Epidemiology of COVID-19 in India; A review
Abstract

SARS-CoV2 tentatively called Covid-19 by WHO, has become an effectively contagious disease throughout the world. The virus infects more than 200 countries with 765,903,278 confirmed cases of Covid-19, including 6,927,378 deaths as of May, 08 2023. A total of 13,349,320,292 vaccine doses have been administered so far. In India, first Covid-19 case was reported on January, 30 2020 and highest Covid-19 cases were reported in May 2021 with cases of about 4 lakhs and weekly change of 5.45 %. The infection then spread to almost all the states. Effective measures were implemented by state governments for prevention and control of disease such as social distancing, minimizing public gatherings, frequent hand wash, and awareness against the disease. A total of 25,178 active cases are present in India as of May. 08 2023. In India vaccination was introduced in July, 07 2021, with high-risk groups such as older people with comorbidities, health care workers as top priority. The vaccination was then extended to general population with priority on highly affected states. Currently, vaccination against Covid-19 is available across the country for all the citizens irrespective of age, gender and domicile. This review is aimed at assessing the current epidemiological status of Covid-19 in India.
Introduction

COVID-19 is a respiratory infectious disease caused by SARS-CoV2. Coronavirus is derived from Latin word meaning crown shaped. They are enveloped, single stranded RNA first isolated from humans in 1965 [1]. Coronavirus belongs to family Coronaviridae which cause mild respiratory disease in humans. In recent times, there has been many outbreaks which led to major economic and health burden. SARS-CoV was reported first in 2002 in China, which then followed by MERS-CoV in 2012 in middle east and SARS-CoV2 in December 2019 in China. In December 2019, China reported an outbreak of pneumonia of unknown cause in Wuhan [2]. In a short period, this epidemic changed into global pandemic and got spread to different nations [3]. In January 2020, WHO declared this pandemic as an international health emergency and reported that this pandemic is because of novel coronavirus (2019-CoV) and thus named as COVID-19 [4]. During early stages most of the cases were linked with Huanan seafood market where aquatic animals were sold [2]. During genetic sequencing, a Betacorn virus was discovered from lower respiratory tract samples of the patients [5].

SARS-CoV-2 Epidemic; The Indian scenario

Currently, India has highest number of Covid-19 cases in the world only after United States and China [6]. The first COVID-19 case was reported on January, 30 2020, an Indian national evacuated from China and since then the number of cases has been increasing continuously [7]. The country first reported the disease from Kerela where three individuals who had travelled to China confirmed the disease on 3, February 2020 [8]. No further cases were reported in February; however, by mid-March the cases started to increase and sporadic cases were reported from all the states of India. By April, the disease spread to all the states except Sikkim. The first COVID-19 death in India was reported in March 2020 [9]. The epidemic reported cases from almost every state with most of the cases reported from Maharashtra (1,950,171), Karnataka (923,353), Andhra Pradesh (883,587), Tamil Nadu (822,370), Kerala (784,488), and Delhi (627,698) [10]. The nation-wide lockdown was implemented from March to May, which helped in flattening the peak of incidences [11]. The lockdown resulted in slowing the doubling of cases to six days which was three days prior to lockdown. Preventive and public health measures such as isolation of suspected cases, quarantine of positive cases for 14 days etc. were introduced to slow down the transmission. Preventive measures such as screening of immigrants at airports were introduced to curb the spread as the disease was mainly spread by travellers [12]. Further, the nation was divided into three zones viz red zone, orange zone, and green zone. The red zone comprised states and districts with high doubling of cases and highest number of cases, followed by orange zone and green zone with low to minimal transmission and number of cases. These steps were taken on the recommendation of Executive Director WHO. Michael Ryan. Apart from these important steps, IT was used to contain the spread of virus by developing Aarogya setu App, that helps a person in finding hotspots and to prevent them from encountering with the infected person.
National Institute of Virology (NIV) also developed a rapid testing kit based on ELISA for detection of Covid-19 infection [14]. Total number of cases as of May, 08 2023 are 44,971,469 with number of active cases as 25,178. 44,414,599 patients were discharged till May, 08 2023. Total number of deaths in the country due to Covid-19 are 531,692 with CFR of 1.18% as of May, 08 2023.

Transmission

During early stages of the pandemic, zoonotic transmission was thought to be a major transmission factor among cases [2]. However, by the end of January, people who did not visited the Huanan seafood market and developed disease suggested person to person transmission [15]. The exact mode of transmission of disease is still unknown. But as other respiratory disease droplet borne mode of transmission is probably the predominant mode of transmission.

Transmissibility of SARS-Cov2

The basic reproduction number (R0) is the number of possible cases which could arise due to one suspect case in the population. Estimated R0 for SARS-CoV2 is reported to be in between 2-3 [16]. According to a study conducted by Institute of Mathematical Sciences, Chennai, R0 for Covid-19 at the beginning of lockdown in India was 1.8 between March and April [17]. In April, it came down to 1.55 and between April and May it further came down to 1.23 [18].

Incubation period

The average incubation period of COVID-19 ranges from 5-6 days [19]. Laurel et al estimated that about 2.5% of cases develop symptoms within 2.2 days and 95 % of cases develop symptoms within 11.5 days of possible infection [20]. In India, Minister of health and family welfare has reported incubation period of five days on an average. In Kerala, median incubation period was estimated to be four days. It was also found that females, person with comorbidities had a longer incubation period as compared to males and person without comorbidities [21].

Period of infectivity

The duration for which a patient remain infective is still unclear. During early stages of infection, viral load is found to be highest in oropharyngeal secretions [22]. During this stage, the transmission rate is very high through droplet mode or person to person transmission. The patient can continue to shed the virus even after the symptom resolution. A study from China reported median duration of virus shedding was 20 days among the survivors [23]. Transmission during asymptomatic period has also been reported from various countries such as Singapore, where 157 cases of COVID-19 were locally reported during asymptomatic phase of the disease [24].

Case fatality rate

Case fatality rate (CFR) is defined as proportion of deaths due to certain disease among the total number of infected people due to a certain disease within a certain period of time. During early stages of pandemic, the overall CFR was 2.3% according to Chinese Centre for
Disease Control and Prevention [25]. Compared to China, where the disease originated, CFR was reported to be highest in Italy with CFR of 7.2% [26]. During early stages of epidemic and before lockdown, CFR was 1.9% in India. A study conducted in Tamil Nadu and Andhra Pradesh estimated overall CFR of 2.06%. Age specific estimates ranged from 0.05% to 16.6% in 5-10 years and above 85 years respectively [27]. Currently, CFR of Covid-19 in India is at 1.18% and has drastically reduced from 1.9%. [28].

**Clinical manifestations and clinical features**

Fever is probably one of the most important clinical manifestations of the disease. The spectrum of disease ranges from asymptomatic to critical including mortality. 80% of the patients had no to mild pneumonia, 15% with severe symptoms including dyspnea and lung infiltrations, and 5% with critical conditions including respiratory and muti organ failure [25]. A study conducted in China reported 80% of the cases with fever followed by 60%-70% of the cases who has reported dry cough. Hyposmia and Anosmia has been reported in 80% of the cases. Anorexia is also a frequent clinical manifestation reported by 60% of the cases. Myalgia and dyspnea are seen in about 30% of the cases. Gastrointestinal symptoms such as diarrhea, abdominal pain, nausea and vomiting was also reported as minor symptoms [29].

**Risk factors and high-risk population**

Any age group can be at risk for the infection, but children and old age people are at higher risk of getting COVID-19. Mortality was reported to be highest in older people above 60 years of age [25]. Children as susceptible due to weak immunity. Elderly people with comorbidities such as diabetes, asthma, COPD, hypertension, and other associated respiratory disease are at higher risk with high mortality rates [25].

**Prevention**

COVID-19 is a preventable disease through vaccination. Different vaccines have been approved by WHO for prevention against the disease. Until availability of vaccines, public health measures such as social distancing, isolation of suspected cases and quarantine of confirmed cases were in place and were effective in controlling the spread of disease. WHO recommends frequent hand washing, continuous and proper masking, avoid public gatherings, and maintaining distance of approximately 6 feet (1 m) to help preventing spread of disease [30]. Sputnik V was the first vaccine against Covid-19 developed by Russia. Different countries have manufactured vaccines against COVID-19 and so has India. The Serum Institute of India developed Novavax, that helps by producing T-cells which helps the body to protect from infection [31]. COVAXIN is India’s first indigenous Covid-19 vaccine developed by Bharat Biotech along with ICMR-NIV. COVISHIELD was developed by Serum Institute of India in joint efforts with AstraZeneca. The two vaccines have been approved by Ministry of Health for use against the disease. Currently, two doses of each vaccine are given for all the citizens. The vaccines are given free of cost at different vaccination centres across the country. A total of 2,206,686,764 vaccines has been administered till May, 11 2023 [28].

**Conclusion**
Covid-19 is a serious infectious disease which has caused huge disaster worldwide and so in India. It is a serious global challenge and it is very important for every stakeholder to frequently develop its cure and to its new emerging variants. Despite, much less virulent than SARS-CoV and MERS-CoV, it is associated with high mortality among susceptible individuals. It has been grossly controlled throughout the world and so in India due to effective vaccination and prevention measures. A small number of cases are still reported from various states and that is due to lack of proper vaccination cover or probably non-compliance of people for taking vaccine against Covid-19. Vaccination is very important to prevent mortality and to achieve herd immunity. Different countries have already introduced vaccination against Covid-19 which has helped to contain the disease to a larger extent. People should be made aware about benefits of vaccination through people centric approach, so that no one is left without vaccination against the disease. This will not only help in preventing the disease, but a step towards eradicating the disease.

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