

Calculating risk measures

Outcome		
Exposure	D1	D2
E1	a	b
E2	c	d

Exposure vs. Outcome

- **Exposure variable:** predictor variable
 - *e.g. In a SARS study, researchers were interested in whether the likelihood of death is different for those taking Ribavirin. The variable identifying whether the person takes the drug or not is the exposure variable.*
- **Outcome variable:** response variable or the variable the study attempts to predict
- E1 and E2 (refer to risk measures table): the categories for the exposure variable; risk for the E1 group is compared to the risk for the E2 group.
 - E1 = exposed group.
 - *e.g. If gender is the exposure variable and E1 is defined as males, the risk of the outcome in males is compared to the risk in females.*
- D1 and D2 are categories for the outcome variable.

Risk Ratio (≡ relative risk)

- **Risk:** probability of the outcome occurring.
 - $R_{E1} = \frac{a}{a+b}$
 - $R_{E2} = \frac{c}{c+d}$
- **Risk ratio (or relative risk):** ratio of the risks of an outcome for two groups. The estimated risk ratio (RR) of outcome D1 occurring is:
 - $RR = \frac{R_{E1}}{R_{E2}} = \frac{\frac{a}{a+b}}{\frac{c}{c+d}}$

- An RR of 1 = estimated risk of the outcome is the same in the two groups.
 - RR of 2 = estimated risk in the exposed group is twice that of the unexposed
 - RR of $\frac{1}{2}$ = estimated risk of the exposed group is half that of the unexposed.

Odds Ratio (OR)

- **Odds:** the ratio of the probability that the event occurs to the probability that the event does not occur.
 - **Odds** = $\frac{p}{1-p}$, where p is the probability of the even occurring.
 - e.g. The probability that a cornea transplant is successful (no rejection) is 0.8. The odds of success are **odds** = $\frac{0.8}{1-0.8} = \frac{0.8}{0.2} = \frac{4}{1} = 4$.
 - The probability of the outcome, D1, for the first exposure group E1, is the risk previously estimated as $R_{E1} = \frac{a}{a+b}$.
 - The probability D1 does not occur in the E1 group is $1-R_{E1}$ or $\frac{b}{a+b}$. The odds are shown below, which is similarly computed for the second exposure group E2.
 - $O_{E1} = \frac{\frac{a}{a+b}}{\frac{b}{a+b}} = \frac{a}{b}$
 - $O_{E2} = \frac{\frac{c}{c+d}}{\frac{d}{c+d}} = \frac{c}{d}$
 - **Odds ratio (OR):** ratio of the odds of an outcome for two groups. The estimated odds ratio outcome D1 occurring is:
 - $OR = \frac{O_{E1}}{O_{E2}} = \frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a \cdot d}{b \cdot c}$
 - OR of 1 = estimated odds of the outcome are the same in both groups.
 - OR of 2 = estimated odds in the exposed group are twice that of the unexposed.
 - OR of $\frac{1}{2}$ = estimated odds in the exposed group are half that of the unexposed.