Review Article

Different Covid-19 Vaccines in Pakistan: Administration and Effectiveness

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Abstract: Pfizer-BioNTech, Moderna, Sputnik V (typically manufactured in Russia), CoronaVac (China), Sinopharm (China), Vaxzevria, and Cansino (both made in China) are among the vaccines that have been certified for emergency use in several countries. All of the above vaccinations were authorized to Pakistan, bypassing Pfizer and Moderna. The effectiveness, safety, mechanism of action, dosage, and availability of mandatory vaccines in Pakistan up to May 20, 2021. We searched PubMed and Google Scholar for all known material on COVID-19 vaccinations. We also looked at grey literature papers. Instead of Pfizer and Moderna, Pakistan has approved all the preceding vaccines. Moderna and Pfizer were determined to be the most effective among all vaccinations, with 90% effectiveness, followed by Vaxzevria, Sputnik V, Sinopharm, and Cansino. All immunizations have caused lesser bad effects like fever, injection site pain, or headaches. Further clinical studies are being done throughout the world to combat the epidemic. In large populations, public attention plays a critical role in vaccination efforts.

Keywords: Covid-19, Vaccines, Sinopharm (China), Sputnik V (Russia), CoronaVac Pfizer, Moderna, Administration, Effectiveness.

INTRODUCTION

COVID-19 infection-induced severe acute respiratory syndrome (SARS CoV-2) which is created a serious, unprecedented social, economic, and healthcare catastrophe worldwide. After its expansion outside of China, the World Health Organization (WHO) designated it a pandemic in March 2020 [1]. Being a healthcare issue in its own right, it led to the prevalence of numerous disorders, whether directly or indirectly. These included epidemics of depression and anxiety and obstacles to effective treatment. By June 2021, there have been around 163,312,429 confirmed cases and 3386,825 related fatalities documented globally [2]. Vaccines are desperately needed to lessen global destruction and stop this pandemic. Many groups are striving to develop viable vaccinations, and worldwide cooperation has been formed. Considering the situation, research and testing of vaccinations have been intensified to halt the spread of the illness. In the world, many COVID vaccines were being developed in clinical or pre-clinical settings [3]. The World Health Organization has authorized nineteen vaccinations for use in an emergency. Meanwhile, other nations are authorizing various vaccines based on their criteria and feasibility. South Africa has approved six vaccinations for emergency use, while Pakistan and the United Kingdom have approved approximately three or five important vaccines [4, 5]. Two important factors are part of the FDA's broad definition of vaccine effectiveness. Firstly, it stops the dispersion of viruses from targeted individuals to weak individuals. Second, it also reduces the use of intensive care resources. FDA has chosen the 50 % vaccination criteria for effectiveness. Any vaccination that exceeds this level may be used in an emergency. According to one research study, Pfizer or Moderna vaccines are shown 95% efficacy, whereas Voysey or colleagues show 70% efficacy in Vaxzevria (previously called AstraZeneca) [6]. Pakistan has been able to offer five vaccinations from the list of prospective vaccines, like the Chinese vaccine Sinopharm, the Russian vaccine Sputnik V, Vaxzevria, or Cansino. This study describes the benefits, side effects, action mechanisms, effectiveness, or availability of vaccines in Pakistan [7]. The following key phrases and Mesh keywords were used to search all available material on PubMed and Google Scholar: COVID-19 vaccine, "Coronavirus Disease 2019 vaccine, "COVID-19 vaccine," and "SARS-CoV-2 vaccine." Grey literature was discovered on several government portals or in newly released papers. This study examined all accessible research published up to May 20, 2021.

PFIZER–BIONTECH AND MODERNA

Pfizer-BioNTech and Moderna were identified as the initial vaccines chosen for emergency utilization in December 2021.149 countries approved the Pfizer-BioNTech vaccine with 100 trials in 31 countries. Or 88 countries have approved Moderna with almost 70 clinical trials [8]. Clinical studies of phase III trials proved that it contains a 95% effectiveness rate. Pfizer-BioNTech or Moderna vaccines contain two doses, 21 or 28 days apart. Obtaining maximum protection against diseases requires the administration of two doses. Research proved 90% effectiveness after a complete dosage of the vaccine. After the arrival of the new variant, it decreased their efficacy rate [9]. The CDC stated the full protection activity of vaccines against severe diseases or infections. These vaccines employed modified mRNA

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delivery mechanisms or lipid nanoparticle delivery technology. COVID spike proteins are produced by modified mRNA; mutant messenger RNA is added to lock the spike proteins in the three-dimensional structure, which induces interaction between viral neutralizing antibodies or spike proteins [10]. Such type of RNA vaccines has a powerful impact or might be produced quickly and cheaply. Because they are generated using genuine pathogens and are not integrated into host DNA like other viral vaccines [11]. However, their fragile mRNA requires intense freezing for preservation. Pfizer and Moderna require refrigeration temperatures ranging from -60 to -80 degrees or -15 to 25 degrees, respectively [12, 13]. These vaccines weren't accessible in Pakistan due to the requirement for extremely cold temperatures during storage. Nonetheless, different organizations and the government subsequently managed to organize air conditioning systems for vaccine storage. Both vaccinations have caused regional adverse effects such as nausea, vomiting, fever, headache, and muscular pains. These immunizations have also been linked to anaphylactic responses in rare circumstances [14].

COVAX has delivered the first shipment of Pfizer's mRNA vaccine to Islamabad. Scholars of the National program manager on immunization claimed that this delivery contains 106,000 doses. Pakistan's national health services, coordination, or regulations said that the Pfizer-BioNTech vaccine arrived in the first week of June 2021, which might be late for some reasons. Experts viewed the strong efficacy or safety rate of the vaccine [15]. Due to this reason Drug Regulatory Authority of Pakistan (DRAP) allowed the use of vaccines in Pakistan. Approximately 23 ultra-cold chain refrigerators were arranged in 16 locations in Pakistan to store or save the mRNA vaccine [16]. Pfizer double vaccine shows six months shelf life when stored at -70 degree Celsius. It appeared to pose a significant challenge globally, as it required specialized refrigerators with cooling capabilities. Pakistan installed 23 cold chain refrigerators in the federating units to save the Pfizer-BioNTech vaccine with the help of UNICEF. It might be used for the storage of other future vaccines [16, 17].

VAXZEVRIA

The vaccine was called ChadOx1 nCoV-19 in the past but was later known as Vaxzevria. Vaxzevria is also called AstraZeneca vaccine to collaborate with the University of Oxford. In January 2020, the development of the vaccine has started [18]. Firstly, the United Kingdom administrated it for emergency use and was used in many world countries. It showed a 70% efficacy rate. However, in March 2021, researchers claimed it may cause blood clots or blockage in the body. Several countries have stopped the use of this vaccine, along with the investigation [19]. Following the confirmation of a safe vaccine process, it became available with specific age restrictions. It was administered in numerous countries around the world by August 2021.

In Pakistan, it was granted emergency approval for use on January 16, 2021. Individuals aged 18 or above were eligible to receive this vaccine. AstraZeneca is easily available in Pakistan for 18-plus individuals with severe symptoms of already stable COVID-19 patients, expecting women, hypertension persons, heart disease people, diabetes patients, and post-chemotherapy or transplantation phase [20]. Government vaccination hospitals or nationwide centers can administrate this vaccine. Pakistanis register themselves on mobile phones, visit nearby centers or with the help of the national immunization management system. Mobile phones are mostly used in rural areas, which are promoted or aware by mobile vaccination teams. Clinical trials admit their strong efficacy rate, proving it is safe [21, 22].

To elicit immunological responses, Vaxzevria used a chimp adenovirus with poor replication to inject SARS-CoV-2 proteins into the body. After receiving the vaccination, the body detects these proteins and begins to build defensive reactions that, in turn, prevent the SARS-CoV-2 from entering the body virus entering in the body. This type of vaccine should store at a temperature of 2 degrees. Numerous effectiveness studies of the Vaxzevria vaccine have been conducted in Brazil or South Africa, which show 70% efficacy. This vaccination has caused milder systemic adverse effects such as diarrhea, tiredness, headache, cold, and nausea in 13 people. After millions of doses of vaccines are given, this thrombotic event has sometimes noticed. Vaxzevria vaccine has two types of doses. After 1st dose, the second dose was given between 4 and 12 weeks. Or after the second dose of 3 months, a booster dose was given for strong immunity. Vaxzevria is mostly injected in two forms on the upper arm muscle. National Public health agencies recommended the use of this vaccine [23]. Booster doses are not only injected into old people but also in adults, which strong the immune system for further diseases. Many international agencies, including the WHO, UK Healthcare and medicines regulatory agency or European medicines agency, assessed that the advantages of vaccines outweigh the risks. According to the preliminary statistics, thrombotic episodes are recorded more frequently in females as compared to males. Studies clear that the use of estrogen, which contains contraceptives, greater the risk of thrombosis.

SPUTNIK V

The Sputnik vaccine is considered to be the most trusted source to prevent COVID-19. Russia has developed the vaccine in the microbiology research institute Gamaleya. It was the first COVID-19 vaccine which is registered in the world and received an approval letter in August 2020. This vaccine has used two distinct vectors which are based on adenovirus. It transfers the genetic material of the coronavirus that allows COVID-19 to enhance the immune system [24]. Sputnik V has III phase trials, with 91.6% effectiveness recorded. There were fourteen applications of the Sputnik vaccine that also functioned with AstraZeneca. It utilized two types of adenovirus vectors: Ad5 and Ad26. It is involved in the synthesis of spike protein genes. Pakistan has bought 50,000 doses from Russia. Mild headache and soreness at the injection site are reported as adverse effects. 34 Additionally, it is stored at - 18°C, and two doses must be delivered at 21-day intervals, as recommended by Pakistan's regulations, collaborations, or Ministry of health services. A clinical trial of this vaccine has been done in many countries of the world, including

thousands of people, which shows that it has positive results in decreasing COVID-19 infection. Several countries like India, Pakistan, and America use this vaccine as an emergence use. Some concerns arise about this vaccine that how the approval of this vaccine is so fast in Russia. Many questions were also raised on clinical trial data of the Sputnik vaccine [25].

Pakistan approved the use of the Russian-made Sputnik vaccine for emergency use in September 2021. The vaccine was approved by the Drug Regulatory Authority of Pakistan (DRAP) in January 2021. According to the latest news, Pakistan had signed an approval with Russia to obtain approximately five million doses of the Sputnik vaccine. High-risk groups or front desk workers used the first batch of vaccines in February 2021. Pakistan is considered to be the most popular nation in the world. They choose the Sputnik vaccine to add in national vaccination portfolio. It is crucial for people's health. Pakistan uses the Sputnik vaccine because of its higher efficacy or safety rules. It has a lot of benefits. The Sputnik vaccine shows full protection against the COVID-19 virus, as many journals or medical report confirmed their effectiveness. More than 250 clinical studies approved the safety or benefits of the vaccine, which also has a lack of long-term negative impacts. Researchers collaborate with AstraZeneca to improve its benefits, and the Sputnik vaccine shows minimal allergic reactions, requires two doses spaced 21 days apart, utilizing novel adenoviruses; over 60 adenovirus types cause illness [26].

SINOPHARM VACCINE

Sinopharm is also known as the Beijing Institute of Biological Sciences (BIBP) vaccine, which is an inactivated vaccine developed by the Chinese state-owned pharmaceutical company Sinopharm. The World Health Organization (WHO) has approved it for emergency usage, and the vaccine is currently being employed in multiple countries across the globe. Sinopharm vaccine has done phase III trials in Peru, Pakistan, Morocco, UAE, Bahrain, Argentina, and Egypt. Phase III trials show 78% efficacy against many diseases [27]. As Moderna or Pfizer shows 90% effectiveness, but due to some challenges, WHO approved Sinopharm for emergency use? The Sinopharm vaccine could be stored or delivered at normal temperature. Asia, Europe, America, and Africa started different campaigns to advertise this vaccine. During May 2021, Sinopharm produced or transported 200 million doses to vaccinate affected people. Sinopharm also has the approval to purchase 170 million vaccines from COVAX. After 3 to 4 weeks, 2nd dose of the Sinopharm vaccine must be recommended [28].

Sinopharm is likely to be the second vaccine that is assigned for use in emergencies. Pakistan is still working on clinical trials of different vaccines. However, due to the widespread nature of the virus, the drug regulatory authority of Pakistan entered into agreements with vaccine-producing countries to secure the delivery of millions of vaccine doses. Sinopharm has Beta variant activity against the virus. 81% of the Sinopharm vaccine produces antibodies against ACE2 receptors which regulate the virus [29]. Sinopharm also produces T and B memory cells which increase the immune system of an infected person. It would be more beneficial for reducing infection, illness, or hospitalization, with an efficacy rate of 79%. Like other vaccines, Sinopharm also has diverse effects like temperature, pain, weakness, headache, or soreness. But these side effects are generally mild and go away on their own within a few days. As with any vaccine, it is important to consult with a healthcare professional to determine if the Sinopharm vaccine is appropriate for you and to discuss any potential risks or concerns [30].

COVID-19 VACCINATION IN PAKISTAN

Vaccines from Sinopharm, Sinovac (CoronaVac), Sputnik V, and Oxford University AstraZeneca are now approved for emergency use in Pakistan, as the immunization program commenced on February 2, 2021. The Chinese government launched a vaccination campaign in Pakistan. Table **1** shows vaccines, administration, and Dosages in Pakistan.

Table 1. Shows Vaccines, Administration, and Dosages in Pakistan.

Vaccine Name	Administration	Dosages	Effectiveness
Pfizer -BioNTech	85-90%	Two shorts 21 days apart	75%
Moderna	80%	Two shorts 21 days apart	60%
Vaxzevria	65-70%	Two shorts 21 days apart	87%
Sputnik V	85%	Two shorts 21 days apart	71%
Sinopharm	76%	Two shorts 21 days apart	76%
Cansino bio	15%	Single shot	43%

Nevertheless, this vaccine effort has not taken traction, with just three people out of every 100 being vaccinated. Pakistan has begun acquiring vaccinations to speed up the immunization effort. According to one estimate, Sputnik V contains 50,000 doses which were imported from Russia or Pakistan and will get additional doses shortly to expedite the underactive immunization program.

CONCLUSION

Vaccination is the only viable or effective method to stop this catastrophic epidemic. To that end, researchers and governments throughout the world have formed alliances to make the best possible struggle that precedes adequate vaccinations. Such vaccine effectiveness was confirmed by several clinical trials. Around 70 to 80 per cent of effectiveness was attained with such trials. Additional studies were required to develop sufficient vaccinations or to effectively halt the spread of the disease. This is

the duty of the government to ensure that appropriate vaccinations are accessible in the nation or to design a framework to control its management or ensure that it remains accessible to its citizens.

AUTHORS' CONTRIBUTION

- **Anwaar Iftikhar**: Conception and design of study, Manuscript writing and Data analysis.
- **Muhammad Farooq Sabar**: Manuscript writing and Drafting of manuscript.
- **Quart ul Ain**: Data collection, Analysis and comparison of data writing.
- **Rida Farooq**: Writing manuscript and making correlation of the manuscript.
- **Mubeen Akhtar**: Design of study, Analysis and Data collection.

CONFLICT OF INTEREST

Declared none.

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