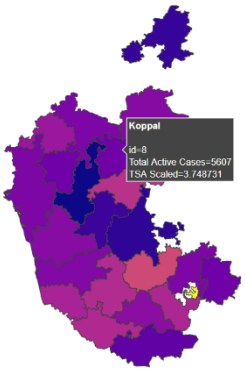
COVID19 in Karnataka

Objectives of this project include:

- Predicting the next possible Covid19 hotspots in Karnataka
- Understanding vulnerability of various populations
- Developing an application/website for dynamic projection of infection trend

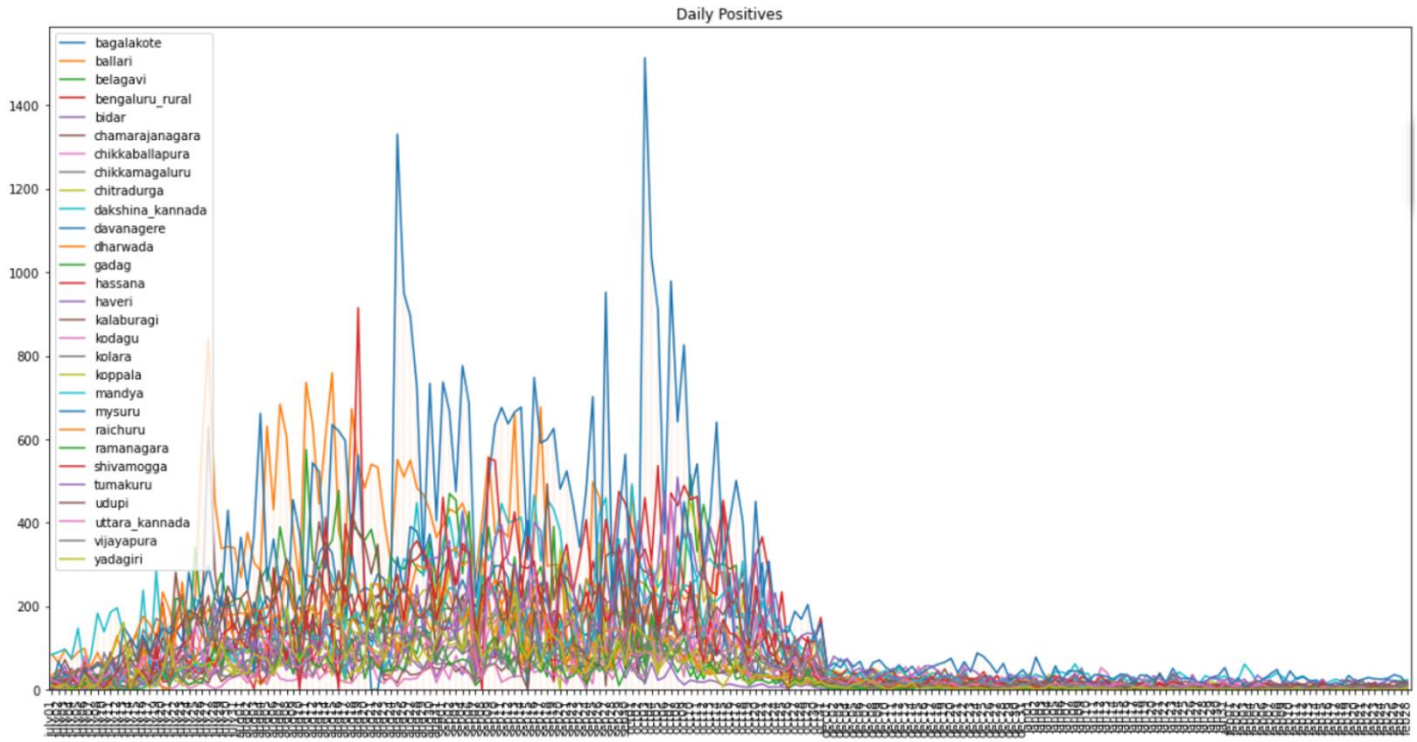
Desired output: AI based district level infection projection model for the state of Karnataka.



Initial Exploratory Data Analysis

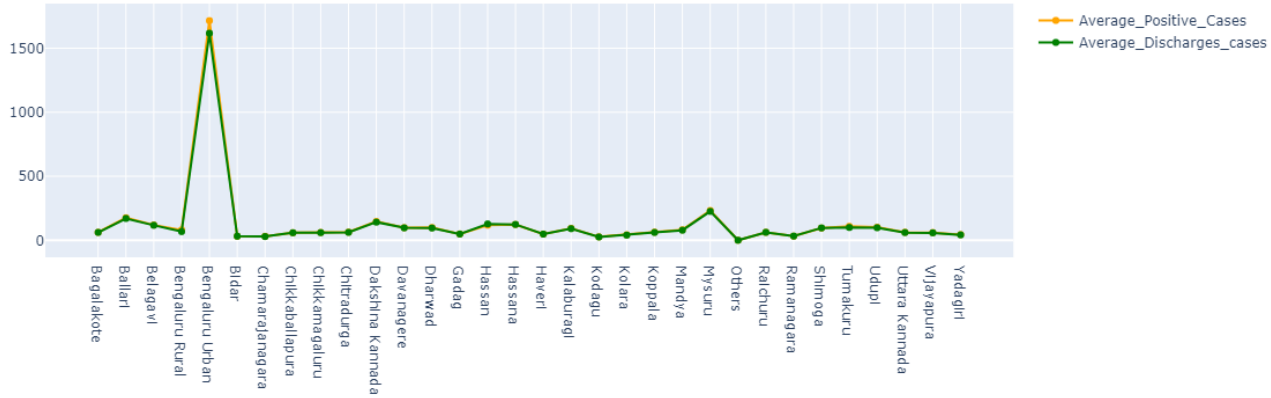
Wave: 01

The following graph plots the number of daily positive cases from July 1, 2020 to February 28, 2021. The first COVID-19 wave seems to have concluded during October 2020 and lasted for about 4 months.

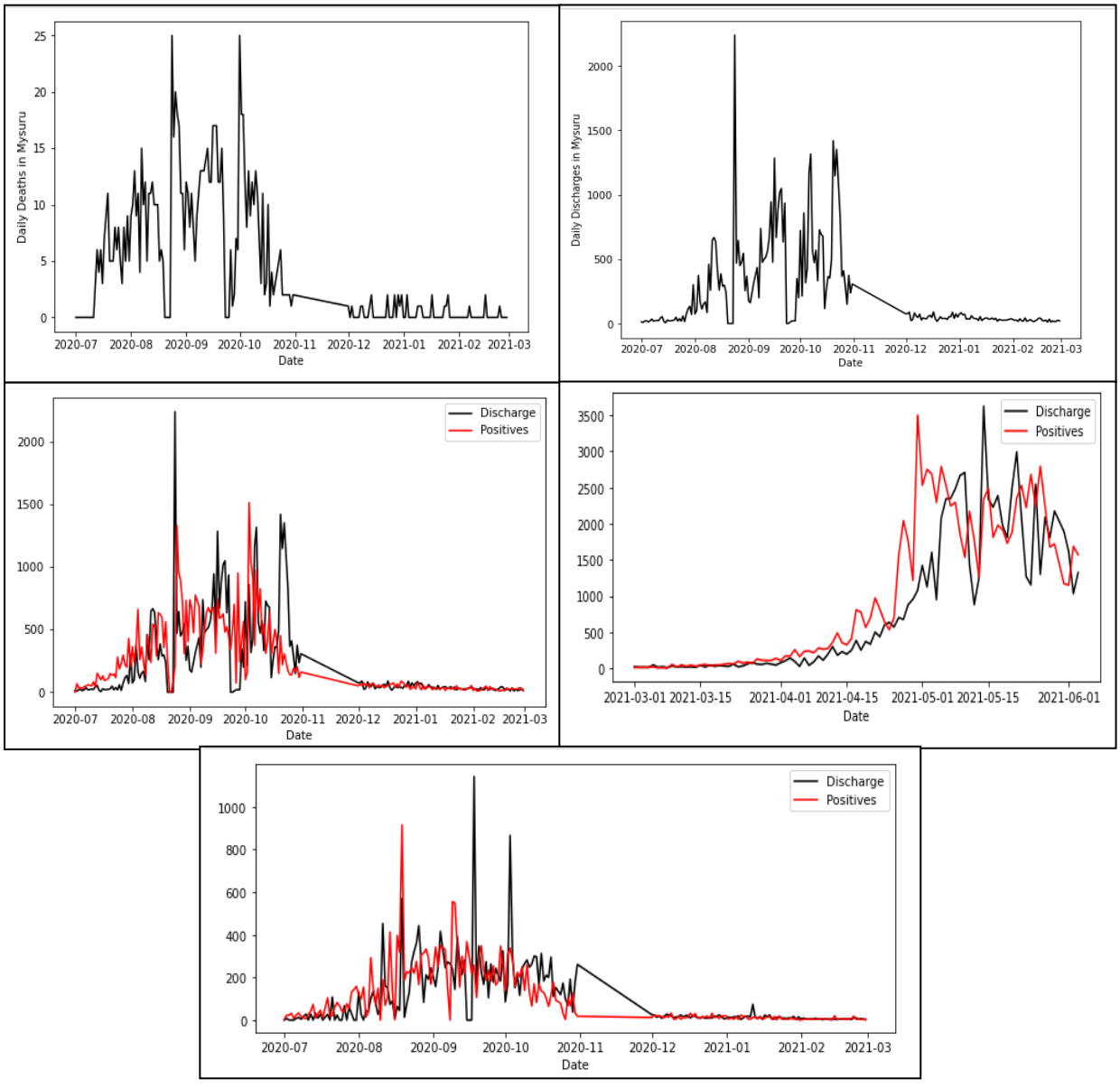


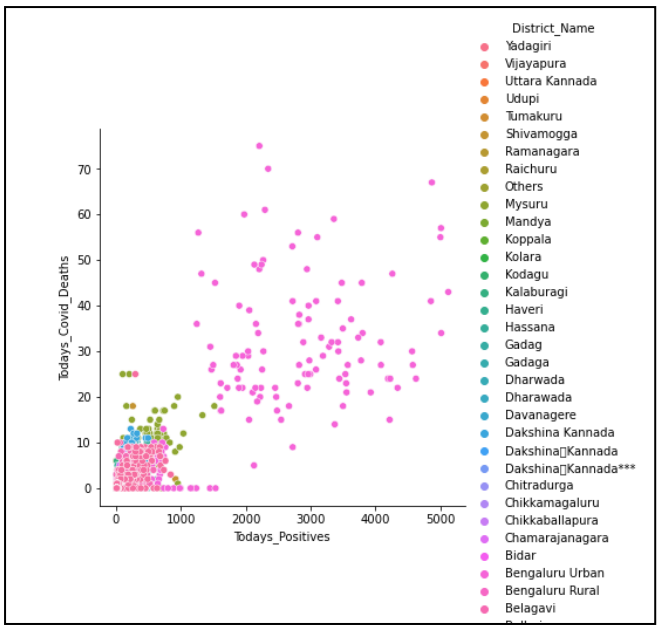
- The above graph records all districts other than Bengaluru Urban. Among all districts Bengaluru Urban has the highest population with over 96 lakh residents. It is also the smallest (in terms of area), and hence also has the highest population density.
- According to the latest (2011) census, all districts other than Bengaluru Urban are primarily rural. Bengaluru Urban is hence an exception with over 90% of the population being urban.

- Even after adjusting absolute covid numbers for the population, we see that Bengaluru is the worst performer. This can be attributed to both the high population density as well as urbanization.

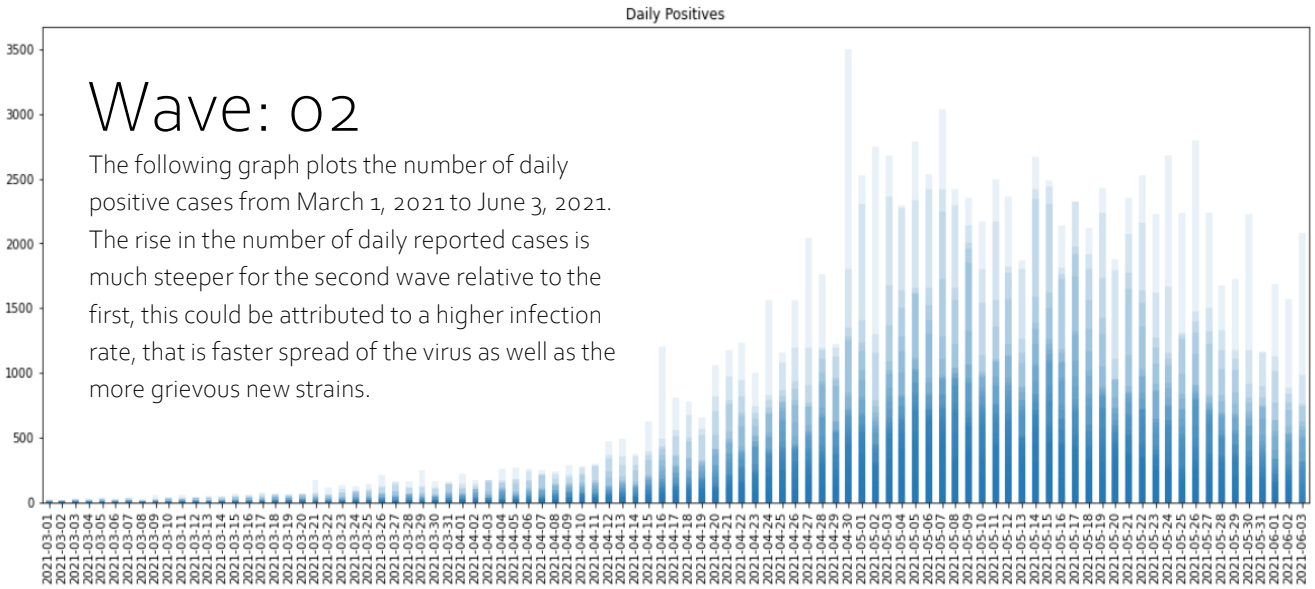


Visualizations: Absolute numbers for Mysuru





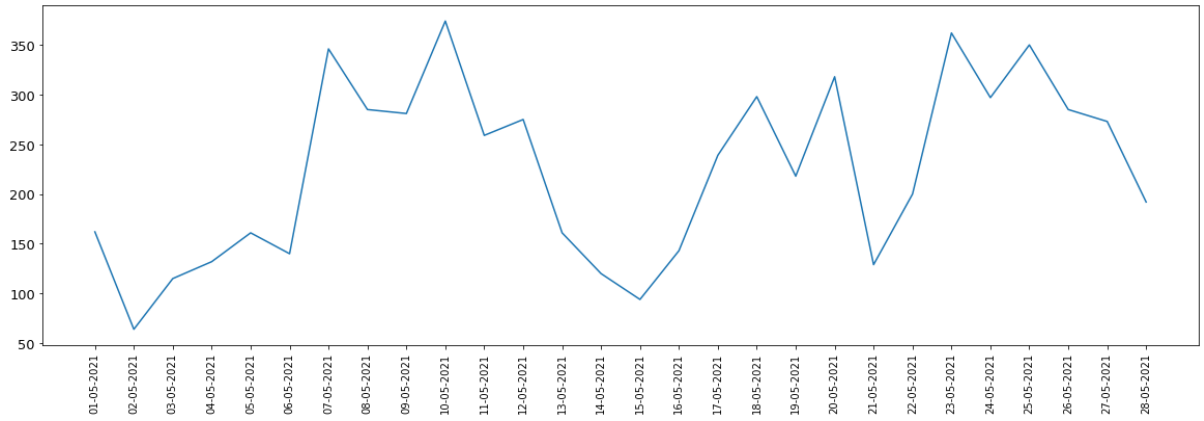
The scatter plot to the left portrays the large numbers for Bengaluru and the relationship between daily positives as well as daily deaths.



Bengaluru as of May 2021

This section documents the analysis of data containing information regarding the deaths in the state. The rows depict the individuals who passed away while the columns include the district they were in, their age and gender, symptoms, place of death, etc. Here, we have focused on the deaths in the Bengaluru Urban district for May 2021.

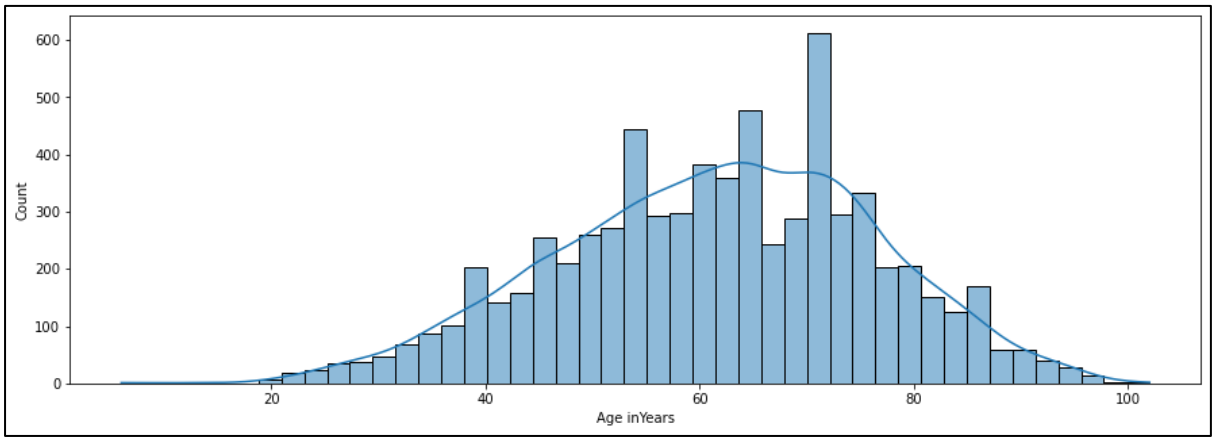
Daily deaths due to Covid

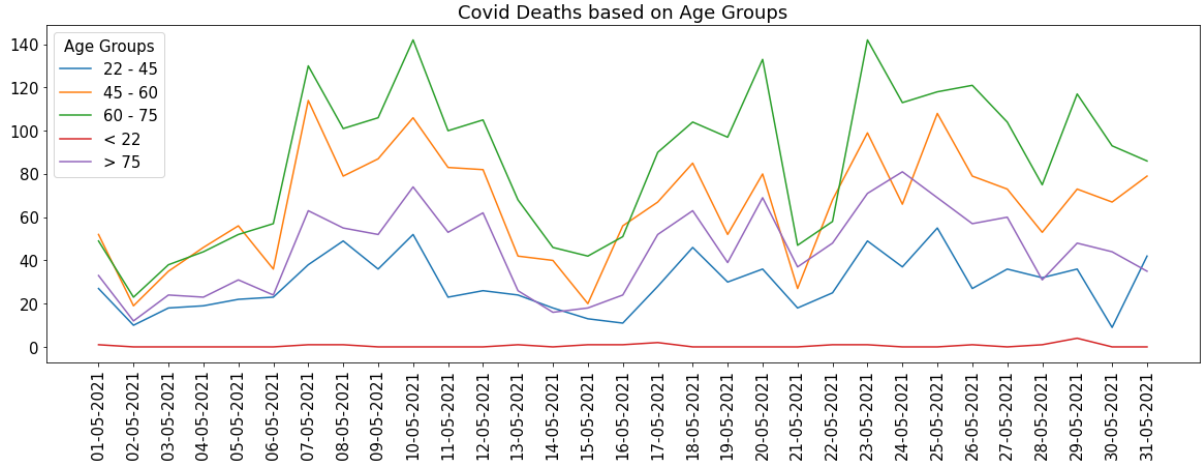


- The number of daily deaths peaks on 10th May with a close second on 23rd. Since this is just one month, not much information can be gained with regards to trends and such but we do notice a lot of variation with a series of peaks and troughs.

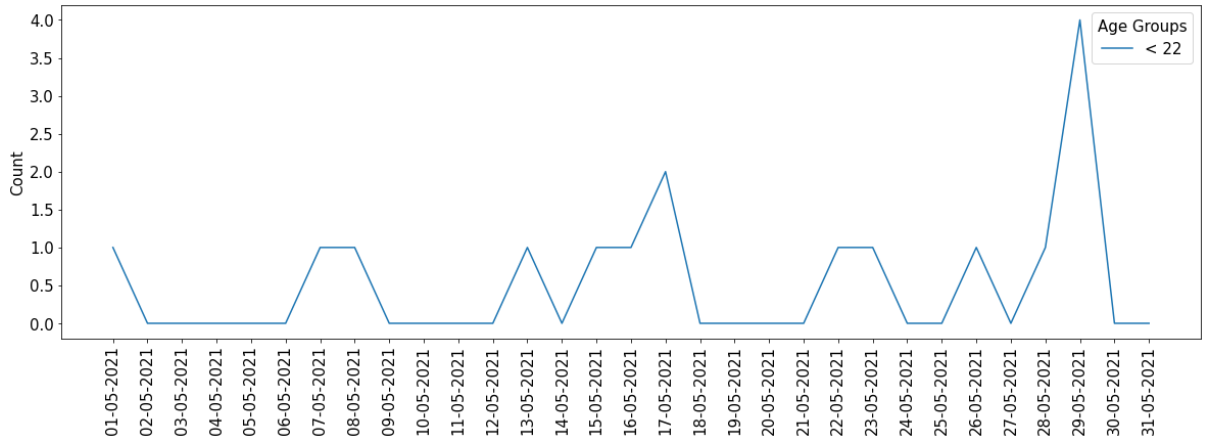
We now move on to trying to better understand the variables at play. Starting with univariate plots we have:

AGE:





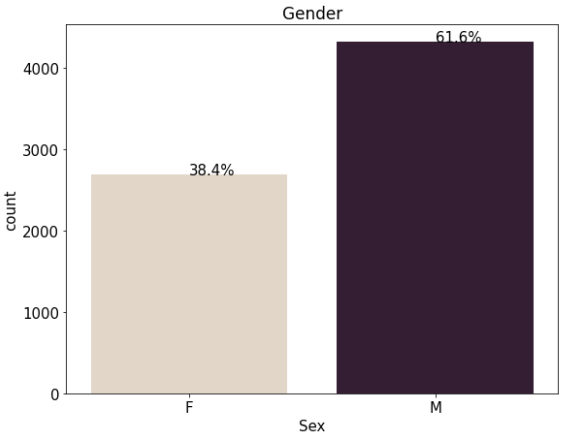
- **Majority of the people who suffered and died from Covid-19 belong to the age gap 60-75.**



- **We can see that there were at most 4 deaths per day among the people of age group below 22.**

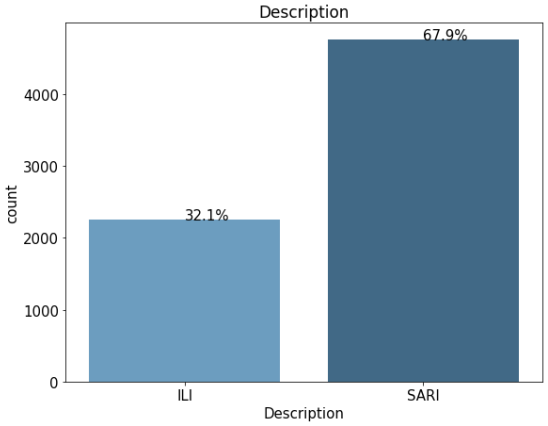
Gender:

- With respect to the first graph, we see that it is the males who are leading by a percentage of 61.6 when compared to the females who attained the percentage of 38.4. It is quite evident that the admission and death rate of males is greater than females.

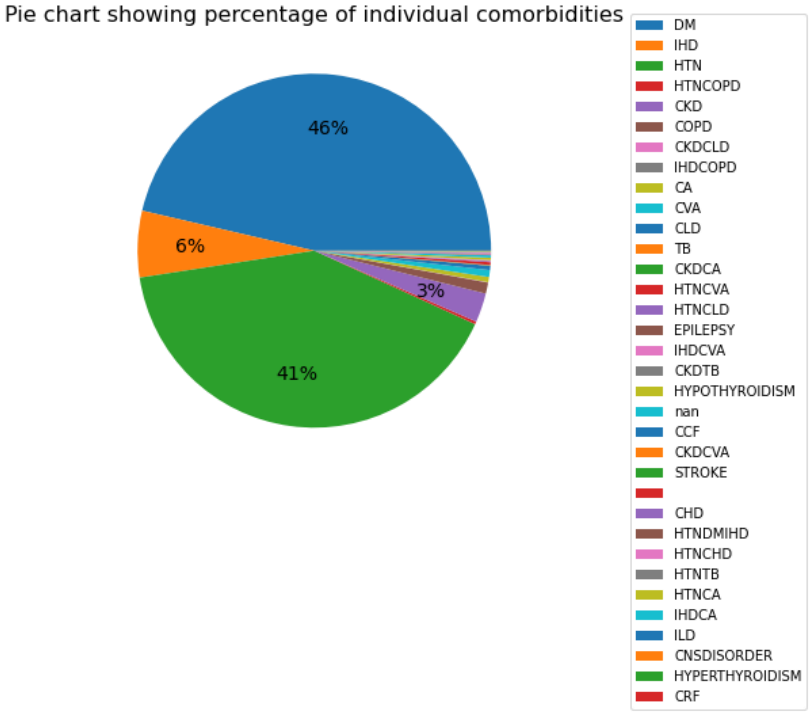


Description:

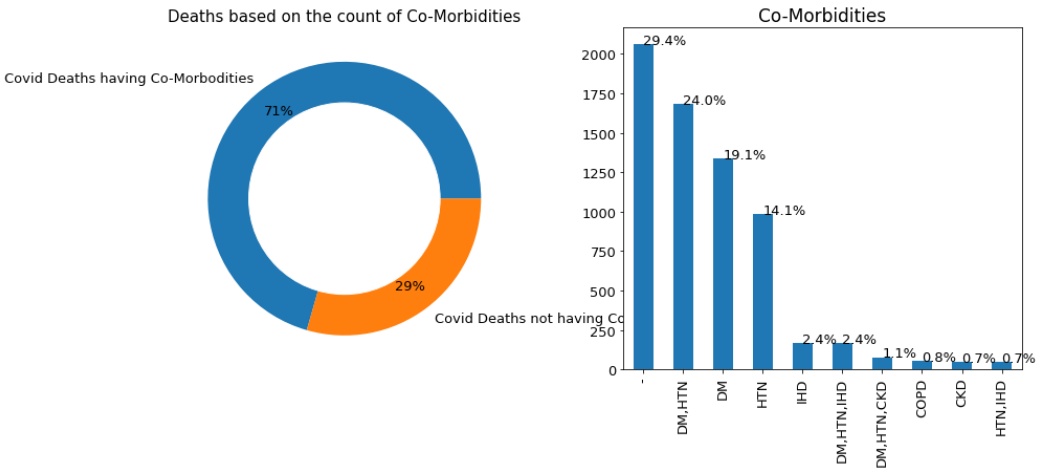
- Here SARI which indicates Severe Acute Respiratory Illness is seen in about 67.9% of people while ILI which stands for Influenza Like Illness is seen 32.1% of the people. This indicates that severe respiratory problems were experienced by majority of the people who suffered from Covid 19



Comorbidities:

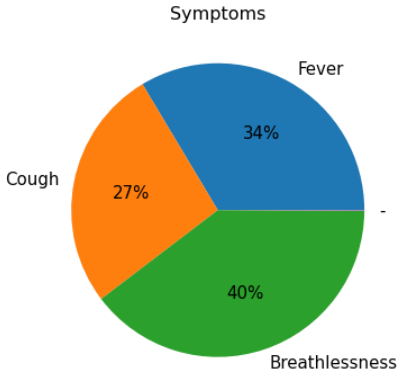


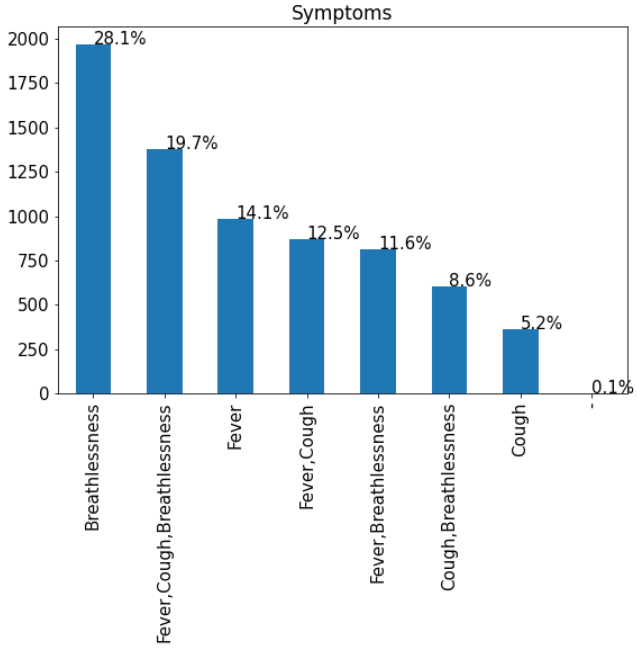
- Among the people who died, 46% of them were suffering from Diabetes Mellitus, while 41% of them were suffering from Hyper Tension followed by 6% with ischemic heart disease and 3% with chronic kidney disease. And there were a number of other comorbidities whose percentage was less than 1.



- It's interesting to note that among the people who died due to covid-19, 29% did not have any pre-existing health issues.
- Among the 69% with comorbidities, 55.6% were suffering from either Diabetes Mellitus, Hypertension or both.

Symptoms:





- Among the major symptoms observed in the patients, breathlessness occupies 40% while fever is seen in 34% of people followed by Cough with 26%. But its also interesting to note that patients did not experience only one kind of symptom but a combination of them. Among which 18.2% suffered from a combination of fever, cough, breathlessness. There were 28.1% of patients who suffered only from breathlessness, 14.3% from fever only, and the rest had a combination of either symptom.
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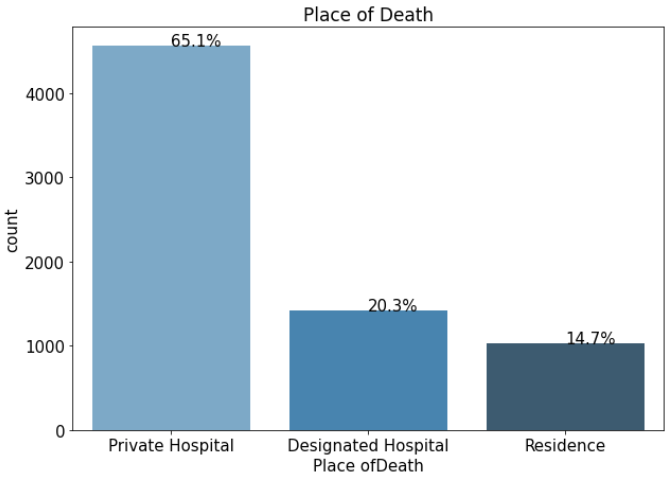
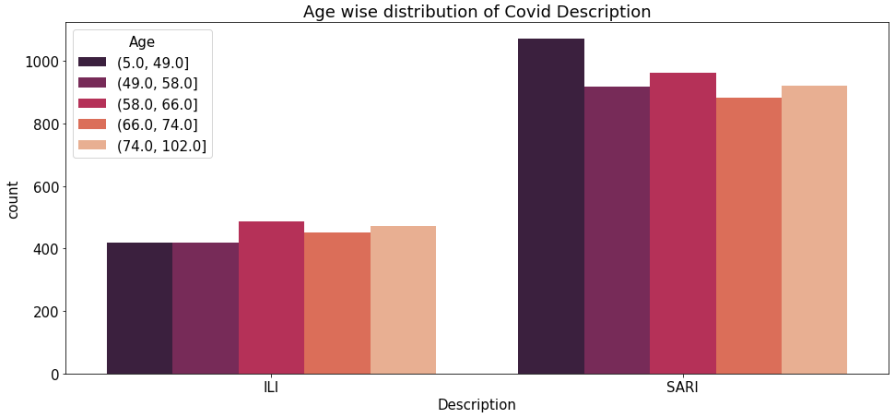
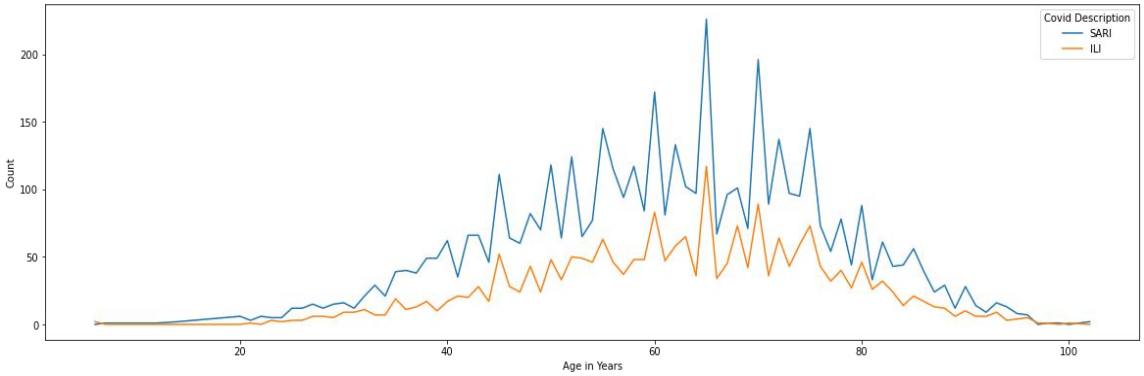
Place of Death:

- Nearly 65% of people died in Private hospitals. And 14.7% of the people died at their residence



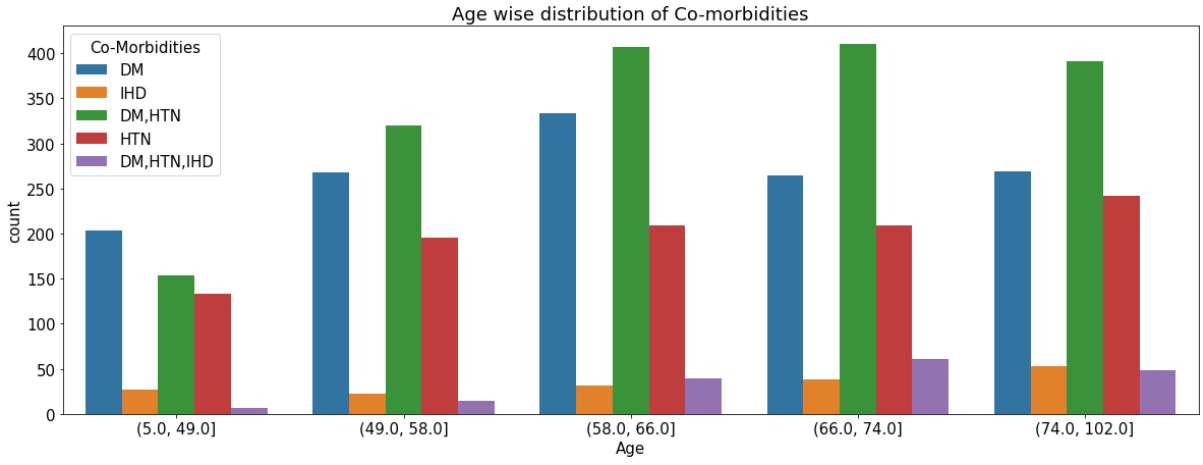
AGE vs DESCRIPTION:

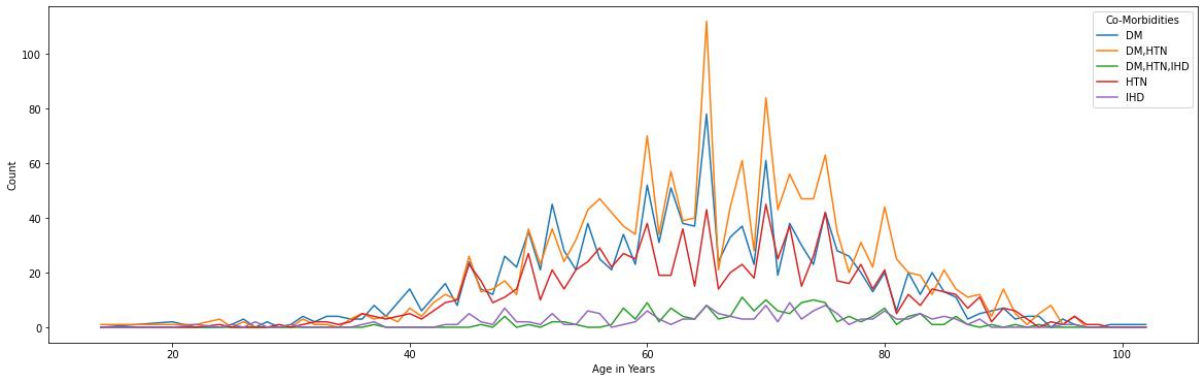




- Among the people who suffered from Influenza like illness majority of them were from age group 58-75.
- And among the people who suffered from Severe Acute Respiratory Illness majority of them were from age group 5-49.

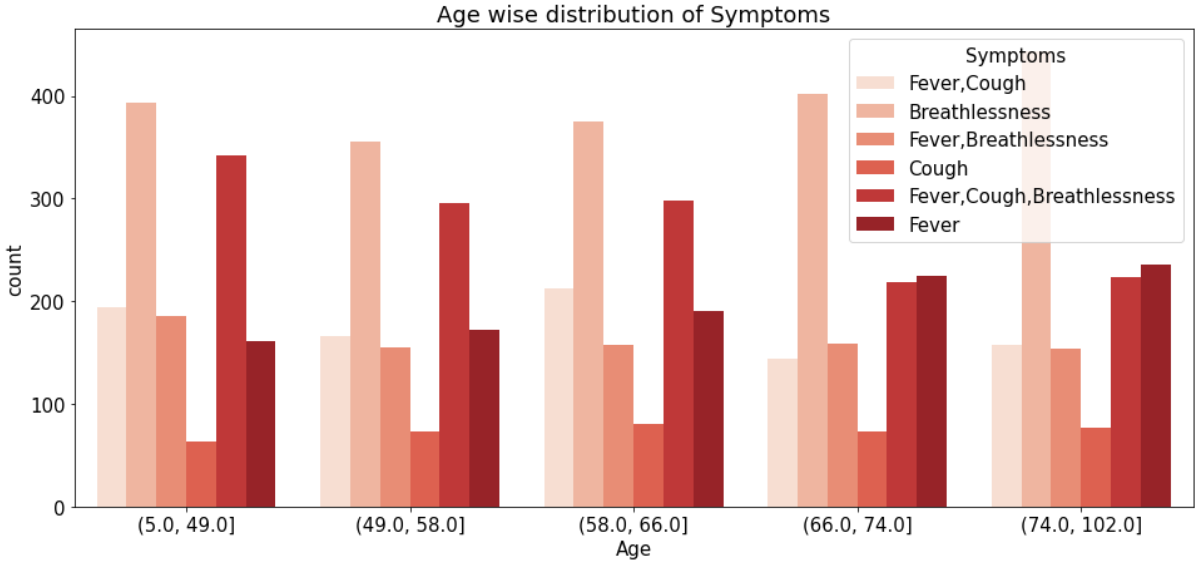
AGE vs Common COMORBIDITIES

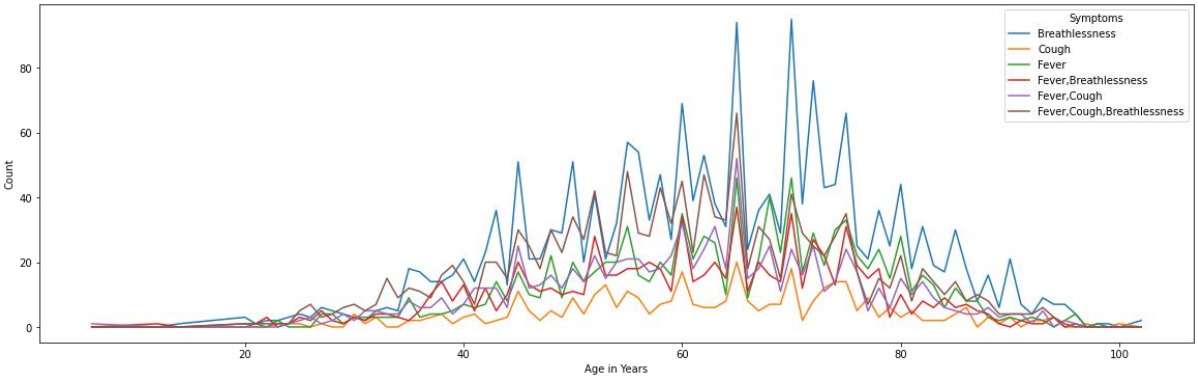




- We see that majority of people who suffered due to covid 19 belonged to age grp 60-75 and they had a pre-existing health of both Diabetes Mellitus and Hyper Tension.
- It is notable that patients below 49 years did not have as many comorbidities as others, but it was Diabetes Mellitus which was leading among them.

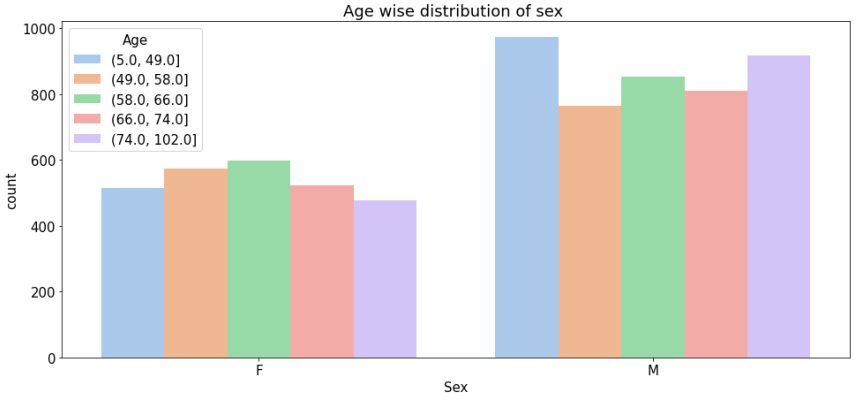
AGE vs Common SYMPTOMS





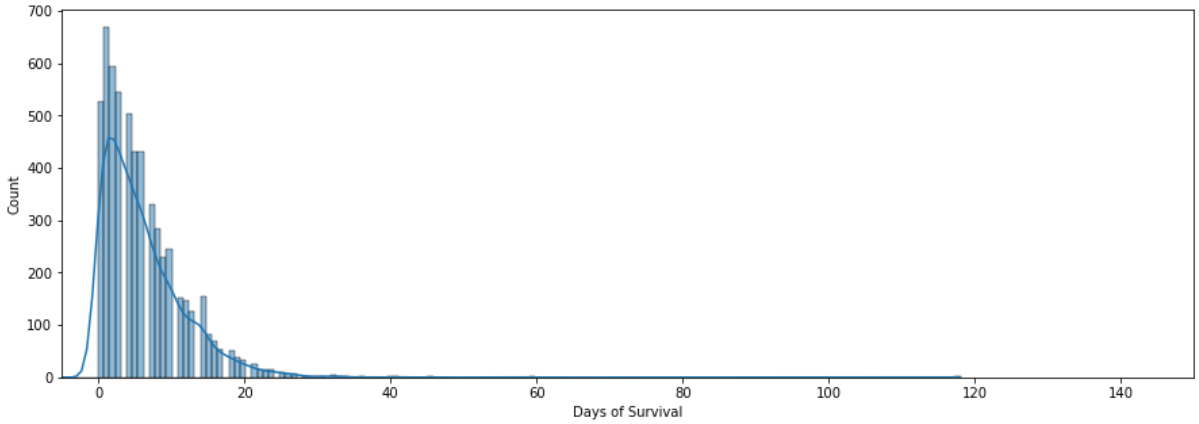
- We see that in general irrespective of which age group one belonged to, they had only Breathlessness as a common and a leading symptom.
- People above 66 years majorly had either breathlessness or fever as a leading factor of symptoms. While people below 66 years did have a number of indicators which includes a combination of fever, cough, breathlessness.

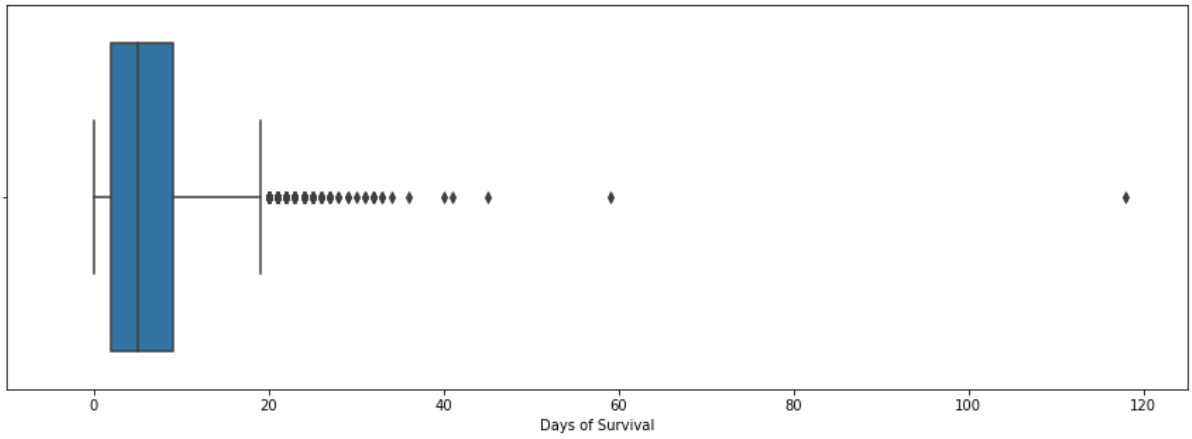
AGE vs GENDER



- We see that among the males who are leading, majority of them who have succumbed to death due to covid are below 49 years of age. While minority of them who have succumbed to death are in the age of 49-58
- Among the females which is a minority compared to males, it is majorly women within the age 66-75 who have succumbed to death

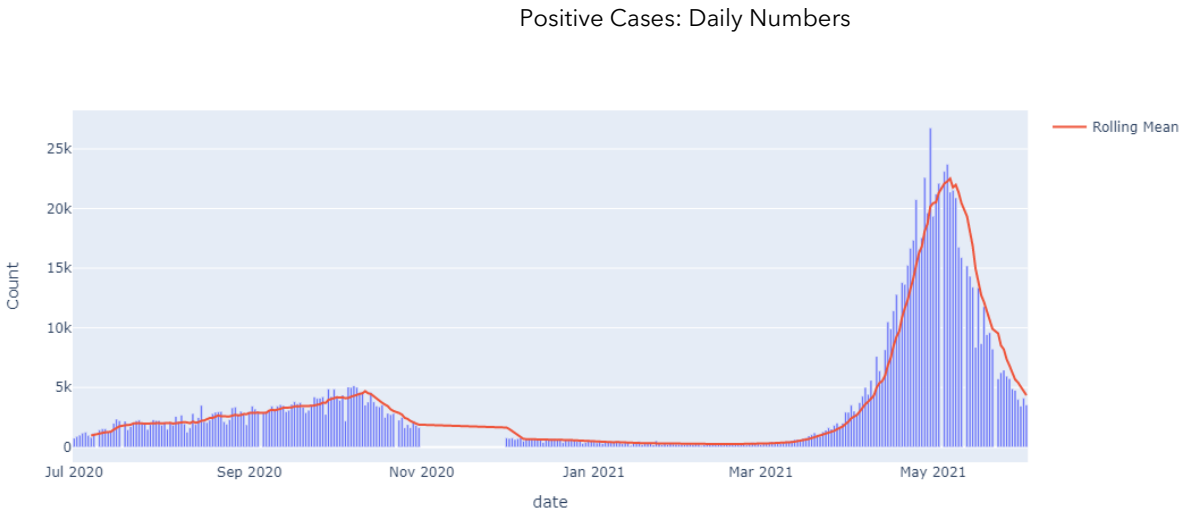
As additional analysis, we calculated the no of days of survival which was obtained by subtracting the date of admission from the date of death.

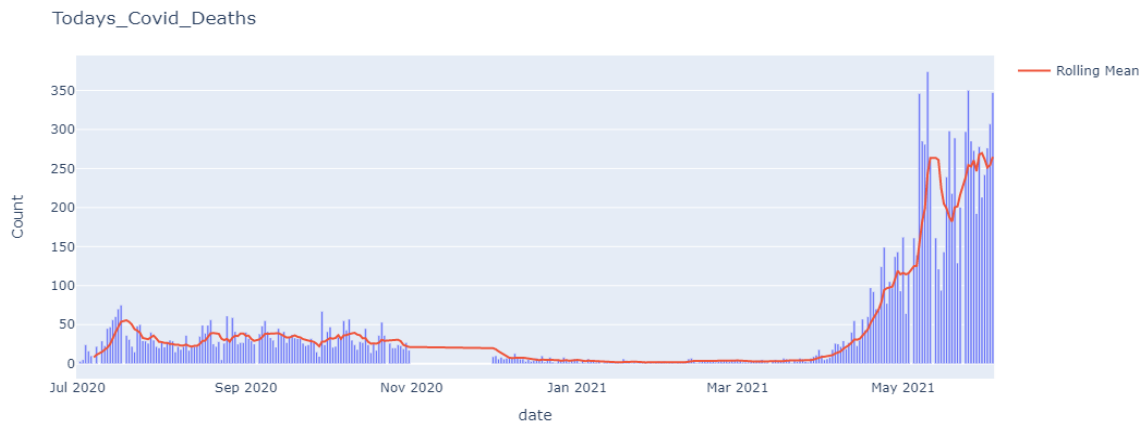




- Among the people who died at the hospital, most of them stayed in the hospital for at most 20 days after the admission. And majority of the people survived less than 10 days.

Wave 1 and Wave 2 comparative analysis: Bengaluru Urban





- While the relative severity of the second wave is clearly portrayed, we notice certain interesting patterns. While the first wave was spread across over three months, and peaked within two, the second wave seems to have peaked within less than a month and cases are seeing a consistent decline since the latter half of the month of May.
- Not only did the number of daily cases increase rapidly, the disease has been much more severe with a similar increase in deaths, hence the reference- 'tsunami'.
- Although the second wave seems to be residing, we are still waiting for the mortality numbers to decline.

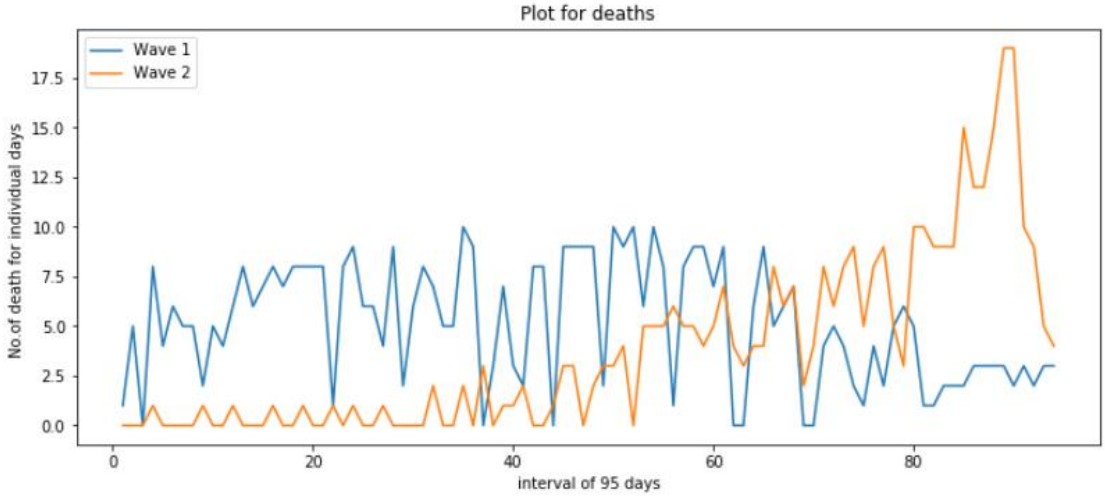
	July'20	Aug'20	Sep'20	Oct'20	Dec'20	Jan'21	Feb'21	March'21	April'21	May'21	pop	density
belagavi	0.000469	0.000654	0.000484	0.000110	0.000040	0.000023	0.000022	0.000044	0.000689	0.002480	4779661	84.149000
uttara_kannada	0.000543	0.000828	0.001719	0.000564	0.000051	0.000045	0.000017	0.000109	0.001749	0.003414	1437169	130.332000
kodagu	0.000215	0.000471	0.000965	0.000373	0.000179	0.000137	0.000099	0.000119	0.007253	0.004067	554519	135.183000
chikkamagaluru	0.000478	0.001071	0.001463	0.000439	0.000105	0.000037	0.000017	0.000120	0.002545	0.005012	1137961	158.028000
chitradurga	0.000277	0.000723	0.000849	0.000367	0.000096	0.000101	0.000045	0.000040	0.000705	0.004236	1659456	196.618000
chamarajanagara	0.000257	0.000520	0.000853	0.000227	0.000078	0.000023	0.000017	0.000033	0.002641	0.002997	1020791	200.116000
shivamogga	0.000640	0.001569	0.001788	0.000383	0.000118	0.000037	0.000036	0.000110	0.002074	0.003502	1752753	206.766000
vijayapura	0.000365	0.000341	0.000321	0.000242	0.000033	0.000007	0.000026	0.000092	0.001418	0.000894	2177331	207.483000
yadagiri	0.000395	0.001021	0.000617	0.000197	0.000022	0.000013	0.000010	0.000061	0.002071	0.001553	1174271	222.695000
gadag	0.000807	0.001434	0.000547	0.000197	0.000018	0.000010	0.000008	0.000085	0.000759	0.002377	1064570	228.645000
kalaburagi	0.000979	0.000773	0.001067	0.000193	0.000076	0.000073	0.000065	0.000469	0.003502	0.000696	2566326	234.346000
koppala	0.000334	0.001272	0.001348	0.000221	0.000048	0.000005	0.000006	0.000075	0.002275	0.002150	1389920	249.761000
tumakuru	0.000408	0.000675	0.001305	0.000600	0.000128	0.000107	0.000093	0.000249	0.005132	0.004464	2678980	252.806000
hassana	0.000671	0.001442	0.001991	0.000673	0.000129	0.000049	0.000049	0.000253	0.003855	0.008124	1776421	260.702000
chikkaballapura	0.000522	0.000614	0.001347	0.000268	0.000177	0.000058	0.000017	0.000069	0.003832	0.003160	1255104	277.432000
raichuru	0.000462	0.000733	0.000750	0.000153	0.000032	0.000009	0.000006	0.000063	0.003097	0.002371	1928812	282.527000
bagalakote	0.000437	0.000400	0.000448	0.000093	0.000015	0.000006	0.000004	0.000034	0.001074	0.000974	1889752	287.415000
ballari	0.001476	0.002082	0.000911	0.000438	0.000075	0.000017	0.000027	0.000141	0.003886	0.003678	2452595	290.248000
udupi	0.001612	0.002143	0.001723	0.000627	0.000064	0.000037	0.000061	0.000558	0.002452	0.004427	1177361	303.444000
ramanagara	0.000670	0.000773	0.000561	0.000214	0.000032	0.000006	0.000006	0.000043	0.001963	0.001842	1082636	304.453000
bidar	0.000386	0.000330	0.000287	0.000036	0.000024	0.000015	0.000028	0.000565	0.002037	0.000203	1703300	312.647000
davanagere	0.000437	0.001179	0.001544	0.000344	0.000058	0.000039	0.000012	0.000030	0.001078	0.002217	1945497	328.409000
haveri	0.000259	0.000762	0.001132	0.000158	0.000010	0.000006	0.000004	0.000009	0.000410	0.001010	1597668	331.260000
kolara	0.000527	0.000473	0.000756	0.000318	0.000081	0.000029	0.000026	0.000113	0.002590	0.004471	1536401	374.549000
dharwada	0.001208	0.001265	0.001374	0.000294	0.000058	0.000032	0.000025	0.000178	0.002073	0.002903	1847023	433.573000
mysuru	0.000852	0.001583	0.002369	0.000544	0.000147	0.000076	0.000068	0.000253	0.003956	0.004867	3001127	437.865000
bengaluru_rural	0.001820	0.000756	0.001780	0.003309	0.000259	0.000085	0.000071	0.000555	0.008443	0.009103	990923	438.656000
mandya	0.000332	0.000916	0.001158	0.000499	0.000081	0.000019	0.000014	0.000138	0.003396	0.003118	1805769	454.968000
dakshina_kannada	0.001407	0.001223	0.002684	0.000838	0.000143	0.000138	0.000100	0.000273	0.003104	0.004371	2089649	458.256000

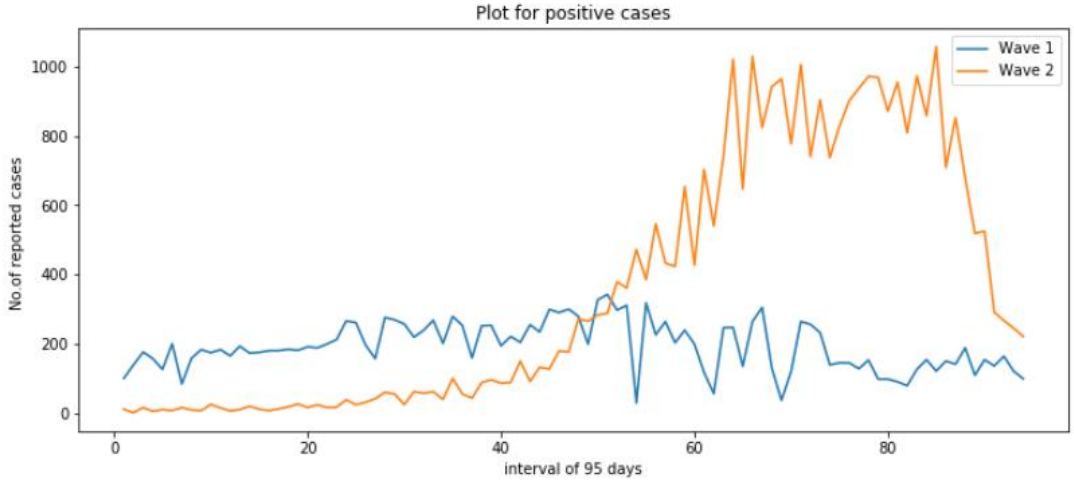
The table to the left records the total active cases at the end of each month divided by the population, i.e., each cell records the percentage of the population that is positive as of the end of the month. This would allow us to compare the relative performance of each district. The darker the cell, the higher is the value.

- For instance, we see that Kodagu performs poorly in January while all other districts perform relatively better.

Wave 1 and Wave 2 comparative analysis: Dharwada

In the following, wave 1 is considered from 14th July to 17th October, and wave 2 is considered from 1st March to 3rd June. The data is considered for only **Dharwada** district.



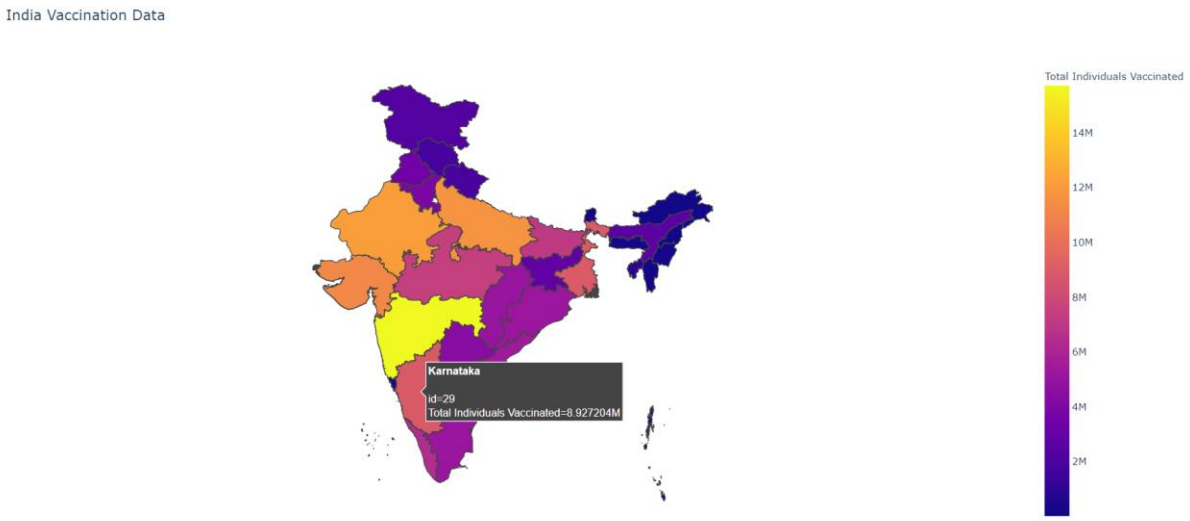


Wave1

- The first wave lasted for more days as compared to wave 2
- And there is a linear but long trend in both the death and the positive cases

Wave2

- The wave 2 is more intensive but for a shorter span.
- The number of deaths and positive cases in wave 2 are high as compared to wave 1



Choropleth Map of India showing Statewide Vaccination Data: