Get vaccinated lol

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Contents

Why this document?

Eyyo!

An interesting but alarming phenomenon happening specifically during this pandemic is people refusing to get vaccinated despite not being anti-vax nor believing that COVID-19 is a conspiracy.
This document is for their friends who are trying to reason with them: use this text as a tool as it contains detailed sources and some common arguments in favor of getting vaccinated, as well as some common arguments in favor of not getting vaccinated - *and why they fall short*. Indeed, we find ourselves looking for that one source or reference quite often during a discussion, and this text is meant to help you help your vaccine reluctant friend.

This document is **not** meant to be a standalone essay. Of course, you can use it as such and simply share it away, but debate is the prime context where opinions can change. You should get involved and use this text as a means to an end rather than your whole apology of vaccination. Also, just as a side-note, although most of the people who will read this fluently speak French, English is simply more *inclusive*, in all the meanings you can attach to this word.

In the following, I address myself to a figurative vaccine-reluctant reader whose exact stance at all times will be made clear by the paragraph's context.

Text in red is either a hyperlink or a url. Let's dive in!

1 Covid is real and not to be taken lightly

1.1 But Covid is a hoax...

Oumar coach, bonsoir non. (Translation: No, and this text is not for you.)

1.2 Is Covid *really* this dangerous?

Yes, absolutely. The numbers speak for themselves in India these days (BBC_1). The country is undergoing the nightmare scenario of shortage of drugs, hospital beds, oxygen. Experts criticize the government's insufficient measures ($Lancet_1$), permitting mass gatherings and aiming for mass immunity while releasing suspiciously optimistic reports on the country's capacities in production of medical goods. Lax measures aiming for herd immunity has proven to be a bad strategy in Sweden where death rates were far higher than in neighboring countries ($Lancet_2$), so much that the King has actually apologised ($Guardian_1$). Let's note that apologies were not given in Mexico where the case/fatality ratio is still very high ($Forbes_1$).

This is not all. Despite already incredibly pessimistic figures that I'll let you literally just Google or find on John Hopkins' map (JHU_1), research suggests COVID-19 mortality during the pandemic was actually underestimated (ERS_1).

1.3 Is Covid *really* this dangerous... to me?

You're selfish! You should not even ask this in question in the first place! Living in society means more than surviving alone. Besides, by protecting yourself, you protect others ($CERN_1$), that's the whole point of the sanitary measures literal continents have been undertaking for more than a year now.

If the casualties listed in section 1.2 mean nothing to you, think about your loved ones. If your loved ones are all immune for some reason, now we can get down to business. Seen as you're asking this question, you must not be in a so-called "high risk category" (BAG_1), and chances are you're under thirty or even twenty. Fatality risks still exist for young adults, as researched by the University of Minnesota (UMN_1) and are probably higher than you think, higher than most existent stats even: the Minnesotan article suggests COVID fatalities were not reported as such in the US from March to August 2020, as backed by this research letter from the JAMA medical review ($JAMA_1$).

Let me reiterate though, whether Covid is actually dangerous to you or not is beside the point. This pandemic has not been nearly as deadly as previous ones the world as known - *yet* -, and yes, chances are high you, personally, might not even experience the slightest symptom as a bearer of the virus. The point is the people you would contaminate along the way who might not have this chance! The Covid pandemic will end one day, our goal as a society should

be making sure that this happens with the least casualties possible. If these casualties mean nothing to you, think of it this way: the longer we drag this pandemic out, the longer restraining measures need to be undertaken (let me remind you where lax measures lead) which is at least a discomfort to you and a tragedy to other people - think about your favorite band, your favorite burger joint, your hairdresser.
Now that we're convinced this pandemic is a dangerous thing, how do we stop it?

2 How to stop this pandemic: get vaccinated

2.1 Introduction

This is the crux of this document. Let me explain this section title: *vaccines* won't stop this pandemic alone, it's actually *getting vaccinated* (massively) that will. Details below.

2.2 But vaccines are hoaxes...

Oumar coach, bonsoir non. (Translation: No, and this text is not for you.)

2.3 Don't vaccines cause autism?

Vaccines causing autism is just misinformation (CDC_1), detailed information and research results on the page CDC_1.

2.4 Aren't (real) vaccines side-effects worse than Covid's wrongdoings?

You are as selfish as when you asked whether Covid is actually dangerous to you. You're also wrong.

2.4.1 Fatal incidents, Pfizer and Moderna

Let's start with fatal incidents involving Moderna and Pfizer products. $f = 16$ fatal cases reported in Switzerland by the 24th of February 2021 ($Swissmedic_1$), I quote: *"In 16 serious cases, the people concerned died at differing intervals after receiving the vaccine. Their average age was 86, and the majority of them had serious pre-existing conditions."*. As you can check in the report, these 16 cases come from a larger set of 364 reported cases, 74% of whom did not have serious side-effects - I will come back to lighter common side effects later. Even some of the serious side-effects ultimately only involved fever and headaches. It is worth noting, in Figure 1 of $Swissmedic_1$, that $\frac{1}{6}$ of the reported cases come from adults between 18 and 44.

Now let's work out the fatality rate of Moderna and Pfizer vaccines up to 24/02/2021 in Switzerland. $T = 750,842$, that is the number of administered doses of Pfizer and Moderna vaccines up to 24/02/2021 (FOPH_1): scroll down to *Development over time*, click on *Absolute values*, check the data. $\nu = 220,903$ of these doses were second doses (FOPH_2) as ν people were fully vaccinated in Switzerland on 24/02/2021.

We can finally do this long awaited calculation:

$$\boxed{\textit{Fatality rate (Pfizer-Moderna)} = \frac{f}{T-\nu} = \frac{16}{750,842 - 220,903} \lessapprox 0.00301922\%}$$

Furthermore, if one restricts the computation of the fatality rate to **people under 75** up to the 24/02/2021, *Fatality rate (Pfizer-Moderna)* will get even closer to 0 since the average age of the 16 fatal cases was 86 with serious pre-conditions, we do not have more information though.

We can retrieve the number of laboratory confirmed deaths (FOPH_2), and we find that, in Switzerland, by 24/02/2021, Covid had killed *at least* $r = 89.96$ people per $s = 100,000$ inhabitants. Why *at least*? Simply because, as discussed in section 1.2, there is some number of unaccounted Covid related deaths. Thus:

$$\boxed{\textit{Fatality rate (COVID-19: absolute)} = \frac{r}{s} \geq \frac{89.96}{100,000} = 0.08996\%}$$

Finally, what one should really consider as Covid fatality rate is its cases/fatality ratio, i.e the number of fatal cases among the cases themselves. In Switzerland today according to John Hopkins' mortality data (JHU_2), it amounts to **1.6%**:

$$\boxed{\textit{Fatality rate (COVID-19: relative)} = 1.6\%}$$

Indeed, it is incorrect to consider absolute COVID-19 fatality rate, as in: number of Covid related deaths over total population, as we are comparing the risks of Covid against the risks of getting a Pfizer or Moderna vaccine. The absolute COVID-19 fatality rate additionally takes into account the *probability* of carrying the virus, which has nothing to do with the risks you're taking when you actually catch the virus. I've computed it anyway to show you once again that, even in an extremely unfair comparison, it makes no sense to favor the odds of Covid over the odds of a Pfizer or Moderna vaccine.

Lastly, about the correctness of the relative COVID-19 fatality rate, since it was measured today and not on 24/02/2021. Note that the number of daily deaths related to Covid in Switzerland has decreased since then while the number of daily cases has increased (WOM_1), amounting for a smaller relative fatality rate in 24/02/2021.

I hope you can see that even when the raw numbers are in your favor, it still makes no sense to believe that Pfizer and Moderna vaccines are riskier than Covid. In the computation of *Fatality rate (Pfizer-Moderna)* I've even ignored the "risk" of getting a second dose as I've subtracted these doses away $(T - \nu)$, which is certainly imprecise, but is, again, in your favor.

Time to come to some conclusions. I will be the first to agree that the following results will gloss over many approximations and are probably highly imprecise, I don't know which side benefits the most from those. For example, we're assuming independence of the events "getting vaccinated" and "catching Covid" which is obviously not true. It also assumes that the event "getting vaccinated" implies "Covid related death" has probability zero, which, as will be discussed later in the text, isn't certain yet. So, for your consideration with a grain of salt:

- It is at least $\frac{\textit{Fatality rate (COVID-19: absolute)}}{\textit{Fatality rate (Pfizer-Moderna)}} \geq \frac{0.08996}{16 \times 100}(750,842 - 220,903) \geq$ 29.7958 times riskier to roam free vaccine-less in this pandemic than to get vaccinated. This overlooks the fact, as stated above, that fatal cases in Switzerland averaged the age of 86 and all had *"serious preconditions"* (Swissmedic$_1$).
- It is $\frac{\textit{Fatality rate (COVID-19: relative)}}{\textit{Fatality rate (Pfizer-Moderna)}} = \frac{1.6}{16 \times 100}(750,842 - 220,903) = 529.939$ times riskier to catch Covid than to get vaccinated. This mostly overlooks that not at all people are in equal danger in both cases.

2.4.2 Fatal incidents, AstraZeneca

Maybe that's just me, but I've heard countless times now that the AstraZeneca vaccine is "more dangerous" than Pfizer's and Moderna's. I will not go over the math and logic again, it suffices to state that, out of 20+ million doses administered, only 31 fatal cases were reported up to 21/04/2021 (MHRA$_1$), check page 14.

2.4.3 Non fatal incidents and normal symptoms

Normal side effects of Covid vaccines are the same as for any vaccine, here's a list of common ones (CDC$_2$). Benign side-effects are normal and to be expected with the Pfizer vaccine (ICSI$_1$) where *"77.4% reported at least one systemic reaction during the seven days after vaccination"*, same goes for Moderna and Johnson & Johnson. It is also normal not to experience any side-effect (NPR$_1$). You may ask: Do I really want to get vaccinated at the cost of highly probable fever and headache? Indirectly, you're asking:

2.5 Are vaccines actually effective? What about the variants?

How do we measure *how good* a vaccine is? In short, **vaccine effectiveness** is the *ability of vaccine to prevent outcomes of interest in the "real world"* (WHO_1). As can be read in WHO_1, **vaccine efficacy** isn't quite the same measurement: it is more controlled and validated, *"often at the expense of generalizability"*. It is the *"% reduction in disease incidence in a vaccinated group compared to an unvaccinated group under optimal conditions"*. Vaccine effectiveness as defined in these slides corresponds to our intuitive notion of vaccine effectiveness as the considered outcomes of interest include death, hospitalisation, dependence, etc. This is a measure of how often we can expect immunity after getting vaccinated with vaccine V, in a real-world setting, whereas efficacy is lab-based and less long term than effectiveness. However, effectiveness is, at this stage, hard to measure, thus labs rely on efficacy measurements based on severe symptoms. Specific information regarding COVID-19 here (CDC_3) and here ($Lancet_3$). I'll use both terms below.

2.5.1 Moderna's protection

CDC states (CDC_4): *"Based on evidence from clinical trials, the Moderna vaccine was 94.1% effective at preventing laboratory-confirmed COVID-19 illness in people who received two doses who had no evidence of being previously infected"*. Yale states ($Yale_1$): *"Some research has suggested that Moderna's vaccine may provide protection against the B.1.1.7 and B.1.351 variants. Researchers are still studying this"*. Side-note: B.1.1.7 and B.1.351 are the strains first detected in Great Britain and South Africa respectively.

Such research is available on bioRxiv ($bioRxiv_1$) although it has not been peer-reviewed yet, while the NIH keeps investigating (NIH_1). Other research shows efficacy against B.1.526 ($bioRxiv_2$), the strain detected in N.Y.C.

2.5.2 Pfizer's protection

Pfizer efficiency is predicted to be comparable to Moderna's ($Guardian_2$), as indicated by non peer-reviewed research ($medRxiv_1$). Non peer-reviewed research claims the vaccine has low efficacy against B.1.351 ($medRxiv_2$).

2.5.3 Other vaccines' protection

According to $Yale_1$, protection of AstraZeneca and Johnson & Johnson have been measureed to, respectively, *76% effectiveness at reducing the risk of symptomatic disease 15 days or more after receiving the two doses, and 100% against severe disease* and *72% overall efficacy and 86% efficacy against severe disease in the U.S.* The article also mentions Novavax, a vaccine still in clinical trial with 96.4% efficacy against the original strain but 48.6% efficacy against predomi-

nantly variant strains (Novovax$_1$) although no severe symptoms were observed in the non-placebo group.

2.5.4 Conclusion on vaccine protection

Effectiveness against variants remains the main question, although for most vaccines, early results are rather encouraging although conflicting for some vaccines. Note that severe symptoms are avoided almost all the time for all vaccines and strains.

2.5.5 Can vaccinated people carry the virus?

The data is not clear enough to decide whether vaccination lowers virus carrying probability yet (GlobalNews$_1$), therefore Harvard advises caution (Harvard$_1$) when meeting non-vaccinated people. Reunions of vaccinated people are, according to Harvard$_1$, safe.

2.6 Doesn't the needle hurt?

Nah it's fine :)

Conclusion: Towards herd immunity?

Vaccination in England reduces, more or less quickly, the spread of the virus through households (KHUB$_1$). According to Nature true herd immunity is not a realistic short to medium term target (Nature$_1$). Quoting the article: *"We're moving away from the idea that we'll hit the herd-immunity threshold and then the pandemic will go away for good," says epidemiologist Lauren Ancel Meyers, executive director of the University of Texas at Austin COVID-19 Modeling Consortium. This shift reflects the complexities and challenges of the pandemic, and shouldn't overshadow the fact that vaccination is helping. "The vaccine will mean that the virus will start to dissipate on its own," Meyers says. But as new variants arise and immunity from infections potentially wanes, "we may find ourselves months or a year down the road still battling the threat, and having to deal with future surges"*. Nonetheless, let me reiterate the critical importance of getting vaccinated for all reasons detailed above, as well as returning to something resembling normal life. We may need to take one more dose of Pfizer (CNBC$_1$) or take a Moderna variant booster (CNBC$_2$), this is an insignificant (possible) price to pay as we may need to learn to live with Covid as we live with influenza.

Contribution and discussion

Feel free to send suggestions via Discord to *Dicedead*#8849. If you wish to discuss anything in this text, you can also text me, I frankly may or may not answer depending of the time I have + whether I actually care about you + (most importantly) the validity of your points. Indeed, I will ignore every email or Discord message coming from *random.user@troll.com* saying Covid is a conspiracy designed to elect Biden.

Thanks

Thank you for reading and, possibly, sharing this document! Now, it is your turn to demystify vaccines and limit the spread of misinformation.

Special thanks to Alexandre Doukhan as he inspired me to write this text and provided some important sources. Another special thanks to my friends for their suggestions and energy.

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