COVID-19 in Karnataka: Rise of Omicron

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ABSTRACT

The rise of the Omicron variant has been studied in the state of Karnataka in India for the period March 2021-June 2022. The % contribution of the Omicron rose from 1.5% to 99.2% as the time passed from March 2021 to June 2022. The Delta variant, which was the major strain before Omicron was almost replaced. The pathogenicity and virulence of all the three variants Original (Alpha and Beta), Delta, and Omicron have also been compared. The rate of spread of more transmissible Omicron strain was found to be proportional to the increase in new infections reported in the Karnataka. The pathogenicity of the Omicron variant was the least compared to the Original and Delta strains. The fatality rates of Original, Delta, and Omicron variants followed the order 1.29%>1.26%>0.2%, respectively whereas the positivity rates were 5.43%<6.12%<6.56%, respectively. The positivity rate was highest during the Omicron surge however the fatality rate was the least.

Keywords: Delta variant, Omicron variant, Omicron pathogenicity, Omicron prevalence and transmissibility, SARS-CoV-2 mutation.

I. INTRODUCTION

As of August 18, 2022, the world has reported almost 600 million (599,076,486) cases and 6.4 million deaths [1] with most cases registered in the US. The US has registered a majority of these cases over 93 million followed by India with around 44 million cases. In the last one month, the deaths linked to the COVID-19 have risen by 35% globally. The world over, 15,000 people lost their lives in just one week which is a big number. With the pandemic entering into its third year, there is no end in sight. Experts believe that the world has to live with the COVID-19 virus circulating in the air around us. The steps one can take are to keep COVID-19 appropriate behavior, get vaccinated, and receive booster doses to avoid infection and passing the virus to others. It has been established that the vaccination prevents severe symptoms and death.

Currently, BA.5 sub-variant of the Omicron strain has the share of more than 90% out of the total novel coronavirus sequences. Other Omicron sub-variants such as BA.4 and BA.2 appeared to be decreasing as BA.5 took the control. In the week August 3-10, 2022, there were about 7 million new cases with 1,700 deaths all across the globe [2]. Though there was a dip in the cases in North America and Europe. In Africa, COVID-19 fatalities dropped by more than 70%, whereas in Europe it went down by 15%. The Americas (North and South) reported a 10% reduction in mortality rate. The number of COVID-19 patients and deaths in Japan during the current BA.5 surge (seventh wave) have jumped 2.5 and 1.2 times, respectively compared to that in the sixth
BA.2 Omicron sub-variant’s wave [3], [4]. The highly contagious BA.5 Omicron sub-variant of the novel coronavirus has caused the recent surge. In the ongoing seventh COVID-19 pandemic wave, BA.5 sub-variant accounts for almost 100% of all the new COVID-19 cases in Japan. BA.5 grows more easily in lungs than the previous dominant BA.2 sub-variant. But people infected with BA.5 are at the lower risk of developing serious symptoms than BA.2 as the mortalities caused by the former are lower than the latter. Comparing to the Delta surge (fifth wave), in Japan, BA.5 daily case load was 10 times higher, and deaths were reduced by 4.3 times to that reported during the Delta wave.

BA.5 is less pathogenic than all the variants appeared so far before it. Comparing the CFR (case fatality rate), the BA.5 has the least of 0.12% followed by BA.2 and the Original variants with 0.25% and 1.5%, respectively. Because of the large caseload reported in the seventh wave, Japan had the highest occupancy rate of hospital beds for COVID-19 patients among all the waves that hit Japan. The occupancy rate of hospital beds was high at 75% as reported in Okinawa prefecture whereas it was 41% in Osaka and 42% in Tokyo. As the cumulative cases in Japan have reached up to 10 million, the % of the population who has acquired natural immunity through infections stands at only 8%. The figure is very low comparable to the US and Europe where one-third of the population was infected with SARS-CoV-2 infection.

On the vaccination front in India, a total of 156.6 million precaution doses have been inoculated till now with 103.9 million [5] doses were given alone between July 15-August 30, 2022 in a special drive. Around 11% Indian population has taken precautionary dose as of August 30, 2022 [6]. Of 168 million population of the cohort 60 years and plus, 35% have taken precautionary dose. Besides, healthcare, and frontline workers have also been given the dose. Taking the overall vaccination in India, till August 2022, 98% (75% full population) and 92% (70% full population) of the adult population have been partially and fully vaccinated, respectively. The state health authority in Maharashtra state of India reported [7] in December 2021 that more than 80% Omicron infected individuals had taken both the doses of the vaccine. Out of 54 Omicron infected individuals, 44 were fully vaccinated. The above data showed that the Omicron variant has big immune escaping potential. Apart from vaccine BTI (breakthrough infections), the Omicron is known to evade the immunity generated by the previous infection. However, above breakthrough infected and re-infected patients develop mild infections or remain asymptomatic.

Thus vaccination has an important role in controlling the COVID-19 pandemic. The Omicron evades the immunity but its replication inside the body is limited due to vaccination that keeps the infection milder. Studies were conducted and it was found that previous SARS-CoV-2 infection offered 80% protection against the Delta strain but the protection against Omicron remained low just at 20%. Therefore, the cases surged globally in January-February 2022 when the Omicron emerged and became the dominant variant. Vaccination against SARS-CoV-2 is effective in preventing serious illness and death. For instance in the UK, 82% population has been fully vaccinated whereas 90% has received partial vaccination. Also, a big population has taken booster shots. The daily caseload in the UK is near 100,000 cases reported in the last week of January 2022 with the death toll nearly at 280 making CFR 0.28%. The CFR reported in January 2021 was 3.0 in the UK, much higher than registered during Omicron surge.

The data collected from Kerala during the first ten days of the second half of January 2022 have shown that more than 60% fully vaccinated individuals were infected [8]. Of 396,723 cases reported in Kerala during the above period 240,745 (60.68%) were fully vaccinated. In the current Omicron wave, only around 3% of the active cases required hospitalization as most of the patients had mild symptoms. The COVID-19 data collected from Delhi, the capital city of India, were as follows. Only 1,372 new COVID-19 cases were registered on August 8, 2022. It was said that due to the low testing rate, the infection tally remained low. The number remained below 2,285 average cases reported over the last five days. Delhi’s positivity rate was 17.85% [6], [9], [10] on the above date. In August 2022, the spike reported in COVID-19 infections in Delhi was big compared to the other smaller spikes that were reported in April and June 2022. During the latter spikes, the cases remained below 1,800 marks with TPR about 10%. The experts had opinion that this increase and decrease pattern in the infection rate is likely to continue for some time before the infection tally reached at the baseline cases finally. In the first 8 days of August 2022, 25 deaths were reported in Delhi with the mortality rate at 0.16%. In the month of June and July, 50 deaths were reported in each month making CFR at 0.17% and 0.23%, respectively.

A number of articles [11]-[22] were published covering several topics on COVID-19 disease and the nature of the virus. The development of herd immunity [11], “health index theory” and the dynamics of the spread [12], [13], serological surveys [14], [15], stability of the virus and sanitization method [16], SARS-CoV-2 in pets [17], application of supercomputer in treatment and prevention of the disease [18], vaccine development [19], detection and treatment [20], and antibodies enhancement by vaccination [21], [22] have been described in details in the mentioned articles. The spread dynamics of the Omicron variant in India has also been studied in detail [23], [24]. The increase of% contribution of Omicron virus versus the viral load was established. The less pathogenic and more virulent nature of the Omicron strain was noticed as worked out from hospital incidences and occurrences. The BTI during delta wave among general population of India were studied [25]. Because of the BTI, the caseload increased but BTI could not cause enough surge to create a new wave of the infection. The vaccine BTI among healthcare workers (HCWs) during the Delta and Omicron waves were compared. The BTI were more at 6-25% in Omicron wave whereas they were less at 1.6%-2.6% in Delta wave [26]. BTI rate was high during the Omicron wave because of the high viral load environment the HCWs exposed to during the Omicron surge as compared to the Delta wave. But the rates of hospitalization, oxygen requirement, ICU care, and mortalities were less in Omicron wave than Delta wave. This was due to vaccination ramping up, high sero prevalence, and lower pathogenic nature of Omicron strain than the Delta variant. In the following article we have described the emergence of the Omicron variant in the state of Karnataka in India.
II. METHODS

In the state of Karnataka (India), a total of 4,441; 6,099; and 2,215 samples were analyzed for the period March 2021-December 2021, January 2022-April 2022, and May 2022-June 2022, respectively for genome sequencing. Of 6,099 samples analyzed during January 2022-April 2022; 5,356 (87.8%) had the Omicron lineage. The Omicron lineage was detected in 2,198 (99.2%) samples of the total 2,215 samples analyzed during May 2022-June 2022.

III. RESULTS AND DISCUSSION

A. Rise of the Omicron Variant

During the period March 2021-December 2021, the % share of the Omicron variant was just 1.5% which later became the dominant strain (87.8%) [27] between the period January 2022-April 2022. The genome sequencing results for the period between March 2021 and June 2022 have been shown in Fig. 1 and Table I reported in Karnataka. The genome sequencing conducted during May 2022-June 2022 showed that most of the COVID-19 patients (99.2%) in Karnataka were infected with the Omicron variant whereas the Delta and its sub-lineages were the dominant strains (90.7%) during the period March 2021-December 2021. The Omicron variant took the strong hold (87.8%) in the period January 2022-April 2022. Out of the dominant Omicron variant (87.8%), 1.8% was BA.1, 17.6% was BA.1.1.529, and BA.2 had the major share of 80.6% as shown in Fig. 2 and Table II. When the % contribution of Omicron variant rose to 99.2%, the Omicron sub-lineages BA.2 (89.4%), BA.3, BA.4, and BA.5 combined (2%), and BA.1.1.529 (8.6%) were reported. Most of the COVID-19 patients in Karnataka were infected with BA.2 sub-variant of Omicron. Currently, there are five sub-variants of novel coronavirus: BA.2, BA.3, BA.4, BA.5, and BA.1.1.529 circulating with the largest (89.4%) share of BA.2 sub-variant.

![Fig. 1. Bars showing the decrease in % share of Delta and increase of Omicron variant in Karnataka with time; % contribution of other variants has also been shown.](image1.png)

![Fig. 2. Bars showing % share of various Omicron sub variants when it was a major lineage in Karnataka.](image2.png)

**TABLE I: Genome Sequencing Results of COVID-19 Virus in Karnataka Population Until June 2022 (Percent Contribution of Each Variant Reported)**

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Variants</th>
<th>March 2021-Dec 2021</th>
<th>April 2022</th>
<th>May 2022-June 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alpha</td>
<td>3.5%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Beta</td>
<td>0.2%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Delta &amp; Sub lineages</td>
<td>90.7%</td>
<td>9.8%</td>
<td>0.1%</td>
</tr>
<tr>
<td>4</td>
<td>Others (Eta, Kappa, Pango)</td>
<td>4.1%</td>
<td>2.4%</td>
<td>0.6%</td>
</tr>
<tr>
<td>5</td>
<td>Omicron</td>
<td>1.5%</td>
<td>87.8%</td>
<td>99.2%</td>
</tr>
</tbody>
</table>

**TABLE II: % Contribution of Each Omicron Sub Variants Reported out of Dominant Omicron Lineage in Karnataka COVID-19 Patients Until June 2022 (Percent Contribution of Each Variant Reported)**

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Variants</th>
<th>Jan 2022-April 2022</th>
<th>May 2022-June 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Omicron of which</td>
<td>87.8%</td>
<td>90.7%</td>
</tr>
<tr>
<td>2</td>
<td>BA.2</td>
<td>80.6%</td>
<td>89.4%</td>
</tr>
<tr>
<td>3</td>
<td>BA.1.1.529</td>
<td>17.6%</td>
<td>8.6%</td>
</tr>
<tr>
<td>4</td>
<td>BA.1</td>
<td>1.8%</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>BA.3, BA.4, BA.5</td>
<td>-</td>
<td>2%</td>
</tr>
</tbody>
</table>

B. Comparison of Pathogenicity (Hospitalization and Mortality) of Delta, Omicron, and Original Wuhan Variants

The Karnataka’s State Health Department reported [28] the hospitalization rates of COVID-19 patients. The hospitalization percentage was at 16%, 21%, and 5% at the peak of the first, second, and third waves as shown in Fig. 3 and Table III. The rate of hospitalization in the third Omicron wave remained low at 5%. Though the case load at the peak of the third wave (50,210) was nearly the same as that of the second wave (50,112) and it was 4.5 times than that of the first wave (10,947) as shown in the Table IV. Also, the active cases at the maxima of the third wave (362,487) were three times more than the first wave (120,929). The cumulative cases, deaths, positivity rate, and the CFR registered during the first, second, and third waves have been given in Table V. The cumulative cases in the first wave, second wave, and third waves were 934,228; 2,045,387; 956,746, respectively (Fig. 4). The cumulative cases in the third wave were marginally more than the first wave but much lesser than the second wave. The CFR reported in the third wave was much lower at 0.2% than the first (1.2%) and the second (1.26%).

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wave (Fig. 5). The TPR rates were 5.43%, 6.12%, and 6.56% for the first, second, and the third wave, respectively (Fig. 6). The total fatalities were 12,102; 25,847; and 1,965 during the first, second, and third wave, respectively (Table V). The above data showed that though the positivity rate during the third wave was highest but fatality rate remained the lowest due to low pathogenic nature of the Omicron variant.

![Fig. 3. Comparison of the hospitalization rate (%) in all the three waves that hit Karnataka.](image)

![Fig. 4. Comparison of the cumulative cases in all the three waves that hit Karnataka.](image)

![Fig. 5. Comparison of the CFR in all the three waves that hit Karnataka.](image)

**TABLE III: COMPARISON OF HOSPITALIZATION RATE IN ALL THREE WAVES IN KARNATAK**

<table>
<thead>
<tr>
<th>Wave number</th>
<th>Hospitalization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Wave (Original)</td>
<td>16%</td>
</tr>
<tr>
<td>Second Wave (Delta)</td>
<td>21%</td>
</tr>
<tr>
<td>Third Wave (Omicron)</td>
<td>5%</td>
</tr>
</tbody>
</table>

**TABLE IV: COMPARISON OF THE CASELOAD AND ACTIVE CASES Recorded IN ALL THE THREE COVID-19 WAVES IN KARNATAK**

<table>
<thead>
<tr>
<th>Wave Number</th>
<th>Caseload at the Peak</th>
<th>Active Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Wave (Original)</td>
<td>October 7, 2020</td>
<td>10,947</td>
</tr>
<tr>
<td>Second Wave (Delta)</td>
<td>May 5, 2021</td>
<td>50,112</td>
</tr>
<tr>
<td>Third Wave (Omicron)</td>
<td>Jan 23, 2022</td>
<td>50,210</td>
</tr>
</tbody>
</table>

**TABLE V: COMPARISON OF THE CUMULATIVE CASELOAD, DEATHS, AND CFR (CASE FATALITY RATE) REGISTERED IN ALL THE THREE COVID-19 WAVES IN KARNATAK**

<table>
<thead>
<tr>
<th>Wave number</th>
<th>From to Until</th>
<th>Cumulative cases</th>
<th>Overall Positivity Rate</th>
<th>Cumulative deaths</th>
<th>CFR (Case Fatality Rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Wave (Original)</td>
<td>Jun 22, 2020 - Feb 10, 2021</td>
<td>934,228</td>
<td>5.43%</td>
<td>12,102</td>
<td>1.29%</td>
</tr>
<tr>
<td>Second Wave (Delta)</td>
<td>Feb 11, 2021 - Nov 3, 2021</td>
<td>2,045,387</td>
<td>6.12%</td>
<td>25,847</td>
<td>1.26%</td>
</tr>
<tr>
<td>Third Wave (Omicron)</td>
<td>Nov 4, 2021 - Apr 6, 2022</td>
<td>956,746</td>
<td>6.56%</td>
<td>1,965</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

C. The Viral Load versus the Pathogenicity of the Omicron Variant (the Dynamics of the Spread)

Over the course of receding the Delta wave in Karnataka, the daily baseline cases of less than 400 (356 cases; December 28, 2021) were registered. Until December, 2021, the Omicron lineage was just 1.5% and the Delta lineage was the dominant variant (90.7%). The prevalence of highly transmissible Omicron variant at a small percentage (1.5%) could not increase the new infections in the month of December 2021. In the first week of January 2022, the cases
started surging as shown in the caseload versus time plot (Fig. 7). On January 1; 1,033 new cases were reported. Surge continued till January 23 (50,210 cases) after that cases started receding as on January 24; 46,426 new cases were reported whereas case count was 31,198 on January 28. During January 2022-April 2022, the highly transmissible Omicron variant’s share reached to 87.8% which was the reason of the above surge.

Fig. 7. Daily new case load recorded in Karnataka during the Omicron surge during December 26, 2021-January 28, 2022.

IV. CONCLUSIONS

The genome sequencing conducted during the period May 2022-June 2022 in Karnataka found that that most of the COVID-19 patients (99.2%) were infected with the Omicron variant. The Delta and its sub-lineages were the dominant strains (90.7%) during the period March 2021-December 2021. Omicron variant took the strong hold (87.8%) in the period January 2022-April 2022. Out of the dominant Omicron variant (87.8%), 1.8% was BA.1, 17.6% were BA.1.1.529, and BA.2 had the major share of 80.6%. The hospitalization rate in the third Omicron wave remained the lowest at 5%, though the case load at the peak of the third wave (50,210) was nearly the same as that of the second wave (50,112) and it was 4.5 times than that of the first wave (10,947). The data showed more contagious and less pathogenic nature of the Omicron variant of the novel coronavirus. The emergence of new variants of COVID-19 virus is a continuous threat for containing the pandemic and establishing the efficacy of the vaccines. The present study shed light on the pattern of the virus spread and the role of the Omicron strain in Karnataka. The study is useful in understanding and controlling the pandemic.

STATEMENTS

The data and results in this article are reproducible. No animal or laboratory experiment was conducted. Author Zameer Shervani (ZS), Ph.D. is the Director General of the Food & Energy Security Research & Product Center, Sendai, Japan. The copyrights of the article belong to the corresponding author (ZS). Co-authors contributed online.

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