Risk and Odds

LET Mathematics & Statistics

This workshop focuses on understanding how to quantify the likelihood of an event occurring using two different measures: Risk and Odds. You will also look at how to compare these measures between groups using Ratios.

Risk and Relative Risk (RR)

Risk is the number of people who experience an event divided by the total number of people in that group.

$$\text{Risk} = \frac{\text{Number of events}}{\text{Total number in group}}$$

Relative Risk (RR) is used to compare the risk in two different groups (usually an ”exposed” or ”intervention” group vs. a ”control” group).

$$\text{Relative Risk} = \frac{\text{Risk in intervention group}}{\text{Risk in control group}}$$

- RR = 1: The risk is the same in both groups.
- RR $>$ 1: The risk is higher in the intervention group.
- RR $<$ 1: The risk is lower in the intervention group.

1. 400 people were recruited into a study regarding ”sweaty palms.” 160 people were given a New Treatment, and 240 people continued with the Standard Treatment.

   - In the New Treatment group, 50 had an attack of sweaty palms.
   - In the Standard Treatment group, 120 had an attack of sweaty palms.

   (a) Complete the table based on the information provided above

Group	Sweaty Palms	No Sweaty Palms	Total
New Treatment	**50**	**110**	**160**
Standard Treatment	**120**	**120**	**240**

(b) Calculate the risk of sweaty palms for the New Treatment group (as a decimal).

Solution

Risk $= 50/160 = 0.3125$

(c) Calculate the Relative Risk (RR) of the New Treatment compared to the Standard Treatment.

Solution

Standard Risk $= 120/240 = 0.5$.
RR $= 0.3125/0.5 = 0.625$.

(d) How would you interpret the risk of sweaty palms in the new treatment compared to the standard treatment?

○ There is no difference in risk
○ There is an increased risk in the new treatment group
⊗ **There is a decreased risk in the new treatment group**

Odds and Odds Ratio (OR)

While Risk compares the number of events to the total group, Odds compare the number of events to the number of non-events.

$$\text{Odds} = \frac{\text{Number of events}}{\text{Number of non-events}}$$

In a retrospective case-control study, we start with people who already have a condition (cases) and look back. In these studies, we often don't know the total population at risk, so we cannot calculate Risk. Instead, we use the Odds Ratio (OR).

$$\text{Odds Ratio} = \frac{\text{Odds of exposure in cases}}{\text{Odds of exposure in controls}}$$

2. 320 people with ruptured nodules (cases) were investigated; 64 had been exposed to a cold bungee rope. 360 people without nodules (controls) were investigated; 40 had been exposed.

	Ruptured (cases)	**No Rupture (controls)**
Exposed	64	40
Not Exposed	256	320

(a) The odds of exposure in the ruptured group is 0.25. Which calculation correctly shows how this value is reached?

Solution

Odds is Events (64) divided by Non-events (256).
$64/256 = 0.25$.

(b) Calculate the odds of exposure in the group where ruptured nodules did not occur (the controls).

Solution

For the controls: $40/320 = 0.125$.

(c) Calculate the Odds Ratio (OR) for exposure in the Ruptured group compared to the No Rupture group.

Solution

OR $= 0.25/0.125 = 2$

(d) How would you interpret this odds ratio?

Solution

The odds of having been exposed to a cold bungee are 2 times higher for those with ruptured nodules compared to those without.

Odds Ratios in Regression

In medical research papers, you will often see Odds Ratios reported from ”Multivariate Regression Models.” These models tell us the odds of an outcome occurring based on several different factors at once.

- OR > 1: The factor increases the odds of the outcome.
- OR < 1: The factor decreases the odds of the outcome.
- P-value < 0.05: The result is considered statistically significant.
- 95% Confidence Interval (CI): If the range includes 1, the result is usually not significant.

3. The following table includes all factors from a study on delayed discharge.

Factor	**p**	**OR**	**95% CI for OR**
Discharge EMS ≥ 14	0.075	0.72	0.50 - 1.03
CFS ≥ 5	0.009	1.74	1.15 - 2.63
Delirium	0.008	1.79	1.17 - 2.74
Lives Alone	<0.001	1.98	1.40 - 2.81
New Institutionalization	<0.001	2.78	1.67 - 4.62
New Package of Care	<0.001	4.05	2.68 - 6.10

(a) Based on the table, are there higher or lower odds of a delayed discharge if the patient has a discharge EMS of 14 or greater? Is this significant at the 5% level?

Solution

The OR is 0.72 (lower odds), and the p-value is 0.075 (not significant at the 5% level).

(b) Does the 95% Confidence Interval for the EMS variable concur with the significance result found in Question 3a?

Solution

Yes. The interval 0.50 to 1.03 includes 1.0, meaning the result is not statistically significant.

(c) Approximately how many times higher are the odds of being delayed in discharge if the patient lives alone?

Solution

The OR for 'Lives Alone' is 1.98, which is nearly double the odds.