

Table Odds and Odds Ratios

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Overview

- Continue working with the smoking data
- But add in some things on odds and odds ratios
- Plus a chance to practice all of it!

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Let's look at the Smoking data using a slightly different approach – odds and odds ratios

		Subject Still Smoking		
		YES	NO	
Subject Treatment	Nicotine Patch	64	56	120
	Placebo	96	24	120
Column Margins		160	80	240

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Odds and Odds Ratios

- **Odds** and **Odds Ratios** have become a popular way of displaying scientific data for dummy variables and categorical data
- Whenever you hear an expression such as, “*One group is 3 times more likely to suffer from chronic disease*”, this is an odds ratio.
- An **Odds** expresses the likelihood of one group experiencing a situation relative to not experiencing the situation.
- An **Odds Ratio** is the ratio of two odds

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Calculating the Odds

- The Odds of an event is the ratio of the probability of the event to probability of not in event

- For example, for the those who received a Nicotine Patch, the odds of Not Smoking versus Still Smoking is:

		Subject Still Smoking		
		YES	NO	Row Margins
Subject Treatment	Nicotine Patch	64	56	120
	Placebo	96	24	120
Column Margins		160	80	240

- $(56/240)/(64/240) = .8750$
- $.2333/.2667 = .8750$

With a few algebraic manipulations, it simplifies to:

$$(56/240)/(64/240) = 56/64 = .8750$$

This is the ratio of the two cell values

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Calculating the Odds

- If you calculated the odds in terms of Still Smoking versus Not Smoking

- $64/56 = 1.143$

- Note that 1.143 is the reciprocal of .875

- $1/.875 = 1.143$

		Subject Still Smoking		
		YES	NO	Row Margins
Subject Treatment	Nicotine Patch	64	56	120
	Placebo	96	24	120
Column Margins		160	80	240

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Calculating all the Odds for our 2x2 table

- Odds Not Smoking to Still smoking for Nicotine Patch

$$56/64 = .875$$

- Odds Still Smoking to Not Smoking for Nicotine Patch

$$64/56 = 1.143$$

- Odds Not Smoking to Still smoking for Placebo

$$24/96 = .250$$

- Odds Still Smoking to Not Smoking for Placebo

$$96/24 = 4.000$$

		Subject Still Smoking		
		YES	NO	Row Margins
Subject Treatment	Nicotine Patch	64	56	120
	Placebo	96	24	120
Column Margins		160	80	240

In a 2x2 table (2 rows, 2 columns) there are essentially 2 odds

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Odds - the pivot point is 1.0

- An odds of 1 is interpreted as both groups have equal probabilities for the event
- An odds greater than 1 is interpreted as the one group is more likely to experience the event compared to the other group
- An odds less than 1 is interpreted as the one group is less likely to experience the event compared to the other group
- Odds are bounded by zero on the bottom end, but unbounded on the upper end

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Odds Ratio

- An **Odds Ratio** is the ratio of two odds
- It is a way to compare the odds for two levels of a second variable
- We compare the two odds by taking a ratio of one to the other, hence the name, Odds Ratio
- $\text{Odds}_1/\text{Odds}_2$

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Example of Odds Ratio for the Smoking Data

- We will compare the **odds of Not Smoking to Smoking for the Nicotine Patch Group to that of the Placebo group**
- Odds of Not Smoking versus Smoking for the Nicotine Patch group: $56/64 = .875$
- Odds of Not Smoking versus Smoking for the Placebo group: $24/96 = .250$
- Odds Ratio = $.875/.250 = 3.50$

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Say it in words....

Those that received the nicotine patch were 3.5 times more likely to stop smoking than those that received the placebo

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Example of Odds Ratio for the Smoking Data

- **The alternative is to use the reciprocal:** odds of Not Smoking to Smoking for the Placebo Group to that of the Nicotine Patch Group
- Odds of Not Smoking versus Smoking for the Placebo group: $24/96 = .250$
- Odds of Not Smoking versus Smoking for the Nicotine Patch group: $56/64 = .875$
- Odds Ratio = $2.5/.875 = .286$
- **Those that received the placebo were .286 times more likely to stop smoking than those that received the nicotine patch**

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More on Odds and Odds Ratios

- Odds and Odds Ratios are used often in research where the outcome is categorical
- Health fields –
 - die/not die
 - cancer/no cancer
 - respond to treatment/not respond
- Marketing
 - Purchase/don't purchase

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More on Odds - Log Odds

- Sometimes we take the log of the odds – called a **Logit**
- The reference point for a Logit is zero, since the log of 1 is zero
 - $\ln(1) = 0$
- Logits are used in **Logistic Regression**

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Be careful with Odds!

- Odds can be very sensitive to extremes!
- EXAMPLE
 - Odds of the event for group A = $10/1000 = .01$
 - Odds of the event for group B = $1/1000 = .001$
 - Odds Ratio of A to B = $.01/.001 = 10$
- **An odds ratio of 10 seems quite large, even though the probabilities for both groups is quite small.**

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Recent study of Hormone Replacement Therapy (HRT)

- Study of 16,608 postmenopausal women aged 50-79 recruited in 1993-1998
- 8,506 received estrogen + progestin
- 8,102 received placebo
- They were tracked over time
- Let's look at the data just for Cardiovascular disease

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Cardiovascular disease over the time period

		Treatment	Placebo	Row Margins
Cardiovascular Disease Present	Yes	164	122	286
	No	8,342	7,980	16,322
Column Margins		8,506	8,102	16,608

- In which direction should we calculate probabilities? Row or column percents?

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Solve for the following

- What is the probability of having cardiovascular disease?
 - $P(C) = 286/16,608 = .01722$
- What is the probability of having cardiovascular disease, given you received the treatment
 - $P(C|T) = 164/8,506 = .01928$
- What is the probability of having cardiovascular disease, given you received the placebo?
 - $P(C|P) = 122/8,102 = .01506$

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Calculate the Odds and Odds Ratio

- Odds of having cardiovascular disease versus not for those in the treatment group?
 - Odds = $164/8,342 = .01966$
- Odds of having cardiovascular disease versus not for those in the placebo group?
 - Odds = $122/7,980 = .01529$
- Odds Ratio = $.01966/.01529 = 1.286$

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Say it in Words

Women who got the treatment were 1.3 times more likely to have cardiovascular disease (versus not) compared to the placebo group

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Summary

- Odds and Odds Ratios are another way to express data in table form
- Odds expresses the likelihood of one level of a variable experiencing a situation relative to another level
- An odds ratio is the ratio of two odds and express how many times more likely is one group to experience a situation compared to another group