

Herd immunity in the context of COVID-19

Request

On 17 March 2020, ECDC was requested by EC/SANTE in EC request 39 to provide an assessment of the Dutch approach of herd immunity as an alternative to currently implemented measures on social distancing, including considerations on whether this approach makes sense at this stage of the epidemic.

Reply

Herd immunity is an epidemiological concept which relates to the situation when enough people become immune to an infection, through either vaccination or previous exposure, that it no longer significantly spreads among the rest of the population. As there is currently no vaccine available for COVID-19, herd immunity in this context means that enough individuals have become immune following infection to decrease the spread of the disease to the rest of the population. Based on the reproductive number (R_0) for COVID-19 of between 2 and 3, it is estimated that about 60% of the population need to be infected with the virus for there to be a herd immunity effect¹.

Herd immunity in the context of COVID-19 is not a specific approach to tackling the disease, but is the natural outcome of the disease spreading in the population. The result of various 'mitigation' strategies that are being implemented across countries that include measures such as social distancing, case isolation and quarantine will decrease transmission at a population level and therefore affect the time needed for herd immunity to develop. The strategies aim to slow the spread of disease sufficiently to guard against a very rapid acceleration of new cases which could overwhelm healthcare capacity. By slowing the spread over a longer period of time, more time is then available to prepare health systems and as a by-product some level of immunity will develop in the population. It is not known how long it would take to build up "herd immunity" and it is also too early to know

¹ Fine P, Eames K and Heymann DL. Herd Immunity": A Rough Guide. Clinical Infectious Diseases. 2011;52(7):911–916.

how long the protective immune response against SARS-CoV2 will last, as this will require longitudinal serological studies that follow patients' immunity over a period of time¹. Evidence from other coronavirus infections (SARS and MERS) indicates that immunity may last for up to 3 years and re-infection with the same strain of seasonal circulating coronavirus is highly unlikely in the same or following season. This could hold for SARS-CoV2 with emerging evidence from early studies suggesting that individuals develop antibodies after infection and are likely to be immune from reinfection in the short term².

As of 18 March 2020, 1 705 COVID-19 cases and 43 deaths were reported by the Netherlands. The maximum 14 days cumulative notification rate is 9.7 per 100 000 population, lower than the overall EU/EEA and UK rate of 13.0 per 100 000 population. The number of new cases reported by the Netherlands increased 6-fold and the notification rate has tripled since 11 March 2020³. Given the rapidly evolving situation of COVID-19 it is likely that the EU/EEA, including the Netherlands, is days or a few weeks from widespread sustained transmission where healthcare systems are over-burdened due to a large demand for emergency healthcare services, a strained ICU capacity, overworked healthcare workers and reduced staff availability due to illness, lack of PPE and a lack of diagnostic testing capacity.

The Netherlands have implemented a wide range of measures to prevent the spread of COVID-19⁴. These include case isolation and a range of physical distancing measures including working from home, advising vulnerable populations to avoid large events and public transport, cancellation of large (>100 people) gatherings, the closure of schools and day-care facilities and online teaching for university students in place of lectures. Advice has also been given to the public about restricting non-essential travel overseas. These measures aim to slow the spread of the virus and prevent a peak that could overwhelm health services and also try at the same time to protect those most at risk. The measures will not interrupt transmission completely but will reduce the impact of the epidemic, allowing population immunity to develop slowly.

Epidemiological modelling undertaken in the UK has assessed the potential role of a number of public health measures in reducing transmission of the virus. The researchers found that a combination of different 'mitigation' approaches (home isolation of suspect cases, home quarantine for those living in the same household as suspect cases, and social distancing of the elderly and others at most risk of severe disease) could reduce peak health care demand by two thirds and deaths by half but the epidemic would still result in hundreds of thousands of deaths and would overwhelm health care services. Based on their results the authors propose a more aggressive 'suppression' of the epidemic is 'preferable' for countries that are able to achieve it through more strict measures, social distancing of the entire population, home isolation of cases and household quarantine of their family members. However, the authors also note that such measures would need to be in place for a long period of time until a vaccine becomes available, which could be up to 18 months, note that the social and economic effects of such measures would be 'profound'. A key concern in the application of such aggressive measures that

¹ Ferguson NM, Laydon D, Nedjati-Gilani G et al on behalf of *Imperial College COVID-19 Response Team*. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand. Imperial College. Available from: <https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf>

² Bicheng Zhang, Xiaoyang Zhou, Chengliang Zhu, Fan Feng, Yanru Qiu, Jia Feng, Qingzhu Jia, Qibin Song, Bo Zhu, Immune phenotyping based on neutrophil-to-lymphocyte ratio and IgG predicts disease severity and outcome for patients with COVID-19. Pre-print available at <https://www.medrxiv.org/content/10.1101/2020.03.12.20035048v1>

³ European Centre for Disease Prevention and Control. Situation update for the EU/EEA and the UK. Available from: <https://www.ecdc.europa.eu/en/cases-2019-ncov-eueea>

⁴ National Institute for Public Health and the Environment/Ministry of Health, Welfare and Sport. Q&As Novel coronavirus COVID-19. Available from: <https://www.rivm.nl/en/novel-coronavirus-covid-19/questions-and-answers>

break the chain of transmission is that these measures would stop herd immunity developing and there is the risk of a new outbreak as soon the measures are lifted.

In these early months of the COVID-19 pandemic, evidence around the effectiveness of different approaches is still emerging. What is clear in relation to the current epidemiological situation in Europe, where the number of cases are rapidly increasing, is that there is a need for immediate targeted action. All countries need to adopt a strong, strategic and coordinated approach based on the rigorous application of evidence-based public health measures that will help reduce the burden and pressure on the healthcare system, and in particular on hospitals, and will allow more time for the development of therapeutics and vaccines. The implementation of such measures would need to be implemented for a prolonged period of time and obviously need to be carefully considered in the context of the local situation and the likely social and economic impact and their acceptability by the society.

ECDC internal contributors

[REDACTED]

[REDACTED].