

Combating COVID-19 pandemic in India: Demystifying the concept of herd immunity

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ABSTRACT

The concept of Herd immunity is a key factor for epidemic control. According to it only a proportion of entire population needs to be immune either via natural infection or vaccination. The idea of herd immunity via natural infection rather than vaccination is a bit controversial, as it is not clear how long will the antibodies last, and whether re-infection or re-activation of the virus can occur after the antibodies starts weaning from the body. It has been suggested that coronavirus will likely become similar to a seasonal flu once the herd immunity is attained. Till then, it will continue causing outbreaks year-round and there could be multiple waves of virus transmission before achieving herd immunity. Therefore, the public needs to learn to live with it, and continue practising the best prevention measures, including wearing of masks, physical distancing, hand hygiene, and avoidance of gathering.

Keywords: Coronavirus, Covid-19 models, herd immunity, Social distancing

With no specific treatment or vaccine yet available, herd immunity seems to be the only stopping point for the COVID-19 pandemic. Herd immunity is defined as “the resistance of a group of people to an attack by a disease to which a large proportion of the members of the group are immune.” Once a substantial proportion of the population develops immunity against an infection, the chain of transmission gets disrupted, thus protecting the remaining uninfected population.^[1,2] For a population to achieve herd immunity threshold, a proportion equal to $100 \times (1 - 1/R_0)$ must develop immunity against the antigen (R_0 being the basic reproduction number—number of individuals an infective individual would infect). For SARS-CoV-2, R_0 ranges between 1.9 and 6.5, and thus, the threshold ranges theoretically between 50% and 85%.^[3]

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Factors required to control Communicable Diseases

The imperative determinants in controlling any communicable diseases are removing the cause of infection, breaking the chain transmission, and protecting the vulnerable population [Figure 1].

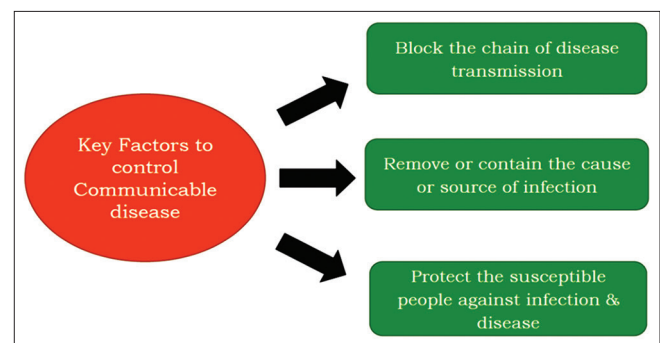


Figure 1: Key factors to control communicable diseases

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Herd Immunity in Relation to Coronavirus Infection

Table 1 shows some of the myths/controversies around herd immunity related to COVID-19. Studies conducted in New York, California and Wuhan reported that nearly 21.2%, 3% and 2-3% of the patients who were exposed to SARS-CoV-2 developed antibodies. This demonstrates that even in worse hit areas the levels for developing herd immunity are very much low.^[4] Epidemiologists at the Harvard School of Public Health also stated that there is no idea about the duration of immunity after contracting coronavirus disease, this can be in months or several years. However, severity wise there might be a decline as there may still be some amount of protection against this virus.^[5] But this cannot be denied that without vaccine even if adults develop immunity because of exposure to the virus, the disease may still persists and circulate in children or people who are immunocompromised which also happened with certain diseases like measles, mumps, chickenpox, etc., before their vaccines were introduced.^[6]

Also, if a patient gets discharged after testing negative, but again becomes positive after few days or months as reported by China and Korea and even in India, this shows that passive acquired immunity does not confer lifelong immunity. Nevertheless, it was reported that this can be because of reinfection, because of dead virus particles, non-infectious remnants of the virus, or may be because of slow shedding of norovirus in people who had weak immune system.^[7] Even the rapid diagnostic tests for evaluating antibodies against coronavirus are not that much accurate and reliable. These tests are not accurate in distinguishing the antibodies developed because of exposure to SARS-CoV-2 or because of other six human coronavirus. The validity of these tests is in question as they can result in false-negative and false-positive cases.^[8] So, even if the patient develops antibodies there are no assurance that person is virus free. Thus, it should not be assumed that developing antibodies will give people “immunity passport” or “risk-free certificate” as there is no evidence and moreover this will imperil continued transmission.^[8]

It is proposed that even after the pandemic gets over, coronavirus will synchronize with seasonal changes and will remain in circulation though with reduced severity. A research conducted by Center for Infectious Disease Research and Policy at the University of Minnesota reported that this coronavirus pandemic will continue for atleast till 18–24 months as it will take time for

herd immunity to develop gradually. Some researchers stated that it will be difficult to control COVID-19 infection as it is highly contagious and spreads to asymptomatic people very easily.^[5] It is suggested that death rate of COVID-19 is 10 times higher than that of and it is even more in high risk people.^[6]

Therefore, the renowned epidemiologists’ states that at population level of 2020, herd immunity against coronavirus disease is unlikely to be achieved.^[9] Even the WHO officials clearly specified that “no-one is safe until everyone is safe” and no country can attain herd immunity against coronavirus disease magically. Herd immunity is only used to calculate the number of persons required to be vaccinated and the population to generate that effect.^[10]

Why bother for herd immunity in the Indian Covid-19 context?

In the milieu of COVID-19, herd immunity has attracted support as well as criticism. There are certain prerequisites for attaining herd immunity, firstly there should be single host species to which the disease agent is limited to, otherwise the effect of herd immunity would not last long because of alternative mode of transmission and secondly there should be direct transmission of disease agent from one individual to another. So, it is accomplished optimally only when there is “random mixing” of the people, that is, people are constantly mixing together.^[1] In a country like India, achieving this is tricky—how do we strategically expose our young population to the virus to help reach the herd immunity threshold, while protecting the vulnerable (the elderly, those with comorbidity, and those lacking healthcare access) is a big question. Hereunder, we have touched upon certain aspects that are relevant to our understanding of the challenges posed to herd immunity by SARS-CoV-2.

Firstly, experts have no clue how long immunity will last. Secondly it is assumed that SARS-CoV-2 will infect young population more as India has 80% of people of <44 of age, so there will not be any severe infection. But, young generation of India also has several underlying conditions like HTN, diabetes, HIV, COPD and asthma, and even risk factors like obesity, consuming tobacco which can increase the mortality rate among those. Putting the experimental strategy of herd immunity can overwhelm the hospitals with patients. Another big obstacle is the concept of “joint family” in India. Since Indians live in multigenerational family homes, it is exceedingly difficult to keep away young family members away from elderlies in home who are at high risk of contracting the disease.

Fourthly, herd immunity alone will not work against COVID-19. Multiprong strategies like public–private partnerships, increase testing and improve health system capacity, maintaining social distancing and following good hygiene practices are required for this. One of the major concerns will always be there that even if the vaccine comes into existence is the “cost of vaccine.” In country like India everyone will not be able to afford the vaccine

Table1: Myths/Controversies around herd immunity related to COVID-19

Some Controversies around herd immunity related to COVID-19 ^[11] : Hydroxychloroquine can prevent or cure COVID-19 Pepper and garlic consumption cures COVID-19 Drinking methanol & ethanol prevents COVID-19 Pneumococcal vaccine and Haemophilus influenza type B (Hib) vaccine protects from novel corona virus infection Only elderly population is susceptible to COVID-19

especially the lower weaker sections of the society, thus it will break the first principle of herd immunity.^[12]

Is there any empirical evidence from International arena that herd immunity works/does not work?

The day since SARS-CoV-2 has hit India, people were in opinion that India should follow the different models of the countries [Table 2]. Nevertheless, is it possible for India to emulate what South Korea or Taiwan did? South Korean’s kept public safety on upper hand with legal framework rather than prioritizing individual privacy. The country managed to conduct extensively affordable testing for detecting novel coronavirus. On the other hand, in India this might be just impossible because of its huge population. Even their policies of intrusive contract tracing and isolation policies cannot be implemented as it has seen Indians concealing their travelling history or providing inadequate information. It now has become a culture of wearing masks by the countries like Singapore, Hong Kong, Taiwan, South Korea, or Japan. Public is not being persuaded for this and governments are proactively keeping the supply. Taiwan has scaled up their local companies for preparing masks, their daily production is set to reach 10 million. While in India, people are being forced to comply. Simple wearing a mask has become a huge task for Indians either they put a handkerchief or some cloth off and on and those who are even trying to wear they do not know the proper way of wearing it. Moreover, it was the faith of the citizens that led Taiwan or South Korea to implement strict measures because people realized that it was for their benefit. They kept national goals at top priority. Korea’s vice minister stated that “public trust has resulted in a very high level of civic awareness and voluntary cooperation that strengthens our collective effort.” which is the need of hour.^[13] In India, even an Aadhaar implementation triggered the backlash from citizens. The trust from every sector of the society in India is required by the government for smooth functioning.^[13]

Recently “the Swedish model” has come into picture Table 3. However, can Sweden model work in India? What we need to learn from this is that firstly, in Sweden, decision-making power was put into the hands of professionals who are expertise in understanding the virus, that is, Chief epidemiologist and not the politicians. India, at this stage strongly requires a separate “Indian Medical Services” to handle such situations and lead the strategy. Secondly, Sweden’s followed an “explicit policy” to tackle such crises situation with free, honest, and open regular communication from Government with the country people to build trust and cooperation. Keeping in mind the bottom-up approach and no discrimination on basis of religion the Indian Government should make their own pro-active policy considering economy, culture, weather, and population size rather than following any other country.^[14]

Thirdly, in Sweden though the worst hit was immigrants, but no one blamed them for this crisis nor even blaming China. It is to learn that “blame game” should be stopped and every individual of India should stay united and become responsible. It is for Indian media and Government to act responsibly rather than creating more conflicts and hatred division wise. Fourthly, Sweden is not treating this crises situation for political expediency but taking it as “public health emergency.” Though Swedes have equipment shortages and had lack of systematic testing, but their system did not collapse as Government is putting sincere efforts to support healthcare workers by providing them sufficient PPEs. India should work in this area by providing resources to support healthcare workers. Swedish Government also remained open few pre-schools and junior school for children of healthcare workers so that they do not fall of health personnel. Even country people volunteered themselves to help healthcare facilities. None of the individual mistreated with healthcare workers because of stigmatization.^[15] This is high time for people of Indian to support, trust, and respect healthcare personnel for better outcomes.

Table 2: Emerging of Different Models during COVID-19 pandemic^[14]

Model with Country’s Name	Ideas Recruited
Taiwan Model	Early Restrictions
Singapore Model	Strict Lockdown
South Korean Model	Testing
German Model	Public Health Care
United States Model	Stimulus Package

Is there any evidence from India that herd immunity works?

Ever since the disease occurred in Bhilwara, a place in Rajasthan, India, it was assumed that it will become “Wuhan of India.” But this was converted to “ruthless containment” and this “Bhilwara model” gained national as well as international appreciation because of the measures that were adopted there. Healthcare professionals and police personnel worked

Table 3: Swedish Model Case Vignette

The Swedish Model- at a glimpse
 Restrictions on areas of more than 50 people
 Teaching in the universities were closed
 Elderly people over 70 years of age were recommended to stay in their homes
 Shops, bars, offices, salons were kept open.
 This was possible because as people in Sweden follows abide to Government laws, and is science trusting society with no religious issues. Many people live in single-person households and have good internet connection. But in recent times it was seen that death toll rise almost three times more in Sweden as compared to its neighbouring countries, though the death took place mostly in capital city of Sweden “Stockholm” among people residing in old age homes and among immigrants. This high number of deaths has put up this strategy into question as they could not keep the curve flat. Still, Sweden has managed to limit the areas and keeping SARS-CoV-2 confine to clusters. Even it is stipulated that Stockholm has probably attained herd immunity.^[15]

incessantly for precaution and treatment. First lesson to be learned from this model is “alertness of state government” with prompt response and decisions on feedbacks. Within no time an inside-out curfew was imposed over there even before national lockdown. There was extension of curfew in some areas by creating buffer zones. Tightening of essential services and door-to-door supply of essentials were also done. Second thing that can be learned is “adaptation according to circumstances and remaining sensitive.”^[16] Thirdly, “aggressive screening” and “continuous testing” of patients which had symptoms. The state government arranged vehicles to take people for testing. Hotels, institutional beds, and hostels were used as quarantine centres. Therefore, strict lockdown period has to be utilized for health system strengthening through better infrastructure, testing, isolating, and treating. Fourthly, “bottom-up approach” was taken into consideration as elected village representatives were given special tasks and specific responsibilities to make participatory action. Thus, with multipronged approach the curve can be flattened and then zone can be made disease free.^[16]

What Could be a Prudent Strategy for Attempting Herd Immunity?

Besides following the methods of prevention and control a “strategic long-term approach” with focus on high risk individuals through mass community testing is required. Also repeated testing of healthcare workers who are constantly exposed to this lethal virus. Government should not delay and approve fast domestic testing kits and permit private labs to conduct tests, keeping into consideration the acceptable standards. The contact tracing should be rampant through mobile-based tracking, home visits, or phone calls. Public health people, police, community leaders, frontline health workers can be utilized for the same. India should also address the ethical issues regarding Aarogya Setu App for building trust and compliance among the citizens. For effective management of cases, separate isolation strategies in different settings for mild, moderate & severe symptoms should be strictly enforced. This can be achieved through splitting workforces like China developed “Fangcang” hospitals to isolate patients with mild-moderate symptoms.^[14]

Government can approve certain private hospitals and clinics which can be used for COVID-19 testing and treatment and incentivize them later, thereby through public-private partnership these private hospitals and clinics will also be not at loss. Local communities’ engagement is required for contact tracing, social distancing, and encouraging people for treatment.^[14] Government should also check small sectors like transport, small businesses for maintain the economy. Lastly, a strong public health system is needed with expertise like epidemiologists, data scientists, and immunologists for long-term planning and better outcomes.

Vaccine hesitancy by the Primary Care Physicians and Herd Immunity

Herd immunity can be achieved either by natural infection or by vaccine or sometimes by a combination of both. The threshold for COVID-19 herd immunity is around 55% and 82% of the population as per the estimates, and this might be affected significantly by a vaccine refusal rate of more than 10%. For new pandemic vaccines the major barriers to vaccine uptake are vaccine hesitancy and refusal. Inadequate health literacy and lower education level concerns regarding the effectiveness of vaccine, developing COVID-19 from the vaccine itself will be a challenge.

In order to facilitate uptake of the vaccine by the community, ensuring public confidence in vaccine safety and effectiveness would be crucial. General practitioners could be highly influential in encouraging uptake and also in removing the allay and anxiety of the general public since they are closer to the community than other medical professionals and hence one of the most trusted sources for patients. It is also anticipated that general practitioners (GPs) will be at the forefront of COVID-19 vaccine delivery in primary care, as well as potentially one of the initial target groups for COVID-19 vaccine receipt and hence can serve as role model for removing vaccine hesitancy.

Once a safe and effective vaccine becomes available in the market, primary care physicians will play a key role in the implementation of a successful immunization programme. As the vaccine becomes available, community, family, friends, relatives will seek advice from general practitioners on whether to get vaccinated discussing the benefits and risks associated with it. Also, they need to structure their practices in order to make receipt of the vaccine as accessible and efficient as possible for their patients once it reaches the health centres. Primary care professional is also anticipated to play a key part in educating the general public about the vaccine, removing their fears and anxiety related to the vaccine and also to clear their doubts regards the COVID-19 vaccine.

For this, primary care physicians needs to have a comprehensive, up-to-date information about the COVID-19 vaccines, as well the rationale behind any immunization campaigns before they commence, in order to maintain trust and clear communication between primary care providers and their patients.

Conclusion

In the end, we would like to re-assert that even the developed countries are having low chances for developing herd immunity. Tests available for detecting antibodies might give false positive results. As there is no proposition as to how much vaccine will be effective against SARS-CoV-2, the best method to break the chain transmission and perpetuate the current levels of infection or even decrease it is through performing social distancing. Apart from maintaining social distancing, maintaining good personal hygiene, quarantine, etc., it is crucial to fathom how vulnerable we remain. It solely has become moral responsibility of every

individual to continue taking preventive measures for extended period till vaccine is developed. This concerted effort will surely bring rewarding results. There is also dire need of escalation in testing that will help us to better understand the scope of infection. Relying on just herd immunity is not only precarious but can be life threatening too. Indian Government should look at the population size and protect every society along with economy and other necessary things. Herd immunity should be attained zone to zone and not one at a time. A far-sighted targeted approach with developing a strong public health system is the need of an hour. Utilization of primary care physicians in clearing myths and removing fears of patients can play a key role. It is time to prioritise otherwise COVID-19 will take over us in no time. Finally, as said by J. K. Rowling “*Understanding is the first step to acceptance, and only with acceptance can there be recovery,*” so it is indispensable to accept that lockdown would not help us for long and we need to learn how to live with it. Ultimately it will always be “*survival of the fittest.*”

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