Received: 4 May 2020 | Accepted: 17 May 2020

DOI: 10.1111/zph.12740

LETTER TO THE EDITOR

WILEY

SARS-CoV-2 vaccination—A plea for fast and coordinated action

The cataclysmic consequences of the pandemic spread of SARS-CoV-2 are mind-numbing. Measures that include social distancing and stringent lockdown scenarios that seemed unthinkable in democratic societies two months ago have become a reality.

As veterinary epidemiologists and virologists, we are well aware of the challenges of controlling infectious diseases that hit susceptible animal populations. Outbreaks of virus diseases including foot-and-mouth disease (FMD) or classical swine fever (CSF) have been controlled by stringent movement restrictions, depopulation, and/or compulsory vaccination. The objective of the measures is to reduce R_t (the effective reproduction number at a given time t) to levels that would stop the epidemic as quickly as possible. Maintaining the label 'disease-free'—and the resulting freedom of trade—is achieved through comprehensive surveillance and strict contact restrictions with regions in which the pathogen is still present. Controlling disease in human populations, however, is quite different, as such measures are not typically possible.

The current efforts of reducing R_t ('flatten the curve') of COVID-19 seem appropriate for giving even advanced and well-funded public health systems the necessary time to prepare for the expected surge in critical cases. However, eventually easing the draconian measures will not result in a drastic change of the behaviour of the pandemic beast, and it is unclear what the options are for countries with less developed health systems. Since there is no realistic chance for any country or region to being SARS-CoV-2-free any time soon, a second wave of the pandemic is all but certain.

Control of COVID-19 will ultimately require adequate levels of herd immunity. If we assume that the level of herd immunity to halt the spread follows the $1 - 1/R_0$ rule (Anderson, Heesterbeek, Klinkenberg, & Hollingsworth, 2020) and given conservative estimates for the basic reproduction number $R_0 = 3$ (Sanche et al., 2020) at least two-thirds of the world's population must mount an effective immune response against the virus to prevent recurrent outbreaks. Even then, SARS-CoV-2 would still be present and likely for the duration.

Flattening the epidemic curve will inevitably slow the development of herd immunity by means of natural infection. That, in turn, would result in the need to continue the current measures for months or years—with all the societal, economic and health consequences—until effective vaccines are in widespread use. Yes, an $R_t < 0.2$ would halt the spread of SARS-CoV-2 in a given population at time t, but any re-introduction of the virus could catapult us back to where we were. Re-introduction is virtually unavoidable in our globally connected societies, there will always be remaining pockets of virus somewhere. It is wrong to create the illusion that strict distancing and lockdown with the sole objective to reduce R_t until the virus is eliminated from a given population is the solution to the problem—it becomes a problem in itself.

Unless serological surveys suggest a much higher-than-expected silent exposure of the human population to SARS-CoV-2, there is no reasonable scenario to reach the required level of herd immunity under the 'reduce spread' paradigm that many countries have emulated. For example, if we take Europe's population of approximately 750 million, it would require a constant infection rate of 678,000 individuals per day for two years to achieve the required herd immunity (66% immune individuals)! Assuming a case fatality rate of 0.3%, which is the lower end of current estimates (World Health Organization, 2020) that would translate into more than 2,000 COVID-19-related deaths per day.

The preferable alternative to herd immunity by infection is herd immunity through safe and effective vaccination. Weighing the risks versus the benefits for global public health, it is essential to implement comprehensive vaccination as soon as this is possible—starting with the high-risk groups (healthcare personnel, shop clerks etc.) who are most likely to contract the virus. The vaccines should be based on platforms that have a proven safety record and were shown to induce protective immune responses to viruses related to SARS-CoV-2. Of course, such immediate implementation of widespread vaccination without going through the usual time-consuming clinical testing phases carries considerable risk. It will require close monitoring of potential adverse reactions, such as antibody-dependent enhancement or Th_2-dependent immunopathology. It may even become necessary to consider challenge infections of vaccinates as has been proposed (Decaro, Martella, Saif, & Buonavoglia, 2020; Eyal, Lipsitch, & Smith, 2020; Peeples, 2020).

Without any further delay, the discussion must focus on the task at hand: finding a solution to a wicked problem by weighing the risks of different actions, recognizing we are in an ethical dilemma. We plead for a globally coordinated strategy of 'vaccinate now and vaccinate comprehensively'. Given the magnitude of this global crisis brought upon all of us by an infectious disease that knows no borders, it is ineffective and divisive for each country to write its own playbook for vaccine development. There is no time to be wasted, every day of inaction costs human lives. It is the responsibility of national governments and international organizations to come together and launch a Vaccine Manhattan Project to end this

nightmare—this time not for the purpose of destruction to end military conflict but for disease prevention that can save lives and the world order as we know it.

Martin Beer[1]
Marcus Doherr[2]
Klaus Osterrieder[3]
Dirk Pfeiffer[4]
Jakob Trimpert[3]

[1]*Institut für Virusdiagnostik, Friedrich Loeffler Institute, Greifswald – Insel Riems, Germany*
[2]*Institut für Epidemiologie und Biometrie, Freie Universität Berlin, Berlin, Germany*
[3]*Institut für Virologie, Freie Universität Berlin, Berlin, Germany*
[4]*Department of Infectious Diseases and Public Health, Jockey Club College of Veterinary Medicine and Life Sciences, City University of Hong Kong, Kowloon, Hong Kong SAR, China*

Correspondence
Klaus Osterrieder, Institut für Virologie, Freie Universität Berlin, Robert-von-Ostertag-Str. 7-13, 14163 Berlin, Germany.
Email: no.34@fu-berlin.de

ORCID

Klaus Osterrieder https://orcid.org/0000-0002-5313-2176

REFERENCES

Anderson, R. M., Heesterbeek, H., Klinkenberg, D., & Hollingsworth, T. D. (2020). How will country-based mitigation measures influence the course of the COVID-19 epidemic? *Lancet*, *395*, 931–934.

Decaro, N., Martella, V., Saif, L. J., & Buonavoglia, C. (2020). COVID-19 from veterinary medicine and one health perspectives: What animal coronaviruses have taught us. *Research in Veterinary Science*, *131*, 21–23.

Eyal, N., Lipsitch, M., & Smith, P. G. (2020). Human challenge studies to accelerate coronavirus vaccine licensure. *Journal of Infectious Diseases*, *221*, 1752–1756.

Peeples, L. (2020). News feature: Avoiding pitfalls in the pursuit of a COVID-19 vaccine. *Proceedings of the National Academy of Sciences USA*, *117*, 8218–8221.

Sanche, S., Lin, Y. T., Xu, C., Romero-Severson, E., Hengartner, N., & Ke, R. (2020). High contagiousness and rapid spread of severe acute respiratory syndrome coronavirus 2. *Emerging Infectious Diseases*. https://doi.org/10.3201/eid2607.200282. [Epub ahead of print].

World Health Organization (WHO) (2020). *Coronavirus disease 2019 (COVID-19) situation report 30*. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200219-sitrep-30-covid-19.pdf?sfvrsn=3346b04f_2