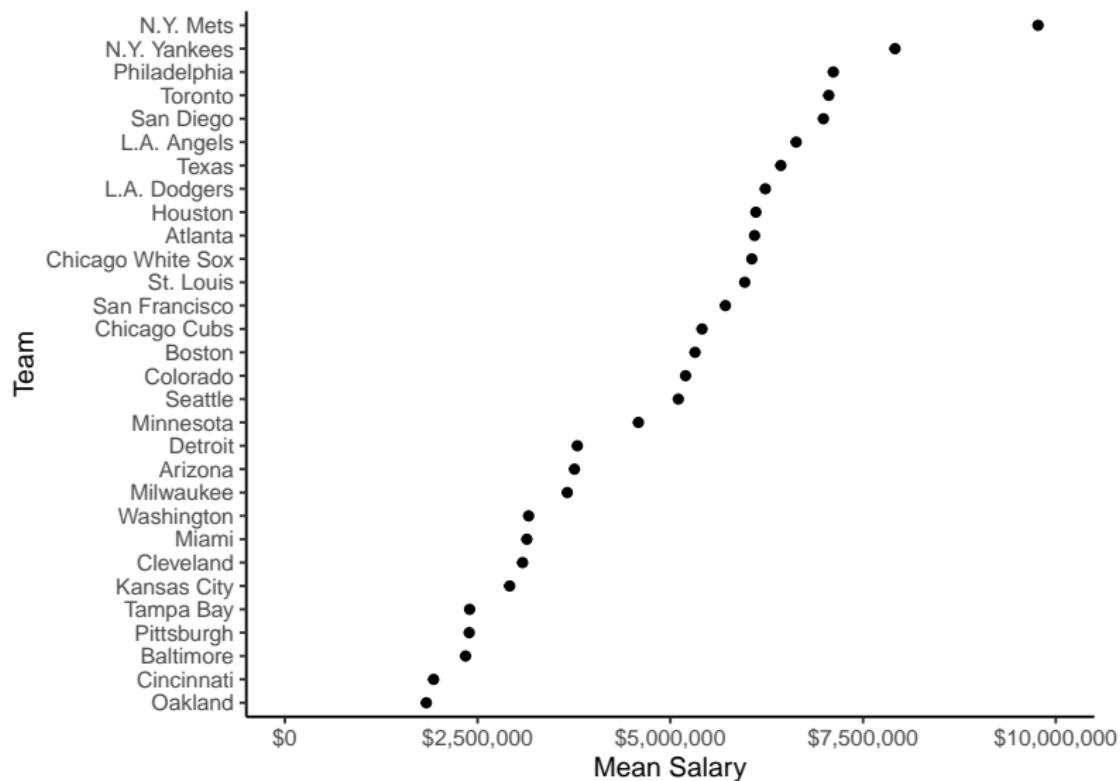
Player	Team	Position	Salary	Years	Total Value
Scherzer, Max	N.Y. Mets	RHP	\$43,333,333	3	\$130,000,000
Verlander, Justin	N.Y. Mets	RHP	\$43,333,333	2	\$86,666,666
Judge, Aaron	N.Y. Yankees	OF	\$40,000,000	9	\$360,000,000
Rendon, Anthony	L.A. Angels	3	\$38,571,429	7	\$245,000,000
Trout, Mike	L.A. Angels	OF	\$37,116,667	12	\$426,500,000

[databases.usatoday.com/major-league-baseball-salaries-2023/](https://databases.usatoday.com/major-league-baseball-salaries-2023/)

# Baseball salaries



# Baseball salaries



# Draw a Sample to Estimate the Mean Salary

```
baseball <- read_csv("https://soc114.github.io/data/baseball.csv")
```

# How to sample baseball players

Players are grouped in 30 teams.

- ▶ Suppose it is costly to contact a team
- ▶ It is cheap to gather salary for many players on the team
- ▶ How would you draw a survey of 150 players?

# How to sample baseball players

Players are grouped in 30 teams.

- ▶ Suppose salary varies a lot across teams
- ▶ You want a sample that represents the salary distribution well
- ▶ How would you draw a survey of 60 players?

# Three types of sampling

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- ▶ Simple random sample: 60 players at random

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- ▶ Stratified sampling by team: 2 players per team

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- ▶ Simple random sample: 60 players at random
- ▶ Stratified sampling by team: 2 players per team
- ▶ Random sample clustered by team: 20 players on each of 3 sampled teams

For reference: [reading](#)

# Three types of sampling

- ▶ Simple random sample: 60 players at random
- ▶ Stratified sampling by team: 2 players per team
  - ▶ stratification makes our sample better
  - ▶ rules out unlucky bad draws that miss whole teams
- ▶ Random sample clustered by team: 20 players on each of 3 sampled teams

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# Three types of sampling

- ▶ Simple random sample: 60 players at random
- ▶ Stratified sampling by team: 2 players per team
  - ▶ stratification makes our sample better
  - ▶ rules out unlucky bad draws that miss whole teams
- ▶ Random sample clustered by team: 20 players on each of 3 sampled teams
  - ▶ clustering makes our sample cheaper
  - ▶ sample is not as high quality—the 3 teams may be unusual

For reference: [reading](#)

# Apply an Estimator

Write a function that I like to call `estimator()`

- ▶ input is a sample
- ▶ output is an estimate

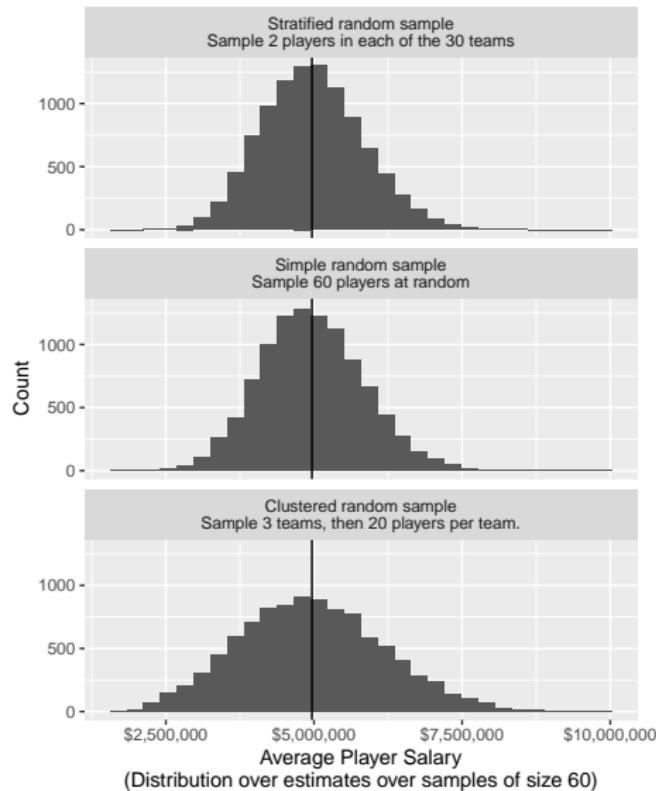
# Evaluate performance

We will first calculate the population mean

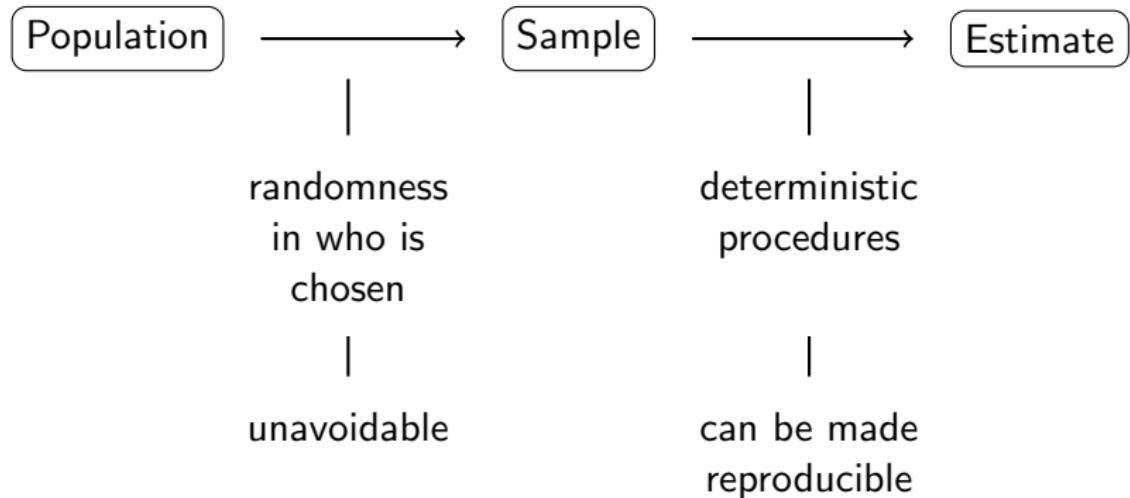
Then we will repeatedly

- ▶ draw a sample
- ▶ apply the estimator
- ▶ store the result

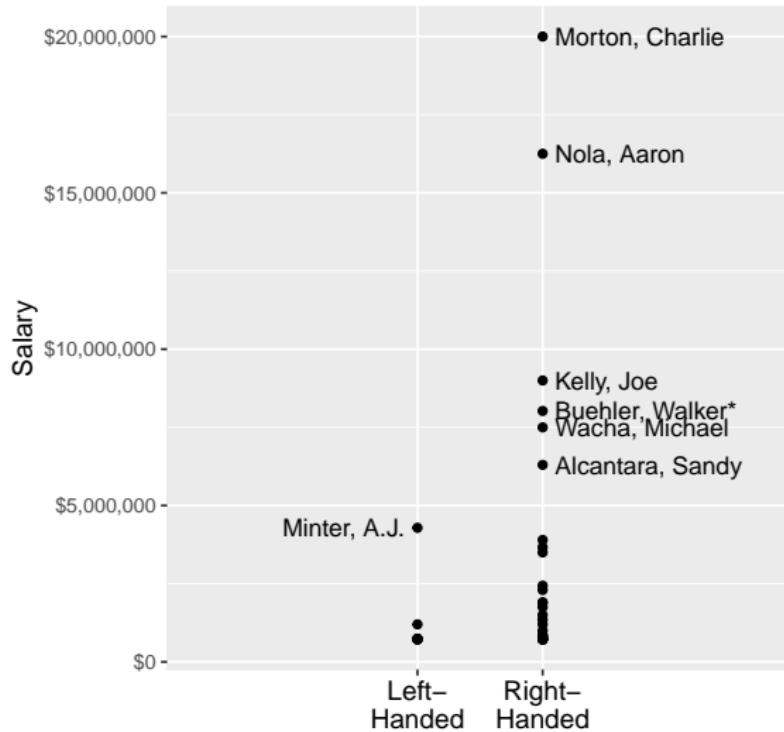
# Three sampling strategies

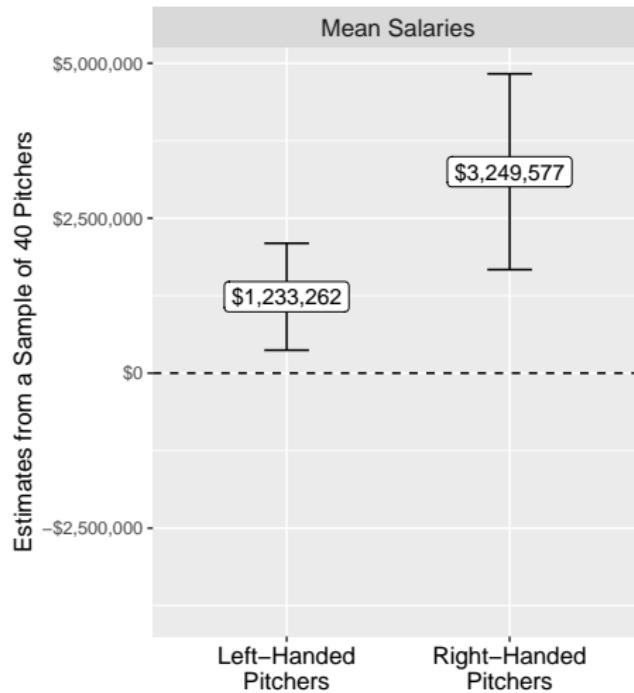


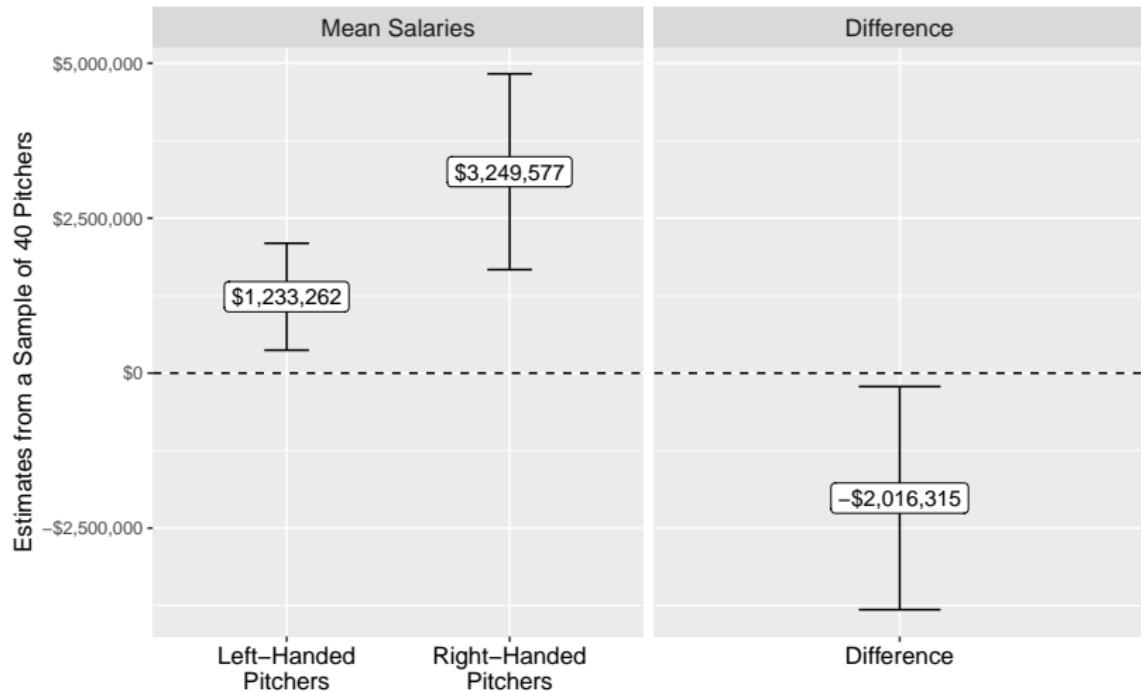
# Danger of One Sample



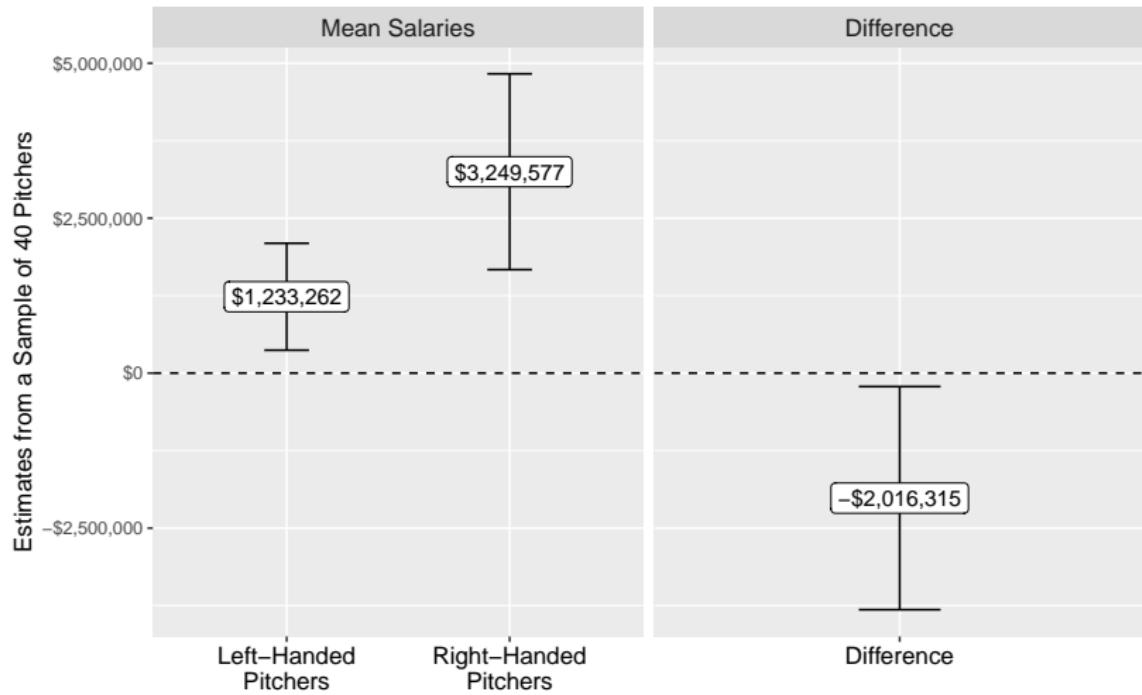
## Sample of 40 Pitchers from Opening Day 2023







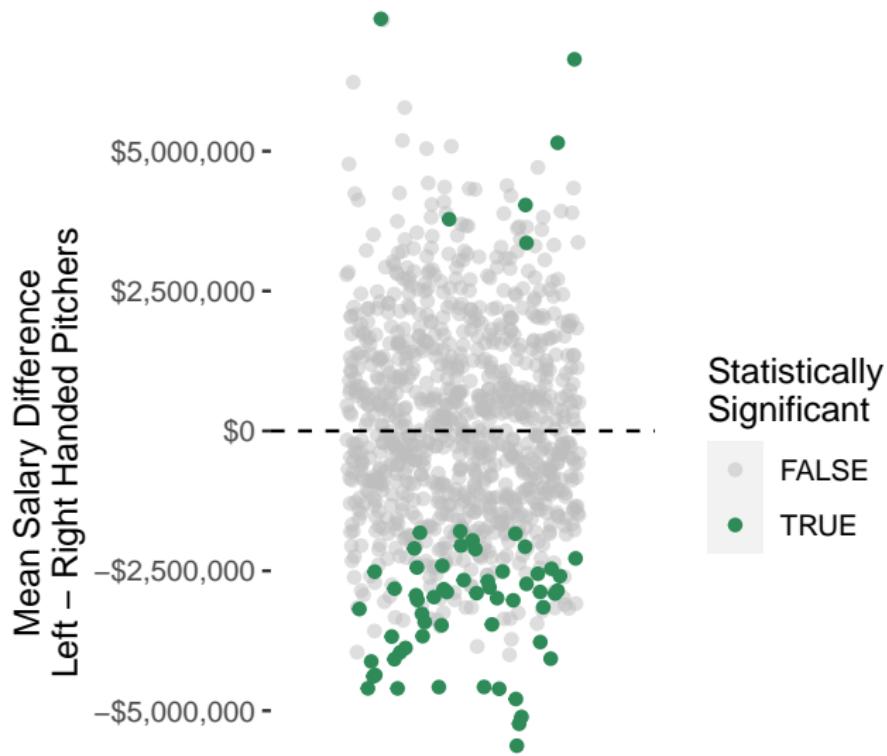
# Why might right-handed pitchers earn more?



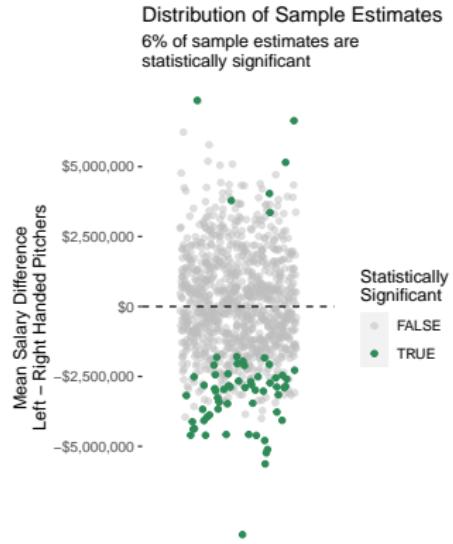
I did this 1,000 times

# Distribution of Sample Estimates

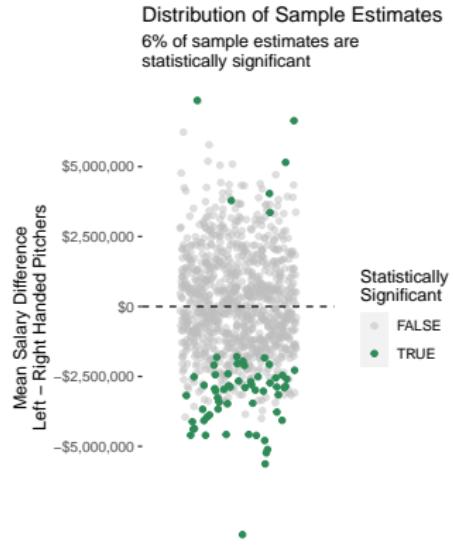
6% of sample estimates are statistically significant



# The replication crisis

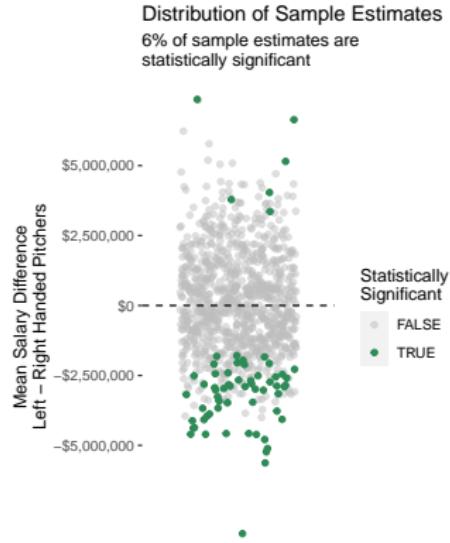


# The replication crisis



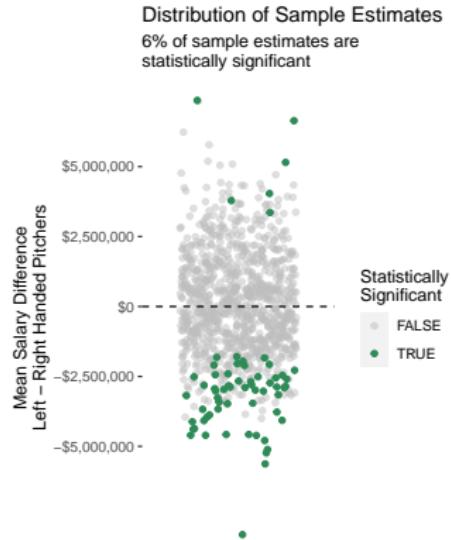
- ▶ unless we see the population, all estimates involve noise

# The replication crisis



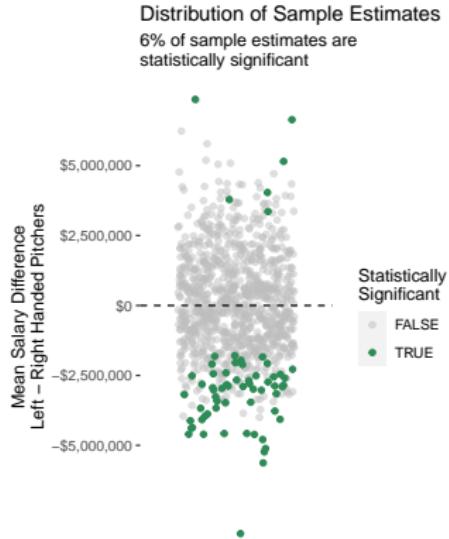
- ▶ unless we see the population, all estimates involve noise
- ▶ surprising findings yield big rewards

# The replication crisis



- unless we see the population, all estimates involve noise
- surprising findings yield big rewards
- unsurprising findings get ignored

# The replication crisis



- ▶ unless we see the population, all estimates involve noise
- ▶ surprising findings yield big rewards
- ▶ unsurprising findings get ignored
- ▶ science is just discovering noise

## Evaluating the replicability of social science experiments in *Nature* and *Science* between 2010 and 2015

Colin F. Camerer<sup>1,2\*</sup>, Anna Dreber<sup>2,3\*</sup>, Felix Holzmeister<sup>3,4</sup>, Teck-Hus Ho<sup>1,5</sup>, Jürgen Huber<sup>2,6</sup>, Magnus Johannesson<sup>2,7,8</sup>, Michael Kirchner<sup>3,5,9</sup>, Gideon Nave<sup>1,10</sup>, Brian A. Nosek<sup>7,8,10,11</sup>, Thomas Pfeiffer<sup>9,12</sup>, Adam Altmejd<sup>12</sup>, Nick Buttrick<sup>14</sup>, Taizan Chan<sup>10</sup>, Yiling Chen<sup>11</sup>, Eskil Forsell<sup>12</sup>, Anup Gampa<sup>15</sup>, Emma Heikensten<sup>16</sup>, Lily Hummer<sup>17</sup>, Taisuke Imai<sup>17</sup>, Siri Isaksson<sup>18</sup>, Dylan Manfredi<sup>16</sup>, Julia Rose<sup>1</sup>, Eric-Jan Wagenmakers<sup>19</sup> and Hang Wu<sup>11</sup>

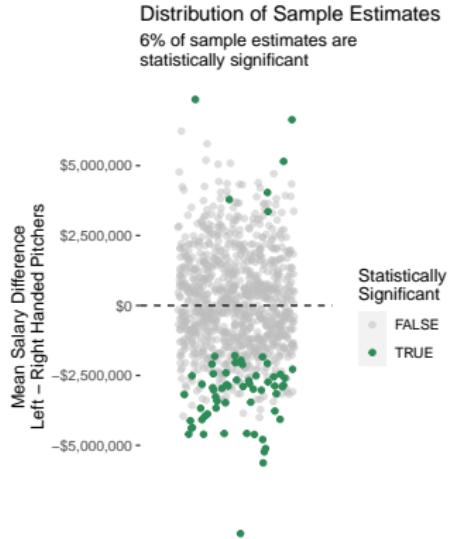
Camerer et al. in *Nature Human Behavior*.

## Essay: The Experiments Are Fascinating. But Nobody Can Repeat Them.

Science is mired in a “replication” crisis. Fixing it will not be easy.

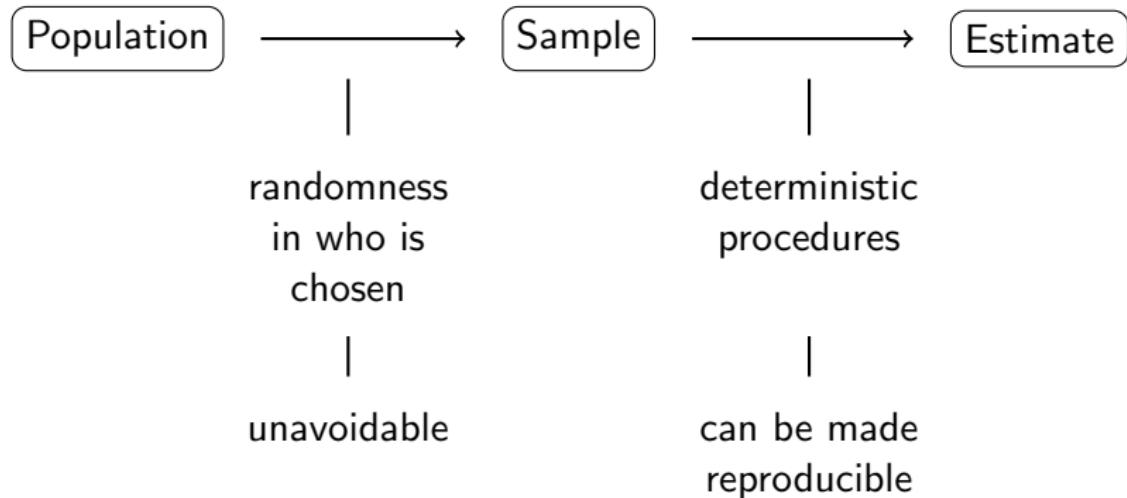
Gelman in NYTimes.

# The replication crisis



- ▶ unless we see the population, all estimates involve noise
- ▶ surprising findings yield big rewards
- ▶ unsurprising findings get ignored
- ▶ science is just discovering noise

# Danger of One Sample



# Reproducibility

What is a typical salary in the three highest-paying teams in American baseball?

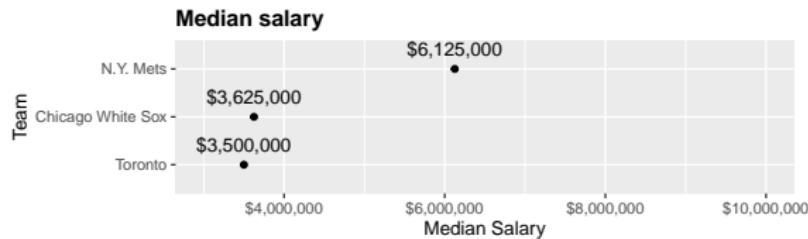
- ▶ how would you answer this question with data?

What is a typical salary in the three highest-paying teams in American baseball?

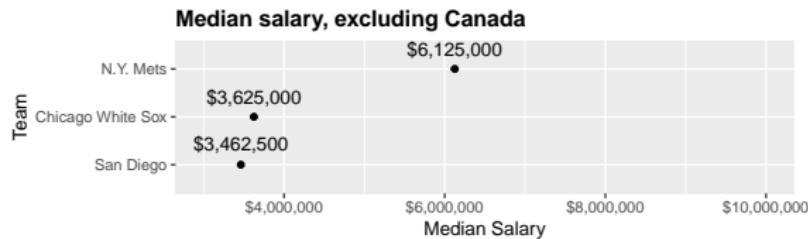
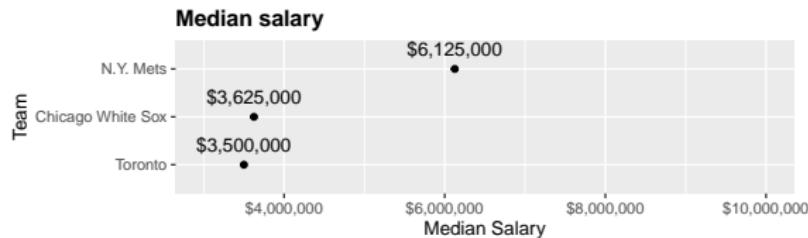
# What is a typical salary in the three highest-paying teams in American baseball?



# What is a typical salary in the three highest-paying teams in American baseball?



# What is a typical salary in the three highest-paying teams in American baseball?





```
---
```

```
title: "Problem Set 1: Visualization"
```

```
format: pdf
```

```
---
```

**\*\*Due: 5pm on Wednesday, January 31.\*\***

Student identifier: [type your anonymous identifying number here]

- Use this template to complete the problem set
- In Canvas, you will upload the PDF produced by your .qmd file
- Put your identifier above, not your name! We want anonymous grading to be possible

This problem set involves both data analysis and reading.

### ### Data analysis

This problem set uses the data

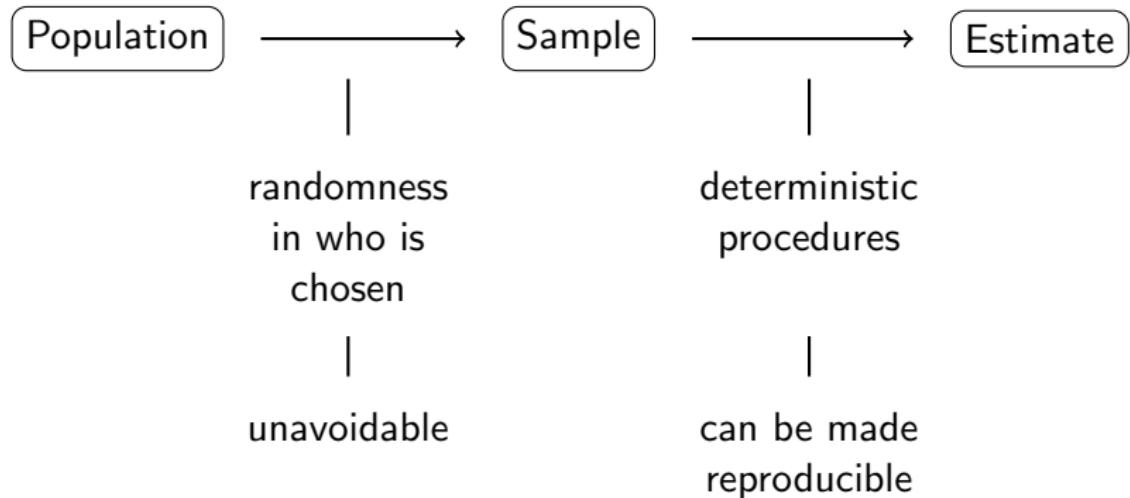
[`lifeCourse.csv`][\(\)](https://info3370.github.io/data/lifeCourse.csv).

```
```{r, comment = F, message = F}
library(tidyverse)
library(scales)
lifeCourse <- read_csv("https://info3370.github.io/data/lifeCourse.csv")
```

```

The data contain life course earnings profiles for four cohorts of American workers: those born in 1940, 1950, 1960, and 1970. Each row contains a

# Danger of One Sample



# The Future of Sample Surveys

Groves, R. M. (2011). [Three eras of survey research](#). Public Opinion Quarterly.

# The Future of Sample Surveys

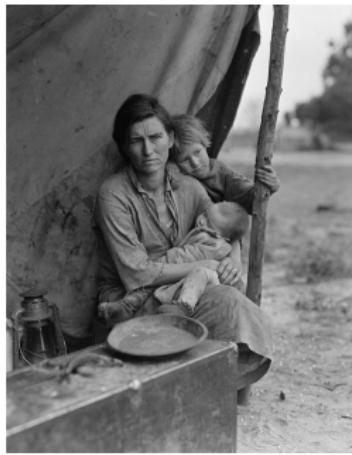
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1930–1960: Era of Invention

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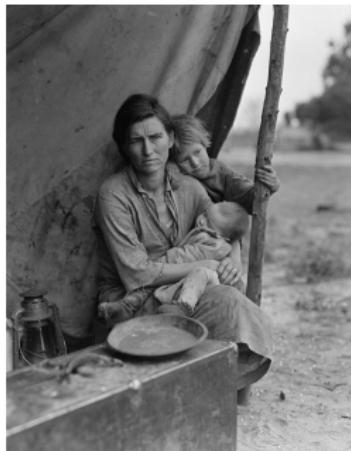
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## 1930–1960: Era of Invention



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| Fats & Oils            | <a href="#">Data</a>   <a href="#">PDE</a>   <a href="#">GDX</a> |
| Released at 3:00 pm ET |  |
| Flour Milling          | <a href="#">Data</a>   <a href="#">PDE</a>   <a href="#">GDX</a> |
| Released at 3:00 pm ET |  |

MILK PRODUCTION ENHANCED Visualizations and Interactive Data

DATA ACCESS: We are updating our systems and plan to avoid interruptions. However, NASS data and reports are available in multiple ways in addition to this website - Cornell University Mann Library (a USDA repository) [website](#) and [e-mail report subscription service](#), QuickStats [database](#), [API](#), and downloadable [data files](#), and a [JSON file](#) for principal economic indicator data.

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1930–1960: Era of Invention

sampling frame

pieces of land

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## 1930–1960: Era of Invention

sampling frame

pieces of land

mode

face-to-face interviews

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## 1930–1960: Era of Invention

|                |                         |
|----------------|-------------------------|
| sampling frame | pieces of land          |
| mode           | face-to-face interviews |
| cost           | high                    |

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## 1930–1960: Era of Invention

|                |                         |
|----------------|-------------------------|
| sampling frame | pieces of land          |
| mode           | face-to-face interviews |
| cost           | high                    |
| response rate  | over 90 percent         |

# The Future of Sample Surveys

Groves, R. M. (2011). [Three eras of survey research](#). Public Opinion Quarterly.

1960–1990: Era of Expansion

Technology helped: Telephones



Source: Wikimedia

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Technology helped: Telephones  
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Source: Wikimedia

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- Technology helped: Telephones
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1990–Present

Technology brought challenges    Technology brought opportunities

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1990–Present

Technology brought challenges    Technology brought opportunities  
— answering machines

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1990–Present

- |                               |                                  |
|-------------------------------|----------------------------------|
| Technology brought challenges | Technology brought opportunities |
| — answering machines          |                                  |
| — cell phones                 |                                  |

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1990–Present

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| — caller ID                   |                                  |

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1990–Present

- |   |                                  |
|---|----------------------------------|
| Technology brought challenges   | Technology brought opportunities |
| <ul style="list-style-type: none"><li>— answering machines</li><li>— cell phones</li><li>— caller ID</li><li>— response rates plummeted</li></ul> |                                  |

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1990–Present

Technology brought challenges

- answering machines
- cell phones
- caller ID
- response rates plummeted

Technology brought opportunities

- digital trace data
- internet panels

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1990–Present: Designed and Organic Data

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1990–Present: Designed and Organic Data

Designed data

Organic data

## Example

Census age distribution

## Example

Web histories

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## 1990–Present: Designed and Organic Data

Designed data

— high cost

Organic data

— almost free

### Example

Census age distribution

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Web histories

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## 1990–Present: Designed and Organic Data

### Designed data

- high cost
- becoming scarce

### Organic data

- almost free
- becoming abundant

#### Example

Census age distribution

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## 1990–Present: Designed and Organic Data

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- high cost
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### Example

Census age distribution

### Organic data

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- becoming abundant
- iffy for population

### Example

Web histories

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1990–Present: Designed and Organic Data

Designed data

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Organic data

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**Example**

Census age distribution

**Example**

Web histories

future of **organic data**

future of **designed data**

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## 1990–Present: Designed and Organic Data

### Designed data

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### Organic data

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#### Example

Census age distribution

#### Example

Web histories

the future is **together**

# Learning goals for today

By the end of class, you will be able to

- ▶ explain a stratified sample
- ▶ explain a clustered sample
- ▶ connect sampling to the replication crisis
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