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Short Communication

Microbiology Section

An Analysis of the COVID-19 Vaccination Campaign in India

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ABSTRACT

The Coronavirus Disease-2019 (COVID-19) pandemic has been affecting people all across the world for the past two years. For the virus to be destroyed, basic personal health education is a need, and it plays a significant role in the virus's downfall. The entire population of a country cannot be protected by coronavirus vaccines, which only offer some amount of protection. World Health Organisation (WHO) claims that affluent nations are now able to immunise the majority of their citizens, poor nations are unable to immunise even their medical staff. The present study primary goal was to examine India's immunisation campaign. In this study paper, secondary data predominately were used.

Keywords: Corbevax, Coronavirus disease-2019, Covaxin, Covishield, Sputnik V, Vaccination

INTRODUCTION

The COVID-19 pandemic, which started in the Chinese city of Wuhan in December 2019 and is still going strong today and has gripped the world [1]. Since, the pandemic is still raging around the globe and the death toll is rising every day, we have now reached the preventative stage and are using vaccines. Developed nations like the United States, China, India, the United Kingdom and Russia had produced vaccines. For wealthy nations, providing vaccinations to their populations comes first.

India launched the largest COVID-19 vaccination campaign in the world on January 16, 2021, utilising 3006 vaccination facilities throughout all of its states and union territories [2]. AstraZeneca Oxford University's Covishield and Bharat Biotech's Covaxin, which are produced by Serum Institute of India Ltd., and Bharat Biotech International Ltd., respectively, are the two vaccines used to start the COVID-19 vaccination program in India [3]. More recently, on April 12 and June 29, 2021, two more vaccines- the Russian COVID-19 vaccine, Sputnik V, and the COVID-19 vaccine manufactured by the US pharmaceutical company Moderna were given the go-ahead for use in India. The COVID-19 vaccination program in India, the second most populous nation in the world (1.38 billion people), aims to immunise 300 million people by August 2021, including 10 million Healthcare Workers (HCWs), 20 million frontline workers (such as soldiers, policemen and municipality workers), and 270 million people over the age of 50 and/or with co-morbidities in the second phase (commenced from March 1, 2021) [4]. However, any HCW or frontline employees who missed out on vaccination in phase one are still eligible for vaccination in phase two. The Ministry Of Health and Family Welfare (MOHFW) developed the COWIN website, wherein the advance appointment for vaccination may be booked, to enhance and streamline the registration and immunisation procedure [5]. According to Annexure 4 of the guidance document of COWIN 2.0 issued by the Ministry of Health and Family Welfare (MOHFW), onsite registration can be completed by going to the closest immunisation facility after 3:00 PM and bringing identification proof (voter ID, passport, aadhaar card, bank passbook, or ration card) [6].

What is a Vaccine?

A vaccine is "an inactivated or attenuated pathogen or a component of a pathogen (nucleic acid, protein) that, when delivered to the host, activates an immune system protective response" or it is "an immunological-biological material designed to produce specific protection against a specified disease." The process of administering the vaccine is called vaccination [7].

Vaccine Types

There are many different types and sizes of vaccines. Each type aims to instruct your immune system on how to resist particular pathogens and the illnesses they can spread.

Scientists consider the following elements when creating vaccines:

- The way your immune system reacts to a germ
- Who should get vaccinated against the virus?
- The most effective technology or method for developing the vaccine.

Several variables influence the type of vaccination that researchers choose to create. There are many different types of vaccines, including:

a) Inactivated vaccines
b) Live-attenuated vaccines
c) Messenger RNA (mRNA) vaccines
d) Subunit, recombinant, polysaccharide and conjugate vaccines
e) Toxoid vaccines
f) Viral vector vaccines

COVID-19 VACCINE STATUS IN INDIA

After China, India became the second nation to reach the milestone with more than two billion doses of the COVID vaccine delivered. Four vaccines are presently used in India: The Oxford-AstraZeneca shot, locally known as Covishield; Covaxin, produced by the Indian company Bharat Biotech; Sputnik V, produced by Russia; and Corbevax, produced by the United States [8].

Up until now, Covishield has been responsible for almost 80% of doses given to adults. In February 2022, India's medicines regulator granted emergency use authorisation for Corbevax, a protein-based vaccine produced by Biological E, for the 12-18 years age range [9]. In June, the Serum Institute of India got approval for the limited emergency use of Covovax in children between the ages of 7-12 years [10]. Additionally, the government had given Cipla, an Indian pharmaceutical company, permission to import Moderna's

vaccine, which has a roughly 95% efficiency rate against COVID-19. However, India has not yet received these dosages [8].

1. **Covishield:** The Covishield vaccine is a vaccine that aims to protect against COVID-19. It is also called Oxford, Astrazeneca vaccine (AZD1222 (ChAdOx1)) [11]. The Oxford-AstraZeneca vaccine is produced domestically at the Serum Institute of India, the largest vaccine manufacturer in the world. It is a recombinant COVID-19 vaccine based on viral vector technology. The vaccine is made using a weakened adenovirus (common cold virus) from chimpanzees [12]. Even though, it cannot cause illness, it has been modified to resemble a coronavirus. The vaccination stimulates the immune system to create antibodies and primes it to combat any coronavirus infection. Two doses of the immunisation are administered, 4-12 weeks apart. It can be easily dispersed in existing healthcare settings like doctor's offices and securely maintained at temperatures between 2°C and 8°C. The Pfizer-BioNTech vaccine, which is presently used in many nations, must be stored at -70°C and can only be transmitted a limited number of times, which presents a particular issue in India where summer temperatures often approach 50°C [11].
2. **Covaxin:** The Covaxin vaccine (BBV1520) is a vaccine that aims to protect against COVID-19. It is a whole-virion inactivated coronavirus vaccine [13]. Using a coronavirus sample isolated by India's National Institute of Virology, Bharat Biotech, a 24-year-old vaccine company with 16 vaccines in its portfolio and exports to 123 nations, is developing a new vaccine. When a deadly virus is injected, immune cells will still recognise it, which triggers the production of antibodies by the immune system against the pandemic virus [14]. Four weeks gap between the two dosages. A 2-8°C are suitable for storing the vaccination. According to preliminary findings, the vaccine has a phase three trial efficacy rate of 81%. According to Bharat Biotech, it has a supply of 20 million doses of Covaxin and expects to generate 700 million doses at its four sites in two cities by the end of the year [15].
3. **Sputnik V:** The Moscow-based Gamaleya Institute created the vaccination, which generated some debate, when it was initially implemented before the full study findings were made public [16]. Scientists assert that its benefits have now been established. It uses a benign cold virus as a carrier to introduce a tiny piece of the coronavirus into the body. The body will learn to recognise the threat and fight it off without getting sick by being exposed to a portion of the virus's genetic code in this manner. Following vaccination, the body starts producing antibodies uniquely tailored to the coronavirus [17]. This guarantees that the immune system will be prepared to fight the coronavirus when it is first exposed to it. It is easier to carry and store because it may be kept at temperatures between 2-8°C (a typical fridge is around 3-5°C). To create more than 750 million doses of Sputnik V in India, the Russian Direct Investment Fund (RDIF), which is selling the vaccine, has struck contracts with six Indian vaccine producers [18]. This year, Dr. Reddy's Laboratories, a pharmaceutical company with headquarters in Hyderabad, will bring the first batch of 125 million tablets into India [19].
4. **Corbevax:** The protein subunit COVID-19 vaccine, also known as Corbevax, was developed by the Texas Children's Hospital Centre for Vaccine Development in collaboration with Baylor College of Medicine and Dynavax Technologies, situated in Emeryville, California [20]. For development and production, it is licensed to the Indian biopharmaceutical company Biological E. Limited (BioE). A variant of the SARS-CoV-2 spike protein's Receptor Binding Domain (RBD) is included in the vaccine, along with the adjuvants aluminum hydroxide gel and CpG 1018. The hepatitis B vaccinations that are currently available use a method similar to that of the yeast *Pichia pastoris*, which produces the protein [21].

Gaps Lies during Vaccination Campaign and to Prevent Further Infection?

During COVID-19 vaccination campaigns, gaps can occur due to a variety of factors, such as a lack of access to vaccines in certain areas, mistrust of vaccines in certain communities, and logistical challenges in administering the vaccines [22]. To fill these gaps and prevent further infections, various strategies can be employed:

1. Increasing education and awareness about the safety and effectiveness of the COVID-19 vaccines.
2. Increasing access to vaccines in under served areas, by for example utilising mobile vaccination units, community health workers and expanding hours at vaccination sites.
3. Working with community leaders and organisations to address any concerns or issues and to build trust in the vaccine.
4. Targeting vaccination efforts for high-risk populations, such as older adults, front-line essential workers and people with underlying health conditions.
5. Collaborating with governments and health organisations to ensure a sufficient supply of vaccines and to improve vaccine distribution and administration.
6. Leveraging technology to help register, schedule and remind people of their vaccination appointments.
7. Offering incentives or rewards to people who get vaccinated.
8. Monitoring and tracking the vaccine distribution and effectiveness, and making adjustments as necessary [23].

How COVID-19 Vaccination affected Different Communities in Different Areas of India?

The COVID-19 vaccination rollout in India has affected different communities in different ways, depending on the area and population. In urban areas, the vaccination drive has been more successful due to better infrastructure and access to healthcare facilities. However, there have been reports of vaccine hesitancy among certain segments of the population, such as the elderly and those with co-morbidities [24]. In rural areas, the vaccination drive has faced challenges due to limited healthcare infrastructure and a lack of awareness about the vaccine. Many rural communities also lack access to transportation and internet connectivity, making it difficult to register for the vaccine [25].

The Indian government has been making efforts to reach out to rural and remote communities by setting up vaccination camps and mobile vaccination units. However, there have been reports of vaccine wastage in some areas due to logistical issues and lack of awareness [26]. The government has also been focusing on vaccinating the most vulnerable populations, such as the elderly and HCWs. However, there have been reports of discrimination and bias in the distribution of vaccines, with certain communities, such as dalits and muslims, facing difficulties in accessing the vaccine [26].

Overall, the COVID-19 vaccination rollout in India has been affected by a combination of logistical, infrastructure and awareness related challenges. The Indian government has been making efforts to address these challenges and increase vaccine access, but more needs to be done to ensure equitable distribution of the vaccine across different communities and areas [27].

Process of Vaccination in India

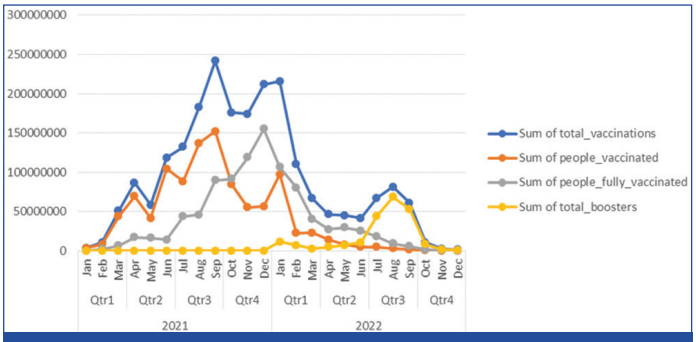
As of 26th December 2022, 2,20,05,34,092 of which 1,02,71,57,412 dose 1 and 95,11,24,245 dose 2 and 22,22,52,435 booster dose vaccine have been given to the people [28]. There are about

68,395 sites conducting vaccination drives of which 61,836 are government and 6,559 are private.

Total number of vaccines given in 2021 is 1,44,88,65,422 and in 2022 till now 75,16,68,670 where 1st doses taken in 2021 and 2022 are 845640601 and 181516811, respectively. And 2nd dose taken in 2021 and 2022 is 603224821 and 347899424, respectively. Booster doses taken in 2021 and 2022 are 0 and 222252435, respectively [Table/Fig-1,2].

Row labels	Sum of total vaccinations	Sum of people vaccinated	Sum of people fully vaccinated	Sum of total boosters
2021	1448865422	845640601	603224821	0
Qtr 1	65117896	55783201	9334695	0
Qtr 2	264040243	215626822	48413421	0
Qtr 3	557267153	377539020	179728133	0
Qtr 4	562440130	196691558	365748572	0
2022	751668670	181516811	347899424	222252435
Qtr 1	393081623	143206374	228014175	21861074
Qtr 2	133387716	27659307	83240707	22487702
Qtr 3	210124533	9864823	33891550	166368160
Qtr 4	15074798	786307	2752992	11535499
Grand total	2200534092	1027157412	951124245	222252435

[Table/Fig-1]: COVID-19 vaccination data till date-26/12/2022 [28].
*Qtr: Quarter



[Table/Fig-2]: Scatter diagram showing the COVID-19 vaccination data [28].
*Qtr: Quarter

OUTCOMES OF COVID-19 VACCINATION

The outcome of the COVID-19 vaccination in India has been mixed. On one hand, the Indian government has been able to vaccinate a significant portion of the population, with over 200 million doses administered as of June 2021 [28]. This has been achieved through a combination of online registration, mobile vaccination units and vaccination camps. On the other hand, there have been challenges and setbacks in the vaccination process. The country has faced vaccine shortages and delays in the delivery of vaccines. This has led to long queues and frustration among people trying to schedule appointments.

Another issue is the slow pace of vaccination in rural areas, due to limited infrastructure and awareness. Many rural communities lack access to transportation and internet connectivity, making it difficult to register for the vaccine [24]. Despite these challenges, the Indian government has been working to increase vaccine access and improve the vaccination process. The government has also started to vaccinate people aged 18 and above since May 2021 [3].

In general, the outcome of the COVID-19 vaccination in India has been affected by a combination of logistical, infrastructure and awareness related challenges. However, the Indian government has been making efforts to address these challenges and increase vaccine access, with the goal of achieving herd immunity and controlling the spread of the virus.

CONCLUSION(S)

Vaccines are an important element in the war against COVID-19, and making use of the resources available to us would benefit public health and save lives. We must maintain vaccination even if it is less effective against some COVID-19 viral variants, and we must not postpone immunisation due to concerns about future variants. We must utilise the resources we already have while continuing to fortify them. We are all only secure if everyone is.

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