



## The time to begin plans for COVID-19 eradication is now

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### Abstract

After the world recovers from the pandemic of SARS-CoV-2, it is most likely to stabilise as endemic and seasonal, deserving/demanding control efforts perpetually in all countries, unless it can be eradicated. The risk of mortality is high among those above 65 years and those with chronic “lifestyle” diseases. Endemic circulation will, therefore, take a heavy toll on life annually. Eradication is an extreme form of control, eliminating the disease permanently and globally. Effective vaccines are expected in the near future. As the pandemic abates, herd immunity will be very high, enabling early eradication by additional build-up of a vaccine-induced herd immunity. Public memory of the pandemic will be fresh, which will assist in social mobilisation and fund raising towards eradication. If time is lost, the infection is likely to become non-eradicable as domestic/farmed animals may become fresh reservoirs. Resolve to eradicate and designing its road-map must be made at the earliest.

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**Key words:** COVID-19, pandemics, vaccines, global health

*“We cannot solve our problems with the same thinking we used when we created them.”  
(Einstein)*

### The COVID-19 pandemic, a veritable nightmare

The pandemic of the Coronavirus disease-2019 (COVID-19), caused by an infection with Severe Acute Respiratory Syndrome Coronavirus type 2 (SARS-CoV-2), has sowed disease, death, and devastation in its path across all countries of the world. By the end of June 2020, it has caused over 9.4 million cases and over 480,000 deaths

globally.<sup>1</sup> Risks of severe disease and death are high in those above 65 years and those with chronic non-communicable diseases (co-morbidities).<sup>2</sup> Children, adolescents, and young healthy adults tend to develop asymptomatic infection or only mild symptoms and are at low risk of death.

The mode and speed of the spread of SARS-CoV-2 resembles that of influenza viruses. The 1918 influenza pandemic (causative virus identified by paleo-virology as A H1N1) had three successive waves in March, September–November, and early 1919.<sup>3</sup> H1N1 virus was replaced by H2N2 when it became a pandemic in 1957, which was then replaced by the H3N2

pandemic virus of 1968,<sup>4</sup> but the 2009 pandemic H1N1 virus did not replace H3N2, and since then, both H1N1 and H3N2 are endemic globally. Each pandemic virus became globally endemic unless replaced by another influenza virus, and SARS-CoV-2 will most likely emerge as globally endemic.<sup>5</sup> We have no reason to expect a less virulent beta coronavirus to emerge and replace this highly virulent pandemic virus.

Two other coronaviruses have emerged as zoonosis first and then human-to-human transmission continued: the SARS-CoV-1 and the MERS-CoV, causing severe acute respiratory syndrome (SARS) and the Middle-Eastern respiratory syndrome, respectively. The former did become a pandemic involving 27 countries, resulting in 8,096 cases and 774 deaths.<sup>6</sup> By diligently case diagnosing, contact tracing, and quarantining, SARS was eradicated within one year without a vaccine or anti-viral drug.

This approach failed with SARS-CoV-2 because of greater transmission efficiency and the fact that infected asymptomatic and pre-symptomatic (during incubation period) individuals transmitted infection, whereas SARS virus was transmitted only after a fever developed, allowing case detection and breaking of transmission chains. Fortunately, it has not reappeared as zoonosis in the country of origin as precautions were taken.

MERS-CoV has appeared several times as a zoonosis, often resulting in limited person-to-person transmission. Further spread could be interrupted so that it has neither persisted as anthroponosis nor became a pandemic. However, when imported into the Korean Republic, it caused a major epidemic, but once detected and when non-pharmacological interventions were applied, it could be eliminated.<sup>7</sup> SARS-CoV-2 is a highly efficient person-to-person transmitter and, within a span of 4 months from first recognition in China, it has reached all United Nations member countries. It is now fully entrenched globally as anthroponosis and it would be naive and foolhardy to expect that its transmission could be interrupted

everywhere using non-pharmacological interventions.

To presume it will die out will turn out to be a huge risk if it does not. The world will be safer if we presume the opposite—that it will become pan-endemic when herd immunity grows sufficiently high.<sup>5</sup> In the medium term, as the disease remains endemic with annual seasonal prevalence, senior citizens and those with comorbidities will have to live in fear of infection and its consequences, unless effective anti-viral therapy is developed or at least one safe and effective vaccine becomes available, accessible, and affordable even in low income countries, or unless the disease is eradicated.

### Can COVID-19 be eradicated?

Disease eradication is defined as permanent reduction to zero of the worldwide incidence of the causative infection, with deliberate efforts.<sup>8</sup> For COVID-19 eradication, the coronavirus transmission must be interrupted globally.

Three biomedical criteria determine if a disease can be eradicated: i) availability of vaccine for primary prevention; ii) availability of a diagnostic tool to reliably detect infection; iii) absence of extra-human reservoir of the agent.<sup>8</sup>

Although SARS-CoV-2 only recently jumped species from bats to humans as a zoonosis, it is now an anthroponosis, meaning efficiently spreading person-to-person, hence theoretically eradicable.<sup>8</sup> The presumptive parent virus in the bat is a millennia old. Its emergence as an emerging anthroponosis of zoonotic origin had not happened before 2019, so we have to presume it is a one-off event. As an anthroponosis, it is eradicable, in spite of its original reservoir remaining in nature. However, constant vigilance and escalated surveillance for any new zoonotic to human introduction is needed.

If such re-introductions recur, eradication may have setbacks, but we will know if reintroduction, if any, since surveillance will be of eradication quality. Thus, if we fear reintroduction of either the same or another coronavirus capable of easy/rapid spread, we must eradicate the current

one, instead of remaining unprepared for such eventualities.

Diagnostic tests like reverse transcription polymerase chain reaction (RT-PCR) and antibody tests are already available. SARS-CoV-2 is excreted in the faeces and found in sewage. Environmental surveillance of sewage for SARS-CoV-2 can, therefore, be used to detect infection if during the eradication programme it silently re-emerges in the community. This is a lesson we have learned from environmental surveillance of the polio eradication programme.

The critical intervention tools are vaccines to build herd immunity sufficient to interrupt transmission. Currently several vaccine candidates are in the pipeline. We expect more than one vaccine to be on the market by 2021. Since infection and transmission are based on upper respiratory mucosal infection, the best vaccine that offers upper respiratory mucosal protection should be used for eradication. Since basic reproduction number  $R_0$  is below 4, theoretically the herd immunity threshold for interruption of transmission would be about 75%.<sup>9</sup> Vaccination coverage has to top up the existing herd immunity due to natural infection. Vaccine efficacy will determine the coverage needed: the higher the efficacy, the lower the coverage needed.

### Why think of eradication when the pandemic is still on?

Wisdom calls for early eradication of the virus without providing it time and opportunity to better adapt to human hosts and alter behaviour, antigenicity, or virulence.

We must pre-empt the virus from adapting itself to non-human vertebrates, potentially allowing them to become non-human reservoirs. If that happens, COVID-19 will become theoretically non-eradicable. Already canines, felines, and fur animals (mink and fox) are found to be susceptible to infection—we must not allow time for virus adaptation to any domestic, farm, or wild animals. As mink-to-human transmission has already occurred on limited occasions, no doubt there will be strict infection control in mink farms, but leaks

are always possible.<sup>10</sup> Although such infections have been stray instances of reverse zoonosis (human-to-vertebrate transmission), the natural extension of transmissibility is continued enzootic transmission.

Non-pharmacological deterrents of transmission require social distancing. Humans need social interactions from the cradle to the deathbed. Economic reconstruction and administrative, health management, recreational, educational, and religious activities require social interactions. However, social interactions will promote virus transmission when it is endemic, a potential catch-22.

Most important, we must galvanize the world to prepare for eradication while the memory of the nightmare of the pandemic remains fresh in the public's mind and when public cooperation can readily be solicited. Technically, the best opportunity to eradicate the coronavirus will be in the near-term, when herd immunity will be extremely high as the pandemic peaks and evolves as pan-endemic.

### What will it take to develop a global agenda for eradication?

Eradication becomes a global agenda only when the World Health Assembly passes a resolution to commit the World Health Organisation and its member nations to join in partnership to achieve this goal. For the reasons argued above, eradication must be achieved in the shortest possible time—ideally as short as five years or perhaps a little longer, according to practicality and our collective wisdom. Eradication has to be formally certified, which will take one or two more years.

An innovative immunisation platform will have to be imaginatively created as the existing ones, such as the Expanded Programme on Immunisation, will be insufficient for eradication. The majority of infections are asymptomatic, hence invisible and silent. Children must be vaccinated in spite of low risk of disease; adolescents and adults, young and old, must be vaccinated although individually they may feel no

reason for it. Herd immunity must be rapidly built up through high vaccination coverage. The pandemic has taught us a new way of looking at human health problems—and that innovative solutions must be developed.

Eradication, as an inevitably gargantuan project, will require a huge commitment of human and financial resources across the globe. Implementation will require innovative financial design and must be faster than our past performances addressing global public health problems, including polio eradication. Scepticism from strong quarters is to be expected and must be countered through persuasive thought leadership and a concerted global educational campaign.

The interventions for effective control of the pandemic or country-level epidemics, and for eradication, should not be conceived of as sequential but as simultaneous or overlapping as necessary. We should be ready to implement the eradication programme as soon as a primary prevention tool becomes available. All the deliberations needed and the resolve and resolutions commensurate with the enormity of the challenges should be ready to be in fast-forward gear.

*“Everything is created twice — once in the mind and then in reality”* (Robin Sharma). Let us get the first part done by the time reality opens its door for us.

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