

PH 250B Week 4, Tab 4 Ungraded quiz - **ANSWERS**

Topic: Measures of Association

Problem 1. (Fall 2017 250B Problem set)

Recall the causal “types” from lecture: doomed, causal, preventive, and immune (also see ME3, Chapter 4, Table 4-1).

- a) Write the formula for the risk difference using these probabilities (p_1 , p_2 , p_3 , p_4).

$$RD = R_{exp} - R_{unexp}$$

$$RD = ((p_1 + p_2) - (p_1 + p_3))$$

$$RD = p_2 - p_3$$

- b) Write the formula for the risk ratio using these probabilities (p_1 , p_2 , p_3 , p_4).

$$RR = R_{exp} / R_{unexp}$$

$$RR = ((p_1 + p_2) / (p_1 + p_3))$$

- c) Write the formula for the APe% using these probabilities (p_1 , p_2 , p_3 , p_4).

$$APe\% = (R_{exp} - R_{unexp}) / R_{exp} \times 100$$

$$APe\% = ((p_1 + p_2) - (p_1 + p_3)) / ((p_1 + p_2)) \times 100$$

$$APe\% = ((p_2 - p_3)) / ((p_1 + p_2)) \times 100$$

- d) Describe in words what the RD tells you about the causes of disease among individuals **amenable to intervention**. Assume no preventive types.

$$RD = p_2 - p_3 \quad \text{if preventive types are present}$$

$$RD = p_2 \quad \text{if preventive types are absent}$$

If the exposure does not prevent disease in any scenario (i.e. there are no preventive types), then the RD is a function of only the proportion that are causal (ie, “ p_2 ”, those that are amenable to intervention). Thus, it isolates the impacts of exposure on those amenable to intervention.

- e) Describe in words what the RR tells you about the causes of disease among individuals **amenable to intervention**. Assume no preventive types.

$$\begin{aligned} RR &= ((p_1+p_2) / (p_1+p_3)) && \text{if preventive types are present} \\ RR &= (p_1+p_2) / p_1 && \text{if preventive types are absent} \end{aligned}$$

If the exposure does not prevent disease in any scenario (i.e. there are no preventive types), then the RR is a function of both the proportion doomed (“p1”) and the proportion that are causal (ie, “p2”, those that are amenable to intervention). Thus, it does not isolate the impacts of exposure on those amenable to intervention.

- f) Describe in words what the APe% tells you about the causes of disease among individuals **amenable to intervention**. Assume no preventive types.

$$APe\% = [p_2 / (p_1 + p_2)] \times 100$$

The above formula assumes no preventive types exists. We can see that it is a function of both the proportion doomed (“p1”) and the proportion that are causal (ie, those that are amenable to intervention, “p2”). Thus, it does not isolate the impacts of exposure on those amenable to intervention.

Problem 2. (Fall 2017 250B Practice exam)

Now imagine that rather than conducting an observational study, you are able to conduct the ideal counterfactual experiment to study the association between smoking and lung cancer. Using the causal types (doomed, causal, preventive, and immune) presented in lecture and in Rothman, describe in words what the risk difference (RD) and relative risk (RR) represent in terms of these causal types. You can assume that smoking never prevents lung cancer.

The RD measures the net difference in lung cancer incidence caused by smoking (causal – preventive). If you assume no preventive types, RD captures the total incidence in lung cancer caused by smoking (causal).

The RR measures the incidence of lung cancer caused by smoking and all other causes, relative to the incidence due to all other causes and incidence prevented by smoking (causal + doomed)/(preventive + doomed). Or if there are no preventive types it is (causal + doomed)/(doomed).