

# ADS2 Problem set notes: Conditional probabilities

ADS2 (based on MI Stefan)

Semester 2, 2023/24

## News reporting of probabilities

The nutshell paragraph tells us that those who tested positive for COVID were 1.8 times (i.e. nearly two times) more likely to report working (or going to school) outside of the house.

The resulting headline was “Americans who go out to work are nearly twice as likely to test positive for coronavirus...”

Do those mean the same thing? Not if you look closely. The bullet paragraphs talks about how likely someone who tests positive is to be working outside the house. In other words, it is saying:

$$\frac{P_{(WFH \mid +)}}{P_{(WH \mid +)}} = 1.8$$

where “WFH” means “working from home”, “WH” means “working home”, and “+” means “tested positive”.

The headline essentially states that

$$\frac{P_{(+ \mid WFH)}}{P_{(+ \mid WH)}} \approx 2$$

Fundamentally, the probability of testing positive for someone not working from home is not the same as the probability of not working from home for someone who tests positive.

The first fraction is influenced not only by the relative COVID risks in both groups, but also by how big both groups are. For instance, if there are twice as many people working outside their homes as there are working from home, you would get that ration of around 2 even if the infetion risk for both groups is the same!

Mixing up conditional probabilities (thinking that  $P(A|B) = P(B|A)$ ) is a frequently made mistake. You will find it in newspapers, politicians’ speeches, or even scientific papers if you pay close attention.

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