COVID-19 Vaccines & COMMUNITY IMMUNITY

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Q: Will the COVID-19 vaccines prevent the transmission of the coronavirus and bring about community immunity (aka herd immunity)?

A: *Jury not in yet but vaccines do not have to be perfect to thwart the spread of infection.*

While vaccines induce protection against illness, they do not always stop actual infection, so you can be perfectly well but carry a deadly virus or bacteria and spread it to others. Typhoid Mary springs to mind, where in the nineteenth century Mary Mallon unknowingly infected at least 53 people with typhoid fever while perfectly well herself. Vaccines such as the HPV and measles vaccines prevent infection all together so vaccinated people do not transmit the infection, while other vaccines such as pertussis (whooping cough) prevent disease pretty well but not infection so well. Stopping infection as well as disease is called sterilizing immunity and it is a very desirable goal, and a tall order.

We now have efficacy data on three COVID-19 vaccines. These are the mRNA vaccines from Pfizer and Moderna and a viral vector vaccine from Oxford/AstraZeneca (AZ).

These three vaccines prevent most vaccinated people getting sick with COVID-19. However, do they also stop people carrying the virus in their throat and nose and spreading it?

This is currently the billion-dollar question, we do not yet have empirical data (patience, it won't be long). However, I think the worst-case scenario is there will be at least some effect. Here is why.

Prevent coughing and spluttering

SARS-CoV-2 is spread through respiratory particles from the throat and nose that contain the virus from an infected person being passed to another person, usually in close proximity. Preventing the virus infection in the respiratory tract completely in the first place is very desirable, but reducing it could also be very helpful.

People who get sick with COVID-19 transmit more virus, for example, coughing may result in loads more viral particles spreading as opposed to just talking and breathing. Therefore, removing these symptomatic people from the equation by immunising them must have an effect on transmission and therefore community immunity. In fact, modelling showed that even a modest impact on the duration of infection could have a significant affect on subsequent cases. Vaccines that decrease the infectious period could decrease transmission in the broader population overall.

Reduce the virus reproducing

- *There is data from animals (monkeys) to show that the Pfizer vaccine will prevent transmission in them*
- *There is no strong evidence for humans yet for the Pfizer vaccine but the AZ and Moderna vaccines have some encouraging data.*

It does not have to be perfect to kick COVID

There are many examples of diseases being virtually eliminated using vaccines that are very good at preventing severe disease, quite good at preventing any disease, but that do not completely prevent infection in everyone. Examples are rotavirus and chickenpox. Yet, these vaccines lead to the disease becoming uncommon in the whole population. This is because the level of transmission and R0 is reduced enough to produce good community immunity.

We can determine how contagious a disease is by tracking its spread throughout a population. In doing so, we can attribute each disease a reproductive number denoted by the symbol R0.

Current estimates on COVID's R0 vary but estimates of 2.5-3.5 are often cited. In order to eliminate infection the basic reproduction rates of the virus must be brought below '1'. There are many things that affect this number – physical distancing, mask wearing, hand washing, environment, geography…. and vaccination.

- *A vaccine that prevents coughing will presumably have an effect on this R0*
- *A vaccine that reduces the viral load will presumably have an effect on R0*
- *A vaccine that reduces the viral load or virtually eliminates it and is administered rapidly and widely will do the job of eliminating COVID circulation very, very fast if deployed widely in a short timeframe*

Together the evidence to date suggests that there will be an effect on transmission **to a great or lesser extent**.

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