Much remains unknown about the coronavirus. A new paper published in The Lancet estimates that roughly 60% of the population needs to be immune to COVID-19 to achieve herd immunity.

For social and economic reasons, the lockdown simply cannot last much longer. As the country begins to reopen, there will be several major unanswered questions, perhaps the biggest of which is, "Will there be a second wave of COVID-19?"

Tackling this question first requires an understanding of the immunological response to the coronavirus and, specifically, what is needed to achieve herd immunity. A new paper published in The Lancet provides some insights. Below is a summary of some of the paper's major points in the form of a Q&A.

**What is herd immunity and how is it achieved?**

Herd immunity is the resistance that an infectious disease encounters when it attempts to spread in a population. If a sufficient number of people are immune to the disease, then the microbe cannot spread. Herd immunity can be achieved through infection (and recovery) or vaccination.

**What percentage of people must be immune for us to achieve herd immunity?**

The more infectious the disease, the greater the percentage of immune individuals needed to
block its spread. Infectiousness is quantified by a measure known as $R_0$, which is an estimate of the average number of people to whom an infected person will spread the disease in a totally susceptible population. With an $R_0$ between 12 and 18, measles may be the most infectious disease among humans. To achieve herd immunity against measles, public health officials say that at least 90% (perhaps 93% to 95%) of people must be immune. With an $R_0$ of roughly 2.2, SARS-CoV-2 would require a herd immunity of about 60%.

**Can a person be reinfected with coronavirus?**

This is unknown, but it's also unlikely in the short-term. Anecdotal reports of immediate reinfection are a bit suspect. Evidence from other coronaviruses suggests that a person should have at least some immunity for a couple of years.

**What percentage of the population has been infected?**

This is unknown. However, initial data suggests to the authors that herd immunity will not be achieved during this "first wave."

**Can vaccine production be sped up?**

It's very difficult to speed up the production of a vaccine faster than 12-18 months. The reason is because vaccines must be tested thoroughly for safety. This takes time. If a vaccine elicits an improper immune response, it can be harmful or even lethal. The authors provide a hypothetical scenario in regard to SARS-CoV-2:

> "Some features of the immune response induced by infection, such as high concentrations of tumour necrosis factor and interleukin 6, which could be elicited by some candidate vaccines, have been identified as biomarkers of severe outcome."

**Will there be a second wave?**

The authors don't address this question directly, but given their analysis, a second wave seems very likely.