

# TEAM LEADER : PAVITHRA V



# OUR TEAM



1. PAVITHRA V
2. SHARU DHARSHINI S
3. SUBATHRA E
4. SHALINI S



# COVID-19 VACCINES ANALYSIS





# INTRODUCTION

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An introduction to the analysis of COVID-19 vaccines provides an overview of the critical processes and considerations involved in evaluating these crucial tools in the fight against the pandemic. COVID-19 vaccines have been at the forefront of global healthcare efforts, offering hope for controlling the spread of the virus and mitigating its impact on public health. The analysis of these vaccines encompasses a multifaceted approach, combining rigorous clinical trials, real-world effectiveness studies, safety monitoring, and logistical assessments to ensure their successful deployment.



# What are COVID-19 Vaccines?

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COVID-19 vaccines are designed to stimulate the body's immune system to recognize and fight the virus. There are currently three types of vaccines available: **mRNA**, **vector**, and **inactivated** vaccines. Each vaccine works differently but they all aim to provide immunity against COVID-19.



# Why Vaccination is Important

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Vaccination is important because it helps to prevent the spread of COVID-19. It also reduces the severity of the disease if someone does get infected. This helps to protect individuals and communities.

# Types of COVID-19 Vaccines

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There are several types of COVID-19 vaccines, including mRNA vaccines, viral vector vaccines, and protein subunit vaccines. They all work by teaching the immune system to recognize and fight the virus.



# COVID VACCINES ANALYSIS PROCESSES



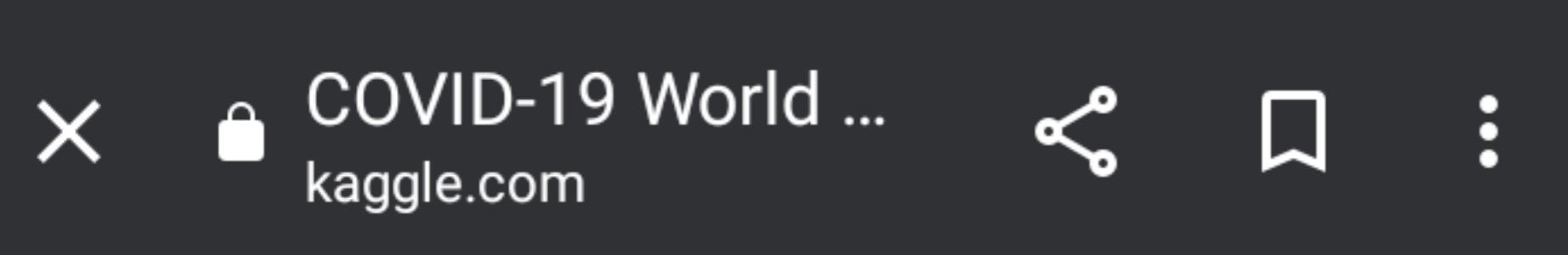
# DATA COLLECTION



COVID VACCINES ANALYSIS  
is done by using the dataset of  
"COVID-19 World Vaccination  
Progress" provided by the  
dataset site [www.Kaggle.com](https://www.Kaggle.com)

DATASET :

<https://www.kaggle.com/datasets/gpreda/covid-world-vaccination-progress/download>



A	B	C	D	E	F	G
location	date	vaccine	total_vaccinations			
Argentina	12/29/2020	Moderna	2			
Argentina	12/29/2020	Oxford/Astra	3			
Argentina	12/29/2020	Sinopharm/E	1			
Argentina	12/29/2020	Sputnik V	20481			
Argentina	12/30/2020	Moderna	2			
Argentina	12/30/2020	Oxford/Astra	3			
Argentina	12/30/2020	Sinopharm/E	1			
Argentina	12/30/2020	Sputnik V	40583			
Argentina	12/31/2020	Moderna	2			

country_vaccinations												
B	C	D	E	F	G	H	I	J	K	L	M	N
date	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations	daily_vaccinations_smoothed	total_vaccinations_smoothed	people_vaccinated_smoothed	people_fully_vaccinated_smoothed	daily_vaccinations_smoothed	vacines	source_name	iso_code
2/22/2021	0	0	0	0	0	0	0	0	0	0	Johnson&JoWorld Healthht	
2/23/2021	0	0	0	0	0	0	0	0	0	0	Johnson&JoWorld Healthht	
2/24/2021	0	0	0	0	0	0	0	0	0	0	Johnson&JoWorld Healthht	
2/25/2021	0	0	0	0	0	0	0	0	0	0	Johnson&JoWorld Healthht	
2/26/2021	0	0	0	0	0	0	0	0	0	0	Johnson&JoWorld Healthht	
2/27/2021	0	0	0	0	0	0	0	0	0	0	Johnson&JoWorld Healthht	
2/28/2021	8200	8200	8200	0	0	1367	0	0	0.02	0.02	Johnson&JoWorld Healthht	
3/1/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/2/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/3/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/4/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/5/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/6/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/7/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/8/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/9/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/10/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/11/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/12/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/13/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	
3/14/2021	0	0	0	0	0	1367	0	0	0	0	Johnson&JoWorld Healthht	

# DATA PREPROCESSING



## Cleaning & Formatting

Remove irrelevant data and handle missing values.  
Transform data into a consistent format.



## Normalization & Standardization

Scale data to a common range and format to ensure fairness in analysis.

## Feature Engineering

Create new features, derive meaningful insights, and enhance the predictive power of the data.

## Dimensionality Reduction

Reduce the number of variables to simplify analysis and improve model performance.

## Data Preprocessing

In [6]:

```
cov19.isnull().sum()
```

Out[6]:

```
country          0  
iso_code         0  
date             0  
total_vaccinations 42905  
people_vaccinated 45218  
people_fully_vaccinated 47710  
daily_vaccinations_raw 51150  
daily_vaccinations    299  
total_vaccinations_per_hundred 42905  
people_vaccinated_per_hundred 45218  
people_fully_vaccinated_per_hundred 47710  
daily_vaccinations_per_million 299  
vaccines          0  
source_name        0  
source_website     0  
dtype: int64
```

In [7]:

```
cov19_fillna = cov19
```

In [8]:

```
cov19_fillna.fillna(cov19_fillna.mean(), inplace=True)  
# count the number of NaN values in each column  
print(cov19_fillna.isnull().sum())  
  
cov19_fillna
```

```
country          0  
iso_code         0  
date             0
```

In [8]:

```
cov19_fillna.fillna(cov19_fillna.mean(), inplace=True)  
# count the number of NaN values in each column  
print(cov19_fillna.isnull().sum())
```

```
cov19_fillna
```

```
country          0  
iso_code         0  
date             0  
total_vaccinations 0  
people_vaccinated 0  
people_fully_vaccinated 0  
daily_vaccinations_raw 0  
daily_vaccinations    0  
total_vaccinations_per_hundred 0  
people_vaccinated_per_hundred 0  
people_fully_vaccinated_per_hundred 0  
daily_vaccinations_per_million 0  
vaccines          0  
source_name        0  
source_website     0  
dtype: int64
```

Out[8]:

	country	iso_code	date	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations
	Afghanistan	AFG	2021-02-22	0.000000e+00	0.000000e+00	1.413830e+07	27051
	Afghanistan	AFG	2021-02-23	4.592964e+07	1.770508e+07	1.413830e+07	27051
	Afghanistan	AFG	2021-02-24	4.592964e+07	1.770508e+07	1.413830e+07	27051
	Afghanistan	AFG	2021-02-25	4.592964e+07	1.770508e+07	1.413830e+07	27051



# EXPLORATORY DATA ANALYSIS (EDA)

## Correlation Analysis

Explore the relationships between different variables to uncover patterns and potential factors.

## Data Visualization

Create informative charts, graphs, and plots to visually present the COVID vaccines data.

## Hypothesis Testing

Formulate hypotheses and perform statistical tests to validate or refute assumptions.

# EDA

In [4]:

```
cov19.describe()
```

Out[4]:

	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations_raw	daily_vaccinations
count	4.360700e+04	4.129400e+04	3.880200e+04	3.536200e+04	8.621300e+04
mean	4.592964e+07	1.770508e+07	1.413830e+07	2.705996e+05	1.313055e+06
std	2.246004e+08	7.078731e+07	5.713920e+07	1.212427e+06	7.682388e+06
min	0.000000e+00	0.000000e+00	1.000000e+00	0.000000e+00	0.000000e+00
25%	5.264100e+05	3.494642e+05	2.439622e+05	4.668000e+03	9.000000e+03
50%	3.590096e+06	2.187310e+06	1.722140e+06	2.530900e+04	7.343000e+04
75%	1.701230e+07	9.152520e+06	7.559870e+06	1.234925e+05	4.409800e+05
max	3.263129e+09	1.275541e+09	1.240777e+09	2.474100e+07	2.242429e+07



# STATISTICAL ANALYSIS

## Descriptive Statistics

Summarize the COVID vaccines data using measures like mean, median, and standard deviation.

## Inferential Statistics

Draw conclusions about the population based on sample data and calculate confidence intervals.

## Regression Analysis

Examine the relationship between variables and predict future trends using regression models

```
# Statistical Analysis
# Example: Calculate the correlation
between total_vaccinations and
people_fully_vaccinated
correlation =
df['total_vaccinations'].corr(df['peo
ple_fully_vaccinated'])
print(f"Correlation between total
vaccinations and people fully
vaccinated: {correlation:.2f}")
```



# DATA VISUALIZATION

## Interactive Dashboards

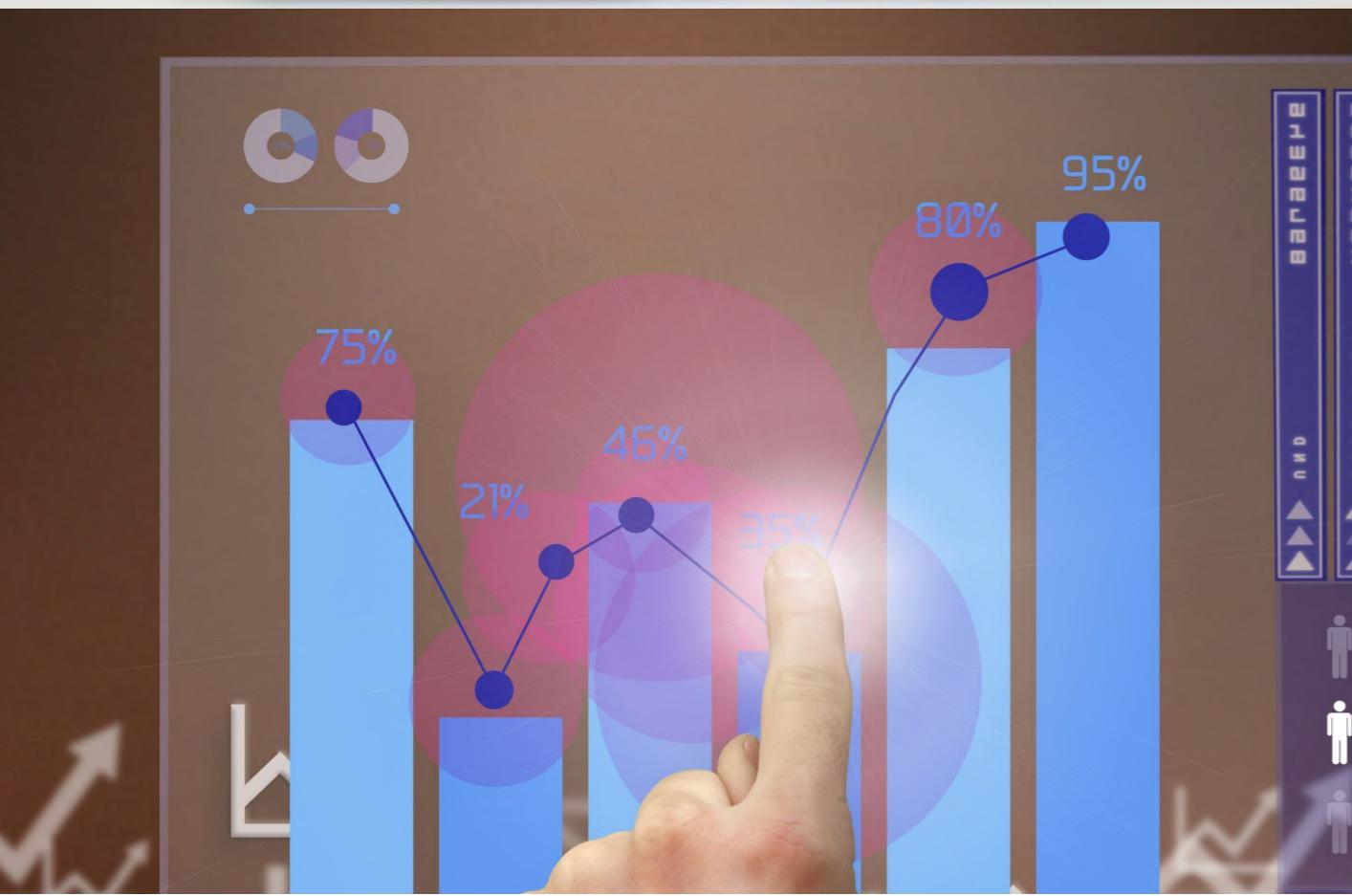
Develop interactive dashboards that allow users to explore the COVID vaccines data visually.

## Storytelling through Infographics

Create compelling infographics that convey key insights and make complex data more accessible.

## Animated Data Presentations

Utilize animations and dynamic visualizations to engage audiences and enhance understanding.



## Storytelling - Visualization

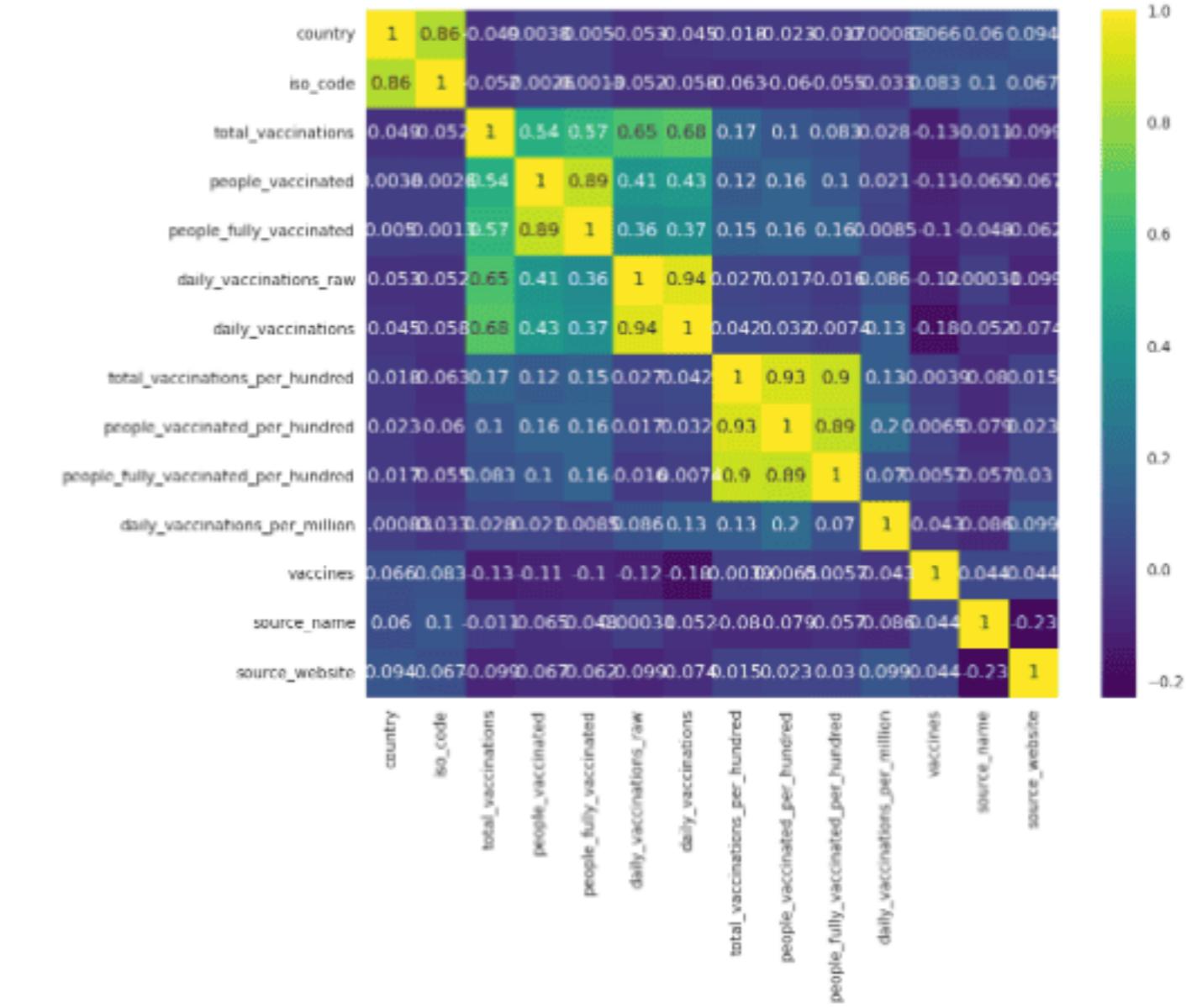
```
# Visualization
# Example: Create a line chart
# showing the vaccination progress over
# time for a specific country
country_name = 'United States'
country_df = df[df['country'] ==
country_name]
plt.figure(figsize=(12, 6))
plt.plot(country_df['date'],
country_df['total_vaccinations'],
marker='o', linestyle='--')
plt.xlabel('Date')
plt.ylabel('Total Vaccinations')
plt.title(f'{country_name}
Vaccination Progress Over Time')
plt.grid(True)
plt.show()
```

In [17]:

```
corr = cov19.corr()
plt.figure(figsize=(10, 8))
sns.heatmap(corr, cmap='viridis', annot=True)
```

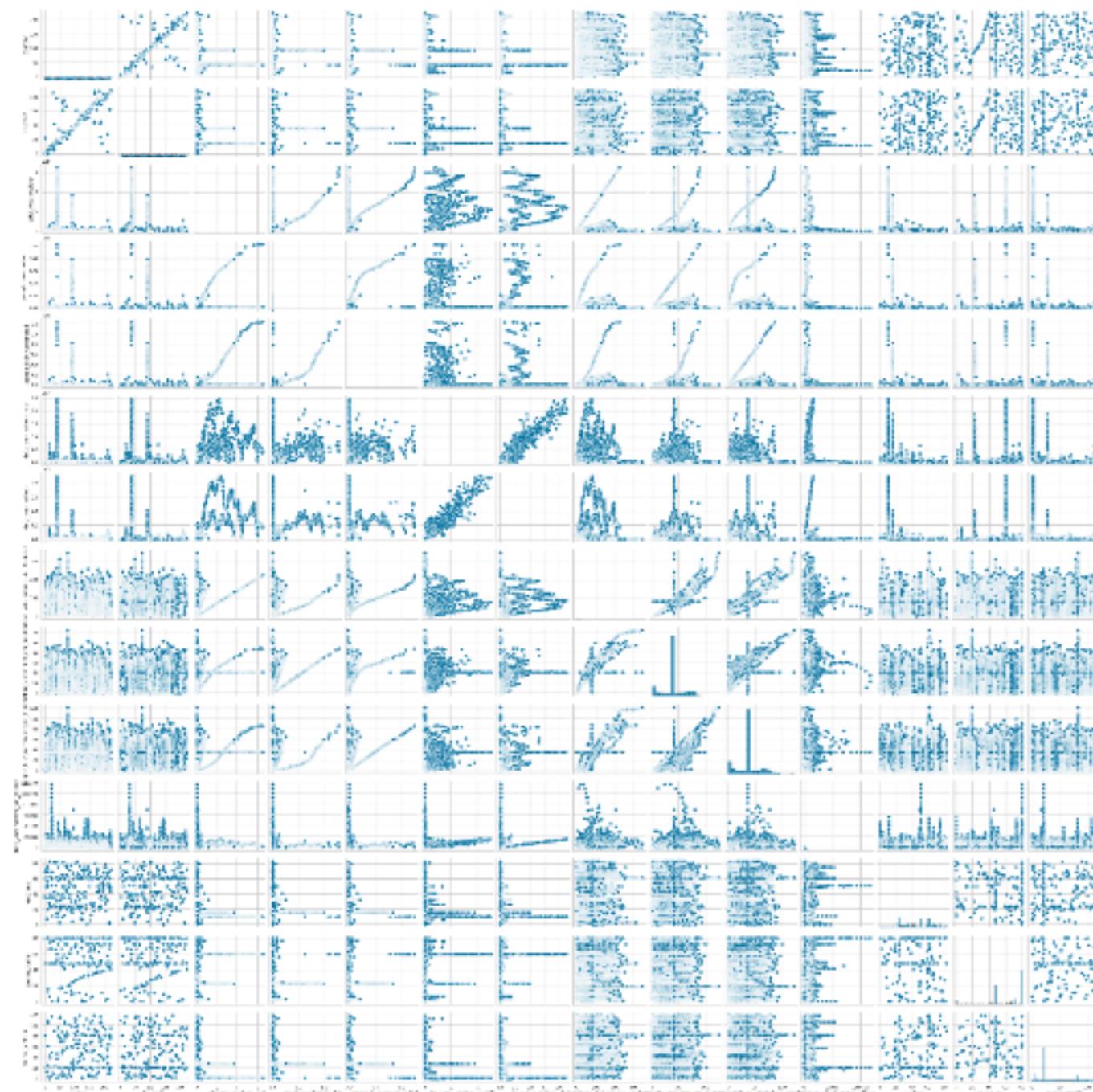
Out[17]:

<Axes: >



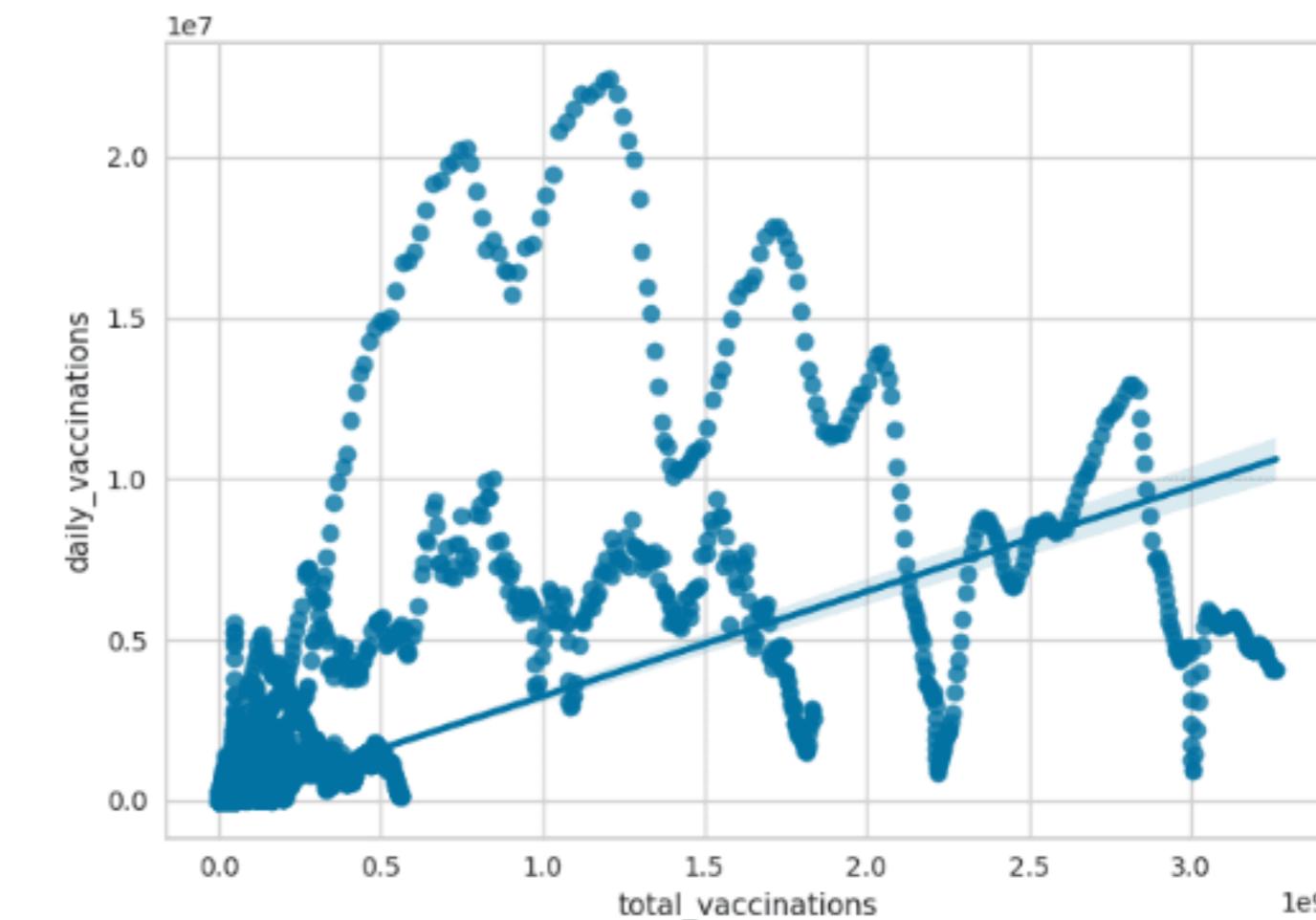
```
In [18]:  
sns.pairplot(cov19)
```

```
Out[18]:  
<seaborn.axisgrid.PairGrid at 0x7f08ac754a90>
```



```
In [19]:  
sns.regplot( y="daily_vaccinations",x="total_vaccinations", data=cov19)
```

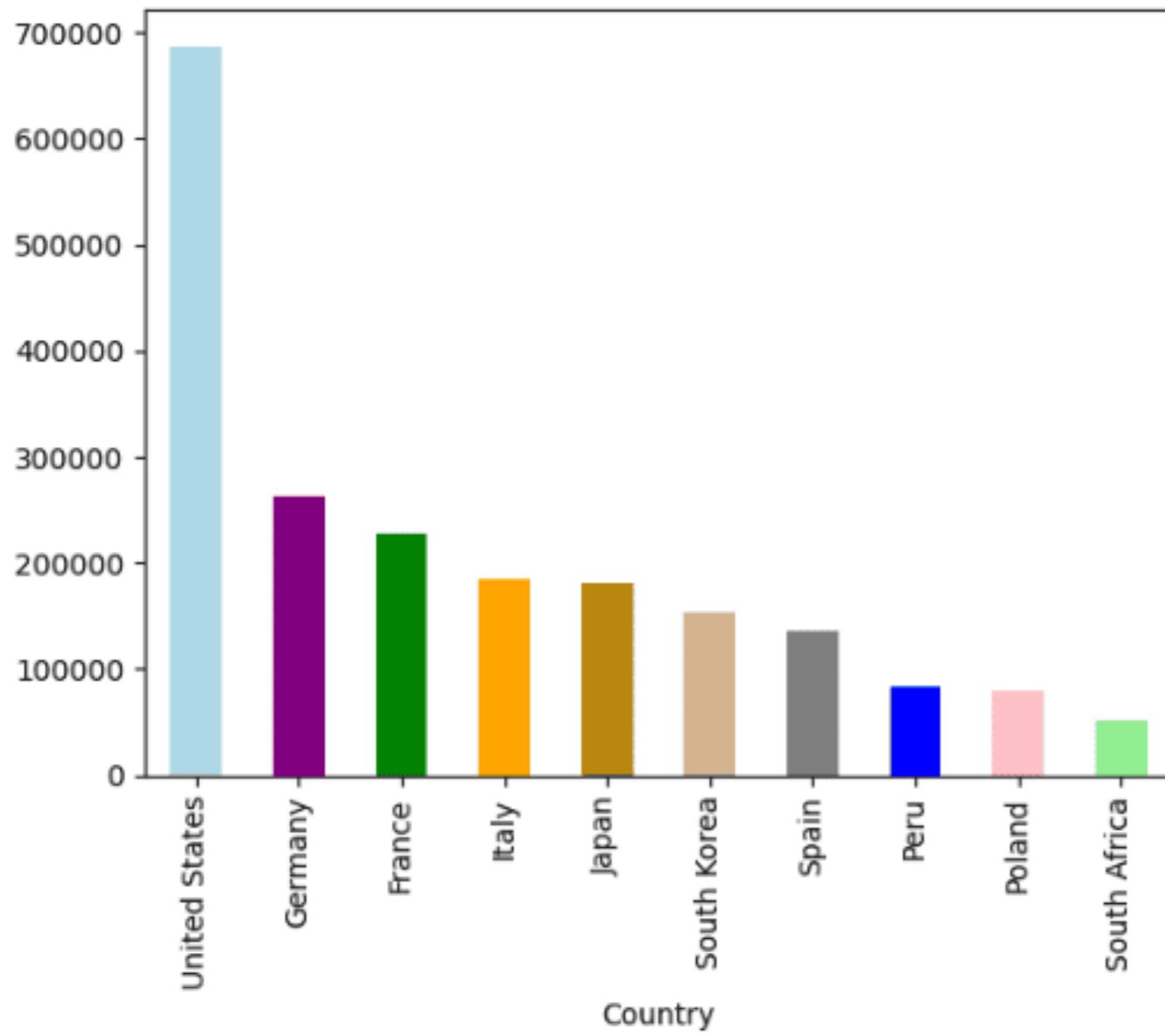
```
Out[19]:  
<Axes: xlabel='total_vaccinations', ylabel='daily_vaccinations'>
```



```
In [21]:  
dtfrm.set_index("Country",inplace=True)
```

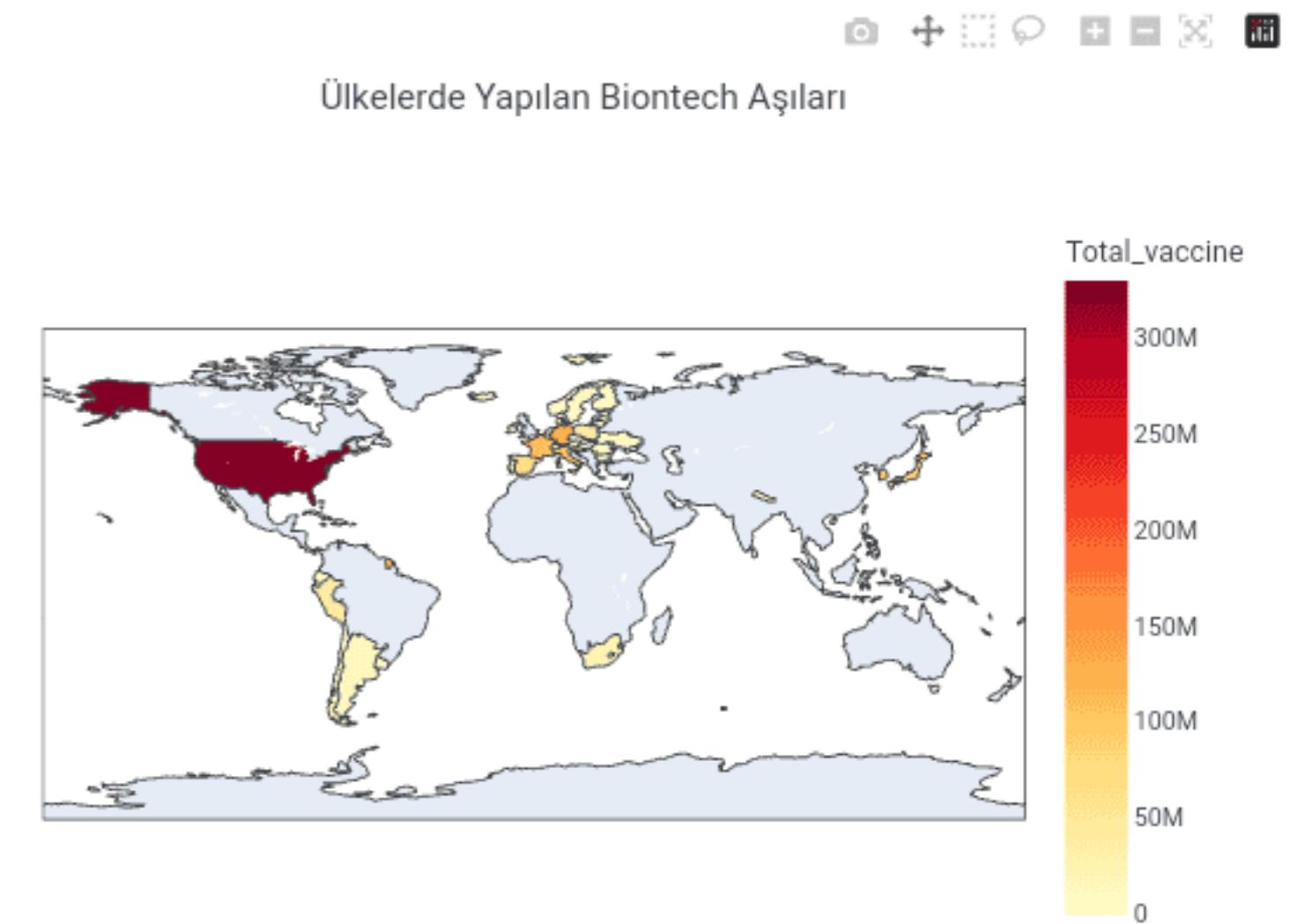
```
In [22]:  
color=["Lightblue","Purple","Green","Orange","darkgoldenrod","tan","Gray","Blue","Pink","Lightgreen"]  
dtfrm[ "average_vaccination_count"].sort_values(ascending=False).head(10).plot(kind="bar",color=color)
```

```
Out[22]:  
<Axes: xlabel='Country'>
```



```
In [25]:
```

```
fig = px.choropleth(data_frame=dtfrm,  
                     locations=dtfrm.index,  
                     locationmode='country names',  
                     color='Total_vaccine',  
                     color_continuous_scale='YlOrRd',  
                     title='Ülkelerde Yapılan Biontech Aşları')  
  
fig.update_layout(title_x=0.5)
```

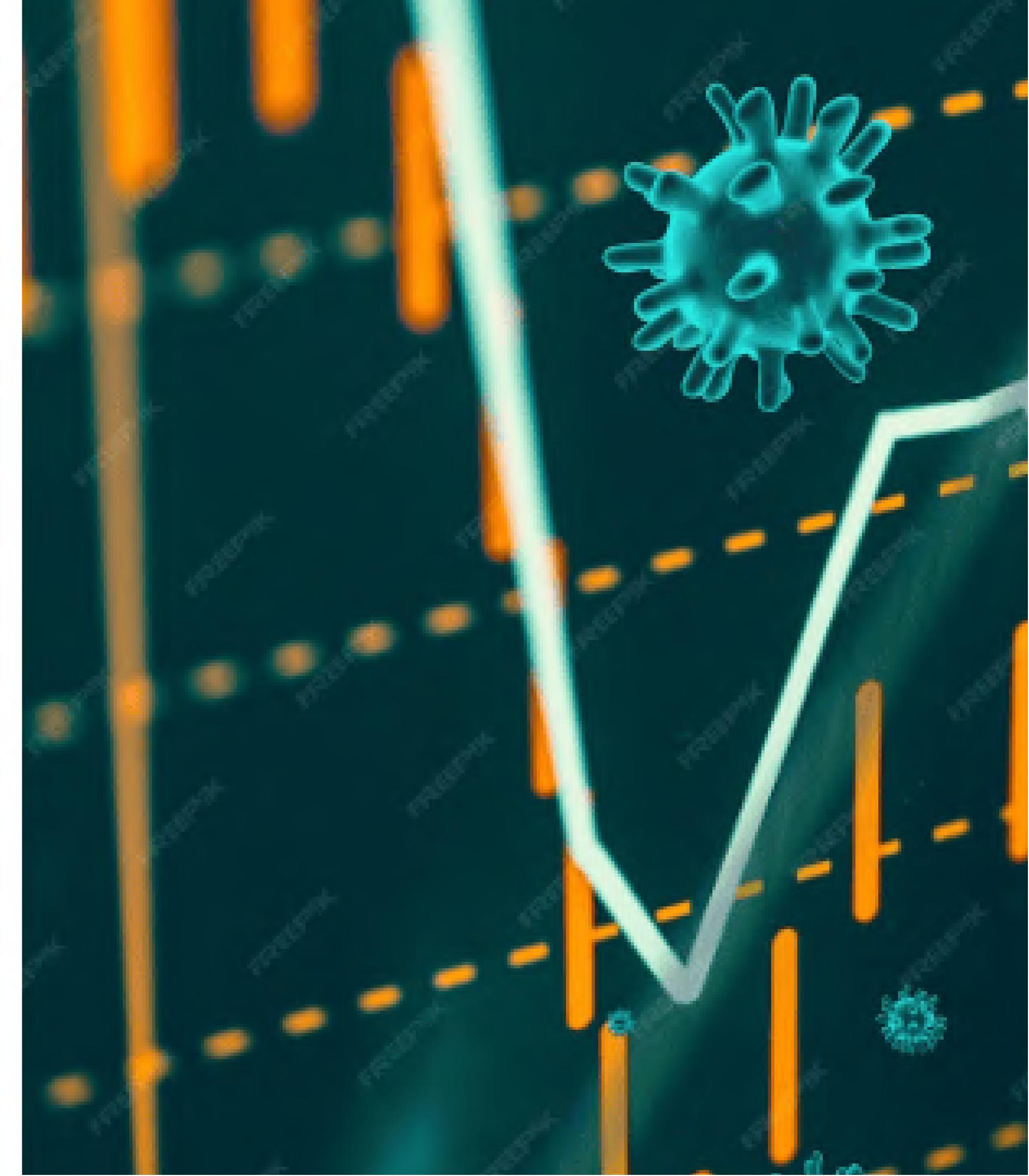


## Efficacy of COVID-19 vaccines

Clinical trials have shown that COVID-19 vaccines are highly effective in preventing infection and severe illness.

The **Pfizer-BioNTech** vaccine has an efficacy rate of 95%, while the **Moderna** vaccine has an efficacy rate of 94.1%.

The **Johnson & Johnson** vaccine has an efficacy rate of 66.3% against moderate to severe disease.



# Safety of COVID-19 Vaccines

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COVID-19 vaccines have undergone rigorous testing to ensure their safety.

The most common side effects are mild and include pain at the injection site, fever, and fatigue. Serious side

effects are rare but have been reported. It is important to discuss any concerns with a healthcare provider.



# Side Effects of COVID-19 Vaccines

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COVID-19 vaccines can cause side effects, but they are generally mild and go away quickly. The most common side effects include pain at the injection site, fever, and fatigue.





## VACCINE DISTRIBUTION STRATEGIES

The distribution of COVID-19 vaccines has been a complex and challenging task. Strategies have included prioritizing high-risk populations, setting up mass vaccination sites, and partnering with community organizations to reach underserved communities.

# Conclusion

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COVID-19 vaccines are a crucial tool in the fight against the pandemic. They have shown high efficacy rates and have undergone rigorous testing to ensure their safety. However, vaccine distribution and access must be equitable to ensure that all populations have access to these life-saving vaccines.



**THANK YOU**