

# DATA ANALYSIS ON COVID VACCINES

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## ABSTRACT

Vaccines, together with adequate water and sanitation, have made substantial contributions to worldwide illness reduction and elimination, saving millions of lives. Vaccine started development in the 19th century and has progressed tremendously since then. Understanding the immune system and how invading pathogens activate it has resulted in the development of several novel vaccines, vaccination classes, and methods of protection.

In today's society, we have been assaulted by a fatal epidemic known as Coronavirus illness (Covid-19). Covid-19, discovered in December of 2019, affects different people in many different ways. Following the discovery of COVID-19 illness, there has been a need for vaccines to be developed at a rapid unprecedented pace. This study aims to give a data analysis overview of various COVID Vaccines, their importance to mitigate the effect of Covid-19 virus or its various variants. A summary of the consequence of Covid-19 virus on the population before and after vaccination is also provided.

**Keywords:** Vaccines, Covid-19, Data Analysis, Coronavirus

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## INTRODUCTION

Vaccination is a huge success in development and health, saving millions of people every year. Vaccines reduce the chances of getting an illness by improving the immune system. Vaccines are now accessible to avoid about 20 possibly deadly ailments, helping individuals of all ages live a better, healthier life.

Vaccination is an important part of both healthcare and fundamental rights. Vaccines are also helpful in controlling and preventing illnesses. It is also one of the most beneficial health investments. [1]

## About Covid-19

The majority of patients infected with the COVID-19 virus (triggered due to SARS-CoV-2 virus) will suffer trivial to moderate respiratory illness and will heal with no special treatments. While others will become very ill and will need medical attention[2]. Persons above the age of 65 and one with medical illness like diabetes, severe lung ailment, cardiovascular illness or cancer are more susceptible to infection though COVID-19 has the possibility to cause severe illness or even death in

people of all ages [3].

The virus can spread when a person who is infected sneezes, speaks, coughs, sings, or even breathes in the form of tiny or large liquid particles through mouth or nose. The best method to avoid and reduce viral transmission is to educate yourself about the illness, how it spreads, and how to protect yourself and others from infection. Ways to be protected are: maintaining a minimum of one metre distance from others, wearing a well-fitted mask, and using hand sanitizer or washing hands often. However, if one becomes ill, one can recover by practising respiratory hygiene, such as coughing into a flexed elbow, isolating at home and quarantining until recovery.

### About Covid-19 vaccines

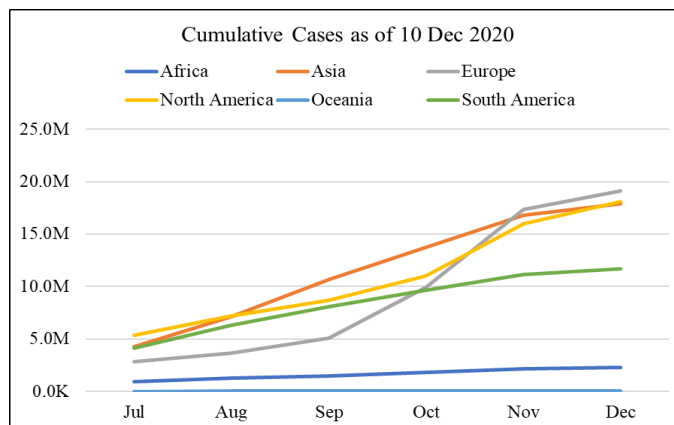
Following the discovery of the SARS-CoV-2 virus and its ability to cause the worldwide spread of COVID-19 illness, leading to an urgent need to develop vaccines at an unparalleled speed and scale. COVID-19 vaccines have proven to lessen the possibility of contracting and transferring the virus and also protect people of all ages from getting very sick in case they develop COVID-19. Not only for themselves, making everyone aged 5 and above vaccinated protects families and communities, including those who are ineligible to get vaccinated and those who are at risk of serious COVID-19 illness[4].

Countries have just started to use COVID-19 vaccinations, providing new hope in the fight against the worldwide epidemic. WHO, UNICEF, Gavi, and many other partners are collaborating to assist nations in preparing for the launch of the vaccines for COVID-19. The first widespread vaccination campaign started in early December 2020. Countries will ensure infrastructure and technical assistance to safely distribute COVID-19 vaccinations with careful planning.

### Data analysis

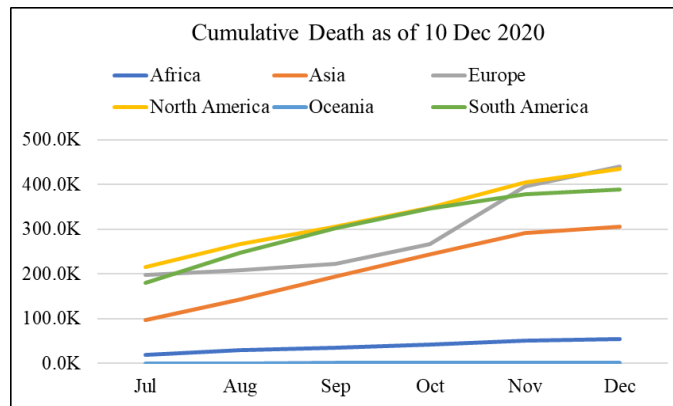
The dataset for COVID-19 cases was retrieved from Coronavirus (COVID-19) cases [5], while data for COVID-19 deaths was retrieved from Coronavirus (COVID-19) deaths [6]. The dataset is filtered out for analysis using Excel and, using PivotChart and PivotTable, it is summarised by the max of total cases and deaths. Finally, the data is visualised using a line chart.

**Covid-19 situation before the proper administration of vaccines till Dec 2020 is shown in figure 1 and table1. Figure 2 and table 2 shows the cumulative death cases till 10 Dec 2020 in major continents of the world.**



**Fig. 1 Cumulative number of cases as of 10 December 2020**  
**Table 1 Cumulative number of cases as of 10 December 2020**

Row Labels	Africa	Asia	Europe	North America	Oceania	South America
Jul	928.1K	4.3M	2.9M	5.4M	19.0K	4.1M
Aug	1.3M	7.1M	3.6M	7.2M	28.7K	6.3M
Sep	1.5M	10.7M	5.1M	8.7M	31.4K	8.1M
Oct	1.8M	13.7M	10.0M	11.0M	37.5K	9.7M
Nov	2.2M	16.8M	17.3M	16.0M	45.1K	11.1M
Dec	2.3M	17.9M	19.1M	18.1M	46.3K	11.7M



**Fig. 2 Cumulative number of deaths as of 10 December 2020**

**Table 2. Cumulative number of deaths as of 10 December 2020**

Row Labels	Africa	Asia	Europe	North America	Oceania	South America
Jul	19.7K	96.7K	198.4K	216.4K	0.2K	180.5K
Aug	29.8K	142.7K	208.1K	267.1K	0.7K	247.1K
Sep	35.9K	195.1K	222.9K	306.6K	0.9K	302.8K
Oct	42.9K	243.3K	266.4K	348.4K	1.0K	346.8K
Nov	52.0K	292.2K	395.5K	405.6K	1.0K	378.9K
Dec	54.9K	306.8K	440.2K	434.9K	1.0K	389.6K

Till December 31, 2020 it is estimated that COVID-19 has infested more than 82 million persons and over 1.8 million have been killed. But estimates show that the "excess deaths" will be at least 3 million, which is 1.2 million more than the official data provided to WHO [4].

Excess deaths are deaths that occur in excess of what would be anticipated in "normal" conditions. It contains confirmed deaths, as well as COVID-19 deaths that were not correctly identified and recorded, and deaths caused by general crisis conditions. While comparing only documented COVID-19 deaths, this provides a more precise figure[7]. The reason is that some countries only report COVID-19 demises that happen in hospitals or only those that are tested positive. Also, because of poor or under-resourced health information systems, many countries are incapable to properly recognise or record the reason of death properly and accurately.

Covid-19 situation till Dec 2021 with cumulative number of cases is shown in figure 3 and table 3. Figure 4 and table 4 shows the cumulative death cases till 19 Dec 2021 in major continents of the world.

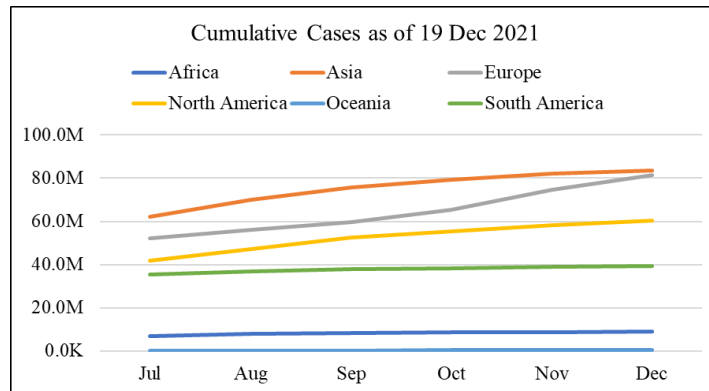


Fig. 3 Cumulative number of cases as of 19 December 2021

Row Labels	Africa	Asia	Europe	North America	Oceania	South America
Jul	6.7M	62.0M	52.1M	41.9M	105.4K	35.5M
Aug	7.8M	70.1M	56.0M	47.3M	164.0K	36.9M
Sep	8.3M	75.8M	59.7M	52.4M	230.8K	37.8M
Oct	8.5M	79.4M	65.3M	55.3M	317.5K	38.4M
Nov	8.7M	82.1M	74.6M	58.2M	369.3K	38.9M
Dec	9.2M	83.5M	81.3M	60.5M	412.1K	39.3M

Table 3 Cumulative number of cases as of 19 December 2021

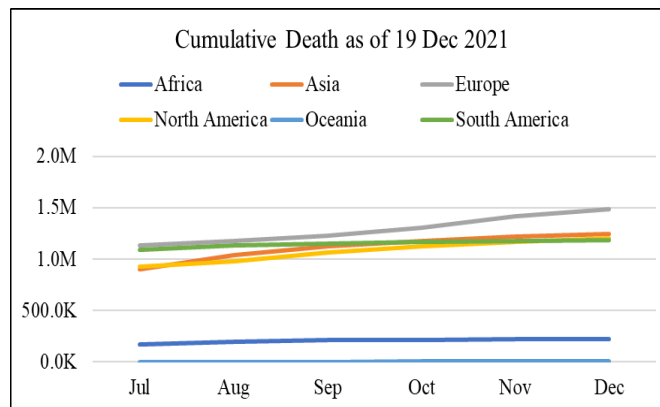


Fig. 4 Cumulative number of deaths as of 19 December 2021

**Table 4 Cumulative number of deaths as of 19 December 2021**

Row Labels	Africa	Asia	Europe	North America	Oceania	South America
Jul	170.1K	899.5K	1.1M	924.0K	1.5K	1.1M
Aug	196.3K	1.0M	1.2M	977.7K	2.2K	1.1M
Sep	210.4K	1.1M	1.2M	1.1M	2.9K	1.2M
Oct	218.2K	1.2M	1.3M	1.1M	3.7K	1.2M
Nov	222.9K	1.2M	1.4M	1.2M	4.2K	1.2M
Dec	225.2K	1.2M	1.5M	1.2M	4.4K	1.2M

**Following the correct administration of vaccinations all over the globe, there has been a major change in worldwide deaths, as well as a modest change in new cases internationally, and individuals have discovered increased protection against the virus.**

**However, just because you were lucky enough to receive a vaccination does not imply you may resume your pre-pandemic lifestyle.** Currently available research indicates that the immunizations are not completely effective. This means that even persons who have been properly vaccinated may get COVID-19.

**Individually, the COVID-19 vaccinations are quite effective, but they are most effective when everyone receives one. New vaccination will protect from serious sickness and will almost certainly prevent from contracting COVID-19. However, one might still have a minor or asymptomatic illness, which could kick off a chain reaction of infections and consequences in others.**

### 1. Covid-19 variants

The virus that causes COVID-19 and other viruses has developed with time and will continue to develop as they outspread. Virus variations might appear with different intervals of time[8]. A variant virus is one that incorporates at least one new alteration from the original virus. The majority of these variations have very little or no influence on the virus's characteristics. Though, certain changes may have an effect on the virus's characteristics, like how rapidly it spreads, the intensity of the related sickness, the efficiency of vaccines, or other public health and social procedures [9].

Table 5 shows the list of all variants of SARS-CoV-2.

**Table 5 "Variations of concern" (VOC) that are currently identified**

Label (WHO)	Documented Samples	Designation Date
Alpha	United Kingdoms, Sep 2020	18 Dec 2020
Beta	South Africa, May 2020	18 Dec 2020
Gamma	Brazil, Nov 2020	11 Jan 2021
Delta	India, Oct 2020	VOI: 4 Apr 2021 VOC: 11 May 2021
Omicron	Multiple Countries, Nov 2021	VUM: 24 Nov 2021 VOC: 26 Nov 2021

Variants that appear to match one or more of the particular criteria evaluated during the COVID-19

pandemic may be labelled as "variants of interest" or "variants under investigation" (VUI), needing verification and validation. Once validated, VUI may be referred to as VOC by monitoring agencies. The WHO has identified five SARS-CoV-2 variations as being of concern: the Alpha, Beta, Gamma, Delta, and Omicron variants shown in fig. 9. **(At the moment, WHO is working with a huge number of researchers from across the world to better understand Omicron, but information is limited.)**

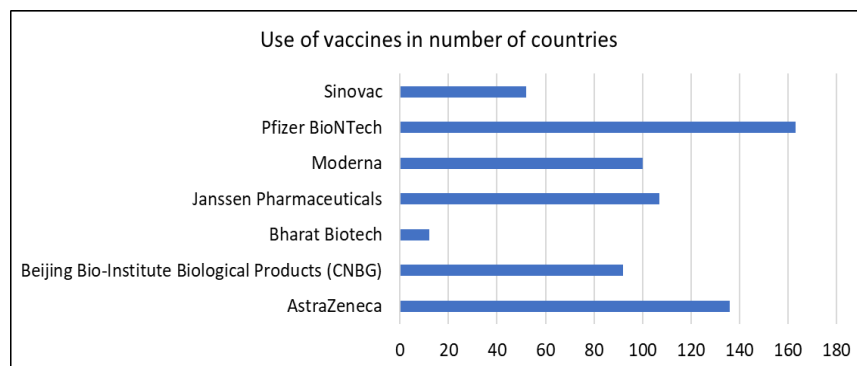
### Why are variants developed?

**Viruses develop variants because they manufacture carbon copies to replicate, but they aren't flawless at it. Faults can slip in and alter the genetic code, causing in a new version of the virus - a variation. Survival of a virus due to this will lead to the outbreak of new strain [9].**

**The more opportunity coronavirus has to replicate itself in humans - the host - the more potential for mutations to arise. That is why it is critical to keep infections to a minimum. Vaccines aid in reducing transmission while also preventing against major disease.**

### Vaccines approved by WHO

The dataset for COVID-19 vaccines was extracted from the WHO Coronavirus (COVID-19) Dashboard [10]. The dataset is filtered out for analysis using Excel and, using PivotChart and PivotTable, it is summarised by the "count of ISO3", where ISO3 is the country code. Finally, the data is visualised using a bar chart. Sum of count of countries administrating different vaccines is displayed in figure 5 and table 6.



*Fig. 5 Sum of count of country administrating each vaccine*

*Table 6 Sum of count of country administrating each vaccine*

Row Labels	Sum of Count of ISO3
AstraZeneca	136
Beijing Bio-Institute Biological Products (CNBG)	92
Bharat Biotech	12
Janssen Pharmaceuticals	107
Moderna	100
Pfizer BioNTech	163
Sinovac	52

**Out of all the other vaccines, the list of vaccines shown in table 6 are the ones approved by WHO for emergency use.**

## **Conclusion**

While the vaccinations give a high level of (but not total) protection against COVID-19, it takes time for the immunizations to attain their maximum level of protection. Because vaccines are so new, we don't have statistics on how long they provide protection. However, researchers think there may be a need of booster in the future but it is still a question that when or how frequently?

However, people can still get sick after getting vaccinated. As more and more people get vaccinated, the possibilities of becoming sick are reduced much more thanks to a concept called "herd immunity." Vaccinated people who become sick have very few virus particles and are less likely to spread them to others[11]. Getting vaccinated lowers your chance of getting sick and also protects the community by lowering the possibility of viral transmission.

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