Relative risks and odds ratios: What's the difference?

Allen Last, MD, and Stephen Wilson, MD
Goutham Rao, MD, Feature Editor
UPMC St. Margaret Family Practice Residency, Pittsburgh, PA

Some studies use relative risks (RRs) to describe results; others use odds ratios (ORs). Both are calculated from simple 2x2 tables. The question of which statistic to use is subtle but very important.

■ RELATIVE RISK

Probability is the likelihood of an event in relation to all possible events. If a horse wins 2 out of every 5 races, its probability of winning is 2/5 (40%).
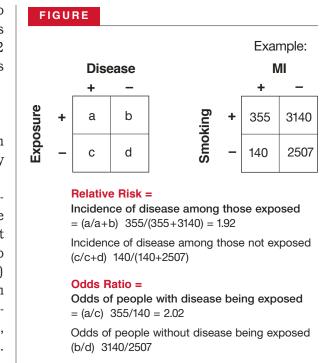
Relative risk is a ratio of probabilities. It compares the incidence or risk of an event among those with a specific exposure with those who were not exposed (eg, myocardial infarctions in those who smoke cigarettes compared with those who do not) **(Figure).** RR is based upon the incidence of an event given that we already know the study participants' exposure status. It is only appropriate, therefore, to use RR for prospective cohort studies.

■ ODDS RATIO

Odds compare events with nonevents. If a horse wins 2 out of every 5 races, its odds of winning are 2 to 3 (expressed as 2:3).

An odds ratio is a ratio of ratios. It compares the presence to absence of an exposure given that we already know about a specific outcome (eg, presence-to-absence ratio of cigarette smoking in those who had an MI compared with the same ratio in those who did not have an MI) **(Figure).**

Correspondence: Allen Last MD, 3518 Fifth Avenue, Pittsburgh, PA 15261. E-mail: lasta@upmc.edu.

FIGURE

Example: MI

Disease / Exposure table with cells a, b, c, d; Smoking / MI example with 355, 3140, 140, 2507.

Relative Risk =
Incidence of disease among those exposed
= $(a/a+b)$ $355/(355+3140) = 1.92$

Incidence of disease among those not exposed
$(c/c+d)$ $140/(140+2507)$

Odds Ratio =
Odds of people with disease being exposed
= (a/c) $355/140 = 2.02$

Odds of people without disease being exposed
(b/d) $3140/2507$

Source for MI data: Njolstad I, et al. Smoking, serum lipids, blood pressure, and sex differences in myocardial infarction. *Circulation* 1996; 93:450–456.

OR can be used to describe the results of case control as well as prospective cohort studies.

■ COMPARING THE TWO

OR and RR are usually comparable in magnitude when the disease studied is rare (eg, most cancers). However, an OR can overestimate and magnify risk, especially when the disease is more common (eg, hypertension) and should be avoided in such cases if RR can be used.