

Odds Ratio

Overview

The odds ratio, similar to other metrics like relative risk, is designed to calculate association between events, typically an exposure (e.g., smoking) and an outcome (e.g., lung cancer). In calculations, the odds ratio is often represented as *OR*. This brief overview will focus on applying the odds ratio equation to a classic epidemiological 2x2 table.

When to use

Odds ratios should generally only be used when the prevalence of the outcome is low in both exposed and unexposed group (typically $\leq 5\%$). This cutoff is somewhat subjective.

In case-control studies, you cannot use relative risk, so the odds ratio is often calculated instead even if prevalence is larger than 5%.

Calculation on 2x2 table

The numerator of the odds ratio is the number of individuals who developed the outcome of interest (e.g., disease) that were exposed to the exposure of interest divided by the number of individuals who were exposed but did NOT develop the outcome.

The denominator is the number of individuals who developed the outcome of interest that were not exposed divided by the number that did not develop the outcome among the unexposed.

More concretely, given a 2x2 table in the following form:

		Disease/outcome Status	
		+ (yes)	- (no)
Exposure Status	+ (yes)	a	b
	- (no)	c	d

You can calculate the odds ratio as:

$$OR = \frac{a/b}{c/d}$$

If you need a refresher on the basics of 2x2 tables, see my notes [here](#).

Interpretation

The OR can be interpreted as:

"The odds of developing <disease/outcome> was X times higher among the <exposed group> than among the <unexposed group>. OR... "The odds of developing <disease/outcome> was X% higher among <exposed group> when compared with the <unexposed group>.

Example

Consider the following (made-up) example.

Suppose a case-control study was conducted to analyze the association between heavy drinking and pancreatic cancer. Among heavy drinkers, there were 259 individuals who had pancreatic cancer, and 2201 who had not. Among non-heavy drinkers, 23 developed pancreatic cancer, and 1995 did not. Calculate and interpret the odds ratio.

The 2x2 table should look like:

	pancreatic cancer	no pancreatic cancer
heavy drinker	259	2201
non-heavy drinker	23	1995

$$OR = \frac{259/2201}{23/1995} = 10.2$$

The odds of developing pancreatic cancer among heavy drinkers is approximately 10.2 times higher than the risk of developing pancreatic cancer among non-heavy drinkers.