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COVID-19 DURING FIRST AND SECOND WAVE IN INDIA: AN ANALYSIS

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ABSTRACT

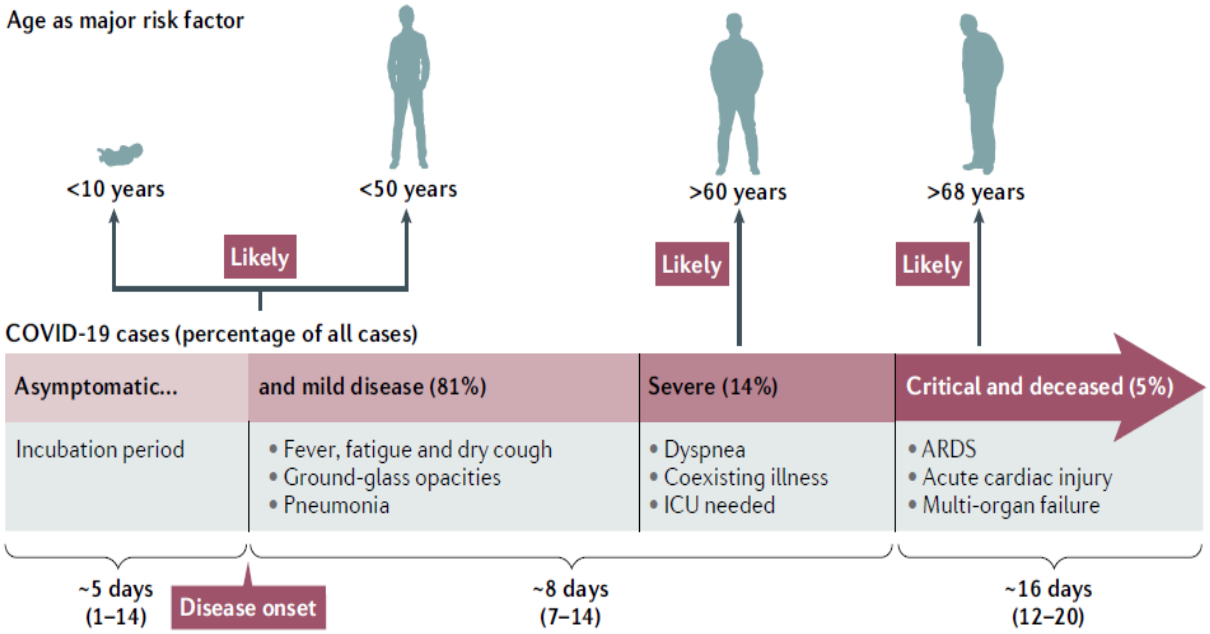
SARS-CoV-2 is an etiological agent of COVID-19, causing mild to severe respiratory disease which escalates to acute respiratory distress syndrome (ARDS) or multi-organ failure. The virus was first reported from the animal market in Hunan, Hubei province of China in the month of December, 2019, and was rapidly transmitted from animal to human and humanto- human. Many countries including India have seen a two-wave pattern in reported cases of coronavirus disease-19 during the2020 pandemic, with a first wave during Oct-Nov. 2020 followed by the current second wave in April-May2021. The virus primarily targets the upper and the lower respiratory tract and quickly disseminates to other organs. SARS-CoV-2 dysregulates immune signaling pathways which generate cytokine storm and leads to the acute respiratory distress syndrome and other multisystemic disorders. In the present review an attempt has been made to comparatively analyses the first and second wave in India. Patients in the second wave were more younger and children than those in the first wave. The most frequent signs and symptoms in both waves were fever, dyspnea, pneumonia, and cough, and the most relevant comorbidities were cardiovascular diseases, type 2 diabetes mellitus, and chronic neurological diseases.

KEYWORDS: Coronaviruses, COVID-19, SARS-CoV-2, Spike glycoprotein.

INTRODUCTION

Coronaviruses are a diverse group of viruses infecting many different animals, and they can cause mild to severe respiratory infections in humans. In 2002 and 2012, respectively, two highly pathogenic coronaviruses with zoonotic origin, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), emerged in humans and caused fatal respiratory illness, making emerging coronaviruses a new public health concern in the twenty-first century (Cui et al 2019). At the end of 2019, a novel coronavirus designated as SARS- CoV-2 emerged in the city of Wuhan, China, and caused an outbreak of unusual viral pneumonia. Being highly transmissible, this novel coronavirus disease, also known as coronavirus disease 2019 (COVID-19), has spread fast all over the world (Wu et al 2020; Hui et al 2020). COVID-19 pandemic is a tremendous threat globally. The causative agent of COVID-19 is SARSCoV-2 which causes a lower respiratory tract infection that can progress to severe acute respiratory syndrome and even multiple organ failure (Lv et al., 2020a; Yang et al., 2020). SARS-CoV-2 is a single-stranded positive-strand RNA virus whose genome encodes four structural proteins: spike (S), small protein (E), matrix (M), and nucleocapsid (N) (Chan et al., 2020). The S protein is a type I fusion protein that forms trimers on the surface of the virion. It is composed of two subunits, with S1 responsible for receptor binding and S2 for membrane fusion (Walls et al., 2020; Wrapp et al., 2020). The SARS-CoV-2 utilizes angiotensin-converting enzyme 2 (ACE2) as the receptor for entry into target cells (Letko et al., 2020). Therefore, the S protein determines the infectivity of the virus and its transmissibility in the host (Hulswit et al., 2016).

SARS-CoV-2 shares 96% genome similarity with a bat Coronavirus (Woo et al 2010; Zhang et 2020). The primary targets are the type-II alveolar epithelial cells and airway-epithelial cells, which highly express the Angiotensin converting enzyme-2 (ACE2) receptor on their surface. The ACE2 receptor is used for internalization, similar to SARS-CoV-1 and Human Coronavirus-229E (HCoV-229E) (Zou et al 2020). The SARS CoV- 2 quickly replicates inside the cells and kick-start the plethora of signaling cascade, from activating the proinflammatory response to antiviral response leading to cytokine storm. The virus rapidly disseminates through peripheral blood to other organs like, heart, kidney, liver spleen, etc. (Xu et al 2020). However, the pathogenicity of SARSCoV-2 is notably less than SARS-CoV-1 and MERS-CoV, but its high transmissibility led to the pandemic, which resulted in the global lock-down and affected the global health scenario adversely Li et al 2020).



Clinical features of COVID-19. Typical symptoms of coronavirus disease 2019 (COVID-19) are fever, dry cough and fatigue and in severer cases dyspnea. Many infections, in particular in children and young adults, are asymptomatic, whereas older people and/or people with co- morbidities are at higher risk of severe disease, respiratory failure and death.

The incubation period is ~5 days, severe disease usually develops ~8 days after symptom onset and critical disease and death occur at ~16 days. ARDS, acute respiratory distress syndrome; ICU, intensive care unit.

Comparative Analysis

Many countries have seen a two-wave pattern in reported cases of coronavirus disease-19 pandemic, with a first wave during 2020 followed by the current second wave in middle of 2021. Empirical data show that the characteristics of the effects of the virus do vary between the two periods. Differences in age range and severity of the disease have been reported, although the comparative characteristics of the two waves still remain largely unknown. India reported over 29 million cases of the coronavirus (COVID-19) as of June 20, 2021, with more than 2.8 million recoveries and about 388 thousand fatalities. After a relatively controlled first wave, the country had been reporting record numbers of new infections and deaths since April 2021 as it experiences the second wave. With the world's second largest population in addition to an even worse second wave of the coronavirus pandemic seems to be crushing an already inadequate healthcare system. Despite vast numbers being vaccinated, a new variant seemed to be affecting younger age groups this time around. During 1st wave there was a peak increase in the cases in between August and November 2020. Govt. of India has taken stern step to control the menace following the complete lock down, maintaining proper social distancing and personal hygiene. Govt. followed the policy of tracking and tracing the history contact of individual infected with covid and quarantined the contacted individual for fourteen days. There was decline in the cases towards the end of year2020.The lock down has adversely affected the economic growth of country, mental health and social culture forcing the Govt.to Unlocking. In year 2021 following February admit the vaccination campaign there was an onset of second wave with peak in cases between April and May 2021**(Fig.4)** of covid with slight declined continued to June which was probably due to different variant strain of covid. Most effected age group individual during1st wave was above 60 years but during the second wave the most effected group was between 40 to 60 years (Fig). The most frequent signs and symptoms in both waves were fever, dyspnea, pneumonia, and cough, and the most relevant comorbidities were cardiovascular diseases, type 2 diabetes mellitus, and chronic neurological diseases. Nearly six months after the peak of the first wave in September 2020, coronavirus cases in India once again started rising from the first week of March signaling the arrival of the second wave of the pandemic in the country.

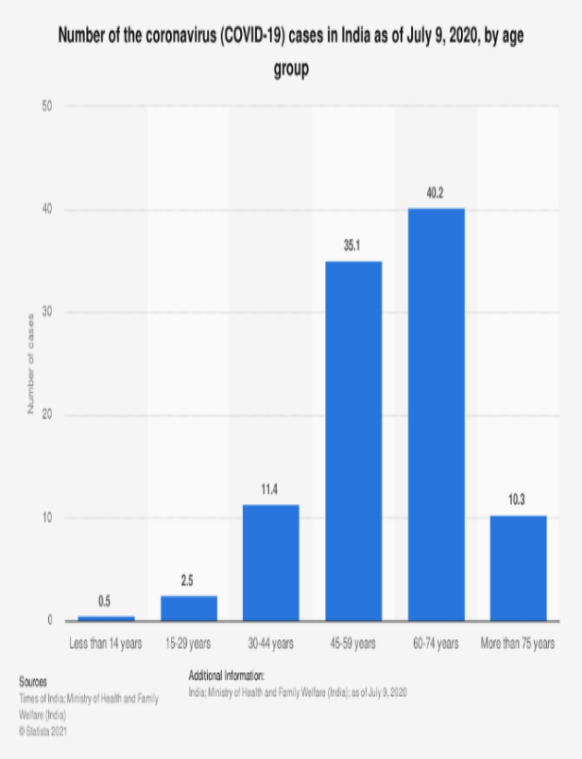


Figure 1

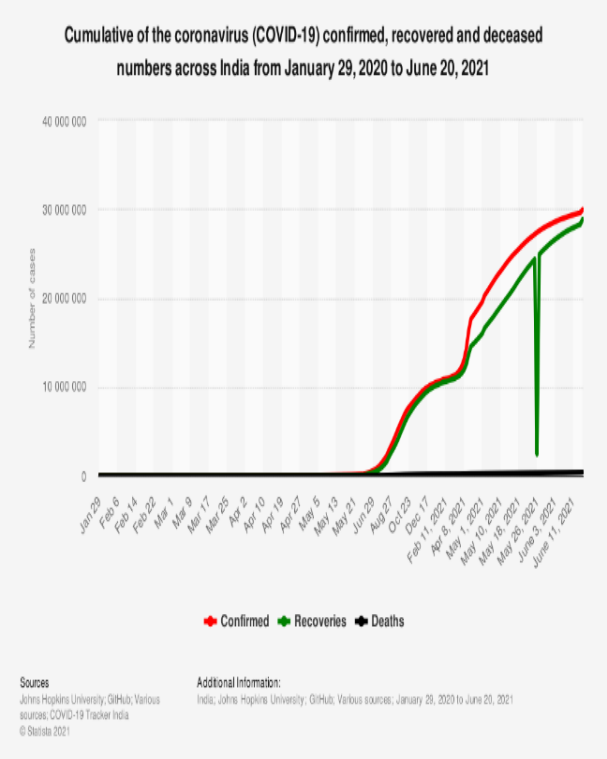


Figure 2

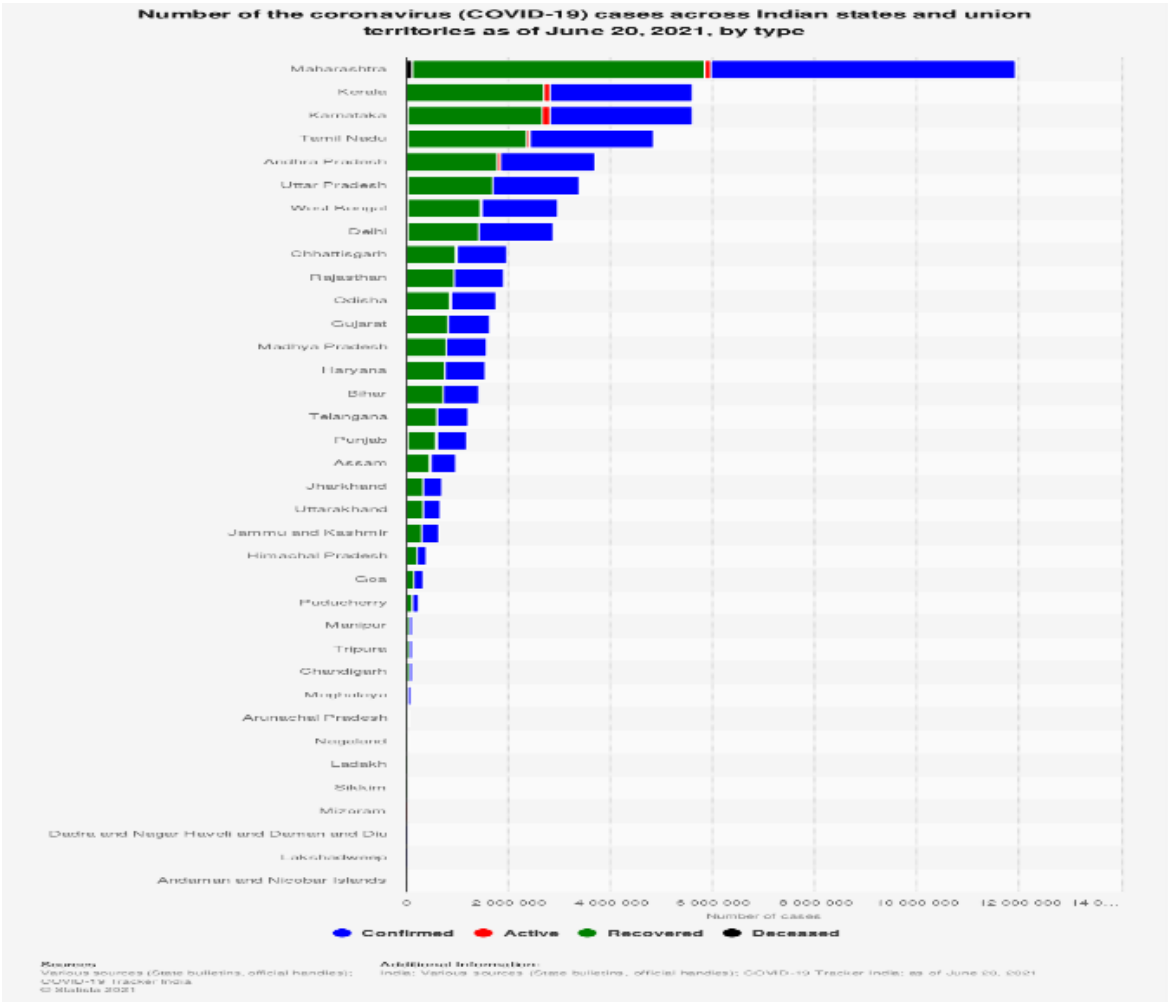


Figure 3

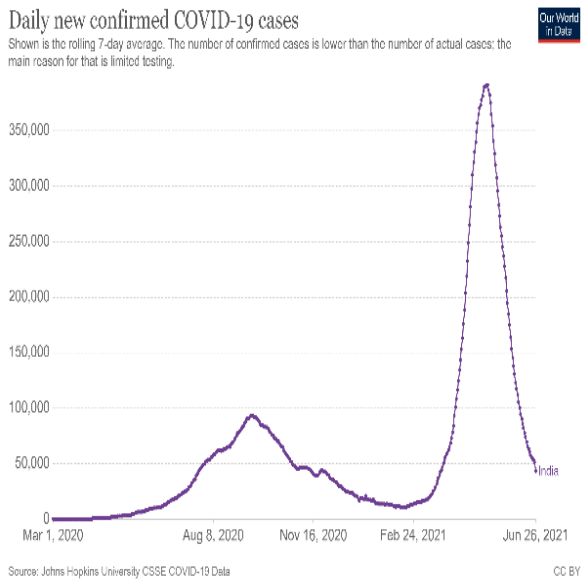


Figure 4

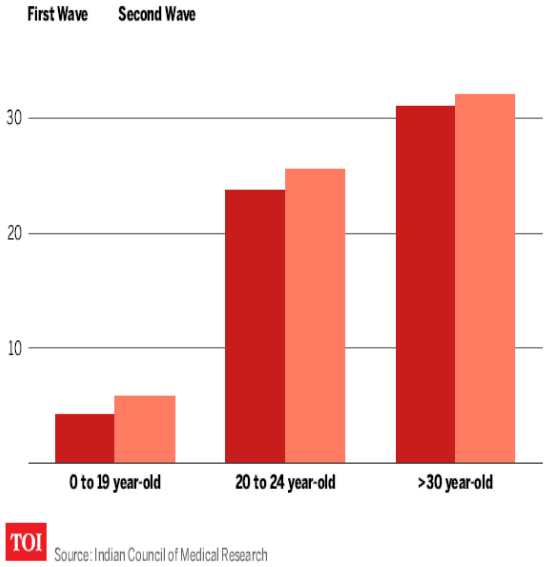


Figure 5

The overall recovery rate from covid is fairly good in India compared to confirmed death rate.

During the first wave of the Covid-19 pandemic in India, local mutations did not play a major contributing role. But many experts believe that the current surge in Covid-19 cases is being pushed by homegrown mutant variants of SARS-CoV-2. Genome sequencing in Maharashtra attributed over 60 per cent of fresh cases to India-grown mutant variants of coronavirus (**Fig.3**). In the second wave of Covid-19 this year, the older population continues to be more vulnerable whereas only a marginal increase has been recorded in the number of younger people testing positive for coronavirus. In the second wave, while the oxygen requirement is higher, ventilator requirement is not high. Doing an analysis of the first and the second wave of Covid-19 that hit India in 2020 and 2021 respectively, there is no major shift in the way different age groups have been affected by Covid-19 in the two waves (**Fig.1& 5**). Among Indian state and union territories Maharashtra continue to top the number of confirmed and recovered cases followed by Kerala and Karnataka. Andaman and Nicobar have least number of cases (Fig.3). India reported over 28 million cases of the coronavirus (COVID-19) as of June, 2021, with more than 2.7million recoveries and about 351 thousand fatalities. After a relatively controlled first wave, the country had been reporting record numbers of new infections and deaths since April 2021 as it experiences the second wave (**Fig.2**). Burden on the healthcare system with the world's second largest population in addition to an even worse second wave of the coronavirus pandemic seems to be crushing an already inadequate healthcare system.

DISCUSSION

The 2nd wave is evolving at a phenomenal speed as compared to the 1st wave. There could be several factors responsible for the increased number of cases in the second wave. It is observed that the mutant virus has more effective transmission capability and its incubation period is also lesser. There has been a widespread disregard to the 'Covid Appropriate Behaviours or CAB' by the public and the quality of masks used are highly variable. N-95 masks are not much favored masks in India, due to their higher costs and the majority public are using either the indigenous masks made of clothes or are repeatedly using the same and worn-out masks. In the 2nd wave the pediatric and younger individuals are getting infected, in addition to older ones (Hippich et al 2021). The symptoms of COVID 2nd wave are also variable, especially gastrointestinal (Jalali et al 2020). Studies have identified various circulating double-mutant and triple-mutant strains of SARS-CoV-2 across different regions of India, which are more pathogenic than the initial strains. Such altered transmissibility and pathogenicity indicate evolution of the virus. The larger the population density, the higher are the chances of viral replication, mutation, and evolution, as suggested by Moya and colleagues (Moya et al 2005). India's overpopulation and poor execution of a coherent containment strategy and policies have allowed a substantial number of viral mutations to persist in the environment. The earlier discovered variants in other countries, such as B.1.351, B.1.1.7, and P.1, as reported by Boehm and colleagues are also circulating within India along with the new variants. The SARS-CoV-2 double-mutant strain B.1.617, possessing the key structural mutations Glu484Gln and Leu452Arg in the spike protein, is highly infectious and less affected by current vaccine responses, and is a central cause of the COVID-19 surge in India (Cherian et al 2021).Similarly, Sahoo and colleagues reported the presence of a triple-mutant strain, B.1.618, carrying the potent mutations Glu154Lys, Pro681Arg, and Gln1071His in addition to others, that is also strongly associated with India's deteriorating COVID-19 situation. Patients in the first wave infected with SARS-CoV-2 were predominantly

older than 60 years and those with comorbid conditions were at increased risk of death. However, surprisingly, younger adults appear to be prone to infection during this latest cycle and many patients have died at a young age, including patients aged between 25 and 50 years.

CONCLUSION

The second wave placed a major strain on the healthcare system, including a shortage of liquid medical oxygen due to ignored warnings which began in the first wave itself. There is dire need to strengthen health care system in India. Mass vaccination campaign and maintaining self-hygiene, observing strict social distancing and bearing proper mask is only measure prevent spreading of covid-19.

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