Math 58B, Spring 2022
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WU # 13
Tuesday, March 1, 2022

Your Name: _____

Names of people you worked with: _____

Instructions: Work on this problem in class with your group. Do your best. This piece of paper will be collected during class.

Task: Consider the article we read for today by Jeffrey Morris: "Israeli data: How can efficacy vs. severe disease be strong when 60% of hospitalized are vaccinated?" `https://www.covid-datascience.com/post/israeli-data-how-can-efficacy-vs-severe-disease-be-strong-when-60-of-hospitalized-are-vaccinated`

> Sometimes, with observational data there is confounding of multiple factors that can make it easy to misinterpret simple percentages like this, and the current vaccination situation in Israel brings a perfect storm of confounding factors that lead to confusion if not thought through carefully.

For each of the datasets below, your task will be to compute the effectiveness. Let $p_{\text{some group}}$ = probability of having severe disease for some group. Then,

$$\text{effectiveness} = 1 - \frac{p_{\text{vax}}}{p_{\text{not vax}}} = \frac{p_{\text{not vax}} - p_{\text{vax}}}{p_{\text{not vax}}}$$

1. Calculate the effectiveness for risk of severe hospitalization for all ages.
2. Calculate the effectiveness for risk of severe hospitalization broken down by age (under 50, over 50).
3. Why is the effectiveness higher after adjusting for age? (Consider looking at the percent of Not Vax and the percent of Vax which have severe hospitalization for each age group.)

Age	Population		Severe cases		Effectiveness
	Not Vax	Vax	Not Vax	Vax	vs. severe hospitalization
All ages	1,302,912	5,634,634	214	301	
< 50	1,116,834	3,501,118	43	11	
> 50	186,078	2,133,516	171	290	

Solution:

1. See table
2. See table

Age	Population		Severe cases		Effectiveness
	Not Vax	Vax	Not Vax	Vax	vs. severe hospitalization
All ages	1,302,912	5,634,634	214 $\frac{214}{1,302,912} = 0.0164\%$	301 $\frac{301}{5,634,634} = 0.00534\%$	67.5%
< 50	1,116,834	3,501,118	43 $\frac{43}{1,116,834} = 0.00385\%$	11 $\frac{11}{3,501,118} = 0.000314\%$	91.8%
> 50	186,078	2,133,516	171 $\frac{171}{186,078} = 0.0919\%$	290 $\frac{290}{2,133,516} = 0.0136\%$	85.2%

3. Why is effectiveness higher after adjusting for age? Note that the **risk of sever hospitalization** is higher in older people than in younger people! Indeed, the risk is different depending on whether or not someone is vaccinated:

   If we look at just the UNVACCINATED POPULATION, we see the risk of severe cases is **91.9/3.9=23.6x higher** in older (>50yr) than younger (<50yr) people.

   Looking at fully VACCINATED INDIVIDUALS, we see the risk of severe cases is **13.6/0.3=43.2x higher** in older (>50) than younger (<50) people.

   Key: the majority of not vaccinated are young. And young people have very low rates of hospitalization. The vaccinated are more evenly split, which means that a high proportion of the vaccinated are older (and therefore have higher rates of hospitalization).