Review of: "Measuring the efficacy of a vaccine during an epidemic"

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Potential competing interests: No potential competing interests to declare.

Overall, I enjoyed reading your article which is really fluent, well written, clear and quite easy to read. The topic is interesting and important. However, I'm not familliar with the methodology used with phase 3 cohort studies : are you sure they do not correct their result regarding the observed attack rate ? The article would really gain attractiveness if you add a litterature review of how the subject has been tackled by the Covid 19 studies.

Moreover, when I accepted to review the article, I was quite sure to see, at one point or another, bayesian probabilities, though you never invoke this kind of argument. It seems reasonable to think that the effect you observed is linked to bayesian probability (see, for example, the medical paradox for a not that far application of bayesian probabilities in a medical problem https://towardsdatascience.com/bayes-theorem-for-medical-test-f1fb12b579c6). Have you tried to see the probleme on a Bayesian point of view ?

Also, here are some diverse remarks ordered by apparition in your article (I have no line number to be more precise, I'm sorry).

Abstract : "we show that" written twice
You should make more clear in the abstract that we are only speaking of the infection probability, and not of the severity of symptoms (it seems relevant since Covid Vaccine mainly affect the severity of symptoms)

The number NP is not necessarily the same at the beginning and the end of the observation period (due to natural deaths). It would be more clear to specify how you consider people dying during the trial (censored observation). I have the feeling that you make the hyotheses that there is no censored information but that's not explicit.

Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine (Pfizer ?) "Key exclusion criteria included a medical history of Covid-19, treatment with immunosuppressive therapy, or diagnosis with an immunocompromising condition."

Since the attack rate can be expressed as $c=i^{-}T$ --> why ? c = A / N; if you have an observation period of 2 days, 10% of people infected at the start of the observation period, nobody heal, nobody get infected during the period. Then, as I undestand i ("the average fraction i^{-} of infectious during the period T") i = 10%, and c = 10% ? but c, as you defined it, is 20%. You may mean something like the average fraction of new infected / people becoming infectious ? I'm pretty sure to miss something here.

SIR / SEIR models have proven to be uneficient for the study of Covid 19. Most of the model include, at least, an asymptomatic compartiment and an hospital compartment (in order to allow for calibration on unbiaised data). To make your point, a SIR model is enough, but you should specify that point

You define the attack rate as the number of case divided by the number of participant. Thus, the attack rate should be smaller than 1 right ? Thus I do not understand the scale of the Figure 1.

Equation 2 : I assume that S is the proportion of the population in the state "susceptible" from a compartmental model, but s has not been formally defined yet I believe (it's defined after though)

Thank you for the read,

Sincerely yours,

Romain