SPECIAL ARTICLE

COVID-19 Eradication for Vaccine Equity in Low Income Countries

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The coronavirus disease 2019 (COVID-19) pandemic will transition into endemic phase with perpetual risk of severe disease and high mortality in vulnerable people – the elderly and those with co-morbidities, unless eradicated. Although several vaccines are already available to rich countries, low-income countries face gross vaccine inequity. We propose COVID-19 eradication to address both problems. An eradication program will ensure vaccine equity and international cooperation to establish public health surveillance and high quality laboratory diagnostic services in all countries. Eradication is biologically and technically feasible. We hope the World Health Organization will accept the proposition and design the necessary strategy without delay.

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Severe Acute Respiratory Syndrome (SARS) caused by SARS Coronavirus type 1 (SARS-CoV-1) began spreading within China in November, 2002, became pandemic in March 2003, and affected 29 countries, with 8096 cases and 774 deaths [1]. By July, 2003, SARS was eradicated under the leadership of the World Health Organization (WHO), using non-pharmacological interventions to curtail virus transmission [1,2].

Coronavirus disease 2019 (COVID-19), caused by SARS-CoV-2 began spreading in China in late 2019, and became pandemic affecting all countries of the world in 2020. By mid-May, 2021, the reported number of global cases exceeded 160 million, with over 3 million deaths [3]. Unfortunately many countries resorted to political rather than public health approaches to contain in-country epidemics; international cooperation was conspicuously absent and WHO leadership did not become effective for a global coordinated effort, in contrast to the global response to SARS.

COVID-19 eradication will be a daunting task for global public health agencies and experts. It will entail high vaccination coverage of a broad age range, in all geographic communities, thus achieving vaccine equity, the major spinoff benefit of an eradication program. The pandemic and responsive interventions have affected existing disease control programs. However, eradication efforts must be carefully designed and implemented so as not to disturb any existing disease intervention.

WHY AN ERADICATION GOAL NOW?

Vaccines against COVID-19 were developed by many companies in several countries, including India, and some became available for Phase III trial or emergency use authorization in 2020 itself. Presently, quite a few vaccines are in use in many countries. While this speed was phenomenal, vaccine inequity is embarrassingly stark. The WHO-led COVAX project was for vaccine equity but its success was less than expected [4,5]. Many high income countries have secured vaccine doses to cover 200% of their population while most low income countries have no access to any COVID-19 vaccine [5].

To make sufficient amounts of vaccines available to low income countries, there has to be a realistic program that binds all nations together. We propose that an eradication goal set by the World Health Assembly (WHA) and managed through the six WHO Regional Offices network will have the double benefit of vaccine equity and also, through it, the targeting of COVID-19 eradication. It will also provide a much needed platform for inter-government cooperation, accountability, and exchange of surveillance information for united action. Unless eradicated, COVID-19 will become pan-endemic with occasional surges [6]. The risk to life among the elderly and those with cancers, chemotherapy, immunosuppression for transplants, and the well-known co-morbidities, will remain and perpetual control measures will be required.

IS ERADICATION BIOLOGICALLY FEASIBLE?

Eradication is the extreme form of disease control, defined as zero incidence of disease globally [7]. To sustain eradication status, transmission of the agent has to be interrupted in all countries [7]. Since a majority of SARS-CoV-2 infections are subclinical, similar to polio, eradication trajectory has to be monitored through protocol-based detection of transmission chains. The goal of eradication is feasible since vaccines for primary prevention and diagnostic tools for confirming infection for clinical diagnosis, and for detecting silent transmission, are available. As control seems to be possible, eradication also is assumed to be possible by enhancing all interventions in all countries.

Smallpox eradication was successful as there was no extra-human reservoir and as the two essential biomedical intervention tools, namely vaccine for primary prevention and diagnostic tests for surveillance were available [7]. These criteria are fulfilled for COVID-19 as of now, although they may change in the future as we will describe herein. Eradication must be achieved before extra-human reservoir develops or vaccines lose protective efficacy due to emergence of vaccine-escape mutants.

The problems of mutant variants with potential for higher transmission efficiency and lower immunity protection will occur even without setting an eradication goal. But under eradication mode, these will be detected fast in all countries and addressed in real-time. New generation vaccines and/or modified diagnostic tests may become essential but the eradication program will be ready for such challenges.

If man-on-moon mission was asked if it would be successful, proof could emerge only after the experiment. Similarly, COVID-19 eradication mission has to prove itself by its success.

WILL VACCINATION LEAD TO INTERRUPTION OF TRANSMISSION?

All currently available vaccines protect against disease, but not against infection. As vaccination coverage increases and vaccine-induced herd immunity level rises, herd protective effect (i.e. probability of reduced human-to-human transmission) can be expected in the unvaccinated segment of population [8-10]. Immune individuals tend to have only sub-clinical infections or with mild to moderate symptoms of COVID-19. They tend to shed less viruses as their virus loads are low, and they shed viruses for shorter durations, than non-immune infected, leading to herd protective effect [8,9]. Recent experience in Israel illustrates rapid decline in COVID-19 cases following high vaccine coverage, confirming herd effect [11]. We may legitimately anticipate interruption of transmission by high herd immunity and consequent herd effect.

CAN WE MONITOR THE DECLINE AND DISAPPEARANCE OF INFECTION?

Clinical, virological and genomic surveillances are crucial to monitoring control trajectory, reach national and regional elimination goals, and finally reach and certify global eradication. Already laboratory diagnostic methods have proved themselves to be of eradication standard and are available in all rich nations. Its global expansion is eminently possible.

Public health surveillance, generally neglected in developing countries except for polio eradication, can be built for COVID-19 eradication on the existing polio platform, using 'influenza-like illness' in all ages as the clinical counterpart of 'acute flaccid paralysis' in under-15 children. To monitor silent community transmission of SARS-CoV-2, existing sewage surveillance to monitor circulating vaccine-derived polioviruses can be adapted and expanded, after the transmission status transits from the pandemic phase.

Genomic surveillance will be needed to detect mutant variants that have potential to escape immunity from natural infection or vaccination, and possibly also from diagnostic tests. Countries should sequence at least 5% of all viruses to detect such emerging variants [12]. Circulation of mutant variants like Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), and recently detected variants Delta (B.1.617.2) and Kappa (B.1.617.1) attest to the need of a standardized protocol and rapid dissemination of information.

Such a global program needs to be designed, covering all low- and middle-income countries.

WHY SHOULD ERADICATION AGENDA BE PROPOSED NOW?

We believe that the basic biological criterion of eradicability, namely absence of extra-human reservoir, may not remain valid for long [13]. SARS-CoV-2 started as a zoonosis (vertebrate-to-human transmitted) but the source remains unknown. Now the pandemic is exclusively human-to-human transmitted anthroponosis. However, several species of *Canidae*, *Felidae*, *Mustelidae* and *Cervidae* have been infected by humans by reverse zoonosis. Some species of *Mustelidae* and *Cervidae* had to be drastically culled when horizontal enzootic transmission was detected. Such animals have the potential of becoming new extra-human reservoirs [14]. Eradication must succeed to pre-empt such eventuality.

The world is at about the peak of herd immunity due to the pandemic itself. If an eradication agenda is initiated now, the vaccination coverage needed to top it up to eradication level herd immunity threshold will be relatively easy. Such an opportunity will not stay valid much longer. Eradication effort must begin before herd immunity level is diluted by new birth cohorts without immunity and by the waning of immunity in the infected.

Since control and eradication are hierarchical goals, the best time to set the eradication goal is when the control goal is in place. The world in general and every country in particular, wants the epidemic controlled. However, low income countries are handicapped with lack of proper public education for behavioral modification and without access to vaccines and to technology of quality diagnosis. The fastest way to building COVID-appropriate behaviors and equity of vaccines and diagnostics, is to set an eradication goal now and work progressively towards bringing all countries under control mode and then graduate to eradication mode.

Setting goal and preparing plans of action are intellectual ideas translated to documents. This exercise will not interfere with ongoing pandemic response activities. Vaccine requirements by timeline and surveillance methodologies for eradication need to be articulated. When the eradication program is implemented, we may expect several hurdles, but we are confident that every problem can be resolved. As public awareness and anxiety are high, raising sufficient funds will hopefully be possible. If we do not attempt eradication, we will be failing to rise to the occasion.

CONCLUSION

We have argued that COVID-19 eradication may be an expedient way to achieve vaccine equity in all low income countries. Under an eradication program low income countries will have to be supplied with vaccines under the program budget – a major step towards building vaccine equity. COVID-19 can be eradicated if a program is designed for both universal vaccine delivery and for monitoring the eradication trajectory.

COVID-19 should be eradicated for the welfare and well-being of humanity – allowing endemic COVID-19 will put the elderly and vulnerable (due to co-morbidities) at perpetual fear of risk to life. An eradication program will ensure cooperation between nations and also give WHO the opportunity to play its legitimate leadership role.

As for India, we have the opportunity to take this agenda forward through the WHO and World Health Assembly, as the WHO Executive Committee Chairman is our own Health Minister and the WHO Chief Scientist is the past Director-General of the Indian Council of Medical Research.

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