Week 1

Live Discussion

Total COVID 19 Cases and Deaths in June 2021 (data from Public Health England)

	Cases	Deaths	COVID Mortality rate (deaths per 100K case)	
Vaccinated	27,192	70	257	(0.257%)
Unvaccinated	53,822	44	82	(0.082%)

3 times higher in vaccinated

Aged at least 50 only

	Cases	Deaths	COVID Mortality rate (deaths per 100K cases)	
Vaccinated	7,499	68	907	(0.907%)
Unvaccinated	976	38	3,893	(3.893%)

So BOTH age categories: higher in the unvaccinated

Aged less that 50

	Cases	Deaths	COVID Mortality rate (deaths per 100K cases)	
Vaccinated	19,693	2	10	(0.01%)
Unvaccinated	52,846	6	11	(0.011%)

A real example of Simpson's paradox

Simpson's Paradox: Cambridge Admissions Data

	WOMEN				MEN		
	Applied	Accepted	%		Applied	Accepted	%
TOTAL	**1,184**	**274**	**23%**		**2,470**	**584**	**24%**

Simpson's Paradox: Cambridge Admissions Data

	WOMEN			MEN		
	Applied	Accepted	%	Applied	Accepted	%
Computer Science	26	7	27%	228	58	25%
Economics	240	63	26%	512	112	22%
Engineering	164	52	32%	972	257	26%
Medicine	416	99	24%	578	135	23%
Veterinary medicine	338	53	16%	180	22	12%

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Medicine	416	99	24%		578	135	23%
Veterinary medicine	338	53	16%		180	22	12%
TOTAL	**1,184**	**274**	23%		**2,470**	**584**	24%

How simple reporting ‘shifts’ can create dangerous safety illusions

Vaccine is a placebo – has no effect all on mortality rates (assumed to be 50 per 100K)

						vaccinated				unvaccinated		
Week	Population	Total deaths	% vaccinated			population	deaths	Vaccinated mortality rate		population	deaths	Unvaccinated mortality rate
1	10,000,000	5,000	1.00%			100,000	50	50		9,900,000	4950	50
2	9,995,000	4,998	2.00%			199,900	100	50		9,795,100	4898	50
3	9,990,003	4,995	4.00%			399,600	200	50		9,590,402	4795	50
4	9,985,007	4,993	8.00%			798,801	399	50		9,186,207	4593	50
5	9,980,015	4,990	16.00%			1,596,802	798	50		8,383,213	4192	50
6	9,975,025	4,988	32.00%			3,192,008	1596	50		6,783,017	3392	50
7	9,970,037	4,985	64.00%			6,380,824	3190	50		3,589,213	1795	50
8	9,965,052	4,983	90.00%			8,968,547	4484	50		996,505	498	50
9	9,960,070	4,980	98.00%			9,760,869	4880	50		199,201	100	50
10	9,955,090	4,978	99.00%			9,855,539	4928	50		99,551	50	50
11	9,950,112	4,975	99.50%			9,900,362	4950	50		49,751	25	50
12	9,945,137	4,973	99.60%			9,905,357	4953	50		39,781	20	50
13	9,940,165	4,970	99.70%			9,910,344	4955	50		29,820	15	50

…but imagine a one week delay in reporting death totals

						vaccinated				unvaccinated		
Week	Population	Total deaths	% vaccinated			population	deaths reported	Vaccinated mortality rate		population	deaths reported	Unvaccinated mortality rate
1	10,000,000	5,000	1.00%			100,000				9,900,000		
2	9,995,000	4,998	2.00%			199,900	50	25.01		9,795,100	4948	50.51
3	9,990,003	4,995	4.00%			399,600	100	25.01		9,590,402	4895	51.04
4	9,985,007	4,993	8.00%			798,801	200	25.01		9,186,207	4793	52.17
5	9,980,015	4,990	16.00%			1,596,802	399	25.01		8,383,213	4591	54.76
6	9,975,025	4,988	32.00%			3,192,008	798	25.01		6,783,017	4189	61.76
7	9,970,037	4,985	64.00%			6,380,824	1596	25.01		3,589,213	3389	94.42
8	9,965,052	4,983	90.00%			8,968,547	3190	35.57		996,505	1792	179.84
9	9,960,070	4,980	98.00%			9,760,869	4484	45.94		199,201	496	248.87
10	9,955,090	4,978	99.00%			9,855,539	4880	49.52		99,551	97	97.55
11	9,950,112	4,975	99.50%			9,900,362	4928	49.77		49,751	47	95.05
12	9,945,137	4,973	99.60%			9,905,357	4950	49.97		39,781	22	56.28
13	9,940,165	4,970	99.70%			9,910,344	4953	49.97		29,820	17	58.36

We get exactly same results (apart from week 1) if newly vaccinated deaths classified as unvaccinated

						vaccinated				unvaccinated		
Week	Population	Total deaths	% vaccinated			population	deaths	Vaccinated mortality rate		population	deaths	Unvaccinated mortality rate
1	10,000,000	5,000	1.00%			100,000	50	50		9,900,000	4950	50
2	9,995,000	4,998	2.00%			199,900	100	50		9,795,100	4898	50
3	9,990,003	4,995	4.00%			399,600	200	50		9,590,402	4795	50
4	9,985,007	4,993	8.00%			798,801	399	50		9,186,207	4593	50
5	9,980,015	4,990	16.00%			1,596,802	798	50		8,383,213	4192	50
6	9,975,025	4,988	32.00%			3,192,008	1596	50		6,783,017	3392	50
7	9,970,037	4,985	64.00%			6,380,824	3190	50		3,589,213	1795	50
8	9,965,052	4,983	90.00%			8,968,547	4484	50		996,505	498	50
9	9,960,070	4,980	98.00%			9,760,869	4880	50		199,201	100	50
10	9,955,090	4,978	99.00%			9,855,539	4928	50		99,551	50	50
11	9,950,112	4,975	99.50%			9,900,362	4950	50		49,751	25	50
12	9,945,137	4,973	99.60%			9,905,357	4953	50		39,781	20	50
13	9,940,165	4,970	99.70%			9,910,344	4955	50		29,820	15	50

Newly vaccinated deaths classified as unvaccinated

						vaccinated				unvaccinated		
Week	Population	Total deaths	% vaccinated	newly vaccinated		population	deaths reported	Vaccinated mortality rate		population	deaths reported	Unvaccinated mortality rate
1	10,000,000	5,000	1.00%	100,000		100,000	0	0.00		9,900,000	5000	50.51
2	9,995,000	4,998	2.00%	99,900		199,900	50	25.01		9,795,100	4948	50.51
3	9,990,003	4,995	4.00%	199,700		399,600	100	25.01		9,590,402	4895	51.04
4	9,985,007	4,993	8.00%	399,200		798,801	200	25.01		9,186,207	4793	52.17
5	9,980,015	4,990	16.00%	798,002		1,596,802	399	25.01		8,383,213	4591	54.76
6	9,975,025	4,988	32.00%	1,595,206		3,192,008	798	25.01		6,783,017	4189	61.76
7	9,970,037	4,985	64.00%	3,188,816		6,380,824	1596	25.01		3,589,213	3389	94.42
8	9,965,052	4,983	90.00%	2,587,723		8,968,547	3190	35.57		996,505	1792	179.84
9	9,960,070	4,980	98.00%	792,321		9,760,869	4484	45.94		199,201	496	248.87
10	9,955,090	4,978	99.00%	94,670		9,855,539	4880	49.52		99,551	97	97.55
11	9,950,112	4,975	99.50%	44,823		9,900,362	4928	49.77		49,751	47	95.05
12	9,945,137	4,973	99.60%	4,995		9,905,357	4950	49.97		39,781	22	56.28
13	9,940,165	4,970	99.70%	4,987		9,910,344	4953	49.97		29,820	17	58.36

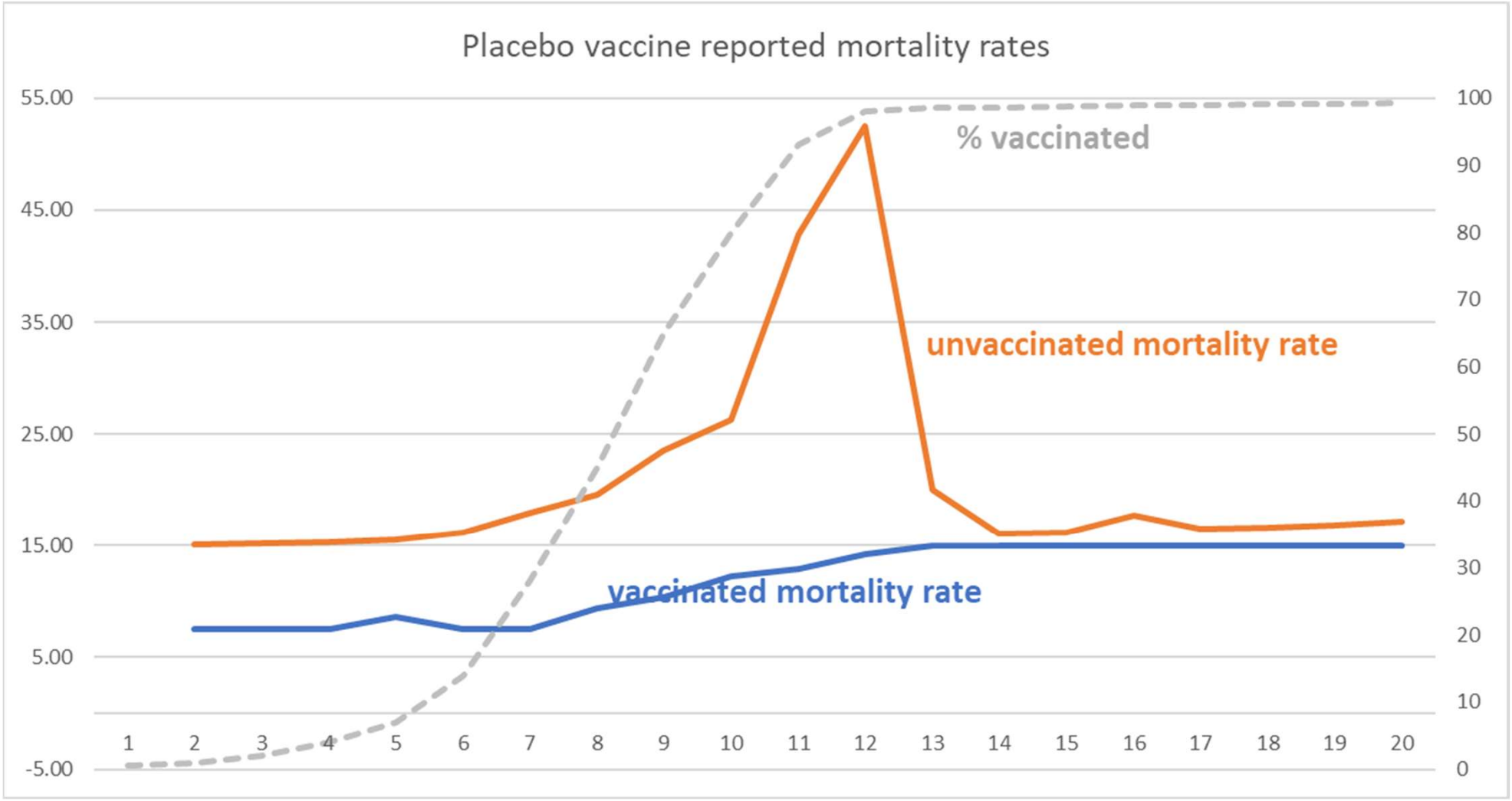
Why one week delay in death reporting is equivalent to misclassifying newly vaccinated deaths

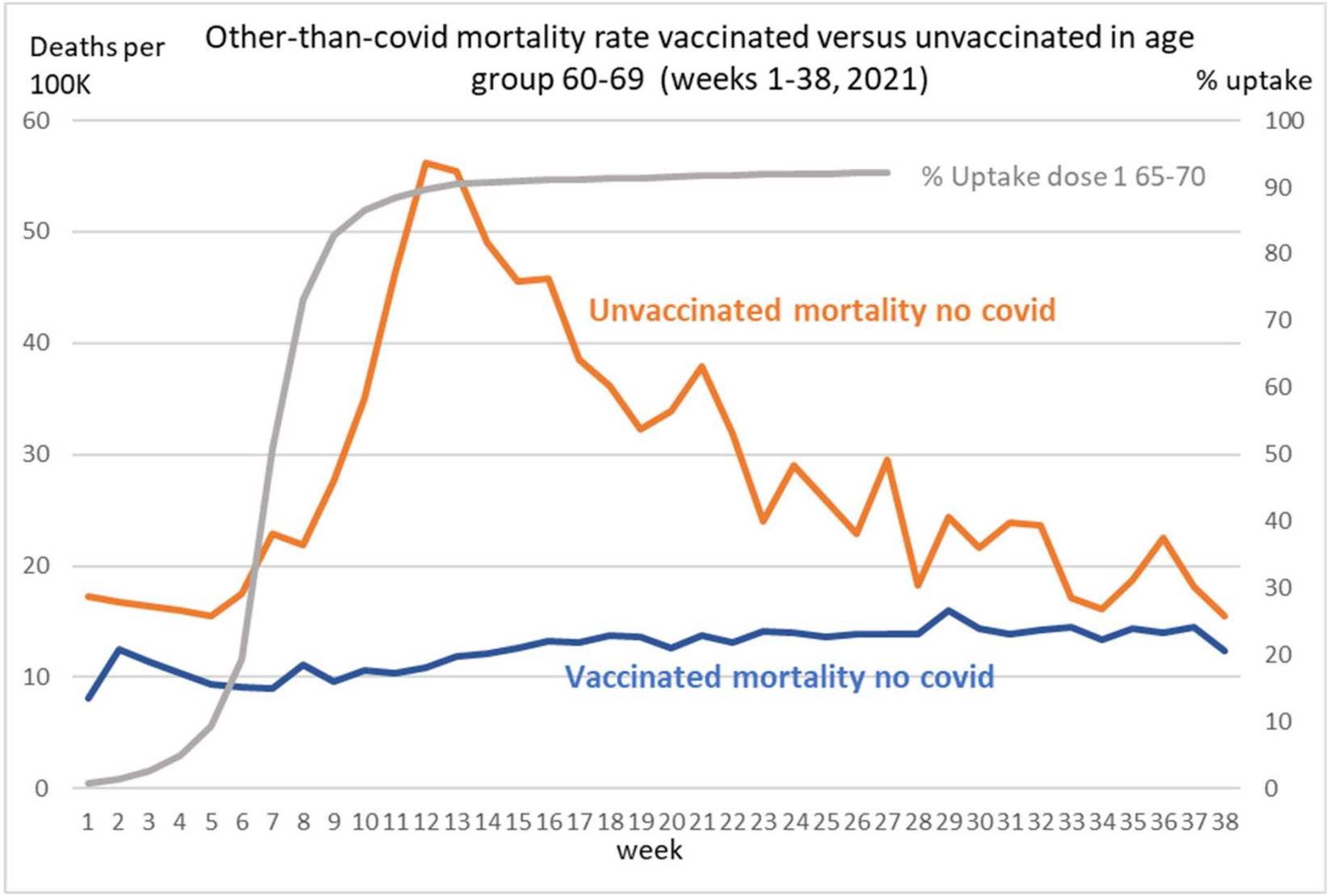
week	Total vaccinated (P)	Newly vaccinated (N)	Weekly vaccinated deaths (A)	Newly vaccinated deaths (B)	Reported vacc deaths 1-week delay	Reported vacc deaths with misclassification (A-B)
1	10,000	10,000	5	5		0
2	100,000	90,000	50	45	5	5
3	200,000	100,000	100	50	50	50
4	400,000	200,000	200	100	100	100
5	800,000	400,000	400	200	200	200
6	820,000	20,000	410	10	400	400
7	830,000	10,000	415	5	410	410

Formal Proof

1. Let m be weekly mortality rate
2. Let P_t be total vaccinated at week t
3. Let N_t be number newly vaccinated in week t. Then $N_t=P_t - P_{t-1}$
4. Let A_t be total number of deaths of vaccinated in week t. So, $A_t=m*P_t$
5. Let B_t the number of deaths of newly vaccinated in week t. So $B_t=m*N_t = m*(P_t - P_{t-1})$ by (3)
6. The number of reported deaths in week t is $A_t - B_t = m*P_t - m*(P_t - P_{t-1}) = m*P_{t-1}$ by (5) which is the number of actual deaths in week (t-1)

Placebo apparently saves lives….




Deaths per 100K
Other-than-covid mortality rate vaccinated versus unvaccinated in age group 60-69 (weeks 1-38, 2021)
% uptake
% Uptake dose 1 65-70
Unvaccinated mortality no covid
Vaccinated mortality no covid
week

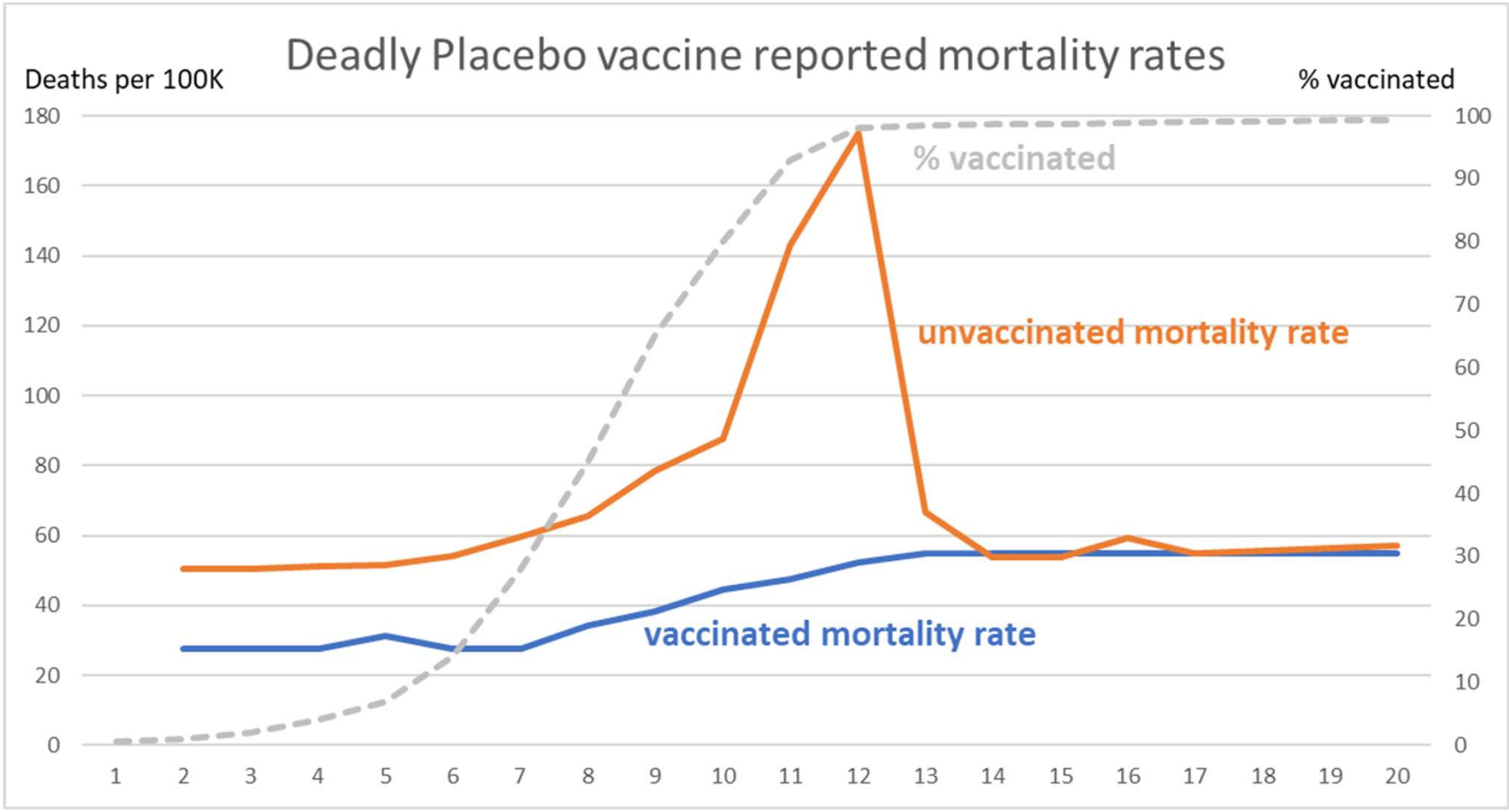
Deadly placebo (mortality rate increases to 55 per 100K)

			vaccinated			unvaccinated		
Week	Population	Percentage vaccinated	deaths	population	Vaccinated mortality rate	deaths	population	Unvaccinated mortality rate
1	1,000,000	0.5	3	5,000	55	498	995,000	50
2	999,850	1	5	9,999	55	495	989,852	50
3	999,700	2	11	19,994	55	490	979,706	50
4	999,550	4	22	39,982	55	480	959,568	50
5	999,400	7	38	69,958	55	465	929,442	50
6	999,250	14	77	139,895	55	430	859,355	50
7	999,100	28	154	279,748	55	360	719,352	50
8	998,950	45	247	449,528	55	275	549,423	50
9	998,801	65	357	649,220	55	175	349,580	50
10	998,651	80	439	798,921	55	100	199,730	50
11	998,501	93	511	928,606	55	35	69,895	50
12	998,351	98	538	978,384	55	10	19,967	50
13	998,201	98.5	541	983,228	55	7	14,973	50
14	998,052	98.6	541	984,079	55	7	13,973	50
15	997,902	98.7	542	984,929	55	6	12,973	50
16	997,752	98.9	543	986,777	55	5	10,975	50
17	997,603	99	543	987,627	55	5	9,976	50
18	997,453	99.1	544	988,476	55	4	8,977	50
19	997,303	99.2	544	989,325	55	4	7,978	50
20	997,154	99.3	545	990,174	55	3	6,980	50

Deadly placebo (reporting shift)

			vaccinated			unvaccinated		
Week	Population	Percentage vaccinated	deaths	population	Vaccinated mortality rate	deaths	population	Unvaccinated mortality rate
1	1,000,000	0.5		5,000			995,000	
2	999,850	1	3	9,999	27.50	498	989,852	50.26
3	999,700	2	5	19,994	27.50	495	979,706	50.52
4	999,550	4	11	39,982	27.50	490	959,568	51.05
5	999,400	7	22	69,958	31.43	480	929,442	51.62
6	999,250	14	38	139,895	27.50	465	859,355	54.08
7	999,100	28	77	279,748	27.50	430	719,352	59.73
8	998,950	45	154	449,528	34.23	360	549,423	65.46
9	998,801	65	247	649,220	38.08	275	349,580	78.58
10	998,651	80	357	798,921	44.69	175	199,730	87.51
11	998,501	93	439	928,606	47.32	100	69,895	142.88
12	998,351	98	511	978,384	52.20	35	19,967	175.03
13	998,201	98.5	538	983,228	54.73	10	14,973	66.68
14	998,052	98.6	541	984,079	54.95	7	13,973	53.58
15	997,902	98.7	541	984,929	54.95	7	12,973	53.85
16	997,752	98.9	542	986,777	54.90	6	10,975	59.10
17	997,603	99	543	987,627	54.95	5	9,976	55.01
18	997,453	99.1	543	988,476	54.95	5	8,977	55.56
19	997,303	99.2	544	989,325	54.95	4	7,978	56.26
20	997,154	99.3	544	990,174	54.95	4	6,980	57.15

Deadly placebo apparently saves lives….



Suppose a screening test for a type of cancer

95% accurate for those with the cancer

so the true positive rate – sensitivity - is 95%, meaning 95% of those with the disease will test positive

90% accurate for those without the cancer

so the true negative rate – specificity - is 90%, meaning 90% of those without the virus will test negative

It is estimated the current population rate for the cancer is 1 in a 2000

Sarah tests positive.

What is the probability Sarah has the cancer?

Social media followers

- If you select one of your Facebook/Instagram/twitter friends/followers at random the probability that you have at least as many friends/followers as that person is about 50%. True or False?