

# Case Study: Using Stents to Prevent Strokes

Colby Community College

## Efficacy of a Medical Treatment

A classic challenge in statistics is to determine how effective a medical treatment truly is.

## Efficacy of a Medical Treatment

A classic challenge in statistics is to determine how effective a medical treatment truly is.

### Note

The terms introduced in this first chapter will be revisited later.

## Efficacy of a Medical Treatment

A classic challenge in statistics is to determine how effective a medical treatment truly is.

### Note

The terms introduced in this first chapter will be revisited later.

### Definition

A **stent** is a device put inside blood vessels that assist in patient recovery after cardiac events and reduce the risk of an additional heart attack or death.

## Efficacy of a Medical Treatment

A classic challenge in statistics is to determine how effective a medical treatment truly is.

### Note

The terms introduced in this first chapter will be revisited later.

### Definition

A **stent** is a device put inside blood vessels that assist in patient recovery after cardiac events and reduce the risk of an additional heart attack or death.

### Case Study

Many doctors have hoped that stents would have similar benefits for patients at risk of strokes.

## Efficacy of a Medical Treatment

A classic challenge in statistics is to determine how effective a medical treatment truly is.

### Note

The terms introduced in this first chapter will be revisited later.

### Definition

A **stent** is a device put inside blood vessels that assist in patient recovery after cardiac events and reduce the risk of an additional heart attack or death.

### Case Study

Many doctors have hoped that stents would have similar benefits for patients at risk of strokes.

The question researchers need to answer is:

***Does the use of stents reduce the risk of stroke?***

## Experiment

The researchers conducted an experiment with 451 at-risk patients. Each volunteer patient was randomly assigned into one of two groups.

## Experiment

The researchers conducted an experiment with 451 at-risk patients. Each volunteer patient was randomly assigned into one of two groups.

## Treatment group (224 patients)

These patients received a stent and medical management.



## Experiment

The researchers conducted an experiment with 451 at-risk patients. Each volunteer patient was randomly assigned into one of two groups.

## Treatment group (224 patients)

These patients received a stent and medical management.

## Note

The medical management included medications, management of risk factors, and help in lifestyle modification.

## Experiment

The researchers conducted an experiment with 451 at-risk patients. Each volunteer patient was randomly assigned into one of two groups.

## Treatment group (224 patients)

These patients received a stent and medical management.

## Note

The medical management included medications, management of risk factors, and help in lifestyle modification.

## Control group (227 patients)

These patients received the same medical management, but did not receive a stent.

## Data Gathering

The researchers studied the effect of stents at two time points:

## Data Gathering

The researchers studied the effect of stents at two time points:

- 30 days after enrollment

## Data Gathering

The researchers studied the effect of stents at two time points:

- 30 days after enrollment
- 365 days after enrollment

## Data Gathering

The researchers studied the effect of stents at two time points:

- 30 days after enrollment
- 365 days after enrollment

## Data

Patient	group	0-30 days	0-365 days
1	treatment	no event	no event
2	treatment	stroke	stroke
3	treatment	no event	no event
4	treatment	no event	stroke
⋮	⋮	⋮	⋮
451	control	no event	no event

## Data Gathering

The researchers studied the effect of stents at two time points:

- 30 days after enrollment
- 365 days after enrollment

## Data

Patient	group	0-30 days	0-365 days
1	treatment	no event	no event
2	treatment	stroke	stroke
3	treatment	no event	no event
4	treatment	no event	stroke
⋮	⋮	⋮	⋮
451	control	no event	no event

## Note

Listing each patient line-by-line is very cumbersome.

# Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378



## Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

## Question

*What percentage of the treatment group had a stroke in the first year?*

# Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

## Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}}$$

## Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

### Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}} = \frac{45}{224}$$

# Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

## Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}} = \frac{45}{224} = 0.20 = 20\%$$

## Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

### Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}} = \frac{45}{224} = 0.20 = 20\%$$

### Question

*What percentage of the control group had a stroke in the first year?*

# Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

## Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}} = \frac{45}{224} = 0.20 = 20\%$$

## Question

*What percentage of the control group had a stroke in the first year?*

$$\frac{\text{number of control group that had a stroke}}{\text{total size of control group}}$$

# Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

## Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}} = \frac{45}{224} = 0.20 = 20\%$$

## Question

*What percentage of the control group had a stroke in the first year?*

$$\frac{\text{number of control group that had a stroke}}{\text{total size of control group}} = \frac{28}{227}$$

# Descriptive Statistics

	0-30 days		0-365 days	
	stroke	no event	stroke	no event
treatment	33	191	45	179
control	13	214	28	199
total	46	405	73	378

## Question

*What percentage of the treatment group had a stroke in the first year?*

$$\frac{\text{number of treatment group that had a stroke}}{\text{total size of treatment group}} = \frac{45}{224} = 0.20 = 20\%$$

## Question

*What percentage of the control group had a stroke in the first year?*

$$\frac{\text{number of control group that had a stroke}}{\text{total size of control group}} = \frac{28}{227} = 0.12 = 12\%$$



## Note

This means an additional 8% of patients with a stent had a stroke!

## Note

This means an additional 8% of patients with a stent had a stroke!

## Definition

A **summary statistic** is a single number summarizing a large amount of data.

## Note

This means an additional 8% of patients with a stent had a stroke!

## Definition

A **summary statistic** is a single number summarizing a large amount of data.

## Why is this important?

- 1 Many doctors expected stents to reduce the chance of a stroke.

## Note

This means an additional 8% of patients with a stent had a stroke!

## Definition

A **summary statistic** is a single number summarizing a large amount of data.

## Why is this important?

- 1 Many doctors expected stents to reduce the chance of a stroke.
- 2 Does the data show a “real” difference between the groups?

## Note

This means an additional 8% of patients with a stent had a stroke!

## Definition

A **summary statistic** is a single number summarizing a large amount of data.

## Why is this important?

- 1 Many doctors expected stents to reduce the chance of a stroke.
- 2 Does the data show a “real” difference between the groups?

## Note

The second question is a real subtle one and most of the statistical tools we discuss will be used to address this question.

## Significance

What is the chance of getting a head when flipping a quarter?

## Significance

What is the chance of getting a head when flipping a quarter?

Theoretically it is 50%. But if you flip a large number of coins, you rarely get exactly half heads and half tails.

heads		tails		total
5,045	50.4%	4,955	49.5%	10,000
4,969	49.7%	5,031	50.3%	10,000
5,064	50.6%	4,936	49.4%	10,000
5,091	50.9%	4,909	49.1%	10,000
4,972	49.7%	5,028	50.3%	10,000
5,021	50.2%	4,979	49.8%	10,000
5,007	50.1%	4,993	49.9%	10,000
5,031	50.3%	4,969	49.7%	10,000
5,056	50.6%	4,944	49.4%	10,000
5,006	50.1%	4,994	49.9%	10,000

## Note

The published results of the study can be summarized as:

*There was compelling evidence of harm by stents in this study of stroke patients.*

---

Chimowitz MI, Lynn MJ, Derdeyn CP, et al. 2011. Stenting versus Aggressive Medical Therapy for Intracranial Arterial Stenosis. New England Journal of Medicine 365:993-1003. <http://nejm.org/doi/full/10.1056/NEJMoa1105335>



## Note

The published results of the study can be summarized as:

*There was compelling evidence of harm by stents in this study of stroke patients.*

---

Chimowitz MI, Lynn MJ, Derdeyn CP, et al. 2011. Stenting versus Aggressive Medical Therapy for Intracranial Arterial Stenosis. New England Journal of Medicine 365:993-1003. <http://nejm.org/doi/full/10.1056/NEJMoa1105335>

## Be careful

Do not generalize the results of this study to all patients and all stents.

## Note

The published results of the study can be summarized as:

*There was compelling evidence of harm by stents in this study of stroke patients.*

---

Chimowitz MI, Lynn MJ, Derdeyn CP, et al. 2011. Stenting versus Aggressive Medical Therapy for Intracranial Arterial Stenosis. New England Journal of Medicine 365:993-1003. <http://nejm.org/doi/full/10.1056/NEJMoa1105335>

## Be careful

Do not generalize the results of this study to all patients and all stents.

- This study considered patients with very specific characteristics who volunteered to be a part of the study and may not be representative of all stroke patients.

## Note

The published results of the study can be summarized as:

*There was compelling evidence of harm by stents in this study of stroke patients.*

---

Chimowitz MI, Lynn MJ, Derdeyn CP, et al. 2011. Stenting versus Aggressive Medical Therapy for Intracranial Arterial Stenosis. New England Journal of Medicine 365:993-1003. <http://nejm.org/doi/full/10.1056/NEJMoa1105335>

## Be careful

Do not generalize the results of this study to all patients and all stents.

- This study considered patients with very specific characteristics who volunteered to be a part of the study and may not be representative of all stroke patients.
- There are many types of stents and this study only considered the self-expanding Wingspan stent.

## Percentages Review

- **Percentage of:** To find a percentage of an amount, replace the % symbol with division by 100 and multiply by the amount.

**Example:** 6% of 1200 responses is  $\frac{6}{100} \cdot 1200 = 72$

- **Decimal to Percentage:** To convert from a decimal to a percentage, multiply by 100%.

**Example:**  $0.25 \rightarrow 0.25 \cdot 100\% = 25\%$

- **Fraction to Percentage:** To convert from a fraction to a percentage, divide the denominator into the numerator and multiply by 100%.

**Example:**  $\frac{3}{4} = 0.75 \rightarrow 0.75 \cdot 100\% = 75\%$

- **Percentage to Decimal:** To convert from a percentage to a decimal number, replace the % by division by 100.

**Example:**  $85\% \rightarrow \frac{85}{100} = 0.85$