CORRESPONDENCE - VIEWPOINT

COVID-19 Vaccination: What Challenges Are We Going to Face

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To the Editor,

From the beginning of the greatest health challenge of the 21st century, the emerging coronavirus disease 2019 (COVID-19), all scientists from all over the world are seeking the best solution to overcome the pandemic. As there was no effective vaccine or medication in the first year of the pandemic, the emphasis was on social distancing and quarantine (1). The development of an efficient vaccine is a promising tool to end the pandemic and despair (2). Hence, researchers all over the world are developing various potential vaccines for COVID-19 (3), which helps the immune system to recognize the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and prevent further infection. Different types of potential vaccines for COVID-19 are inactivated or weakened virus, protein-based, viral vector, and RNA and DNA vaccines (4). According to the World Health Organization (WHO) report, there are 184 vaccines in pre-clinical and 96 vaccines in clinical development (5). Currently, Centers for Disease Control and Prevention (CDC) have recommended three vaccines for prevention of COVID-19: Pfizer-BioNTech for ages above 15 and, Moderna's and Johnson & Johnson/ Janssen for ages above 17 years (6, 7); based on the most recent update of CDC, in the United States 321,549,335 doses of COVID-19

vaccine have been delivered and 249,566,820 doses have been administrated in total (8).

Although population of high-income countries makes up only 14% of the global, they had pledged to buy 51% of all pre-sold doses by 15 November 2020 (9). According to the WHO director-general speech on 18th January 2021, only 25 doses have been administered in one lowest-income country; while more than 39 million doses of vaccine have been bought by at least 49 higher income countries (10). Moreover, some high-income countries have bought vaccines more than their necessity to vaccinate their entire population (9).

Although vaccination is a promising way to combat COVID-19 infection, a number of unsolved challenges still remain. Nowadays, COVID-19 vaccination is a global urgent need, but the process of manufacturing vaccines takes relatively a long time, and large-scale production highly depends on the technology and equipment of the producer companies (11). On the other hand, there are some sociopolitical factors affecting vaccination including lack of social knowledge about benefits of vaccination and public superstitions may be disincentive to receive proper health care. So, vaccination is highly associated with the level of social awareness and people's average literacy. Moreover, it is still unclear that if vaccination is economically cost effective or not; however, some studies suggest that vaccination is a cheaper way, compared to other

preventions (12). Some individual aspects also can influence the efficacy of vaccination. For example, the immune system itself should be competence and vaccines are less effective in elderly people; furthermore, some vaccines, including live-attenuated vaccines, are contraindicated in immunosuppressed patients. Time of protection is another question which determines the dosage (11). Aside all these, one of the major problems is recurrent mutations in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) proteins, which restrict the efficacy of first-generation vaccines. Some unjustified side effects also have been reported among the patients who have received vaccination and in rare cases, deterioration of the disease by means of producing certain antibodies has been observed (13). Another issue is that challenge-studies of vaccines have not practiced directly on humans; choosing an appropriate animal model is also negotiable. Selecting the best rout of administration, identifying the interferences with other drugs or vaccines, and determining the most efficient adjuvant for vaccines are other challenges on the way. Proving the safety of vaccines which can be achieved by performing frequent studies on different animal models in a narrow period of time seems to be the most important problem at the moment (14).

Regardless of so many challenges for COVID-19 vaccination, we can overcome them by considering some keys. Global cooperation is indeed required to pay the costs of large-scale manufacturing and rightful distribution of vaccines. Vaccines should be distributed equitable all around the world, regardless of countries income and race. Providing proper information and education about benefits of vaccination can also be helpful for a higher rate of popular association. It is also important to think of alternatives for a vaccine, in case it is not effective and consider other preventions or treatments. Governments should assign some vaccination priorities for high-risk groups such as elderly or immunocompromised people along observation of necessary hygienic protocols. It is obvious that further trials on candidate people lead to a better understanding of the vaccine's efficacy and side effects.

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