COVID EFFECTS

Project Report

Group 10

Introduction

The emergence of **COVID-19** back in December 2019 shook the entire world. The pandemic made a significant impact on everyone's health, social, and economic well-being. In this project, we have analyzed COVID-19's impact on GDP, unemployment, tourism, and the pharmaceutical sector.

Data description:

1. COVID cases data consists of the cases data of the World, India and USA (we chose India and USA data because they are the top two countries affected by COVID in terms of the total number of cases).
2. Under World COVID-19 data, there are both, country-wise and continent-wise datasets with variables like the Number of COVID cases, Number of Deaths, Number of Recovered Cases and Number of Active Cases.

continent_names	total_cases_of_continents	total_deaths	total_recovered	active_cases
World	642132099	6622261	621490355	14019483
North America	118623539	1559934	114116984	2946621
Asia	196821641	1494115	188996434	6331092
Europe	236411616	1953775	230785699	3672142
South America	64708745	1334323	63019696	354726
Oceania	12838444	21984	12533189	283271
Africa	12693549	257984	12010863	424702

Figure 1: Continent-wise Data

country_names	total_cases_of_countries	total_deaths	total_recovered	active_cases	total_population
USA	100108704	1101843	97662262	1344599	334805269
India	44668951	530553	44130380	8018	1406631776
France	37250370	158089	36612349	479932	65584518
Germany	36180077	156410	35331200	692467	83883596
Brazil	35009176	688886	34162530	157760	215353593
S. Korea	26462319	29925	25527447	904947	51329899
UK	23954192	195530	23679684	78978	68497907
Italy	23823192	179985	23224653	418554	60262770
Japan	23604176	48058	20593558	2962560	125584838
Russia	21525567	391333	20932860	201374	145805947
Turkey	16976729	101327	16875402	0	85561976
Spain	13551539	115357	13335434	100748	46719142
Vietnam	11510919	43168	10606633	861118	98953541

Figure 2: Country-wise World Data

3. USA and India datasets contain state-wise data on variables like Number of COVID cases, Number of Deaths, Number of Recovered Cases and Number of Active Cases along with State Population.

4. The GDP dataset contains the GDP data (in dollars, during the period 2017-2021) of 162 countries along with sovereign states.

5. The unemployment dataset contains the unemployment rate (percentage labour force) data (during the period 2017-2021) of 162 countries along with sovereign states.

6. Tourism dataset contains month-wise data of the number of international tourist arrivals to India from 2019 to 2021.

7. Pharmaceuticals data has data on the exports from India to different regions around the world during the period 2019-2022.

Data Sources:

1. The **GDP** and **unemployment** data was collected from the 'World Bank' site in *CSV format*.

2. The **tourism** dataset was collected in *pdf format* from the official site of Ministry of Tourism in the 'Tourism Statistics 2022' section and uploaded to CSV format.

3. **COVID Cases** data was *web scrapped* from the Worldometer site. **Pharmaceutical** data was *web scrapped* from the official site of the Ministry of Commerce and Industry.

StateName	TotalCases	TotalDeaths	TotalRecovered	ActiveCases	Population
Andaman and Nicobar	10741	129	10612	0	380581
Andhra Pradesh	2339039	14733	2324273	33	84580777
Arunachal Pradesh	66885	296	66588	1	1383727
Assam	746098	8035	738053	10	31205576
Bihar	851315	12302	838984	10	104099452
Chandigarh	99325	1181	98138	6	1055450
Chhattisgarh	1177695	14145	1163514	36	25545198
Dadra and Nagar Haveli and Daman and Diu	11591	4	11586	1	343709
Delhi	2006849	26516	1980189	144	243247
Goa	258960	4013	254894	53	16787941
Gujarat	1277323	11042	1265984	297	1458545
Haryana	1056450	10713	1045650	87	60439692
Himachal Pradesh	312525	4211	308291	23	25351462

Figure 3: India dataset

Country Name	2017	2018	2019	2020	2021
Afghanistan	1.88E+10	1.81E+10	1.88E+10	2.01E+10	2.17E+10
Angola	6.9E+10	7.78E+10	6.93E+10	5.36E+10	7.25E+10
Albania	1.3E+10	1.52E+10	1.54E+10	1.51E+10	1.83E+10
Arab World	2.58E+12	2.79E+12	2.81E+12	2.5E+12	2.85E+12
United Arab Emir	3.86E+11	4.22E+11	4.17E+11	3.59E+11	4.36E+10
Argentina	6.44E+11	5.25E+11	4.53E+11	3.9E+11	4.91E+11
Armenia	1.15E+10	1.25E+10	1.36E+10	1.26E+10	1.39E+10
Australia	1.33E+12	1.43E+12	1.39E+12	1.33E+12	1.54E+12
Austria	4.17E+11	4.55E+11	4.45E+11	4.33E+11	4.77E+11
Azerbaijan	4.09E+10	4.71E+10	4.82E+10	4.27E+10	5.46E+10
Burundi	2.71E+09	2.66E+09	2.58E+09	2.78E+09	2.9E+09
Belgium	5.03E+11	5.43E+11	5.35E+11	5.22E+11	6E+11
Benin	1.27E+10	1.43E+10	1.44E+10	1.57E+10	1.78E+10
Bangladesh	2.94E+11	3.21E+11	3.51E+11	3.74E+11	4.16E+11
Bulgaria	5.92E+10	6.64E+10	6.89E+10	6.99E+10	8.03E+10
Bahrain	3.55E+10	3.78E+10	3.87E+10	3.47E+10	3.89E+10
Belarus	5.47E+10	6E+10	6.44E+10	6.15E+10	6.82E+10
Belize	1.84E+09	1.89E+09	1.95E+09	1.59E+09	1.79E+09
Bolivia	3.75E+10	4.03E+10	4.09E+10	3.66E+10	4.04E+10
Brazil	2.06E+12	1.92E+12	1.87E+12	1.45E+12	1.61E+12
Barbados	4.98E+09	5.1E+09	5.3E+09	4.69E+09	4.9E+09
Bhutan	2.45E+09	2.45E+09	2.54E+09	2.32E+09	2.45E+10
Botswana	1.61E+10	1.69E+10	1.67E+10	1.49E+10	1.76E+10
Canada	1.65E+12	1.73E+12	1.74E+12	1.65E+12	1.99E+12

Figure 4: GDP Dataset

Country Name	2017	2018	2019	2020	2021
Afghanistan	11.18	11.152	11.217	11.71	13.283
Angola	7.408	7.421	7.421	8.333	8.53
Albania	13.62	12.3	11.47	13.329	11.819
Arab World	10.89638	10.50234	10.00615	11.48732	11.62553
United Arab Emirat	2.46	2.352	2.23	3.188	3.358
Argentina	8.35	9.22	9.84	11.46	10.902
Armenia	17.7	18.97	18.3	21.206	20.897
Australia	5.59	5.3	5.16	6.46	5.112
Austria	5.5	4.85	4.49	5.36	6.301
Azerbaijan	5	4.9	4.85	6.463	6.583
Burundi	1.589	1.587	1.589	1.707	1.792
Belgium	7.09	5.95	5.36	5.55	6.42
Benin	1.644	1.47	1.47	1.584	1.574
Bangladesh	4.37	4.413	4.438	5.413	5.229
Bulgaria	6.16	5.21	4.23	5.12	5.424
Bahrain	1.183	1.201	1.196	1.781	1.874
Belarus	5.65	4.76	4.16	4.768	4.736
Belize	6.6	6.644	6.711	8.462	8.219
Bolivia	3.65	3.52	3.82	7.9	8.509
Brazil	12.82	12.33	11.93	13.69	14.403
Barbados	8.62	8.32	8.41	10.377	10.413
Bhutan	2.453	2.444	2.502	3.649	4.332
Botswana	21.566	22.071	22.61	24.93	24.722
Canada	6.34	5.83	5.66	9.46	7.51

Figure 5: Unemployment dataset
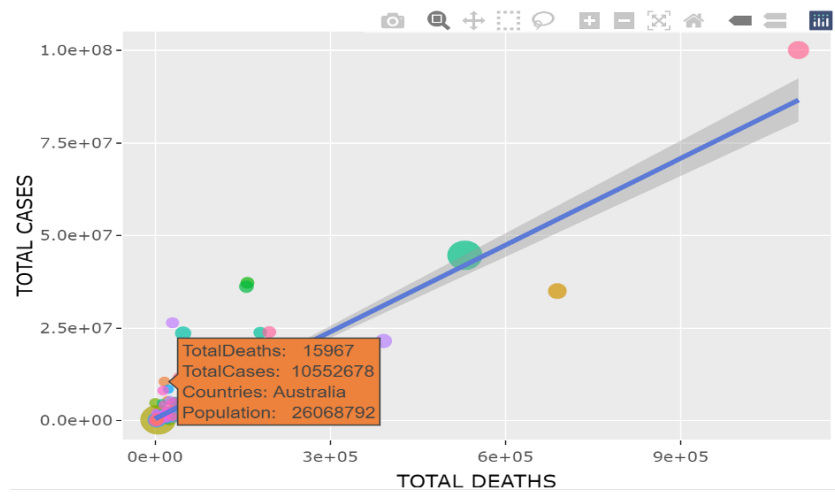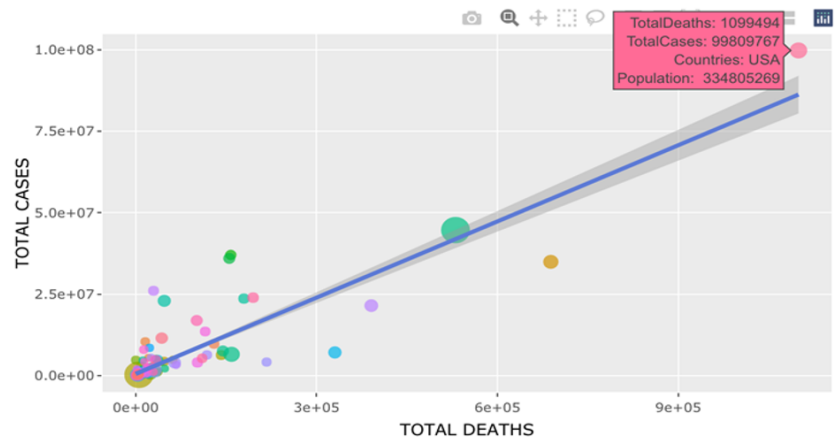
Interesting Questions

1. Did population play a role in the spread of Covid -19?
2. Did health care facilities available play a role in the recovery rate of the country?
3. How were the GDP rates affected by the pandemic? Did any of the countries make a comeback?
4. Did the unemployment rate increase for every country during the COVID-19 period?
5. How was the tourism trend affected due to the lockdown?
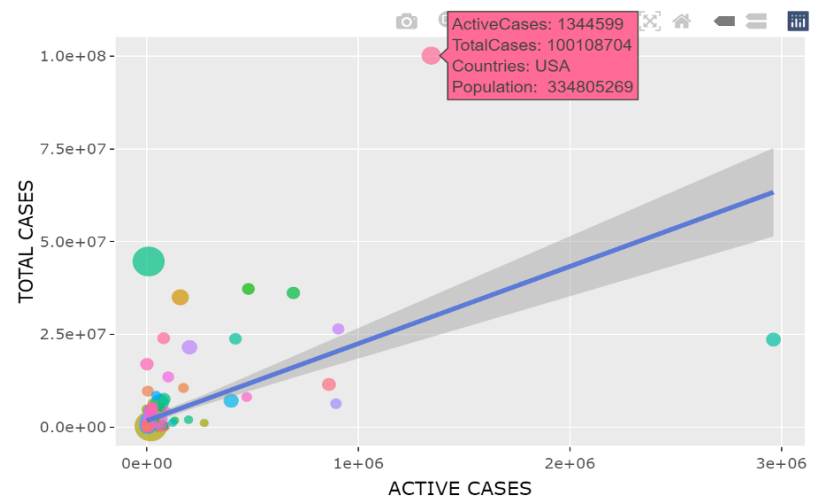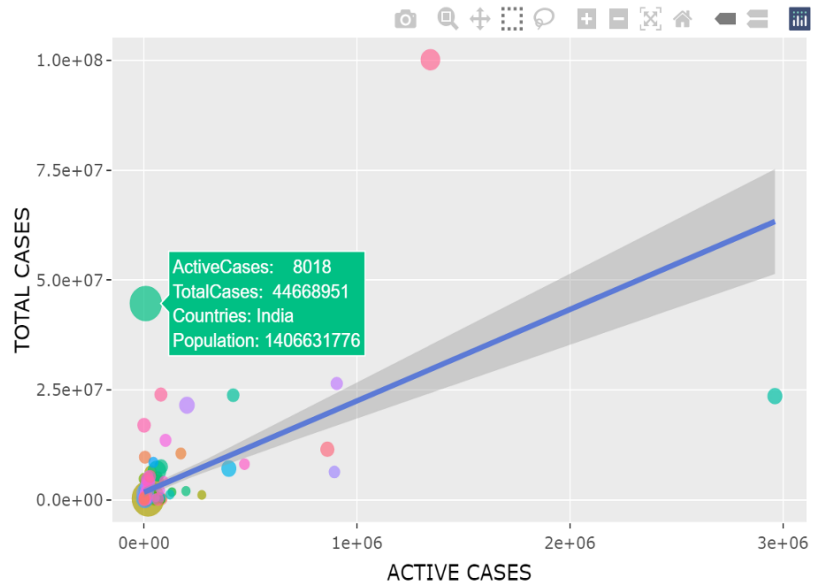6. Did India's pharmaceutical exports experience growth?
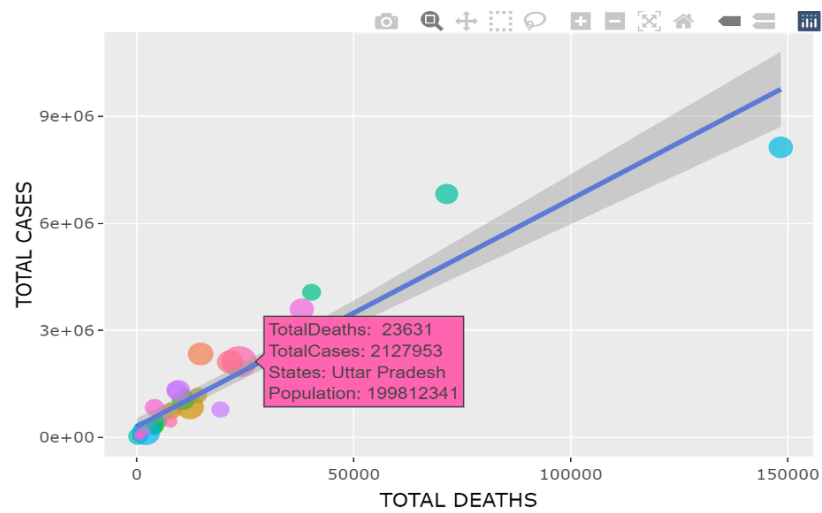
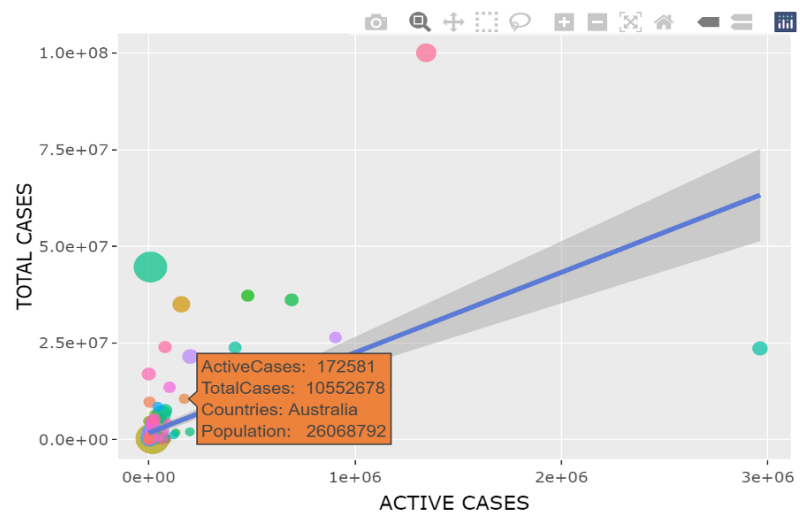## 1. Did population play a role in the spread of COVID-19?

WORLD:

Observation:

In the bubble plots, the size of bubbles depends upon the population of countries and the different colors of bubbles correspond to different countries. The straight line in the above graphs is the line of best fit and the gray-colored part around the line is the confidence interval. From the graph of Total Cases v/s Total Deaths, the population of India is more than the population of the USA but total cases, total deaths, and active cases in the USA are more

ActiveCases: 8018
TotalCases: 44668951
Countries: India
Population: 1406631776

ActiveCases: 1344599
TotalCases: 100108704
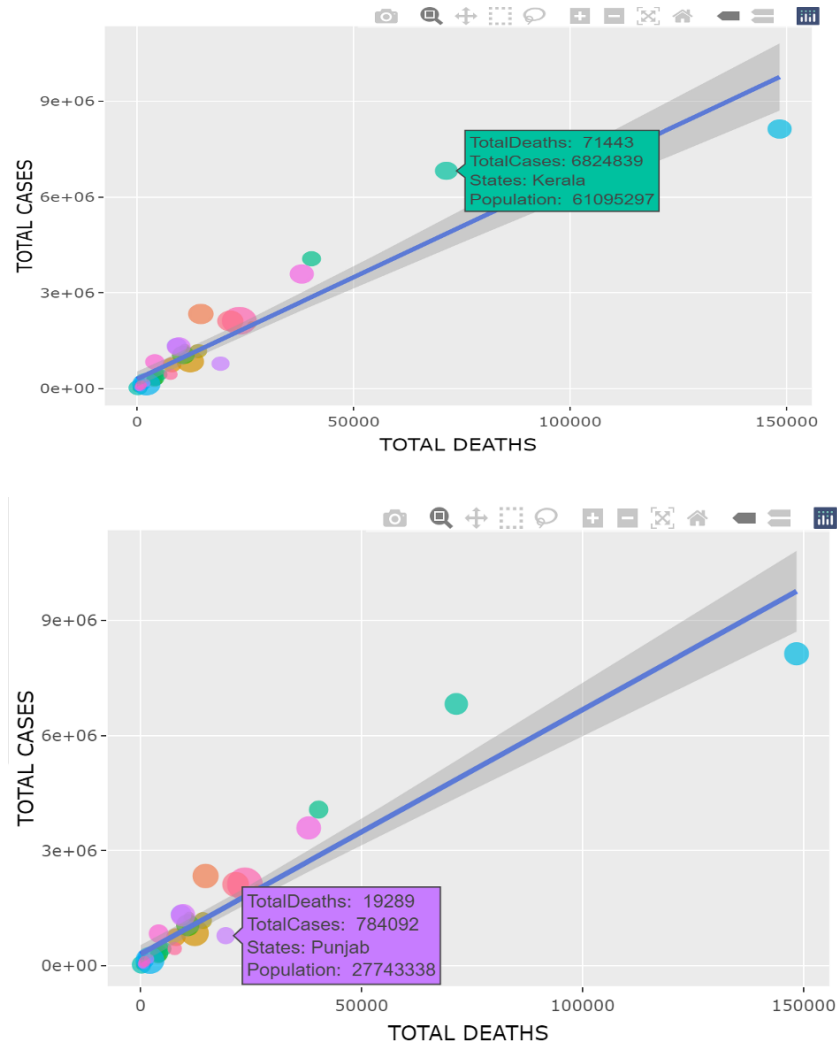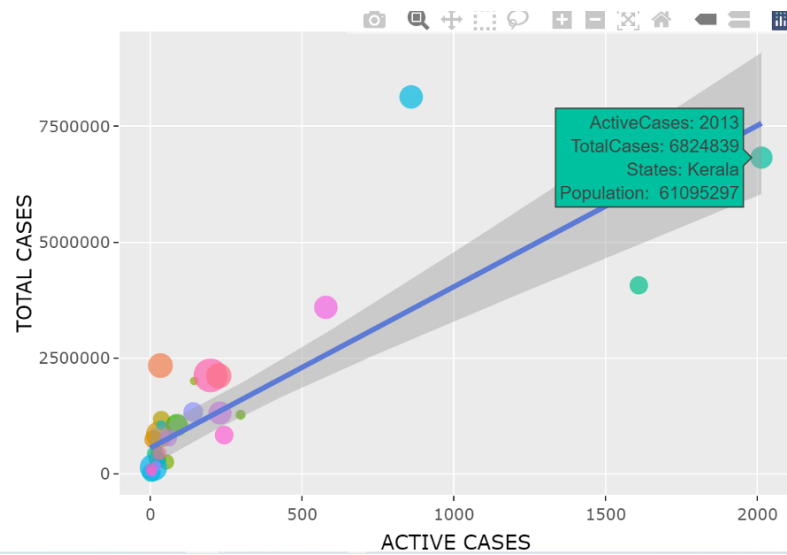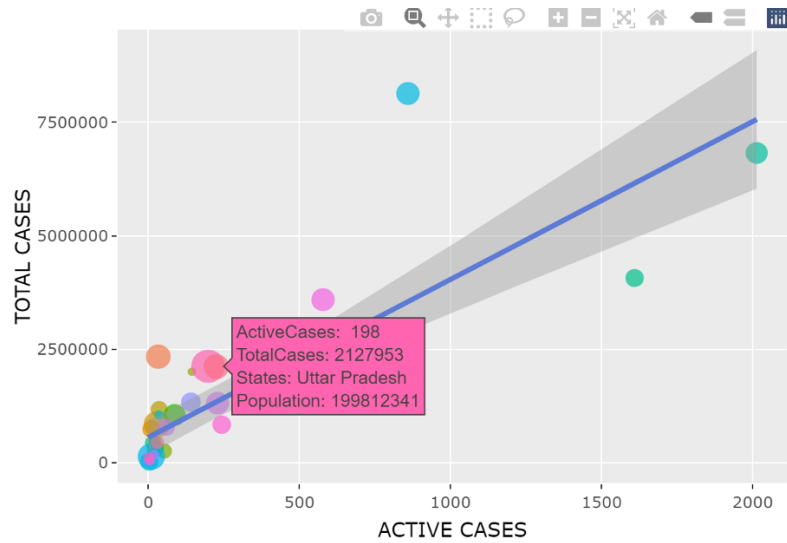Countries: USA
Population: 334805269

than in India. While the population of Australia is less than India and the total cases, total deaths and active cases are also less than in India. So, we observe that the population may not have a significant role in the spread of COVID.
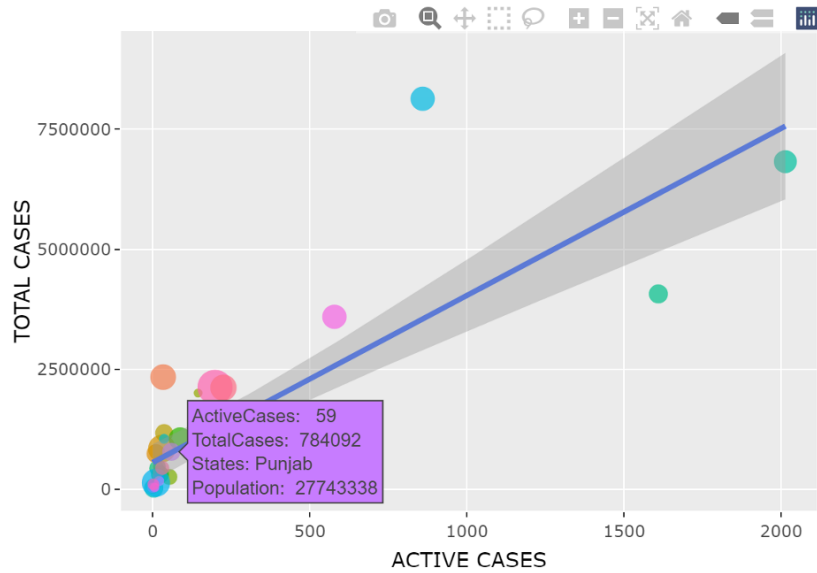
INDIA:

Observation:

The size of bubbles depends upon the population of states and the different colors of bubbles corresponding to different states. The straight line in the above graphs is the line of best fit and the gray-colored part around the line is the confidence interval. From the graph of Total

ActiveCases: 198
TotalCases: 2127953
States: Uttar Pradesh
Population: 199812341

ActiveCases: 2013
TotalCases: 6824839
States: Kerala
Population: 61095297

Cases v/s Total Deaths, the population of Uttar Pradesh is more than the population of the Kerala, but total cases, total deaths, and active cases in the Kerala are more than in Uttar Pradesh. while the population of Punjab less than population of Uttar Pradesh and the total cases, total deaths and active cases are also less than in Punjab. So again, we observe that the population may not have a significant role in the spread of COVID.

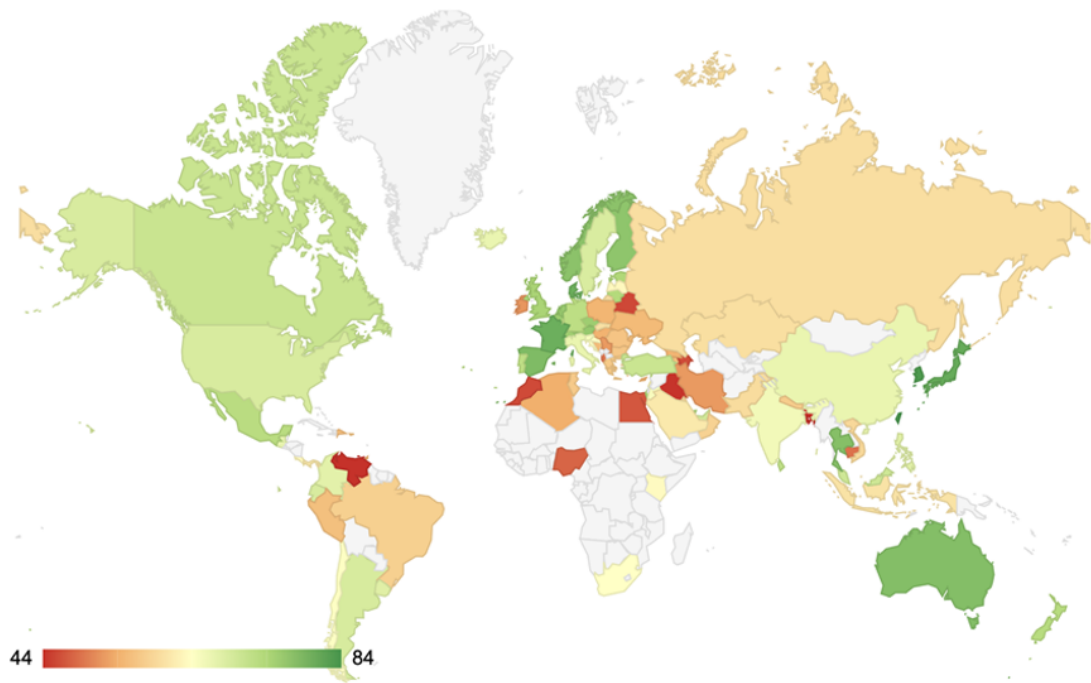**2. Did health care facilities available, play a role in the recovery rate?**
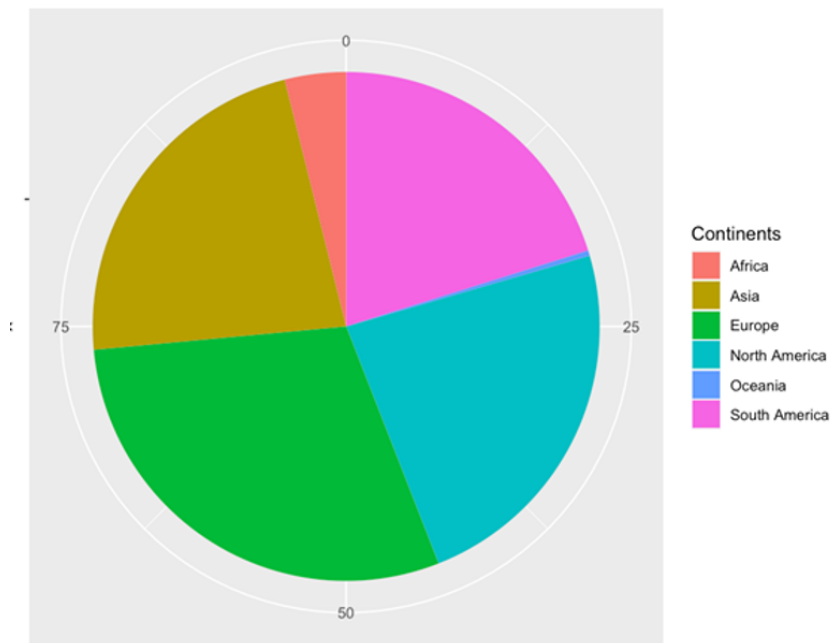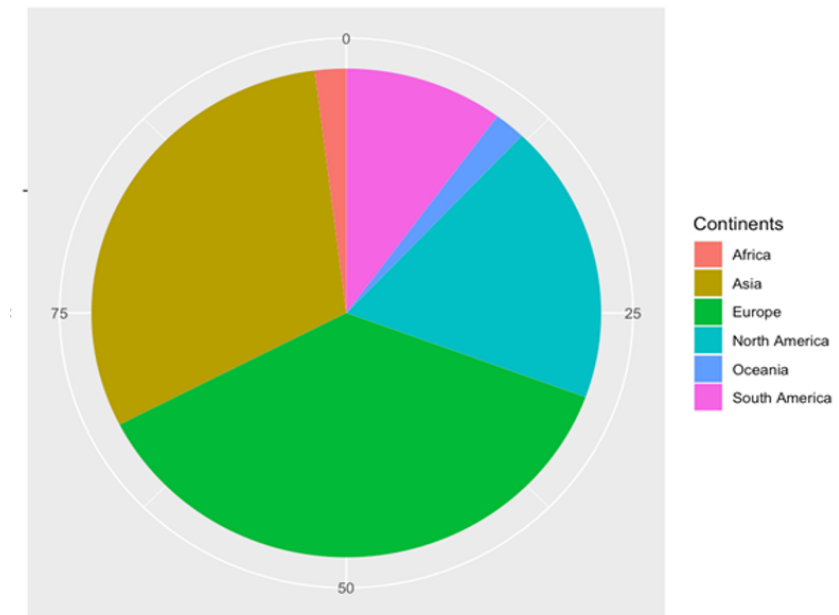

Chart: Health Care Index

In the above chart, red-coloured area indicate very poor health care facilities, while the dark green-coloured area indicate very good health care facilities available in the country.

From the Health care facility chart, we see that majority of South America seem to have overall poor healthcare facilities. Looking at the pie charts, total deaths share a more proportion than total cases. Hence, there is a correlation between the health care facilities in the country and the rate of death/recovery.

3. How were the GDP rates affected by the pandemic? Did any of the countries make a comeback?

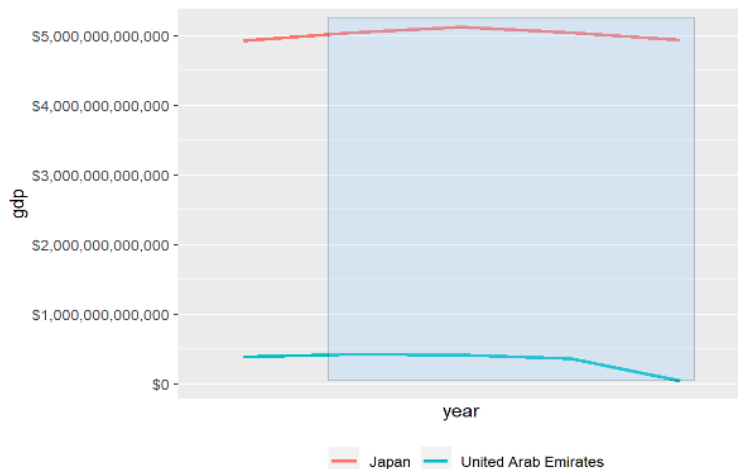| Country	year	gdp
Brazil	2019.00	1873288158977.23
Brazil	2020.00	1448565936739.56
Brazil	2021.00	1608981220812.20
China	2019.00	14279937500608.00
China	2020.00	14687673892882.00
China	2021.00	17734062645371.40
India	2019.00	2831552222519.99
India	2020.00	2667687951796.56
India	2021.00	3173397590816.91
Pakistan	2019.00	320909489229.72
Pakistan	2020.00	300306331697.67
Pakistan	2021.00	346343170486.07
United States	2019.00	21372572437000.00
United States	2020.00	20893743833000.00

Observation:

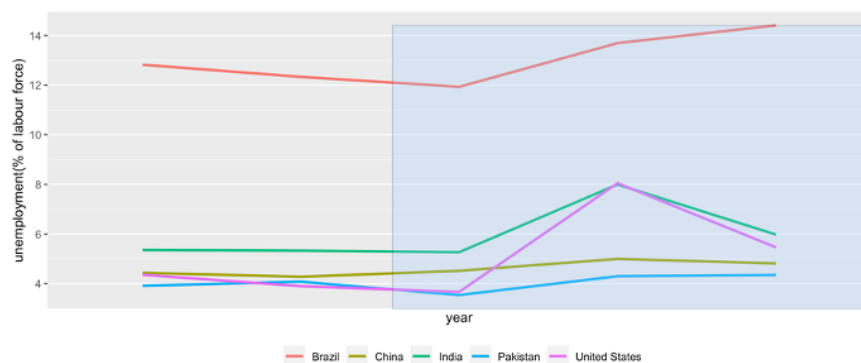The different color lines show the GDP trend of the different countries, most of the countries experienced a GDP drop during the COVID period (in 2020), and many of them did make a comeback, i.e., their GDP increased in the year 2021 but the rate of increase in GDP reduced. The above graph shows that Brazil, China, India, Pakistan, and United States experienced a drop in GDP during 2020, then it increased in 2021.

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Country	year	gdp
United Arab Emirates	2018.00	422215043584.97
United Arab Emirates	2019.00	417215559513.36
United Arab Emirates	2020.00	358868765174.92
Japan	2018.00	5037835383110.97
Japan	2019.00	5123318151510.62
Japan	2020.00	5040107754084.11
Japan	2021.00	4937421880461.55

Some countries didn't make a come back, i.e., their GDP falls during the COVID period (during 2020) and also decreases in 2021. In the above graph showm, Japan's and the United Arab Emirates (UAE)'s GDP decreased during the year 2020 and so in the year 2021 but the rate of decreasing reduces.
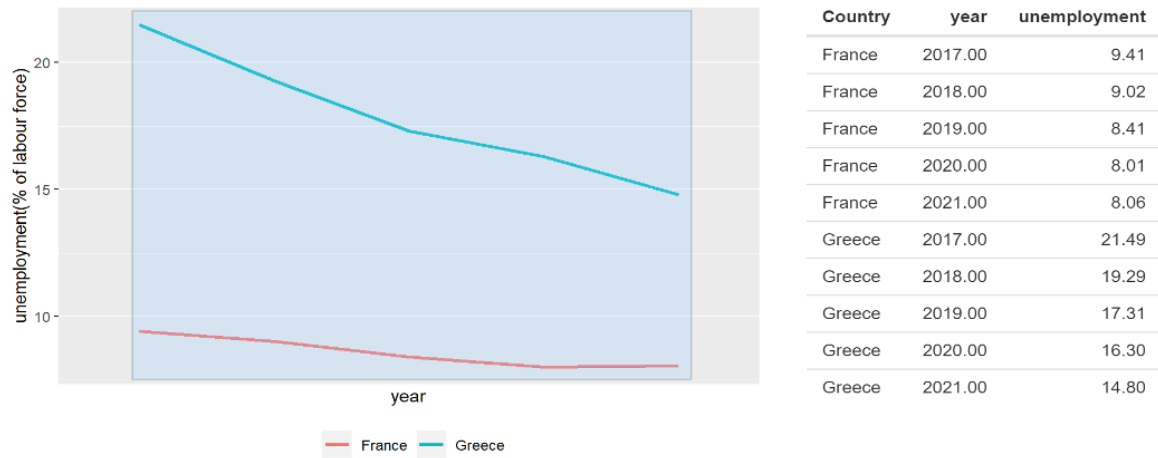
4. Did the unemployment rate increase for every country during the COVID-19 period?

Country	year	unemployment
Brazil	2019.00	11.93
Brazil	2020.00	13.69
Brazil	2021.00	14.40
China	2019.00	4.52
China	2020.00	5.00
China	2021.00	4.82
India	2019.00	5.27
India	2020.00	8.00
India	2021.00	5.98
Pakistan	2019.00	3.54
Pakistan	2020.00	4.30
Pakistan	2021.00	4.35
United States	2019.00	3.67
United States	2020.00	8.05
United States	2021.00	5.46

Observation:

The different color lines show the rate of unemployment trend of the different countries, most of the countries experienced a increase in the rate of unemployment during the COVID period (in 2020), and the rate of unemployment decreases in the year 2021. as the above graph shows

that Brazil, China, India, Pakistan, and United States experience a increase in the rate of unemployment in 2020, then it decreases in 2021.

<table>
<tr><th>Country</th><th>year</th><th>unemployment</th></tr>
<tr><td>France</td><td>2017.00</td><td>9.41</td></tr>
<tr><td>France</td><td>2018.00</td><td>9.02</td></tr>
<tr><td>France</td><td>2019.00</td><td>8.41</td></tr>
<tr><td>France</td><td>2020.00</td><td>8.01</td></tr>
<tr><td>France</td><td>2021.00</td><td>8.06</td></tr>
<tr><td>Greece</td><td>2017.00</td><td>21.49</td></tr>
<tr><td>Greece</td><td>2018.00</td><td>19.29</td></tr>
<tr><td>Greece</td><td>2019.00</td><td>17.31</td></tr>
<tr><td>Greece</td><td>2020.00</td><td>16.30</td></tr>
<tr><td>Greece</td><td>2021.00</td><td>14.80</td></tr>
</table>

Some countries experienced a fall in unemployment rate before COVID period (in 2017, 2018, 2019), during the COVID period (in 2020), and after the COVID period (in 2021). As one can easily analyze from the above graph, Greece's unemployment rate decreased from the year (2017 - 2021). For France, the unemployment rate decreased from the year (2017-2021). The graph also shows that there was more unemployment in Greece than in France during (2017-2021).

5. How was the tourism trend affected due to lockdown?

- India is estimated to contribute 250 bn $ GDP from Tourism, 137 mn jobs in the Tourism sector, 56 bn $ in Foreign Exchange Earnings and 25 mn foreign arrivals are expected to be achieved by 2030.
- India is currently ranked 54th in World Economic Forum's Travel & Tourism Development Index (2021).
- Due to restriction related to COVID-19, The number of Foreign Tourist Arrivals (FTAs) in India during 2021 decreased to 1.52 million as compared to 2.74 million in 2020, registering a negative growth of 44.5%.
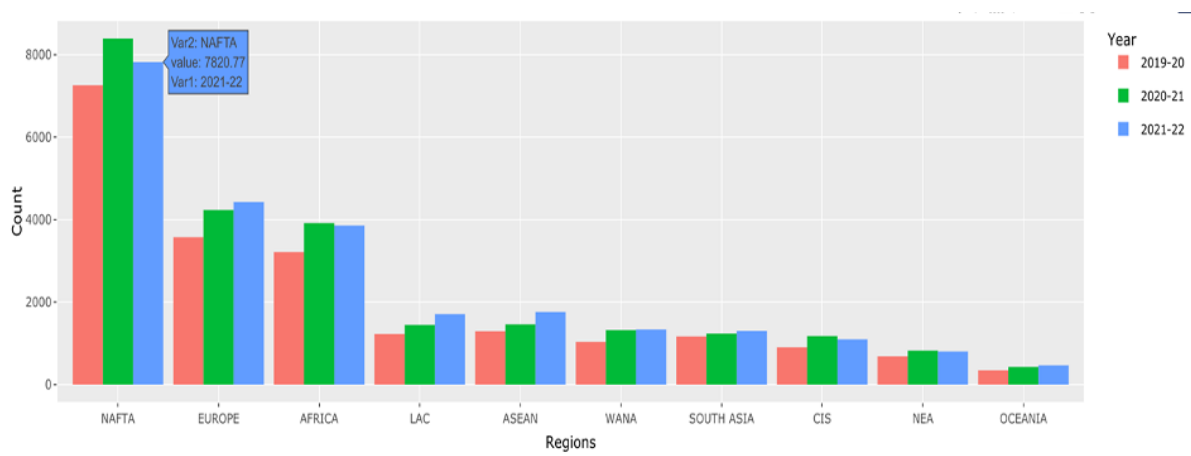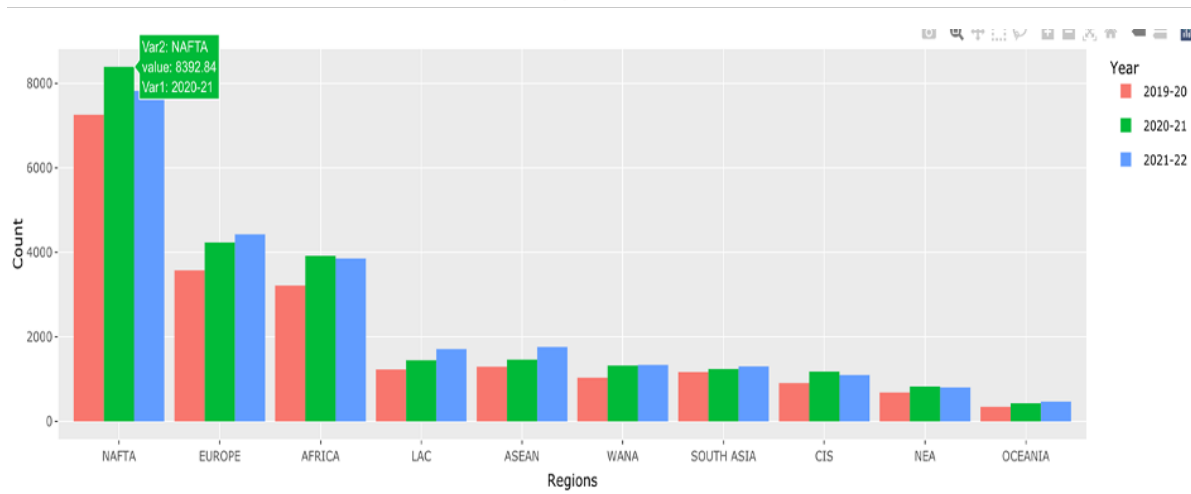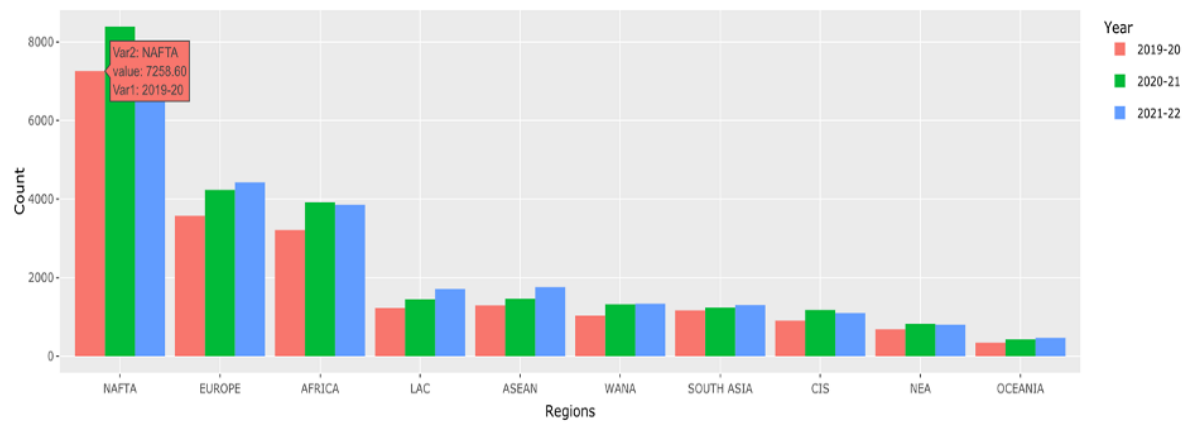
Observation:

As we can see from the graph, before the year 2020, graph line is above the line of no. of tourist arrivals during and after 2020. When we scroll over the line of the graph, we can observe about the no. of tourist arrivals in a particular month as in December 2019. Tourist arrivals were the least in the month of April 2020.

6. Did India's pharmaceutical exports experience growth?

- The total annual turnover of the industry was US$ 36.7 billion in 2019-20. India majorly exports drug formulations & biologicals, and these products contribute to about 75% of the total pharmaceuticals exports out of India.
- India's share of pharmaceuticals and drugs in the global market is 5.92%.
- During 2021-22, the country exported pharma products worth US$ 24.62 billion, flat over the previous year. In 2020-21, the exports were worth US$ 24.4 billion.
- The USA, the UK, South Africa, Russia, and Nigeria are India's top five export destinations.
- India played a key role during the Covid-19 pandemic and demonstrated its ability to be a consistent and reliable pharma supplier to the world even during time of crisis.

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- The country is the biggest vaccine exporter, about 65-70% of the World Health Organization (WHO) vaccine requirements are sourced from India.

Observation:

The different color bars in the cluster bar graph show the exports of pharmaceuticals (in million $) from India to the different regions of the world (during 2019-20, 2020-21, 2021-22). The red color bar shows the exports during the year 2019-20, The green color bar shows the exports during the year 2020-21, The blue color bar shows the exports during the year 2021-22. Pharmaceutical exports from India increases in every region, from the year 2019 to 2021.

About Shiny App :

The R Shiny app has five different tabs :

1. **COVID Cases:** The sidebar panel of the COVID cases tab consists of three different categories: WORLD, USA, and INDIA for selection . as the user selects the category the following graphs are shown; bubble plot and pie chart corresponding to different variables.
2. **GDP:** The row panels of the GDP tab consist of select countries, select years, and plots for plotting the corresponding multiple-line graph, and when the user selects a particular area over the graph a data frame of the corresponding data shown on the right side.
3. **Unemployment:** The row panels of the unemployment tab consist of select countries, select years, and plots for plotting the corresponding multiple-line graph, when the user selects a particular area over the graph a data frame of the corresponding data is shown on the right side.
4. **Tourism:** The Tourism tab shows the line graph of no.of tourists arriving in the month of year 2019, 2020, 2021.
5. **Pharmaceuticals:** The Pharmaceutical tab shows the clustered bar graph of pharmaceutical exports from India in the year 2019,2020,2021.

Users can choose from various tabs and the corresponding graphs see the effect of COVID on different sectors.

CONCLUSION :

1. There was no significant role of population in the spread of COVID.
2. There was a drop in GDP during COVID for most of the countries but later most of them made a comeback.
3. During COVID, the unemployment rate increased, and after COVID, it decreased for most countries. But in some countries, unemployment rate decreased after COVID also.
4. Tourism was affected badly due to COVID in the year 2020.
5. There was a rise in pharmaceuticals exports from India to different regions in the world.

References:

1. **COVID cases:**https://www.worldometers.info/coronavirus/
2. **GDP:**https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2010&most_recent_value_desc=false&start=1961
3. **Unemployment:**https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS
4. **Tourism:**https://tourism.gov.in/annual-reports/india-tourism-statistics-2022
5. **Pharmaceutical:**https://commerce.gov.in/about-us/divisions/export-products-division/export-products-pharmaceuticals/