

Relative risk and odds ratios

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What is relative risk?

- Subjects are exposed (e.g., to a carcinogen) or not exposed
- Subjects get the disease (e.g., cancer) or do not get the disease
- Relative risk (RR) =

$$RR = \frac{\text{Incidence of disease in exposed group}}{\text{Incidence of disease in unexposed group}}$$

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- Incidence of disease in exposed group = 15/100
- Incidence of disease in unexposed group = 10/100
- Relative risk = (15/100)/(10/100) = 1.5

- Suppose that, if you are exposed to second-hand cigarette smoke in your home, you are 1.5 times as likely to get lung cancer as a person who is not so exposed.
- Then your relative risk is 1.5.

Odds ratio

- In many statistical analyses, the odds ratio is used instead of the relative risk
- The odds ratio is conceptually similar to the relative risk
 - both are measures of the relative probability of an event (cancer) given exposure versus non-exposure (to second-hand smoke).
- In many disease settings, the odds ratio is approximately equal to the relative risk.

Odds and probability

- Probability of an event (e.g., having a stroke) is in the interval $[0,1]$
- Odds = (Probability) / (1 – Probability) = $P / (1-P)$
- If the probability of an event is $P = 0.5$,
 - the odds are $0.5/(1-0.5) = 0.5/0.5 = 1$
- If the probability of an event is $P = 0.25$,
 - the odds are $0.25/(1-0.25) = 0.25/0.75 = 0.33$
- If the probability of an event is $P = 0.315$,
 - the odds are $0.315/(1-0.315) = 0.315/0.685 = 0.460$

Odds and odds ratio

- We can use the odds ratio to compare the probability of an event when the patient is exposed versus the probability of the event when the patient is not exposed.
- Event 1: Patient has cancer, given they were exposed
- Event 2: Patient has cancer, given they were not exposed.
- Event 1, $P = 0.315$, odds = 0.460
- Event 2, $P = 0.25$, odds = 0.33
- Odds ratio = Odds of event 1 / Odds of event 2 = $0.46/0.33 = 1.38$