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Dr. Anita Jhajhria
Associate Professor in Zoology, Shri Kalyan Govt. Girls College, Sikar, Rajasthan, India

Corresponding Author:
Dr. Anita Jhajhria
Associate Professor in Zoology, Shri Kalyan Govt. Girls College, Sikar, Rajasthan, India

A review on Indian vaccination drive to combat the corona pandemic

Dr. Anita Jhajhria

Abstract
The world is in the midst of a COVID-19 pandemic. It is important to work together on the response tracking the pandemic, advising on critical interventions, distributing vital medical supplies to those in need they are racing t develop and deploy safe and effective vaccines. Safe and effective vaccines will be a game changer but for the foreseeable future we must continue wearing masks, physically distancing and avoiding crowds. India will be soon entering phase 3 and the daily infection rate is highest in the world and has become epicenter of infection caused by the corona virus.
India is facing shortage of vaccines as only two approve Indian vaccines Covaxin and Covishield are presently used for vaccinating now 18 years above Citizens. The production is unable to meet the daily demand and Russian Sputnik doses will also be given soon. Other vaccines are also in the pipeline. Vaccination is the only way out to curb the infection rate and mortality. The paper reviews the vaccination drive and genome sequencing as important tools in combating the current crisis.

Keywords: Pandemic, Covaxin, Covishield, Sputnik and vaccination drive

Introductions
Vaccines save millions of lives each year. Vaccines work by training and preparing the body's natural defenses the immune system – to recognize and fight off the viruses and bacteria they target. After vaccination, if the body is later exposed to those disease-causing germs, the body is immediately ready to destroy them, preventing illness. There are various types of vaccines designed to protect against the pathogens.
To end the acute phase of the COVID-19 pandemic following methods need to be adopted:

1. speeding up the development of safe and effective vaccines against COVID-19;
2. supporting the building of manufacturing capabilities; and
3. working with government and manufacturers to ensure fair and equitable allocation of the vaccines

Vaccines are a critical new tool in the battle against COVID-19 and it is hugely encouraging to see so many vaccines proving successful and going into development. Safe and effective vaccines will be a game changer: but for the foreseeable future we must continue wearing masks, physically distancing and avoiding crowds. Notable contributions in the field has been made by Lahariya 2014 [9], Kaur and Gupta 2020 [8], John 2010 [7], John *et al.* 2007 [6], Graham 2020 [5], Goel *et al.* 2011 [4], Friesen *et al.* 2021 [3], Eyal *et al.* 2020 [2], Dhama *et al.* 2020 [1], and Sharma 2016 [10].
Worlds largest vaccination drive has been initiated by our country. India's vaccine drive India's huge immunization drive began on 16 January 2021. Less than 10% of India's population has so far had a Covid vaccination, and vaccine shortages have been reported in some parts of the country. The two main vaccine manufacturers, Serum Institute of India (which makes the local version of AstraZeneca's vaccine called Covishield) and Bharat Biotech (which makes Covaxin), can together produce around 90 million m doses a month.

Covaxin
India's indigenous COVID-19 vaccine by Bharat Biotech is developed in collaboration with the Indian Council of Medical Research (ICMR) - National Institute of Virology (NIV). COVAXIN includes the following ingredients: COVAXIN contains 6µg of whole-virion inactivated SARSCoV-2 antigen (Strain: NIV-2020-770), and the other inactive ingredients such as aluminum hydroxidegel (250 µg), TLR 7/8 agonist (imidazoquinolinone) 15 µg, 2-phenoxyethanol 2.5 mg, and phosphate buffer saline up to 0.5 ml.

The vaccine (Fig 1) thus has been developed by using inactivated/killed virus along with the aforementioned chemicals. It is included along with immune-potentiators, also known as vaccine adjuvants, which are added to the vaccine to increase and boost its immunogenicity.

Fig 1: Vaccines Covaxin, Covishield and Sputnik

It is a vaccine with no sub-zero storage, no reconstitution requirement, and ready to use liquid presentation in multi-dose vials, stable at 2-8oC.It is administer as an injection into the deltoid muscle of the upper arm. COVAXIN vaccination series is 2 doses given 4 weeks apart. The vaccine efficacy is of 81%.

Covishield Serum Institute of India has made Covishield Vaccine to prevent Coronavirus Disease 2019 (COVID-19) caused by SARS-CoV-2.(Fig 1)The Covishield vaccination course consists of two separate doses of 0.5 ml each. The second dose should be administered between 4 to 6 weeks after the first dose. The person gets protective immune response 4 weeks after the second dose of Covishield vaccine.

Sputnik A third coronavirus vaccine has been approved for use in India amid a deadly second wave of infections. Russia's Sputnik V has been deemed to be safe, and works in a way similar to the Oxford-AstraZeneca jab which is being made in India as Covishield. Sputnik V gives around 92% protection against Covid-19, late stage trial results (Fig 1).

The Sputnik V vaccine was created at the N.F. Gamaleya Research Center for Epidemiology and Microbiology Ministry of Health of Russia. Unlike other similar vaccines, the Sputnik jab uses two slightly different versions of the vaccine for the first and the second dose - given 21 days apart. They both target the coronavirus's distinctive "spike", but use different vectors - the neutralised virus that carries the spike to the body. Now only single dose Sputnik V vaccine has been developed and from July it will be included in the vaccination process currently run by India. The quality and safety of the Sputnik V vaccine are, among other things, assured by the fact that it uses a 4-stage purification technology that includes two stages of chromatography and two stages of tangential flow filtration. This purification technology helps obtain a highly purified product that goes through mandatory quality control, including control for RCA or any additives presence.

The COVID-19 vaccine Sputnik V is an adenoviral-based, two-part vaccine against the SARS-CoV-2 coronavirus. Sputnik V uses a weakened virus to deliver small parts of a pathogen and stimulate an immune response. Sputnik V is a two-component vaccine in which adenovirus serotypes 5 and 26 are used. A fragment of tissue-type plasminogen activator is not used, and the antigen insert is an unmodified full-length S-protein. Sputnik V vaccine is produced with the HEK293 cell line.

Other vaccines in pipeline for vaccination

There are other candidates which are in different stages of trials in India to test safety and efficacy include:

- ZyCov-Di, being developed by Ahmedabad-based Zydus-Cadila
- A vaccine being developed by Hyderabad-based Biological E, the first Indian private vaccine-making company, in collaboration with US-based Dynavax and Baylor College of Medicine Hyderabad-based Biological E to produce the vaccine developed by US firm Johnson & Johnson
- HGCO19, India's first mRNA vaccine made by Pune-based Genova in collaboration with Seattle-based HDT Biotech Corporation, using bits of genetic code to cause an immune response
- A nasal vaccine by Bharat BioTech
- A second vaccine being developed by Serum Institute of India and American vaccine development company Novavax

The Indian Variant

India on 25 March announced that a new variant of the coronavirus had been detected from samples collected from different states. There is free intermingling of people, carriers are not getting isolated, and testing and tracking is low. This has led to this situation. Viral mutant particles India is entering the 3 phase soon air contamination of the virus particles have been indicated.

Scientists are studying what has led to an unexpected surge, and particularly whether a variant of the novel coronavirus first detected in India is to be blamed. The variant, named B.1.617, has been reported in some 17 countries, raising a global concern. (Fig 2)

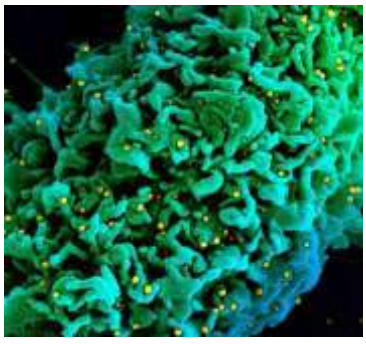

Fig 2: A cell infected with particles (yellow; artificially coloured) of the SARS-CoV-2 variant called B.1.1.7

The Indian variant consists of two mutations on the spike protein of the virus. A spike protein allows a virus to enter the body and infect it. The virus can then spread quickly through the body, if it escapes any antibodies in the immune system or those developed as a result of a vaccine — or, indeed, if there aren't any antibodies. The mutations found in the Indian variant are identified as E484Q and E484K.

Genome sequencing In India

The Indian SARS-CoV-2 Consortium on Genomics (INSACOG) is a grouping of 10 National Laboratories that was established by Ministry of Health and Family Welfare, Govt. of India on 25/12/2020. INSACOG is since then carrying out genomic sequencing and only about 5 percent of genome sequencing has been one in India. This is the main hindrance to identify the genome sequence of the mutant variants. Sequencing to monitor virus evolution and encourage broader geographic representative of genetic testing, rapid sharing of sequences is the need of hour.

While emergence of new variants is common during a pandemic, genome sequencing helps identify a variant of concern (VOC) one that leads to a rise in the number of cases or a spike in the death toll. This warrants a change in strategy for all protocols from diagnostics to treatment. Across the world, scientists have found hundreds of SARS-CoV-2 variants, but only those from the United Kingdom, Brazil and South Africa are classified as VOCs. The rest are called 'variants of interest'. The higher frequency of mutations L452R and E484Q in the spike protein of the SARS-CoV-2. The E484Q mutation can possibly escape antibody neutralization while L452R can increase the rate of transmission.

India develops drug for corona: The Drugs Controller General of India (DCGI) has granted permission on 08.05.21 for emergency use of anti-COVID-19 therapeutic application of the drug 2-deoxy-D-glucose (2-DG) developed by Institute of Nuclear Medicine and Allied Sciences (INMAS), a lab of Defence Research and Development Organization (DRDO), in collaboration with Dr. Reddy's Laboratories (DRL), Hyderabad. It added that being a generic molecule and analogue of glucose, it can be easily produced and made available in plenty in the country. The drug comes in powder form in sachet, which is taken orally by dissolving it in water. It accumulates in the virus infected cells and prevents virus growth by stopping viral synthesis and energy production. Its selective accumulation in virally infected cells makes this drug unique.

Conclusion

The paper focuses on the need to conduct in-depth analyses into the factors contributing to the current surge of cases and deaths, including the potential role of SARS-CoV-2 variants. Prioritizing issues most relevant for vaccine development, regulatory authorization, and policy formulation, through relevant networks and development of blueprint for pandemic needs to be done on war footing.

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