

Common Odds Ratio Calculation

$$\text{OR}_{MH} = \frac{a_1 d_1 / n_1 + a_2 d_2 / n_2}{b_1 c_1 / n_1 + b_2 c_2 / n_2}$$

$$= \frac{(54)(254)/580 + (25)(286)/600}{(246)(26)/580 + (275)(14)/600}$$

$$= 13.565/17.444$$

$$= 2.04$$

Module 34: Risk, Relative Risk, Odds, Odds Ratios

This module provides definitions for risk, relative risk, odds and odds ratios

Typical Data

Sex	Disease		Total
	Yes	No	
Male	7 ($a = x_m$)	3 (b)	10 ($a + b = n_m$)
Female	13 ($c = x_f$)	7 (d)	20 ($c + d = n_f$)
Total	20 ($a + c$)	10 ($b + d$)	30 ($a + b + c + d$)

Risk and Relative Risk

Sex	Disease		Total
	Yes	No	
Male	7	3	10
Female	13	7	20
Total	20	10	30

Risk = Probability of having disease

For males: $R_m = p_m = x_m/n_m = a/(a + b) = 7/10 = 0.70$

For females: $R_f = p_f = x_f/n_f = c/(c + d) = 13/20 = 0.65$

Relative Risk: $RR_{m/f} = R_m/R_f = 0.70/0.65 = 1.08$

Odds and Odds Ratios

Sex	Disease		Total
	Yes	No	
Male	7	3	10
Female	13	7	20
Total	20	10	30

Odds = Number with disease/Number without disease

$$\text{Odds}_m = O_m = 7/3 = 2.33$$

$$\text{Odds}_f = O_f = 13/7 = 1.86$$

$$\text{Odds Ratio} = \text{OR}_{m/f} = O_m/O_f = 2.33/1.86 = 1.25$$

Another Look at Odds

Odds = Probability of having disease/Probability of *not* having disease

For males:

$$O_m = \frac{p_m}{1 - p_m} = \frac{a / (a + b)}{b / (a + b)} = \frac{a}{b} = \frac{7 / 10}{3 / 10} = \frac{7}{3}$$

For females:

$$O_f = \frac{p_f}{1 - p_f} = \frac{c / (c + d)}{d / (c + d)} = \frac{c}{d} = \frac{13 / 20}{7 / 20} = \frac{13}{7}$$

Relative Risk versus Odds Ratios

Relative Risk and Odds Ratios are related concepts and are approximately equal for rare events:

$$RR = \frac{a}{a + b} * \frac{c + d}{c} \approx \frac{a}{b} * \frac{c}{d} = OR$$

when a is very small so that $b \approx a + b$, and c is very small so that $d \approx c + d$.

Mantel-Haenszel Common Odds Ratio

It can be useful to have an “average” or common odds ratios for some situations, such as:

Education Level 1

Treatment	Disease		Total
	Yes	No	
Placebo	54	246	300
Drug	26	254	280
Total	80	500	580

$$\text{Odds}_P = 0.18/0.82 = 0.22$$

$$\text{Odds}_D = 0.093/0.907 = 0.103$$

$$\text{OR}_{P/D} = 0.22/0.103 = 2.14$$

Education Level 2

Treatment	Disease		Total
	Yes	No	
Placebo	25	275	300
Drug	14	286	300
Total	39	561	600

$$\text{Odds}_P = 0.083/0.917 = 0.091$$

$$\text{Odds}_D = 0.047/0.953 = 0.049$$

$$\text{OR}_{P/D} = 0.091/0.049 = 1.86$$