Lecture on Biostatistics: Understanding the Odds Ratio (OR)

Bismillah ar-Rahman ar-Rahim

Welcome to today's lecture on one of the major health indicators in Biostatistics: the Odds Ratio (OR).

1 Introduction to the Odds Ratio

1.1 What is the Odds Ratio?

The **Odds Ratio (OR)** is a statistical measure used to determine the strength of the association between a specific influence (or exposure) and a specific outcome (or result). Essentially, it assesses whether the presence of a particular factor increases the likelihood of a certain outcome.

Key Points:

- **Correlation Measurement:** OR measures the correlation between an influence and an outcome.
- **Risk Assessment:** It helps identify whether exposure to a stimulus is causing the result or if the exposure itself is a risk factor for the outcome.

1.2 Why Use the Odds Ratio?

Imagine you're trying to figure out if using a phone while driving increases the risk of car accidents. The Odds Ratio allows us to quantify this relationship by comparing the odds of accidents occurring with and without phone usage.

1.3 How to Calculate the Odds Ratio?

To calculate the Odds Ratio, we use a contingency table that organizes data based on exposure and outcome. Here's the standard format:

Result	**Negative Effect (-)**	**Positive Effect (+)**	**Effect**
Positive Result (+)	b	a	Effect
Negative Result (-)	d	c	

Table 1: Contingency Table for Calculating Odds Ratio

Formula 1:

$$\text{OR} = \frac{a \times d}{b \times c}$$

2 Defining the Components of the Odds Ratio

2.1 Understanding a, b, c, d

To effectively use the Odds Ratio, it's crucial to understand what each component in the contingency table represents:

1. a**:** The number of cases where the outcome was obtained **and** the exposure was present (+,+).
2. b**:** The number of cases where the outcome was **not** obtained but the exposure was present (-,+).
3. c**:** The number of cases where the outcome was obtained but the exposure was **not** present (+,-).
4. d**:** The number of cases where the outcome was **not** obtained and the exposure was **not** present (-,-).

2.2 Formula Recap

Formula 1:

$$\text{OR} = \frac{a \times d}{b \times c}$$

2.3 Example 1: Phone Usage While Driving and Car Accidents

Let's delve into an example to illustrate how to apply the Odds Ratio.

Scenario: We want to determine whether using a phone while driving is a risk factor for car accidents. We take a sample of 500 car drivers and observe their phone usage and accident occurrence.

Data Collected:

Result	**Negative Effect (-)**	**Positive Effect (+)**	**Effect**
Accident (+)	$b = 23$	$a = 185$	Effect
No Accident (-)	$d = 196$	$c = 96$	

Table 2: Data Collected for Example 1

- $a = 185$**:** Drivers who used the phone while driving and had accidents.
- $b = 23$**:** Drivers who used the phone while driving but did **not** have accidents.
- $c = 96$**:** Drivers who did **not** use the phone while driving but had accidents.
- $d = 196$**:** Drivers who did **not** use the phone while driving and did **not** have accidents.

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3 Calculating the Odds Ratio with the Example

3.1 Step-by-Step Calculation

Using **Formula 1**, we can calculate the Odds Ratio for our example.

$$\text{OR} = \frac{a \times d}{b \times c}$$

Plugging in the values:

$$\text{OR} = \frac{185 \times 196}{23 \times 96} = \frac{36,260}{2,208} \approx 16.42$$

Interpretation: An Odds Ratio of **16.42** suggests that drivers who use their phone while driving are approximately **16 times** more likely to be involved in a car accident compared to those who do not use their phone while driving.

Result	Negative Effect (-)	Positive Effect (+)	Effect
Accident (+)	23	185	Effect
No Accident (-)	196	96	

Table 3: Visual Representation of Data for Example 1

3.2 Visual Representation of the Data

4 Conclusion

In today's lecture, we explored the **Odds Ratio (OR)**, a vital tool in Biostatistics for measuring the association between an exposure and an outcome. Through **Example 1**, we demonstrated how to calculate the OR and interpret its significance in assessing risk factors.

Key Takeaways:

- The Odds Ratio quantifies the strength of the association between an exposure and an outcome.
- It is calculated using the formula: $\mathbf{OR = (a \times d) \ / \ (b \times c)}$
- A higher OR indicates a stronger association between the exposure and the outcome.

By mastering the Odds Ratio, you can effectively evaluate risk factors and make informed decisions in public health and clinical research.

Thank you for your attention!

Stay tuned for our next lecture where we will delve deeper into other biostatistical measures.