Herd Immunity: The Ultimate Measure to Focus in Control of Covid-19 Pandemic

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Herd immunity is a vital concept of epidemic theory regarding the population-level effect of individual immunity to prevent transmission of pathogens. Herd immunity exists when sufficient numbers of people in a community have immunity against an agent such that the likelihood of effective contact between diseased and susceptible individuals is reduced. Only with the gain of Herd Immunity can we dislodge Covid19 from this world as a public health hazard.[1]

A common inference of the term is that the risk of infection among susceptible individuals in a population is reduced by the presence and proximity of immune individuals (this is sometimes referred to as "indirect protection" or a "herd effect").[2] When the herd effect can be achieved, depends on many factors. The most important factor is the percentage of the population already immune to COVID 19, either through infection or through an effective vaccine.

Transmission rate and the transmission likely to die out depends on the basic reproduction number (*R*0) of the COVID-19 virus. Before initiating any disease control strategies, we need to estimate the *basic* reproductive number (R0), or the more 'real-life' *effective* reproductiv e number (Rt) for a given population. R0 is the number of secondary cases generated by the presence of one infected individual in an otherwise fully susceptible, well-mixed population. Rt is a more practical real-life version of this, which uses real-life data (from diagnostic testing and/or clinical surveillance) to estimate the reproductive number for an ongoing epidemic.[3]

For *R*0 > 1, the number infected is likely to increase, and for *R*0 < 1, the transmission is likely to die out. The basic reproduction number is a major concept in infectious disease epidemiology, indicating the risk of an infectious agent concerning epidemic spread.[4] Major initial studies showed that *R*0 for Covid-19 is expected to be around 2–3 (WHO estimate is 1.95).[4] According to some review shows that the R0 value of the 1918 pandemic was estimated to be between 1.4 and 2.8, where one-third of the World population infected and with 50 million death.[5]

By using these Rt values, we can then calculate the minimum ('critical') level of population immunity, Pcrit, acquired via vaccination or naturally-induced (after recovery from Covid-19), to halt the spread of infection in that population. This is by using the formula: Pcrit= 1-(1/Rt). For example, if the value of Rt = 3 then Pcrit= 0.67, i.e. at least two-thirds of the population need to be immune.[6] In this COVID 19 pandemic, Rt assessed in many countries was more than three. Only after 70% of the population achieved immunity through infection or vaccination this pandemic can be halted.[6]

Even though SARS-CoV-2 is a new coronavirus, one source of possible partial immunity may be there from antibody cross-reactivity due to previous infections with the common seasonal coronaviruses (OC43, 229E, NL63, HKU1) that have been circulating in human populations for decades.[7] Before the emergence of SARS-CoV, 5-30% of the mild respiratory illnesses of the seasonal common cold are caused by human pathogenic CoVs (HCoVs) such as HCoV-OC43 and HCoV-229E. This explains why, globally, more than 90% of the population has antibodies against the common cold CoV.[8] This could also be the case for SARS-CoV-2 and might explain why some individuals have milder or asymptomatic infections.[9]

The concept of enhancing herd immunity to control the COVID-19 epidemic may be at a case fatality rate (CFR) of anything between 0.25–3.0% of a country's population.[10] The estimated number of people who could potentially die from COVID-19 when the immunity reaches Pcrit level may not be acceptable for any country.

Herd immunity is a complex issue inherent to a vaccine and the population receiving the vaccine.[11] Vaccination ideally protects susceptible populations from getting the infection and thereby preventing complication. The herd effect or herd immunity is an attractive way to extend vaccine benefits beyond the directly targeted population. It refers to the indirect protection of unvaccinated persons,

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whereby an increase in the prevalence of immunity by the vaccine prevents circulation of infectious agents in susceptible populations.[12]

Different countries have adopted different strategies for the control of COVID 19 pandemic, such as mitigation strategy and suppression strategy. The mitigation strategy to slow down transmission, but not necessarily stopping the spread (reproduction number R not necessarily <1) with the protection of more vulnerable groups and reducing the peak healthcare demand. Suppression strategy in which epidemic spread is reversed to the reproduction number (R) <1. In the mitigation, strategy interventions have to be timely instituted (not too early) to give a chance for herd immunity to develop. With the suppression strategy, the more successful the interventions are applied the less possibility of herd immunity and hence another epidemic is expected later this year after relaxing the instituted interventions.[13]

Mitigation strategy allows us for the early development of herd immunity with a cost of high mortality in the early phase, but suppression strategy will prevent the surge of cases in the early phase of disease, but at a cost of chance for further outbreaks. If an effective vaccine development happens during the suppression stage, and the development of herd immunity happens with vaccination, suppression strategy is well and good.

END NOTE

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