Section: Microbiology

Original Research Article

A STUDY TO COMPARE AND CONTRAST THE COVID WAVE PATTERNS

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Abstract

Background: India has experienced three successive waves since December 2019, with the first peak in September 2020 and the second peak in May 2021. The third wave rapidly evolved, causing widespread disease and significant health risks. **Aim:** This study aimed to comprehensively analyse and compare the epidemiologic features, demographic characteristics, and wave patterns between the first and second waves of the COVID-19 pandemic in Kanyakumari District, South India. **Material & Methods:** In two successive waves, a retrospective analysis was performed on individuals diagnosed using reverse transcription-polymerase reaction (RT-PCR). Data, including daily test counts, laboratory-confirmed cases based on RT-PCR, and demographic information, were collected from April 2020 to February 2022. The waves were defined by the initial day with over 50 new cases for two consecutive days, and the endpoint was the final day before the cases decreased to < 50 for at least seven days. **Results:** The second wave exhibited a more than two-fold increase in the total number of cases compared with the first wave, with an exponential surge during weeks 4 to 8. No significant sex-based differences were observed, and most cases were concentrated in the age group of 21-50. Comparative analyses with previous studies have revealed variations in age group susceptibility and gender-related outcomes. The factors contributing to the rapid increase in the second wave included a mutant virus, decreased public compliance, variable mask quality, and increased testing. **Conclusion:** This study emphasises the importance of early intervention, heightened social distancing measures, and adherence to preventive strategies to successfully mitigate COVID-19 transmission.

INTRODUCTION

COVID-19 was first detected in Wuhan, China, in December 2019. WHO declared COVID-19 as a pandemic on March 11th, 2020. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the causative agent of COVID-19. SARS-CoV-2 belongs to the genus Beta-coronavirus (B-CoV). Coronavirus is a large (120-160 nm) spherical enveloped virus with helical symmetry and a linear positive-sense single-stranded RNA of 26 – 32 kbp. It is the largest among the non-segmented RNA viruses.[1] Envelopes carrying club-shaped or crown–peplomer spikes give the appearance of a solar corona. The virus contains four structural proteins: envelope (E), spike (S), membrane (M) and nucleocapsid (N). Antibodies against S protein are protective (B-CoV).[2]

Human transmission involves coughing, sneezing, and close personal contact with COVID-19 positive patients. SARS-CoV-2 can spread via droplets and also through aerosols.[3] In India, the first case was reported on January 30th, 2020. In our district, catering to a population of about 16 lakhs, we have been getting positive cases regularly since March 2020.[4]

India has witnessed three successive waves of the COVID-19 pandemic since the arrival of SARS-CoV-2 in December 2019. In Kanyakumari district, the first wave attained its pinnacle in September 2020 and has since tested positive by RT-PCR. The second wave commenced before the numbers receded to their base level and displayed a swift ascent. The zenith was reached in May 2021. The third wave evolved like a 'tsunami' at a phenomenal speed compared to the 1st and 2nd wave.[5,6]

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Data showing differences in age, sex, and wave pattern of the disease have been reported, although the comparative characteristics of waves remain largely unknown. A more accurate comparison of the waves is feasible by studying patients for whom the disease was confirmed using reverse transcription-polymerase reaction (RT-PCR). This will help prepare for the next wave and prevent morbidity and mortality.

Aim

This study aimed to compare epidemiologic features, demographic features, and wave patterns between the first and second waves of the coronavirus disease 2019 (COVID-19) pandemic in Kanyakumari district in South India.

MATERIALS AND METHODS

A retrospective analysis of all individuals in Kanyakumari district, India, diagnosed with the disease through reverse transcription-polymerase chain reaction (RT-PCR) during three successive waves.

Data on COVID-19 were gathered on a district-wide scale from April 2020 to February 2022, encompassing the daily number of tests conducted, the incidence rate of laboratory-confirmed cases based on RT-PCR test outcomes, and demographic information. Nasopharyngeal and oropharyngeal swabs were collected from symptomatic individuals, asymptomatic contacts, and random screening. The beginning of each wave was defined as the initial day with over 50 new cases of COVID-19 for two consecutive days, and the end point was determined as the final day before a decrease to under 50 cases for at least seven days. In the Kanyakumari district, the first wave lasted from 24 June 2020 to 14 October 2020, while the second wave stretched from 9 April 2021 to 30 June 2021.

RESULTS

The total number of positive cases during the first wave was 10,775 for 113 days and 23,522 for 83 days during the second wave. The average number of positive cases was 680 per week during the first wave and 1972 per week during the second wave. Daily positive cases peaked during the 5th week in the 1st wave and the 6th week in the second wave.

The total number of cases in the second wave was more than twice that in the first wave, and at the peak, it was approximately three times that in the first wave. [Table 1]

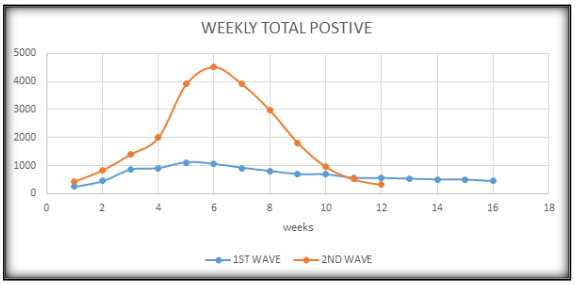

Figure 1: Weekly total positive

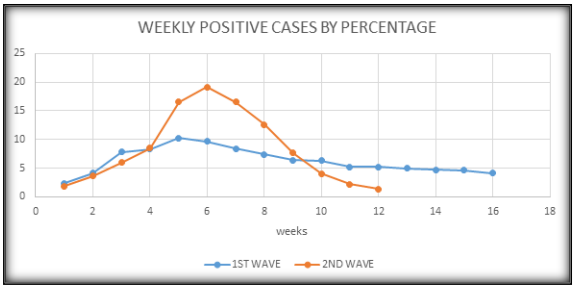

Figure 2: Weekly positive cases by percentage

The increase in several cases in the first wave was approximately linear, whereas, in the second wave, there was an exponential increase during weeks 4 to 8.

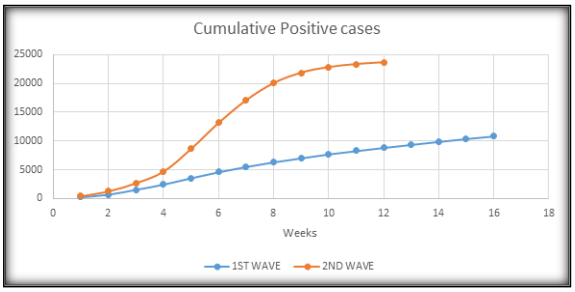

Figure 3: Cumulative positive cases

Of the positive cases, 53.6% were male and 46.4% were female. The distribution was 55% male and 45% female during the first wave. It was 52.6% male and 47.3% female during the second wave. There were no significant differences in the distribution of positive cases according to sex.

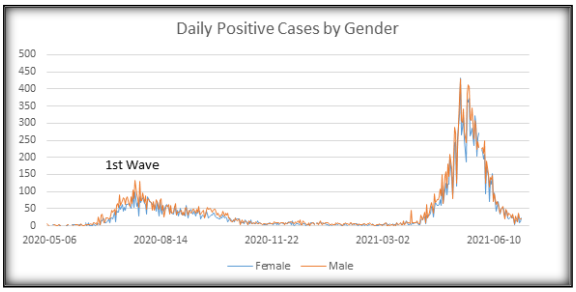

Figure 4: Daily positive cases by gender

The majority of cases belonged to the age group 21-50. There was no significant difference in the age distribution between the first and second waves.

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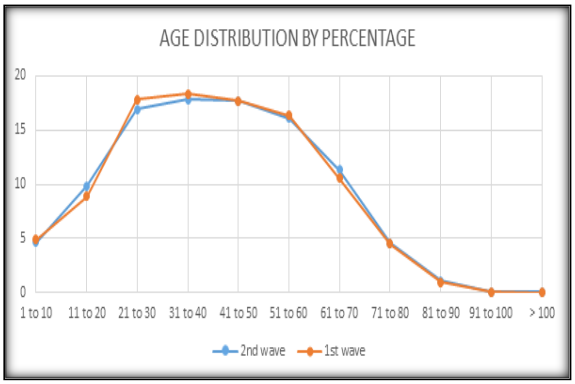

Figure 5: Age distribution by percentage

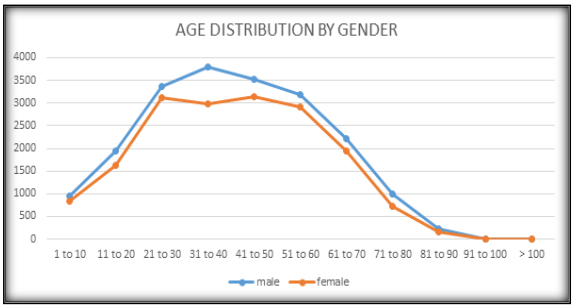

Figure 6: Age distribution by gender

There was no significant difference in sex among the different age groups.

Table 1: Positive cases during the waves

Week	1st wave	2nd wave
1	253	441
2	448	848
3	853	1408
4	904	2016
5	1112	3916
6	1054	4525
7	916	3915
8	809	2979
9	698	1818
10	690	965
11	569	514
12	563	323
13	539	-
14	511	
15	507	
16	451	

DISCUSSION

The primary objective of the present study was to undertake a comprehensive analysis and comparison of the incidence and trends of COVID-19 cases during the initial and subsequent waves in India. Based on the statistical analysis, it was observed that the increase in cases during the first wave was approximately linear. By contrast, during the second wave, there was an exponential increase in these cases. Furthermore, there was no significant variation in the distribution of positive cases by sex between the two waves, and the majority of cases were found in the age group of 21-50 in both waves. In contrast to the present study, Sarkar et al. reported that most infections were between 11 and 30 years old, and those aged 31 to 45 had a high risk of infections and mortality.[7] Hamed et al. reported that male patients had higher mortality and disease severity compared to female patients.8 Another study also suggested that higher male incidence can be due to dwindling T cell activation in males compared to females.[9] The analysis by Sarkar also reported that, except for India and the rest of Asia, the two genders were equally infected in periods I and II of COVID-19 spread across the world. However, the clade-wise analysis showed that both genders were equally susceptible to infection globally in period II.[7]

Compared on a global scale, individuals deemed vulnerable and older people were more susceptible to virus exposure at the pandemic's onset than at the second wave. In Denmark, diverse restrictions, prohibitions, and directives have been implemented since mid-March 2020 to mitigate disease transmission and safeguard vulnerable and elderly populations. Consequently, it is hypothesised that a larger proportion of the population is at an increased risk of developing severe illnesses during the first wave of COVID-19. Second, the initial management of COVID-19 primarily focused on symptomatic treatment. However, as clinical protocols have evolved, it is possible that this refinement could have positively impacted the outcomes for individuals hospitalised later in the pandemic. This refined clinical approach might have contributed to the shorter duration of hospitalisation in the second wave than in the first. Third, potential alterations in the genomic variations of SARS-CoV-2 from the first to the second wave may have influenced the severity of the disease among the patients. It is established that genomic variations in SARS-CoV-2 have been correlated with the mortality rate of COVID-19, suggesting a plausible connection between changes in the viral genome and disease severity across different waves.[10]

Multiple factors may have contributed to the rapid increase in cases during the second wave. One factor is the presence of a mutant virus with an effective

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transmission rate and shorter incubation period. Another factor is the public's fatigue with social distancing measures, which may decrease compliance. Additionally, the quality of masks used by the public was highly variable, and N-95 masks were rarely used because of their high cost and hot and humid climate. Many people use clothes or surgical masks, which may not provide adequate protection. Furthermore, the sharp rise in cases may also be attributed to increased PCR tests conducted. Ultimately, implementing subsequent social distancing strategies and lockdown measures helped suppress the wave.[11] The study by Jadsada Kunno et al. also compared the three waves of COVID-19, where a significant difference between all three waves was reported. In addition, the study revealed that the third wave was more severe than the other two, which can be attributed to the lack of preventive measures. In addition, gender and age were significantly associated with differences across phases and waves ($p < 0.001$) for the pandemic.[12]

The most effective preventive measures to minimise the spread of infectious diseases are hand hygiene, mask-wearing, quarantine, and increased testing to reduce secondary cases. These measures can significantly reduce the risk of contracting and spreading diseases.[13] Additionally, it is recommended to avoid closed spaces, crowds, and close contact with others, commonly referred to as the 3Cs.[14]

In conclusion, it is imperative to implement early and prompt interventions with heightened social distancing measures to curb COVID-19 transmission. Any delay in the initial response may lead to the explosive spread of the virus, making it challenging to contain.

CONCLUSION

In conclusion, our study underscores the significance of early and prompt interventions, heightened social distancing measures, and adherence to preventive strategies to mitigate COVID-19 transmission. Delayed responses may lead to an explosive virus spread, posing challenges to containment efforts.

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