

# Probability and Risk

Improving public understanding of probability and risk with special emphasis on its application to the law. Why Bayes theorem and Bayesian networks are needed



## Norman Fenton

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## Contributors

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Monday, 17 May 2021

## Is the Pfizer vaccine as effective as claimed?

There was massive media fanfare over the [study \(published in The Lancet\)](#) in Israel on the effectiveness of the Pfizer vaccine.

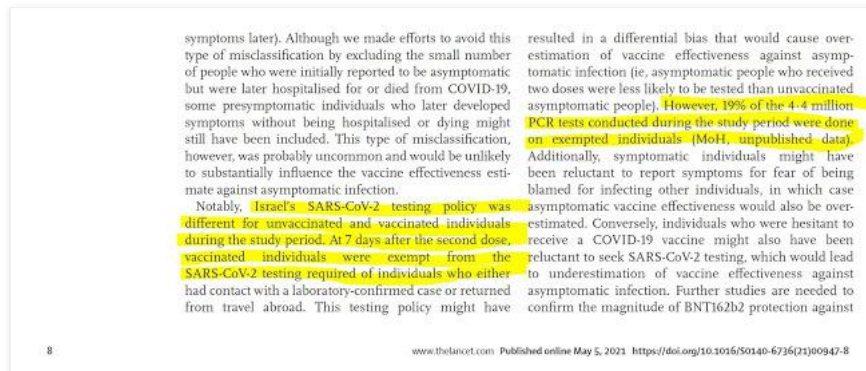


Notwithstanding the fact that 8 of the 15 authors "hold stock and share options in Pfizer" the results look genuinely impressive and provide support for the hypothesis that the vaccine is effective in preventing infection. In particular, the raw data (Table 2 of the paper\*\*) states the following

- Between 24 Jan 2021 and 3 April 2021 there were 109,876 'cases' of SARS-Cov-2 found among those unvaccinated\*\*\* compared to just 6,266 'cases' found among those vaccinated.
- The table also provides the 'incident rate per 100,000 person days' which is: 91.5 for unvaccinated compared to 3.1 for vaccinated
- Based on these data the (adjusted) 'vaccine effectiveness' measure\*\*\*\* is calculated as 95.3% (hence the headline figure picked up by all main stream media).

There are, however, issues with the study and its analysis which mean the 95% effectiveness measure is exaggerated. In [this article](#) Will Jones argues that the researchers have not adjusted for the declining infection rate during the study period and that when you do so, the effectiveness drops to 74% (in the over 65's).

A different problem with the study (that we focus on here) arises from the statement found on page 8 of the paper:



What this is saying is that, whereas unvaccinated people continued to be regularly and routinely subject to PCR tests, vaccinated people no longer had to be. The number of 'cases' stated in Table 2 is, of course, simply the number of positive PCR test outcomes (which includes false positives). If you stop testing vaccinated people then you are not going to find any 'cases' among them. The paper says that 19% of the tests were, however, on 'exempted', i.e. vaccinated people. But, this still means unvaccinated people were much more likely to be tested than vaccinated people, so we have to take account of the absolute number of tests performed on both vaccinated and unvaccinated.

## Book "Risk Assessment and Decision Analysis with Bayesian Networks"

- [Book blog page](#)
- [Buy \(Amazon\)](#)
- [Buy \(CRC Press\)](#)

## Key readings

- [Bayes and cause modelling in decision making, uncertainty and](#)
- [Irrational restrictions on Bayes in the Law](#)
- [Probability Fallacies and the Law](#)

## Labels

- [AgenaRisk](#)
- [Bayes and probability theory](#)
- [case study](#)
- [COVID](#)
- [legal reasoning](#)
- [likelihood ratio](#)
- [medical](#)
- [New paper](#)
- [review](#)
- [risk assessment](#)

## Links

- [BAYES-KNOWLEDGE Blog](#)
- [Agena: Bayesian networks](#)
- [Book: Risk Assessment with Bayesian Network](#)
- [Bayes and the Law](#)
- [Pi Football \(Using Bayesian nets to predict football results\)](#)
- [Probability: Fallacies, Myths and Puzzles](#)
- [Risk Assessment and Decision Analysis at Queen Mary](#)

## Blog Archive

- ▼ [2021 \(14\)](#)
  - ▶ [June \(1\)](#)
  - ▼ [May \(1\)](#)
    - Is the Pfizer vaccine as effective as claimed?
  - ▶ [April \(4\)](#)
  - ▶ [March \(2\)](#)
  - ▶ [February \(5\)](#)
  - ▶ [January \(1\)](#)
- ▶ [2020 \(39\)](#)

- 3,564,000 tests on unvaccinated people (of whom there were 1,823,979; so, on average, each unvaccinated person received two PCR tests)

So, the number of 'cases' per 1000 tests were:

- 30.8 for unvaccinated people (109,876 divided by 3,564,000 times 1000)
- 7.5 for vaccinated people (6,266 divided by 836,000 times 1000)

Using the simple 'cases per 1000 tests' (rather than the biased 'incident rate per 100,000 person days'), **results in an approximate 'vaccine effectiveness' measure of 75.7%**. While this is much less than the 95% headline figure, it is still impressive, so it is strange why the study failed to account for the difference in proportions tested.

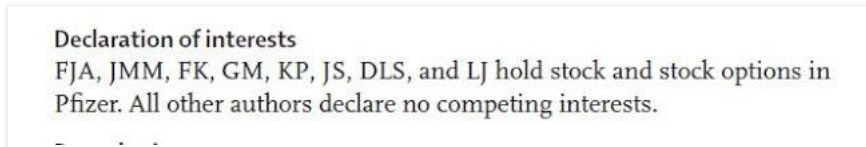
It appears that the failure to adjust the vaccine effectiveness calculation for different testing protocols for vaccinated and unvaccinated people is not restricted to this Pfizer study in Israel. The data in the [FDA briefing document on the Pfizer vaccine \(dated 10 Dec 2020\)](#) suggests there was a similar problem with the phase 3 trial of the vaccine. This was a randomized, double-blinded and placebo-controlled trial of the vaccine in 44,000 uninfected participants. It similarly reports a 95% effectiveness measure based on the fact that (post injection) there were 162 confirmed Covid-19 cases among the placebo participants compared to just 8 among the vaccinated participants. However, the study also reports that there were a much larger number of 'suspected but unconfirmed' cases and that these were more evenly spread between placebo participants (1,816 such cases) and vaccinated participants (1,594 such cases). This seems to suggest that a disproportionately small number of vaccinated participants with symptoms received PCR tests compared to placebo participants with symptoms.

Clearly the failure to properly adjust for both a decreasing infection rate and different testing protocols for vaccinated and unvaccinated people casts doubt on the validity of the studies.

It is also worth noting that, even if we ignore all of the above issues and accept as undisputed the number for 'COVID-19 related deaths' in the Israel study (715 among the unvaccinated and 138 among the vaccinated), then **the absolute percentage increase in risk of death for an unvaccinated person is just 0.036%**. That means that, even if we accept the 95% effectiveness measure, for every 10,000 unvaccinated people, about 3 or 4 would die as a result of not being vaccinated. And this brings us to the final (and critical) problem with the study. It does not provide any information about the number of adverse reactions - in particular the number of deaths - due to the vaccine. Hence, it does not provide the necessary information to make an informed decision about the overall risk/benefit of the vaccine.

***We submitted a 250-word response to The Lancet over a week ago summarising the above concerns about the article, but the response is still "With the Editor".***

\*screenshot of declared interests in the paper:



\*\*Table 2 screenshot from the paper:

- ▶ 2015 (22)
- ▶ 2014 (9)
- ▶ 2013 (7)
- ▶ 2012 (8)
- ▶ 2011 (11)

Age 16-44 years	84 611	95.1	1801	2.3	95.4% (94.0-96.5)	96.1% (95.7-96.5)
Age 45-64 years	18 579	86.1	2264	3.4	93.6% (91.4-95.3)	94.9% (94.2-95.5)
Age ≥65 years	5686	67.7	2201	3.8	93.4% (91.3-95.0)	94.8% (93.9-95.5)
All ages	109 876	91.5	6266	3.1	94.2% (93.2-95.1)	95.3% (94.9-95.7)
<b>Asymptomatic SARS-CoV-2 infection</b>						
Age 16-44 years	40 088	45.1	1174	1.5	92.8% (90.3-94.7)	93.6% (92.8-94.4)
Age 45-64 years	7414	32.6	1343	2.0	89.1% (84.7-92.3)	90.8% (89.6-91.9)
Age ≥65 years	1636	19.5	1115	1.9	85.9% (80.2-89.9)	88.5% (86.4-90.3)
All ages	49 138	40.9	3632	1.8	90.1% (88.0-91.8)	91.5% (90.7-92.2)
<b>Symptomatic COVID-19</b>						
Age 16-44 years	28 196	31.7	352	0.5	97.8% (97.0-98.3)	97.6% (97.3-97.8)
Age 45-64 years	7790	34.3	560	0.8	96.3% (95.0-97.3)	96.7% (96.3-97.0)
Age ≥65 years	3079	36.6	780	1.4	96.1% (94.8-97.1)	96.4% (95.9-97.0)
All ages	39 065	32.5	1692	0.8	96.6% (95.8-97.2)	97.0% (96.7-97.2)
<b>COVID-19-related hospitalisation</b>						
Age 16-44 years	2043	2.3	33	<0.01	98.1% (97.1-98.8)	98.1% (97.3-98.7)
Age 45-64 years	1687	7.4	112	0.2	97.6% (96.9-98.2)	97.6% (97.3-98.1)
Age ≥65 years	1826	21.7	451	0.8	96.6% (95.3-97.6)	96.8% (96.2-97.3)
All ages	5526	4.6	596	0.3	96.7% (95.5-97.6)	97.2% (96.7-97.5)
<b>Severe or critical COVID-19-related hospitalisation</b>						
Age 16-44 years	644	0.7	7	0.01	98.8% (97.3-99.5)	98.9% (97.6-99.5)
Age 45-64 years	1132	5.0	62	0.1	98.1% (97.2-98.6)	98.1% (97.5-98.5)
Age ≥65 years	1425	17.0	295	0.5	97.2% (95.9-98.1)	97.3% (96.8-97.8)
All ages	3201	2.7	364	0.2	97.2% (95.9-98.1)	97.5% (97.1-97.8)
<b>COVID-19-related death</b>						
Age 16-44 years	36	0.04	0	0.0	100	100
Age 45-64 years	125	0.5	14	<0.01	96.2% (92.6-98.0)	95.8% (92.6-97.6)
Age ≥65 years	554	6.6	124	0.2	96.8% (94.6-98.1)	96.9% (96.0-97.6)
All ages	715	0.6	138	0.1	96.6% (93.9-98.1)	96.7% (96.0-97.3)

Numbers and incidence rates of outcomes are shown for unvaccinated and fully vaccinated individuals. Vaccine effectiveness estimates are % (95% CI). \*Defined as people for whom at least 7 days had passed after the second dose of BNT162b2 vaccine. †Total person-days for all outcomes were 88 938 455 for age 16-44 years, 22 734 025 for age 45-64 years, 8 403 760 for age ≥65 years, and 120 076 240 for all ages. ‡Total person-days for all outcomes were 77 280 720 for age 16-44 years, 67 027 505 for age 45-64 years, 57 573 640 for age ≥65 years, and 201 881 865 for all ages. §Model is adjusted for age group (16-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and ≥85 years), sex, and calendar week. ¶Includes asymptomatic and symptomatic infections, as well as cases with positive SARS-CoV-2 tests for which the symptom interview portion of the epidemiological investigation was not completed.

Table 2: Estimated effectiveness of two doses of BNT162b2 (≥7 days after the second dose) against laboratory-confirmed SARS-CoV-2 outcomes by age group (Jan 24 to April 3, 2021)

\*\*\*Although Table 2 states that there were a total of 109,876 'cases' among the unvaccinated, there seems to be an error in the table in that the total number of asymptomatic cases (49,138) and symptomatic cases (39,065) do not sum to 109,876

\*\*\*\*The 'vaccine effectiveness' measure is defined as: 100 times (1 - the incident rate ratio). The incident rate ratio is (approximately) the incident rate of vaccinated divided by the incident rate of unvaccinated.

**Postscript:** The study provides interesting insights into the separate issue of 'asymptomatic' infection that we have covered extensively on this blog. For example, Table 2 shows that, among the unvaccinated, there were 49,138 asymptomatic 'cases' compared to 39,065 symptomatic 'cases', i.e. 56% of all those testing positive (and classified as a 'case') were asymptomatic. It is likely that most of the positives among the asymptomatics were false positives. This is because, especially at times when the infection rate is low, a false positive PCR test rate of, say just 0.4%, would still mean that the majority of positive tests among asymptomatics are false. See [here](#) and [here](#).

at 01:00

Labels: COVID

## 13 comments:



**Monte Carlo Man** 17 May 2021 at 03:56

Also 3632 + 1692 is not 6266 is it?

If only 50% of the asymptomatics are false positive, the efficacy drops to alarmingly low levels both relative and absolute. It would be good to add to your study a realistic efficacy expectation based on false positive percentage of 0.4%.

[Reply](#)

[Replies](#)



**Norman Fenton** 17 May 2021 at 04:15


Indeed, that is something I did not understand about the table.

[Reply](#)



**Unknown** 17 May 2021 at 06:38

Prof Fenton -- I am sure you are aware of the work of Prof Eyal Shahar, who has covered the Israeli vax efficacy issue extremely comprehensively (as far as the published data will allow) on Twitter. I would just point out that Shahar (and Matan Holzer) showed that the mortality curve for unvaccinated subjects did not follow anything like a Gompert curve falloff after the peak, but remained "too flat", especially in younger age groups. This was evidence, suggested Shahar, of misattribution of Covid deaths to a segment of the unvaccinated who tested positive on a PCR test but died of other causes (the "with" vs "from").

 Yes - I now believe that any classification of people having Covid that is based PCR testing cannot be trusted.

[Reply](#)

**Mark Rook** 18 May 2021 at 00:59

This is an interesting analysis, but I think incorrect. The highlighting of the article stops a few words too soon. The vaccinated that were exempt were only those that "... had contact with a laboratory-confirmed case or returned from travel abroad." In other words, the exemption applied to a subset of asymptomatic cases. Those with symptoms still were required to test, and I would guess accounted for most of the 19% of tests performed on exempted individuals. (Why else would a "fully-vaccinated" exempted person undergo an unpleasant PCR test?)

[Reply](#)

[Replies](#)

 **Norman Fenton** 18 May 2021 at 08:39

I am fully aware of what the exemption basis was, but you are surely not serious in suggesting that people haven't been sufficiently brainwashed to voluntarily subject themselves to an unpleasant PCR test even if it was not 'compulsary'? There are millions of people doing exactly that every day. In the UK millions of people are vountarily doing TWO equally unpleasant lateral flow tests every single week.

[Reply](#)

 **Unknown** 18 May 2021 at 08:59

Is another possible complication the fact that tests are not equivalent to people. There might be multiple tests on a single person which will skew the calculations on infections per person ( as opposed to positive case) That is to say we get a completely incorrect impression of the reality of the situation. For example positive case might have 4 positives against their name through multiple confirmatory testing..this could massively affect the ratios you calculated..Also what if people ( especially say vaccinated) whose jobs entail mandatory testing, were tested x times per week.If such instances exist the data could become mush very quickly..

[Reply](#)

 **PTW** 18 May 2021 at 11:31

Great article! Could you please explain why expressing the outcome as incident rate per 100,000 person days is biased?

[Reply](#)

 **Unknown** 19 May 2021 at 08:12

And they're all Jewish Freemasons.

[Reply](#)

 **Unknown** 20 May 2021 at 03:05

MASKS DO NOTHING to stop viruses. NOTHING! 80% of those that got ill WERE WEARING A USELESS MASK! They DO on the other hand CAUSE a host of HEALTH PROBLEMS. Oxygen deprivation, dental problems, BACTERIAL PNEUMONIA and more.

Its VERY important to understand EPSTEIN GUILTY Trump's ROLE in this so you dont make the SAME MISTAKES or support him as he MAKES MORE! CASES NOT DEATHS! EVENT 201 proves this was all a PLANNED FARCE! Understand that Epstein GUILTY Trumpy is a deep state FAKE like all others before him and gave Gates GAVI group a BILLION to FORCE a DNA ALTERING NOT-a-vaccine on YOU using the MILITARY in a 'powerful way' Gates controlled and funded Fauci AND Birc and they ALL should be EXECUTED. Trump PARTIED WITH Clintons, Gates and EPSTEIN and AS A DEMOCRAT! [https://www.youtube.com/watch?v=\\_pV1U9s3wJ0](https://www.youtube.com/watch?v=_pV1U9s3wJ0)

[Reply](#)

 22 דר' פינקי פיינשטיין 22 May 2021 at 22:43

This comment has been removed by the author.

[Reply](#)

 22 דר' פינקי פיינשטיין 22 May 2021 at 22:45

Norman, this Dr. Pinkie Feinstein from IPC Israeli People Committee. We have done an independent work about adverse events in Israel and also about the extensive lack of reporting them including the authorities' extreme effort to hide and bury them including lack of systematic reports from clinics etc. This fact changes all kinds of 'efficacy' articles and also reveals that the official reports are based on false information. the-people-committee.com

[Reply](#)

 **Unknown** 22 May 2021 at 23:09

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