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International Journal of Clinical Biochemistry and Research

Journal homepage: <https://www.ijcbr.in/>

## Original Research Article

## The Vax effect: Role of global vaccination initiatives in pandemic control and impact in Dehradun during COVID-19

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## ARTICLE INFO

## Article history:

Received 22-08-2023

Accepted 04-12-2023

Available online 10-02-2024

## Keywords:

Vaccination

Omicron

Asymptomatic

Symptomatic

COVID- 19

## ABSTRACT

COVID-19 was one of the most contagious diseases spread throughout the world and caused by the Corona virus. Its cellular and molecular profiling was performed on individuals suffering from Covid-19-like sickness in Dehradun. During this investigation, 100 random samples were taken from patients. Real Time PCR amplification of suspected cases of Covid-19 was done where 68% of the cases were positive. The proportions and patterns of positive cases and hospital admissions for covid-19 in the third wave in Dehradun were significantly different when compared to the first and second waves. This disparity was caused by a number of factors, including changes in lifestyle, natural immunological ability to cope with recent waves of natural infections, and the most important factor, which was that more than 83% of people over the age of 18 years had received the first or both doses of the vaccine. The Covid-19 vaccines were so effective due to which there was a very low rate of serious infection, hospitalization, and mortality.

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## 1. Introduction

The eradication of the SARS-CoV-2 beta corona virus, which belongs to the subgenus Sarbeco virus, was one of the most difficult challenges during the third wave. The genetic material of a virus, known as RNA, is continually changing, leading to the generation of new varieties, or strains. This virus is not new to the Earth, but it is new to mankind. Because of the rapid spread and rising number of corona virus disease 19 (Covid-19) cases caused by a new corona virus, severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), rapid and accurate virus and/or disease detection is becoming increasingly important in order to control the sources of infection and assist

patients in preventing illness progression.<sup>1</sup> According to one study,<sup>2</sup> the symptoms of SARS-CoV-2 were fever (59.1%), coughing (55.9%), and asymptomatic (19.3%). SARS-CoV-2 has been labelled a pandemic because the new corona virus has spread around the world as an extremely hazardous illness.<sup>3</sup>

The use of nucleic acid testing or clinical characteristics of infected persons as the gold standard for determining a definitive diagnosis of Covid-19 patients has proven difficult. For accurate sickness diagnosis and management, newer molecular instruments and processes are being applied. The detection of SARS-CoV-2 virus by RT-PCR is significantly more sensitive than normal culture methods; it has a shorter turnaround time and advantages over real-time RT-PCR.<sup>4,5</sup> A rapid turnaround time also contributed in the correct containment of this highly contagious virus

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in the general population during the Covid-19 epidemic. Real-time PCR is commonly employed for diagnosis, and it is unclear whether the semi-quantitative capability of this method, which determines viral load using cycle threshold (Ct) values, may be used. Every government was hunting for vaccinations to protect their citizens, either by creating them or importing them from other countries. Vaccines look to be a game-changing technology, so it's critical to understand their efficacy and safety.<sup>6,7</sup> A recent case study was carried out to evaluate vaccination status, which covers the relationship of numerous indicators with regard to SARS-CoV-2 Virus and its Clinical importance to investigate its epidemiology.<sup>8,9</sup> Inoculation of respiratory infections in humans by air media is crucial to determining the advantages of immunizations, and large-scale surveys are required.

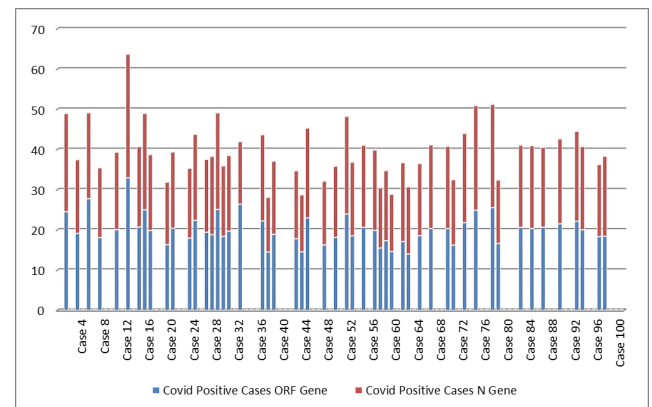
## 2. Materials and Methods

In this investigation, a total of 100 cases exhibiting symptoms of SARS-CoV-2 (covid-19)-like sickness and meeting the criterion of additional symptoms as described by the National Centre for Disease Control, New Delhi, India, were considered. The samples were gathered from various sites within the Dehradun district between September and December 2021. DNA Labs- A Centre for Applied Science (DLCAS) in Dehradun, Uttarakhand, performed the whole SARS-CoV-2 viral genetic profiling. The Covi Path Covid-19 RT-PCR Amplification kit was used to extract the RNA. The Silica Column extraction method was used, as well as a fully automated Insta N Mag-32, Nucleic Acid Extractor, and HiGenoMB was used. The extracted RNA Template was used for Real Time PCR amplification of SARS-CoV-2 probable cases. Master Mix was infected with the SARS-CoV-2 virus for all samples. The Spike protein (S) is encoded by 3831 base pairs of SARS-CoV-2 RNA and determines which type of cell the virus will infect.<sup>10,11</sup> Qiagen's Rotor gene Q Multiplex Real time PCR machine was used for amplification. All requested patients' vaccination status was documented in accordance with ICMR criteria, and data was compiled based on the presence or absence of Ct values, or viral loads indicated by Ct value, and clinical outcomes. Furthermore, a comprehensive overview was conducted to assess the vaccination rate updates in the Dehradun district and other districts within Uttarakhand, considering factors related to both vaccine hesitancy and vaccine acceptance.

## 3. Result

The vast majority of new infections were caused by unvaccinated individuals, and 90% of confirmed positive cases were asymptomatic. Due to the 'de-coupling' of SARS CoV-2 infection from moderate to severe disease, the usage of hospital beds, oxygen beds, and intensive

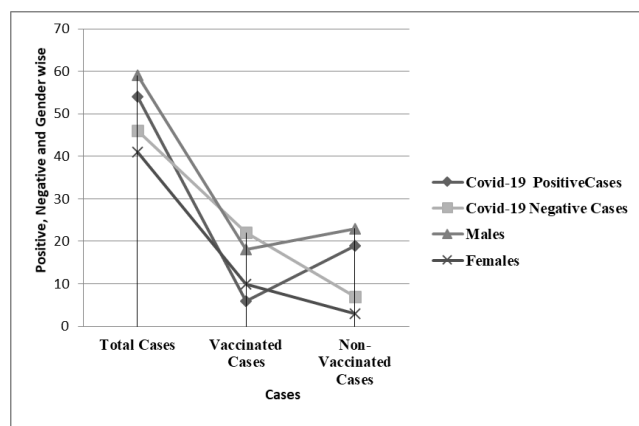
care units (ICUs) has remained modest. Subclinical disease emerged in people who had been fully immunized. Other aspects of the health-care system provide some confidence. Although there were Covid-19 cases admitted to hospitals, a significant proportion of Covid-19 dedicated beds remained empty. Then there was the case when the majority of those hospitalized for suspected Covid-19 were discovered to have other health issues. They were hospitalized for causes other than SARS Covid-19 symptoms. In the third wave, almost all persons who were either unvaccinated or had previous health issues were seen to be hospitalized to the ICU after testing positive for Covid-19.



**Figure 1:** Positive cases with Open Reading Frame(ORF) and Nucleocapsid(N) Gene Positive value and Negative cases

Out of a total of 100 cases (68%), 54 were positive for Covid-19 and 46 were negative, with 6 cases being vaccinated yet positive and 22 vaccinated patients being negative for Covid-19 patients were unvaccinated and positive for Covid-19, while 7 patients were unvaccinated and negative. There were 13 vaccinated but positive instances, and 87 vaccinated but negative ones. Males outnumbered females (59) by a large margin. The gender distribution of patients in the current study revealed a male preponderance over females. Many research<sup>12,13</sup> reported a comparable preponderance of males over girls as 58%, 62%, respectively. A few studies conducted in India also shown that males were more likely to be infected with Covid-19 than females.<sup>14–16</sup> Males are also more likely than females to be infected with Covid-19.<sup>17–19</sup> It has been proposed that females are less susceptible to viral infections due to natural protection from the X chromosome and sex hormones.<sup>20</sup>

The percentages and patterns of positive cases and admitted patients for covid-19 were radically different when we compared the third wave in Dehradun to the first and second waves. According to the findings, the majority of those who tested positive were unvaccinated, while there were rare cases when vaccinated people tested positive, which was not as harmful as not having active protection due to vaccination. Because no vaccine is



**Figure 2:** Covid-19 cases in vaccinated and non-vaccinated patients along with male and female proportion

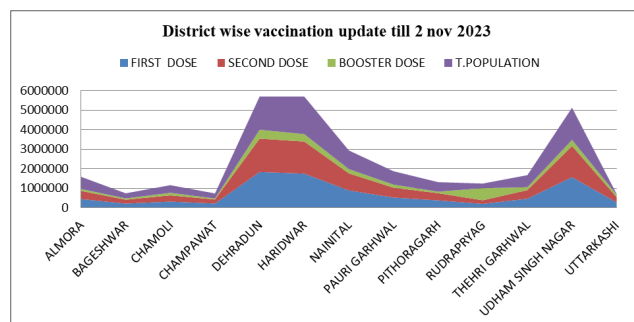
100% effective, "breakthrough infections" were always a possibility. The symptoms are frequently mild, which admits the phenomena of "breakthrough infections" caused by vaccination ineffectiveness, as demonstrated by the yellow fever vaccine's 98% effectiveness. However, this still means that 2% of people will become sick.<sup>21–24</sup>

The current study examines the gender distribution of Covid-19 cases, demonstrating a significant male preponderance over girls, a tendency supported by earlier research. It consistently shows that males have a higher incidence of Covid-19 than females. The study also looks at the influence of vaccination, finding that the majority of positive cases in the third wave in Dehradun were among unvaccinated people.

Aside from the study, an evaluation was conducted to explore Hesitancy against the newly produced COVID-19 vaccinations is a global occurrence. Although, for much clearer data, vaccination/infection history would necessitate substantial investigation, data collecting, and analysis. According to available literature, vaccine reluctance varies greatly between countries.<sup>35–38</sup> Vaccine hesitancy was defined by the WHO as a "delay in acceptance or refusal of vaccination despite the availability of vaccination services." Various survey items deployed to investigate questions pertaining to COVID-19 vaccine hesitancy, such as whether people are willing to be vaccinated, the reasons why they are willing or unwilling to do so, and the most trusted sources of information in their decision-making, across 13 studies conducted in Africa, South Asia, Latin America, Russia, and the United States. Overall, they discovered that the average acceptance rate across all studies in low- and middle-income countries (LMICs) was 80.3%, with the lowest acceptance rates in Burkina Faso.<sup>37–40</sup> When we see the data 10 July to 6 August 2023), approximately 1.5 million new COVID-19 cases and over 2500 deaths were reported globally, and an increase of 80% and a drop of 57%, respectively, While five WHO areas reported decreases in both the number of cases

and deaths, the Western Pacific Region reported an increase in both cases and deaths.<sup>41–45</sup>

When we talk about Uttarakhand Total 91, 18, 676 - 80.00% of citizens received at-least one dose of vaccine in Uttarakhand, about 87,33,083 - 76.61% fully vaccinated.<sup>42,46</sup> The table provides the data of vaccination till 2 Nov 2023 of covid-19 showing the non-hesitancy (Figure 3) of people of districts of Uttarakhand and Dehradun and other districts.



**Figure 3:** Vaccination data of Districts of Uttarakhand including Dehradun

Like the nationwide approach to COVID-19 vaccination in India, the immunization process in Uttarakhand has unfolded in several stages. Initially, healthcare workers, frontline personnel, and senior citizens received primary focus for vaccination. Over time, the eligibility criteria for vaccination may have evolved to encompass various age groups and other specific categories. Vaccination centers were established in multiple government and private healthcare facilities throughout Uttarakhand. Awareness campaigns aimed at promoting vaccination and educating the public on its significance have been conducted by the state government and health authorities.<sup>41–43</sup>

#### 4. Discussion

The study emphasizes that even with immunizations a small number of people may still become infected with the virus. The bulk of the top Covid-19 vaccines achieved efficacy against symptomatic infection of more than 90% in phase 3 trials. Real-world efficacy studies in the United Kingdom, Israel, and Canada show that vaccine efficacy is slightly lower outside of the trial setting, most likely due to the spread of the more vaccine-resistant Delta variant. Estimates suggest protection against symptomatic illness at 60-90 percent, depending on the vaccination. Only a small percentage of fully vaccinated patients who test positive for Covid-19 die.<sup>47–50</sup> PHE's real-world studies show that the BioNTech/Pfizer vaccination is still 96% effective against hospitalization, whereas the Oxford/AstraZeneca vaccine is 92% effective. However, Natalie Dean, a biostatistics professor at Emory University in Atlanta, stressed that

**Table 1:** A summary of prominent Covid-19 vaccines, showcasing their varying efficacy results from Phase III clinical trials conducted across different regions, presented in a tabular format with references

Vaccine	Type	Developer	Phase III Efficacy (%)	Geographical Areas	References
Oxford-AstraZeneca (AZD1222)	Viral Vector (ChAdOx1-5)	University of Oxford, AstraZeneca	70.4 (Overall, 95% CI 54.8–80.6)   62.1 (2-standard dose, 95% CI 41.0–75.7)   90.0 (Low dose + standard dose, 95% CI 67.4–97.0)	UK	(Voysey et al., 2021) <sup>25</sup>
Johnson & Johnson (Ad26.COV2.S)	Viral Vector (Ad26)	Johnson and Johnson	66.9 (95% CI 59.0–73.4)   76.3 (≥60 years old, 95% CI, 61.6–86.0)	USA	(Tehrani and Sajadi, 2021) <sup>26</sup>
Moderna (mRNA-1273)	mRNA	Moderna and NIAID	94.1 (95% CI 89.3–96.8)	USA	(Baden et al., 2021) <sup>27</sup>
Pfizer-BioNTech (BNT162b2)	mRNA	Pfizer and BioNTech	94.6 (95% CI 89.9–97.3)	USA, Germany	(Iannone et al., 2020) <sup>28</sup>
Gamaleya (Sputnik V)	Viral Vector (rAd26+rAd5)	Gamaleya Research Institute, Russia	91.6 (95% CI 85.6–95.2)	Russia	(Logunov et al., 2021) <sup>29</sup>
CanSino (Convidecia)	Recombinant Adenovirus (Ad5)	Beijing Institute of Biotech, CanSino Biological	65.7 (As per company claim)	China	(Zhu, F et al., 2022) <sup>30</sup>
Novavax (NVX-CoV2373)	Protein Subunit	Novavax (Gaithersburg, USA)	89.7 (95% CI 80.2–94.6)	USA	(Ilan J et al., 2021, polack et al., 2020) <sup>31,32</sup> (39,40)
Covaxin	Inactivated Virus	Bharat Biotech	77.8 (95% CI 65.2–86.4)	India	(Ella et al., 2021) <sup>32</sup>
Sinovac-CoronaVac	Inactivated Virus	Sinovac Biotech	Varied	Multiple countries including Brazil, Turkey, Indonesia	(Al Kaabi et al., 2021) <sup>33</sup>
Sinopharm-BBIBP-CorV	Inactivated Virus	China National Pharmaceutical Group (Sinopharm)	Varied	Multiple countries including UAE, Bahrain, Egypt	(Wu, Y et al., 2021) <sup>34</sup>

these findings were based on averages and that efficacy was reliant on individuals' existing risk profiles. Individuals with impaired immune systems may only create enough antibodies to resist a 100-fold dilution. In contrast, healthy young adults may have enough for a 10,000-fold dilution and are "likely impervious" to infection.<sup>51,52</sup> If scientists could establish a happy medium between the two extremes, vaccine manufacturers would be able to update vaccines more quickly for new strains, and policymakers would be able to better determine who needed booster doses the most. Due to the urgent global need to combat the pandemic, COVID-19 vaccinations were created and launched in record time. The Pfizer-BioNTech vaccine was the first COVID-19 vaccine to be approved for emergency use. On December 2, 2020, the United Kingdom authorized its use

for emergency purposes.<sup>53,54</sup> Other vaccines, including the Moderna vaccine, the AstraZeneca-Oxford vaccine, and the Johnson & Johnson vaccine, were also approved for emergency use in a number of nations in late 2020 and early 2021. The precise dates of permission vary depending on the country and regulatory body.<sup>55</sup> On January 16, 2021, India initiated its Covid-19 vaccine campaign. Initially, the nation approved two vaccines for emergency use. Oxford-AstraZeneca's Covishield AstraZeneca licensed the Serum Institute of India (SII) to manufacture the vaccine. Covishield was one of the first vaccinations used in India's vaccination campaign. Covaxin (Bharat Biotech Vaccine) is an inactivated viral vaccine developed in partnership with the Indian Council of Medical Research (ICMR) by Bharat Biotech. It was approved for emergency use

in India and has been used in the country's vaccination efforts. As the immunization campaign progressed, India approved more vaccines for emergency use, although Covishield and Covaxin were the initial vaccinations introduced in the country's Covid-19 programmed.<sup>53,55,56</sup> Although the Omicron variant appears to induce lesser symptoms than prior variants in persons who have been completely vaccinated and boosted, we do not know if another variant with more severe symptoms and the same level of immune escape will emerge. SARS-CoV-2 may also become endemic and continue to circulate in the community for the foreseeable future.<sup>56,57</sup> COVID-19 vaccination hesitancy can stem from a range of factors. Safety concerns and apprehensions about potential side effects may have deterred some individuals. Additionally, distrust in the vaccine development process or pharmaceutical companies can be a driver of hesitancy, and the proliferation of misinformation and vaccine-related myths may have sowed doubts about vaccination. Needle phobia is a significant impediment for certain people, while others may harbor the belief that natural infection offers superior immunity compared to vaccination. Negative encounters with vaccines in the past can further contribute to vaccine hesitancy, as can concerns regarding the rapid pace of vaccine development and approval processes. In regions where COVID-19 cases have remained relatively low, a sense of complacency may have developed among certain individuals, leading to reduced urgency in pursuing vaccination. Meanwhile, a wait-and-see approach may be favored by some, as they prefer to observe how the vaccine performs in others before opting for vaccination themselves. Additionally, cultural or religious convictions can significantly impact vaccination decisions. Limited access to vaccination centers and logistical difficulties can pose substantial barriers to getting vaccinated. Concerns about vaccination may also arise among individuals with specific health conditions or allergies. Lastly, political or ideological beliefs may play a role in influencing vaccine hesitancy. Crucial for public health initiatives is the need to confront these apprehensions through educational outreach, transparent communication, and the widespread dissemination of precise information. This approach fosters vaccine acceptance and contributes to the containment of COVID-19 transmission.<sup>50,58</sup>

## 5. Conclusion

Transmission rate of omicron was limited in third wave because Covid-19 Vaccines was Master key to prevent infection and reduce transmission. In order to maintain the control over omicron and other virulence effect of Covid-19 vaccinated people also need to continue social distancing and keep wearing a mask in public places. It's good thing to see the population of Dehradun were much more conscious of wearing masks more carefully and acquired in the life style as basic requirements.<sup>59</sup> In a nutshell the adoption

rate of the Covid-19 vaccine and vaccination intention were unsatisfactory for achieving herd immunity. It is critical for governments, public health professionals, and economic and social groups to adopt a strategy to increase vaccination acceptance, particularly among the working population.<sup>36,60</sup> This Covid-19 pandemic has changed the way we live, and it will continue to shape our future life. People are conceptually more willing to be vaccinated and wear masks in daily life and remote working and learning will probably become a feasible option in the future. Whether or not we will encounter another pandemic this century is unknown but, just in case, we will need to be prepared mentally, scientifically, and infrastructurally.<sup>35,36,46,49,50,60</sup>

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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**Cite this article:** Singh A, Gurada NC, Mahendru N, Kashyap A, Bhanu S, Sharma N, Kaushik R. The Vax effect: Role of global vaccination initiatives in pandemic control and impact in Dehradun during COVID-19. *Int J Clin Biochem Res* 2023;10(4):320-326.