

STA 6384, Report 2.11

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Problem: Work problem 2.5, p. 62 of Agresti.

Consider the following two studies reported in *The New York Times*.

(a)

A British study reported (Dec. 3, 1998) that of smokers who get lung cancer, “women were 1.7 times more vulnerable than men to get small-cell lung cancer.’ Is 1.7 the odds ratio or the relative risk?

The value **1.7 is the relative risk.**

Explanation

The study’s population consists of “smokers who get lung cancer.” Within this specific group, it compares the probability of having a particular type of lung cancer (small-cell) based on gender.

- **Relative Risk (RR)** is a ratio of two conditional probabilities. In this context, it’s the probability of an outcome (having small-cell cancer) in one group (women with lung cancer) divided by the probability of the same outcome in another group (men with lung cancer).

The statement “women were 1.7 times more vulnerable” means that the probability of a female smoker with lung cancer having the small-cell type is 1.7 times the probability of a male smoker with lung cancer having the small-cell type.

This can be expressed as:

$$\text{Relative Risk} = \frac{P(\text{small-cell cancer} \mid \text{woman with lung cancer})}{P(\text{small-cell cancer} \mid \text{man with lung cancer})} = 1.7$$

This calculation is a direct comparison of risks, making 1.7 the **relative risk**.

(b)

A National Cancer Institute study about tamoxifen and breast cancer reported (Apr. 7, 1998) that the women taking the drug were 45% less likely to experience invasive breast cancer than were women taking placebo. Find the relative risk for (i) those taking the drug compared with those taking placebo, and (ii) those taking placebo compared with those taking the drug.

- Let R_{drug} be the risk of breast cancer for women taking tamoxifen.
- Let $R_{placebo}$ be the risk of breast cancer for women taking the placebo.

The study states that women taking the drug were “45% less likely” to get cancer. This means their risk is 45% lower than the placebo group’s risk. We can write this as:

$$R_{drug} = R_{placebo} - (0.45 \times R_{placebo})$$

$$R_{drug} = (1 - 0.45) \times R_{placebo}$$

$$R_{drug} = 0.55 \times R_{placebo}$$

(i) *Relative Risk (Drug vs. Placebo)*

The relative risk (RR) is the ratio of the risk in the treatment group to the risk in the control group.

$$RR = \frac{\text{Risk in Drug Group}}{\text{Risk in Placebo Group}} = \frac{R_{drug}}{R_{placebo}}$$

Using our equation from above, we can substitute $0.55 \times R_{placebo}$ for R_{drug} :

$$RR = \frac{0.55 \times R_{placebo}}{R_{placebo}} = 0.55$$

A relative risk of **0.55** indicates that the drug reduces the risk of breast cancer by 45%.

(ii) *Relative Risk (Placebo vs. Drug)*

Now, we flip the comparison to find the relative risk of the placebo group compared to the drug group.

$$RR = \frac{\text{Risk in Placebo Group}}{\text{Risk in Drug Group}} = \frac{R_{placebo}}{R_{drug}}$$

This is simply the reciprocal of our first answer:

$$RR = \frac{1}{0.55} \approx 1.8181\dots$$

Rounding to two decimal places, the relative risk is **1.82**. This means women taking the placebo were about 1.82 times, or 82% more, likely to experience invasive breast cancer than women taking tamoxifen.