

Epidemiology

Nandini Sharma

- It was in late December 2019 that a cluster of patients was admitted to hospitals with the initial diagnosis of pneumonia of unknown etiology. These patients were found to have an epidemiological link to a seafood and wet animal wholesale market in Wuhan, Hubei Province, China.
- Between December 18, 2019 and December 29, 2019, 5 patients were hospitalized with acute respiratory distress syndrome (ARDS) and one of them died. By January 2, 2020, 41 patients admitted to the hospital had been identified as having laboratory-confirmed coronavirus disease 2019 (COVID-19) infection. Less than-half of these patients had underlying diseases, including diabetes, hypertension and cardiovascular disease. This disease, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was named COVID-19 on January 12, 2020.
- As of January 22, 2020, 571 cases of COVID-19 were reported in 25 provinces in China. As of January 30, 2020, 7734 cases were confirmed in China and 90 others were reported from other countries including Taiwan, Thailand, Vietnam, Malaysia, Nepal, Sri Lanka, Cambodia, Japan, Singapore, Republic of Korea, United Arab Emirates, United States, The Philippines, India, Australia, Canada, Finland, France and Germany. The case fatality rate was estimated as 2.2%.
- Currently, over 220 countries have reported confirmed case of COVID-19 with a total of above 188 million cases with more than 40 lakh fatalities (as on July 14, 2021). India has reported around 30.9 million cases till now including 4,11,615 deaths. (July 14, 2021).
- World Health Organization (WHO) declared COVID-19 as Public Health Emergency of International Concern (PHEIC) on 30th of January, 2020. Since then, the world has seen unprecedented measures to curb the spread of infection, such as nation wide lockdowns.
- The median R , (reproductive number which refers to the average number of individuals infected by an index case) is between 2 and 2.5 for the current pandemic. This estimated R is less than the previous SARS-CoV epidemic in 2002–2003 which was approximately 3.
- Data from the first cases in Wuhan and investigations from the China CDC (center for disease control and prevention) and local CDCs suggest that the incubation time could be usually within 3 to 7 days and up to 2 weeks, as the longest time from infection to symptom onset has been noted to be 12.5 days [95% confidence interval (CI), 9.2–18].

TRANSMISSION

- The initial cases of COVID-19 were linked to direct exposure to the Huanan Seafood Wholesale Market of Wuhan; hence, animal-to-human transmission was considered as the main mechanism. Later cases were; however, not associated with this exposure mechanism. Therefore, it was concluded that human-to-human transmission is also possible, and symptomatic people most frequently had spread the infection.
- The possibility of transmission before symptom onset seems to be infrequent, yet it cannot be completely excluded. Additionally, there are suggestions that asymptomatic individuals could transmit the virus.
- Use of isolation thus seems the best way to contain this epidemic.
- SARS-CoV-2 RNA has also been detected in blood and stool specimens. Live virus has been cultured from stool in some cases, but according to a joint WHO-China report, fecal-oral transmission did not appear to be a significant factor in infection spread.

MODES OF TRANSMISSION OF VIRUS CAUSING COVID-19

- Current evidence indicates that the virus causing COVID-19 is transmitted among people through respiratory droplets and contact routes.
- Droplet transmission occurs when a person is in close contact, i.e. within 1 m, with someone having respiratory symptoms (e.g. coughing or sneezing) and therefore, there is a risk that his/her mucosae (mouth and nose) or conjunctiva (eyes) are exposed to potentially infective respiratory droplets (which are generally considered to be >5–10 m in diameter).
- Transmission could also occur through fomites in the immediate environment around the infected person.
- Transmission of the COVID-19 virus can, therefore, occur by direct contact with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person, such as stethoscope or thermometer.
- Airborne transmission differs from droplet transmission as it refers to the presence of microbes within droplet nuclei, which are generally considered as particles <5 µm in diameter, and which result from the evaporation of larger droplets or exist within dust particles. They may remain in the air for long periods of time and can be transmitted to others over distances >1 m.
- Airborne transmission of COVID-19 virus may occur in specific circumstances in which certain procedures that generate aerosols are performed (such as endotracheal intubation, bronchoscopy, open suctioning, administration of nebulized treatment, manual ventilation before intubation, turning the patient to the prone position, disconnecting the patient from the ventilator, noninvasive positive-pressure ventilation, tracheostomy and cardiopulmonary resuscitation).
- In an analysis of 75,465 COVID-19 cases in China, airborne transmission was not reported. There is evidence that COVID-19 infection may cause intestinal infection and be present in faeces. However, only one study till date has cultured the COVID-19 virus from a single stool specimen.

There are no reports of feco-oral transmission of the COVID-19 virus thus far. As, the outbreak continues to evolve, new things are being learnt about this new virus

everyday. Summarized below are the facts reported about transmission of the COVID-19 virus. Additionally, it provides a brief overview of available evidence on transmission from symptomatic, presymptomatic and asymptomatic people infected with COVID-19.

Symptomatic Transmission

- A symptomatic COVID-19 case is one who has developed signs and symptoms consistent with COVID-19 infection. Symptomatic transmission is the transmission from a person while they have symptoms.
- Epidemiology and virologic studies have shown that COVID-19 is largely transmitted from symptomatic people to others who come in close contact by means of respiratory droplets, direct contact with infected persons or through contact with contaminated objects and surfaces.
- Data from clinical and virologic studies that assessed repeated biological samples from confirmed patients suggest that SARS-CoV-2 shedding is highest in upper respiratory tract (nose and throat) early in the course of the disease. This means within the first 3 days from onset of symptoms.

Presymptomatic Transmission

- The incubation period for COVID-19, i.e. the time from exposure to the virus to symptom onset, is an average of 5–6 days, but it can be up to 14 days. During this period, which is also known as the “presymptomatic” period, some infected persons can be contagious. Therefore, transmission from a presymptomatic individual can occur prior to symptom onset.
- Some case reports and studies have shown presymptomatic transmission through contact tracing efforts and investigation of clusters of confirmed cases. Data suggest that some people can test positive for COVID-19 from 1 to 3 days before developing symptoms.
- It seems possible that people infected with COVID-19 could transmit the virus before the onset of significant symptoms. However, presymptomatic transmission still requires the virus to be spread through infectious droplets or through touching contaminated surfaces.

Asymptomatic Transmission

- A person who is infected with COVID-19 but does not develop symptoms is an asymptomatic laboratory-confirmed case.
- As per a recent study, the viral load detected in asymptomatic populations was similar to that in symptomatic patients, indicating that asymptomatic infections have the potential for transmission, which may occur early in the course of infection.

SARS-CoV-2 Variants

Since December 2020 many variants of SARS-CoV-2 has been identified as seen with other SARS coronaviruses. WHO has identified these variants as variants of interest (VOI), variants of concern (VOCs) and variants of high consequences. These variants can be highly transmissible and change the course of COVID-19 epidemiology and

result in potential public health intervention measures to fail. Currently, WHO has designated the variants of concern with Greek letters Alpha (first identified in UK), Beta (First identified in South Africa), Gamma (First identified in Brazil) and Delta (first identified in India in May 2021).

HOST FACTORS

Although SARS-CoV-2 can infect people of all ages, the following groups are more vulnerable and are likely to develop more serious disease:

- Elderly (age >60 years)
- Diabetes
- Hypertension
- Pre-existing heart disease
- Immunodeficiency
- Healthcare workers
- Pre-existing pulmonary disease
- Economic inequality.

ENVIRONMENTAL FACTORS

Factors that enhance transmission of the disease are:

- Overcrowding
- Mass gathering.

PREVENTIVE MEASURES

- Vaccination
- Restricting international travel
- Social distancing
- Avoiding mass gatherings
- Regular handwashing/using hand sanitizers
- National/state level lockdowns.

BIBLIOGRAPHY

1. Available at: www.worldometer.info/coronavirus.
2. Bauch CT, Lloyd-Smith JO, Coffee MP, et al. Dynamically modeling SARS and other newly emerging respiratory illnesses: past, present, and future. *Epidemiology*. 2005; 16(6):791–801.
3. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 2020;382(13):1199–2007.
4. Liu J, Liao X, Qian S, et al. Community transmission of severe acute respiratory syndrome coronavirus 2, Shenzhen, China, 2020. *Emerg Infect Dis*. 2020;26(6):1320–3.
5. Ong SWX, Tan YK, Chia PY, et al. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) from a symptomatic patient. *JAMA*. 2020;323(16):1610–2.
6. Ren LL, Wang YM, Wu ZQ, et al. Identification of a novel corona virus causing severe pneumonia in human: a descriptive study. *Chin Med J (Engl)*. 2020; 133(9):1015–24.
7. Tracking SARS-CoV-2 variants (who.int).

8. Wölfel R, Corman VM, Guggemos W, et al. Virological assessment of hospitalized patients with COVID-2019. *Nature*. 2020;581(7809):465–9.
9. Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA*. 2020;323(18):1843–4.
10. Wei WE, Li Z, Chiew CJ, et al. Presymptomatic transmission of SARS-CoV-2- Singapore, January 23-March 16, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:411–5.
11. World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). 16-24 February, 2020 [Internet]. Geneva: World Health Organization; 2020. Available at: <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid19-finalreport.pdf>
12. Zhang Y, Chen C, Zhu S, et al. Isolation of 2019-nCoV from a stool specimen of a laboratory-confirmed case of the coronavirus disease 2019 (COVID-19). *China CDC Weekly*. 2020;2(8):123–4.
13. Zou L, Ruan F, Huang M, et al. SARS-CoV-2 viral load in upper respiratory specimens of infected patients. *N Engl J Med*. 2020;382(12):1177–9.