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WHAT IF NEW SCIENTIST IS RIGHT? AND COULD THE RIVM BE RIGHT?

Short Note, Erik Pruyt, 25/03/2020

Center for Policy, Exploration, Analysis, Simulation

This short note is a follow-up of the short paper I wrote yesterday about the model we made and some basic simulations regarding social distancing measures needed in the Netherlands. These basic simulations were shared because of the urgency of strict social distancing measures. Normally I would first want to do simulations under deep uncertainty.

I was about to work on the set-up for such simulations under deep uncertainty, but then my attention was caught first by super important news related to COVID19 and later by confusing news.

Following my LinkedIn post and the article we posted on www.PEAS.center, Wim Turkenburg attended me to a super interesting article in New Scientist ("Spreading the coronavirus without realising you've got it" see here). One of the main messages of the article is that people can get the virus without having symptoms, causing no noticeable illness, and that these asymptomatic infected people could still spread the virus. Jeffrey Shaman et al. (2020) found that, in the Chinese cities they investigated, 86 per cent of infected individuals were asymptomatic or close to asymptomatic (Science, doi.org/ggn6c2).

The article also pointed to another study, reported on in The Guardian (see here), which showed that when the first symptomatic case was diagnosed in a small Italian town called Vò, about 3% of the population had already been infected, 60% of whom were asymptomatic. Nine days later everyone was tested again, and only 6 out of 89 still had the virus.

Another main message of the New Scientist article was that infectiousness may actually start about 2.5 days before the onset of symptoms and peaks 15 hours before, and once symptoms develop, one's viral load declines, which means infected individuals become less and less infectious. For me this was surprising. What is also surprising is that people seem to keep shedding the virus for some two weeks after recovering from covid-19, via their saliva and stools (medRxiv, www.doi.org/dqbs). This has serious consequences for any strategy to keep the virus from spreading.

So, the question became: what does this news mean for our model results and recommendations?

Hence, I activated the built-in asymptomatic track (that was still disabled), added some variables to be able to simulate that even asymptomatic infected individuals are contagious, and changed the value of some infectivity related parameters to reflect the articles referred to (except for the two week period after recovering). All good. After simulating with these modifications, the conclusion changed to: with asymptomatic spreading, even stricter social distancing measures are needed to end the infection from turning into a full-blown unmanageable epidemic (in terms of ICU capacity).

Right at that moment, Jaap van Dissel of the RIVM (the Dutch National Institute for Public Health and Environment) told Parliament that it seemed the spread of the infection in the Netherlands was slowing down. However, the data we obtained from the RIVM site seemed to contradict this claim. The data from the web site might also be flawed – who knows. But apart from that, Van Dissel's slides (here see Figure 1) did not show yesterdays data (Figure 1), a big upward spike.

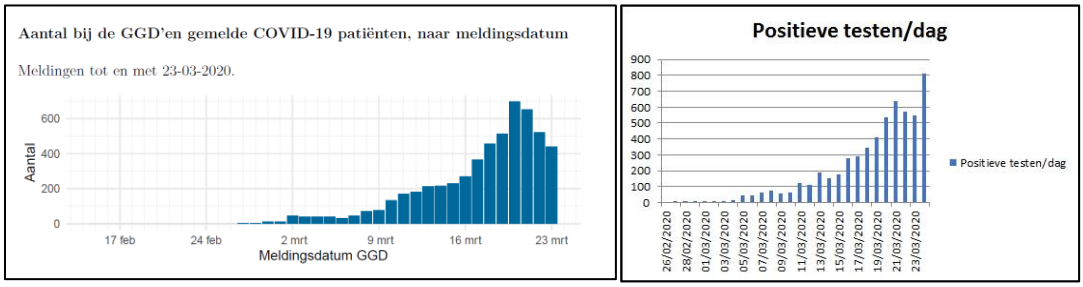

Figure 1: data from RIVM slide (left) and data from the RIVM site (right)

But still, he might have been right even though the data wouldn't directly show it – by using a simulation model, one can derive that particular effects must be taking place or else results cannot be obtained. So I used our model, and understood what he meant, even with the new RIVM data (all numbers substantially up): in order to get results that correspond to the data, there has to be social distancing. However, it took more waiting for the data on the number of new ICU admissions to assess whether this effect might be strong enough. That has to do with the fact that I need both the data on new ICU admissions and data on COVID19 deaths and then set my model such that it replicates what is happening to understand what might be happening. For almost the entire afternoon there was a small chance that indeed, things might turn out favorably…

Helas! ICU admissions – which had more or less stabilised in the past days (note: that being a flow into the stock of ICU capacity, still means that ICU capacity needs to grow linearly) – were up significantly instead of down. If they would have gone down, then… See Figure 2 for a comparison of my simulation (red) with the data (blue).

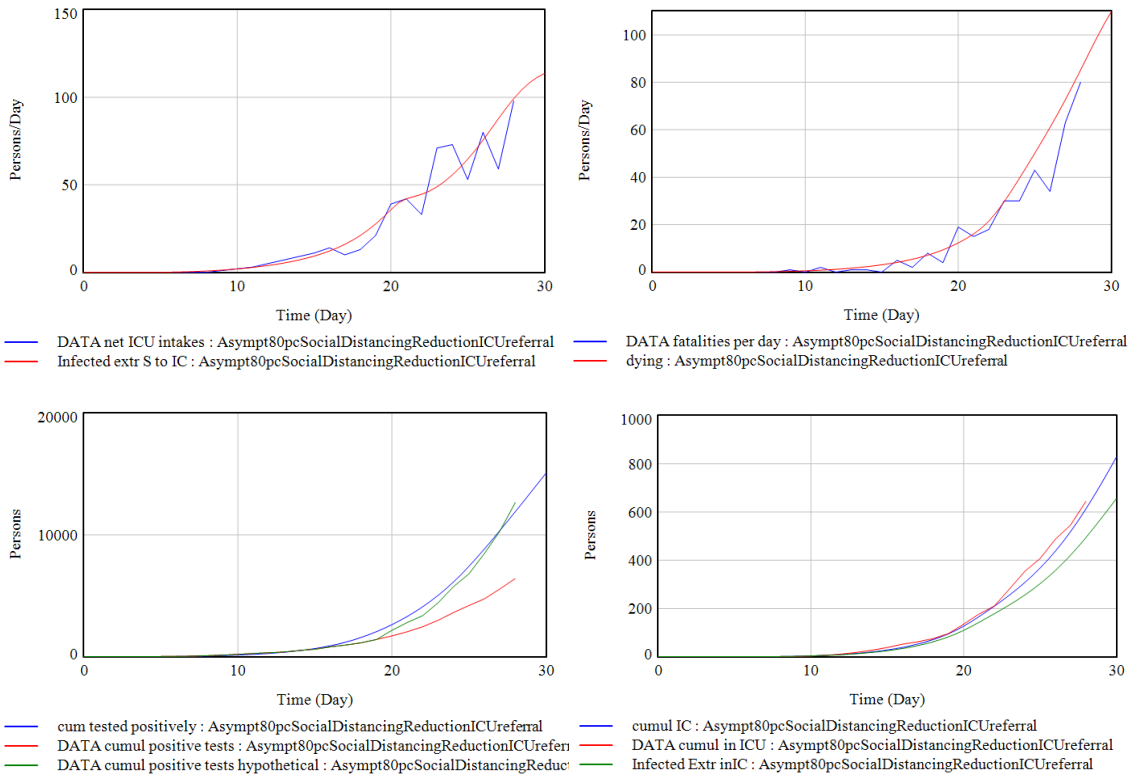

Figure2: Data versus simulation run with asymptomatic infections, a reduction of the fraction of people who need ICUs who actually go to ICUs on day 20 and social distancing measures

If the last blue spike in ICU admissions would not have been there, then indeed there might have been a substantial social distancing effect: after all, if people with extreme symptoms are not taken care of in ICUs, then they die. But the spike is there. However, it is not as high as my model would suggest in the absence of any social distancing effect (see Figure3).

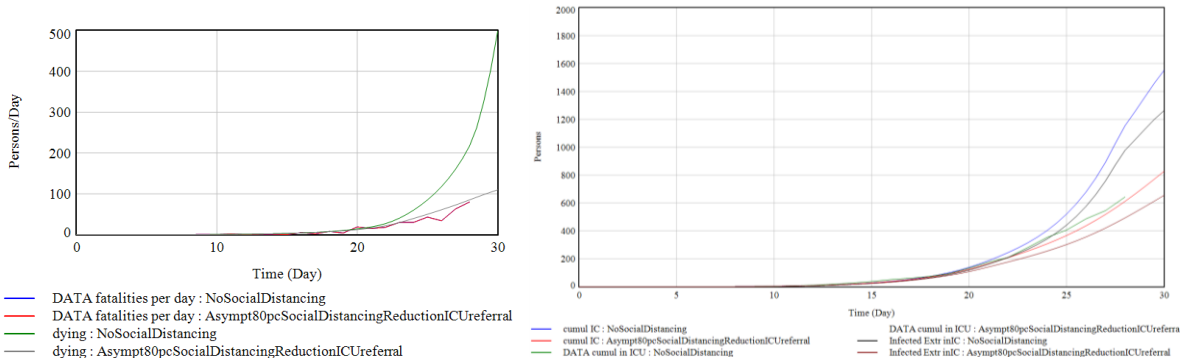

Figure 3: Simulation without any social distancing (green) compared to data and the previous run

This meant that, indeed, there ***is*** a social distancing effect. Apart from that there needs to be some elderly ICU dissuation effect (otherwise ICUs would be fuller and there would be fewer fatalities).

Note that in my simulation (the one with social distancing), daily fatalities are slightly above the data and that cumulative cases in ICU are slightly below the data. I could tinker with the model to get a perfect fit, but that is not what this is about. Normally I would even simulate under deep uncertainty, to get a large set of simulation runs, so that the ensemble could be compared to the data. But I haven't had time to do the setup for simulation under deep uncertainty yet.

Now, let's turn to what really matters: both effects together are ***not likely to be strong enough*** if indeed there asymptomatic infections. Let me show that by simulating over a slightly longer period of time (up to 60 days from the onset in the Netherlands, which means till 26 April 2020) with different degrees of social distancing. The current settings were with 10% reduction in contact rate due to the measures taken on day 9 (no more hand shakes and hygiene measures), 35% reduction in contact rate due to the measures taken on day 16 (all schools closed and many people staying home from work), and 30% reduction in contact rate due to the measures taken on day 23 (Prime Minister's speech). These numbers are really just guestimates, but they generate the response in the model that we see in the data.

Apart from that "basecase" social distancing run, I also simulated more social distancing effect following the Prime Minister's speech (namely 35%, 40%, and 45%), and less (20%). Just to be clear: in case of 45%, this means a total reduction of 10%+35%+45%=90%, which is a near lockdown. All runs correspond to what we are seeing in the data today. So all scenarios might still materialize, depending on how effective the social distancing measures really are. We will know in the coming days. I think we need 7 more days to know what will happen. But compared to the situation without asymptomatic infections we need to do more instead of less.

In our short paper, 75% to 80% social distancing was enough (in the absence of asymptomatic spreading). Now, 75% is not enough anymore, 80% is the minimum for expanding ICU capacity to be

sufficient. Figure 4 shows the different effects in terms of admissions to ICUs. In the 65% and 75% social distancing cases (i.e., the green and purple lines), ICU capacity will soon be full (the zigzaw lines mean people who need ICU will be refused). With 80% social distancing (10-35-35), we will gradually need to start using all ICU and alternative ICU capacity available in the Netherlands for COVID19, before end of April 2020. Only in case of 85% or 90% contact rate reduction will we see ICU admissions going down, which still means that we will get close to or above the current maximum ICU capacity for COVID19 (see Figure 5). Figure 5 also shows the effects in terms of fatalities: the low social distancing policies lead to many people dying since they are not admitted to ICUs when they need them.

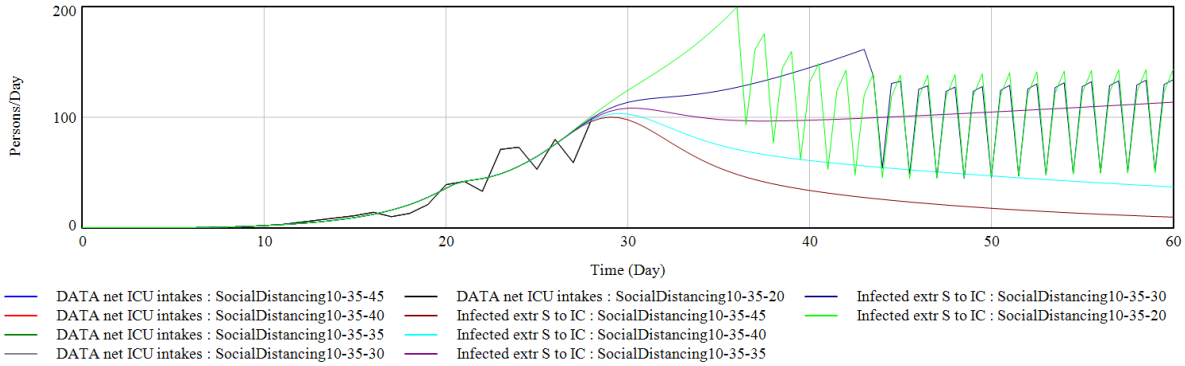

Figure 4: ICU admittence for different social distancing measures

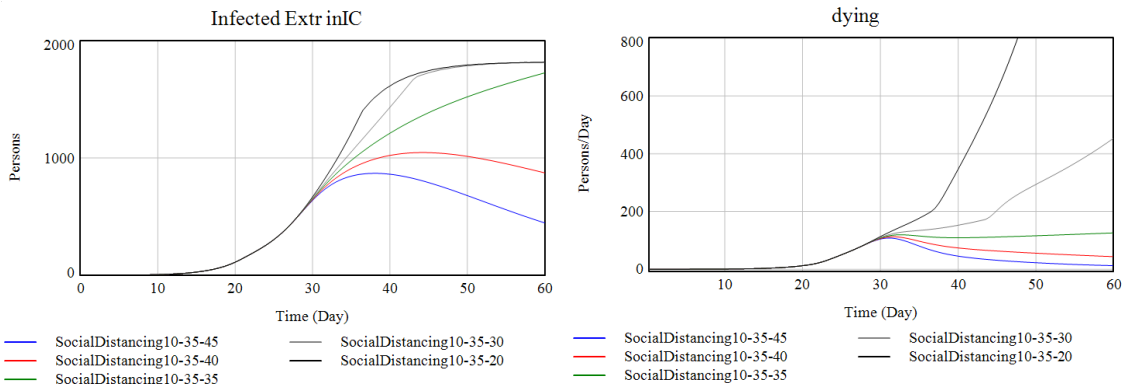

Figure 5: ICU capacity used and number of fatalities per day for different social distancing measures

What is also interesting is to look at how long each of these policies would affect ICU capacity in the Netherlands and how many people would be asymptomatically infected (building herd immunity) and how long it would take to get build herd immunity. Figure 6 shows the infections, the occupancy of IC units (all capacity + all operation rooms with respirators), fatalities (although I really need to do this in the multi-cohort model to get more accurate numbers), and the cumulative number of asymptomatically infected (which builds up our herd immunity).

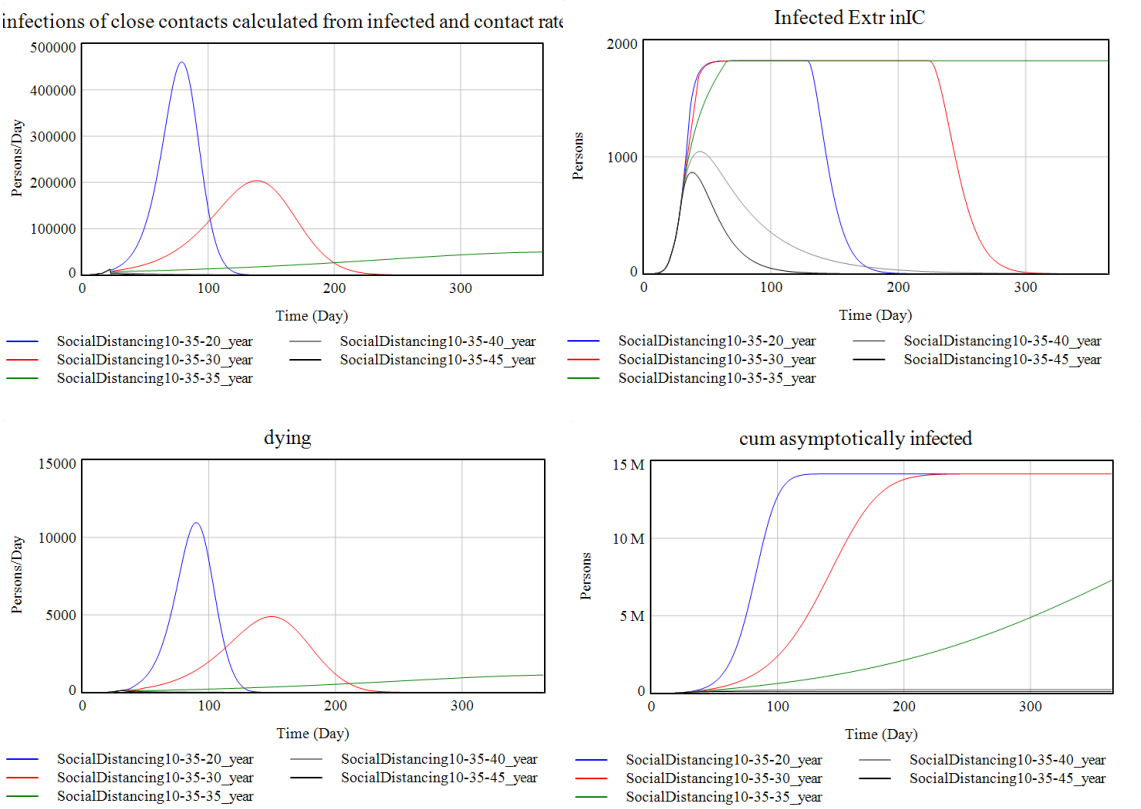

Figure 6: effects of the different social distancing policies over the course of a year

We need to wait a few more days to see the social distancing effects in the data, if it turns out to be insufficient, then I know what we should do. I leave it up to you to decide for yourself to make up your mind about what we should do. But given this information, I personally think we then need even more social distancing – or if the Dutch are not disciplined enough, then we need a (near) lockdown. The consequences of not doing so, are immense: our hospital system would be under continous stress for months, all ICU capacity and all alternative ICU capacity will be used for months for COVID19 only, and even then will it be insufficient resulting in many fatalities.

The near lockdown would need to be long enough. Plus, afterwards, we need testing testing testing and much more discipline.

All the best,

Erik