



# Transmission of SARS-CoV2 and Strategies for Control of Infection: Lessons Learnt

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## Abstract

Coronavirus has affected all spheres of human life; physical, mental, and social aspects to the limit which has never been experienced before. The major symptoms of COVID-19 infection are fever, cough, respiratory distress, loss of taste, loss of smell, body aches diarrhea, vomiting, and so on. Those having symptoms are tested for their COVID-19 infection status either by Rapid Antigen test or real-time polymerase chain reaction (RTPCR)/Gene Xpert method. Those found COVID-19 positive are shifted to COVID care centers or home isolation for 17 days. The epidemiological triad includes an agent (strains of SARS-CoV-2), host (immunocompromised person), environment (overcrowding, temperature, humidity, contaminated surfaces). Various strategies have been implemented from time to time to break the chain of transmission to contain the spread of infection. Various strategies at an individual level and the community level are implemented. Strategies such as wearing mask, frequent handwashing, maintaining a distance of minimum 2 m between two people, screening for risk factors, quarantine, isolation, surveillance, and contact tracing, defining high-risk areas into hotspots/containment zones or micro containment zones, issuing heating, ventilation, and air-conditioning guidelines, work from home and introduction of vaccine as prophylaxis for prevention against the infection were introduced by India as well as globally. The introduction of infection control

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measures has some good affects such as lowering air pollution level and controlling the unnecessary plight of the vehicle on roads but the people have faced some serious effects also such as, it pushed people more into poverty and more down in nutritional graph raising country rank in hunger index. Whatever the strategy be proposed it should be implemented keeping to view the pros and cons of each strategy.

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**Keywords**

COVID-19 · Modes of transmission · Symptomatic and asymptomatic infections · Phases of pandemic · Strategies to break the transmission · Impact of various strategies · Role of vaccines · Success stories

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## 5.1 Introduction

Coronavirus has affected each and every sphere of human life. The physical, mental, and social aspects have been affected to a larger extent as never before in the near past. The first case of Coronavirus appeared in Wuhan city of China in December 2019 as a case of atypical pneumonia. India got its first case of Coronavirus in January 2020 in Kerala. The World Health Organization declared the coronavirus infection as pandemic on 11th March 2020 (The WHO just declared coronavirus COVID-19 a pandemic [n.d.](#)). It was postulated that coronavirus (SARS-CoV-2) originated in bats and just like the Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS) infections (Coronavirus history: how did coronavirus start? [n.d.](#)). The disease due to the 2019 novel coronavirus was named as coronavirus disease 2019 abbreviated as COVID-19 on 11th February 2020 and the virus was named as Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2) (About COVID-19|CDC [n.d.](#)).

The COVID-19 infection usually presents as fever, cough, sore throat, shortness of breath, diarrhea, vomiting, body aches, loss of smell, loss of taste, and so on (Coronavirus disease (COVID-19) [n.d.](#)). In its most severe form, the patient can have acute respiratory distress syndrome or respiratory failure. Mostly the people above 60 years of age or those suffering from any chronic illness such as diabetes mellitus, hypertension, or any kind of malignancy are considered to be at higher risk of contracting the COVID-19 infection.

The person presenting with complaints of fever, cough, breathlessness, running nose, diarrhea, vomiting, body aches, and so on is suspected to be the case of COVID-19. Since the COVID-19 symptoms mimic the seasonal influenza symptoms, it is important to differentiate COVID-19 from other flu-like illnesses. The diagnosis of COVID-19 disease is laboratory-based and is made by real-time polymerase chain reaction (RT-PCR) which is considered as the gold standard test for diagnosing the diseases. Rapid Antigen Testing (RAT) is another test done for diagnosing COVID 19 infection but is less sensitive and specific as compared to the RT-PCR as RAT diagnosis depends upon the type of kit used and skills of the person

performing the test. In India, the Indian Council of Medical Research has released an advisory on the testing strategy for COVID-19 from time to time (Indian Council of Medical Research 2020) Besides symptomatic patients, a large percentage of asymptomatic patients are also tested positive for COVID-19. A study concluded that asymptomatic patients accounted for 40–45% of COVID-19 infections and can shed the virus for more than 14 days (Oran and Topol 2021) Asymptomatic individuals with high-risk exposure to COVID-19 positive people are being tested between days 5 and 14 from the day of last exposure initially, later on, the testing days were revised and were kept between days 5 and 10 to identify asymptomatic COVID-19 infections.

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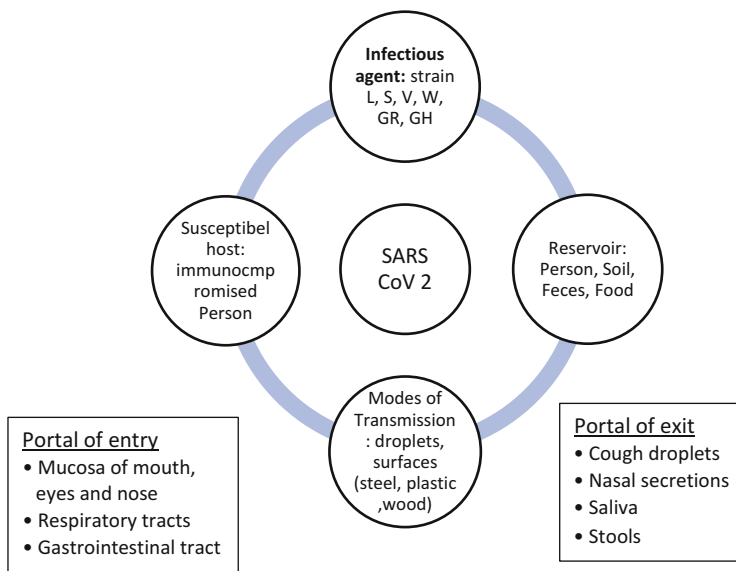
## 5.2 Modes of Transmission

### 5.2.1 Epidemiological Triad of COVID-19

The epidemiological triad of COVID-19 infection comprises of agent, host, and environment. The *agent* is the organism, which causes the infection, that is, the SARS-CoV-2 virus. The strain of SARS-CoV-2, pathogenicity and virulence of the organisms, plays an important role in causing infection. The first strain was the L strain that appeared in Wuhan in December 2019, followed by the S strain in early 2020. Other strains were the V and G strain of coronavirus which appeared in mid-January 2020. The G strain further mutated to GR and GH by the end of February 2020 (The six strains of SARS-CoV-2—ScienceDaily n.d.). The *host* characteristics are the age, immunity of person, preexisting diseases such as diabetes mellitus, hypertension, cancers, or any other immunosuppressed state. With an increase in age and with preexisting comorbidities, the immunity of the body falls low and the body gets susceptible to infections. The *environment* includes components which are in immediate surroundings to the human body such as overcrowding, wind velocity, temperature, contaminated inanimate surfaces, humidity, and so on. The factors such as temperature and humidity favor the survival of SARS-CoV-2 outside the human body and overcrowding and wind velocity favors traveling/transfer of droplets effectively among humans (Eslami and Jalili 2020). The surface which is frequently touched such as television and air conditioner remotes, tables surfaces, desktops keyboards, and so on are the common sources for transmission of SARS-CoV-2 among humans through indirect contact. The stability of the virus on the surface is also an important factor for the transmission of the virus. It is found that SARS-CoV 2 virus survives for maximum days (3–7 days) on plastic and stainless steel, followed by paper and glass for 4 days, for 2 days on wood, and for 4 h on copper surfaces (Chin et al. 2020).

### 5.2.2 Chain of Transmission

The *chain of transmission* is several interconnected steps, which show how COVID-19 pathogen flows from the reservoir to host as illustrated in Fig. 5.1. This infectious



**Fig. 5.1** Chain of transmission of SARS CoV2 infection

agent, which is SARS-CoV2, resides in the *reservoir*, which in this case are human beings or nonliving things such as soil, feces, food, equipment, and so on. For further propulsion of infectious agent, it needs some *portal of exit* from the reservoir body. The COVID-19 disease is an airborne disease, which mainly spreads due to the shedding of the virus in the host saliva in the form of droplets. The droplets are generated while coughing, sneezing, or spitting. Other sources are nasal secretions, saliva, and stools. The *modes of transmission* are either direct or indirect. The direct modes are transmission through inhalation of respiratory droplets ( $>5\text{--}10\mu\text{m}$  in size) or droplet nuclei ( $<5\mu\text{m}$  in size), aerosols formed during various surgical and dental procedures, body fluid secretions (feces, saliva, urine semen, and tears, etc.), and from mother to child. The indirect modes include touching contaminated surfaces, sharing common objects such as remote controls, tap knobs, door handle knobs, linen, and so on, and then touching the face (Modes of transmission of the virus causing COVID-19: implications for IPC precaution recommendations [n.d.](#)). The *portal of entry* is the route by which the infectious organism enters the human body. Touching one's mouth, nose, eyes with infected hands or objects can pave the entry of the organism into the human body. Not all people who contact the pathogen becomes ill. Just like other bacterial, viral, or fungal infections the one who are immunocompromised owing to long-standing illness, or on immune-compromised drugs or the people who are handling the infected patients are at greater risk of getting infected. A study found that the health care workers are at greater risk of contracting COVID-19 infection as compared to the non-essential workers followed by social and education workers (Mutambudzi et al. [2020](#)). The infection keeps on

spreading if the chain of transmission remains uninterrupted. To control the infection, a break in this chain of transmission is needed.

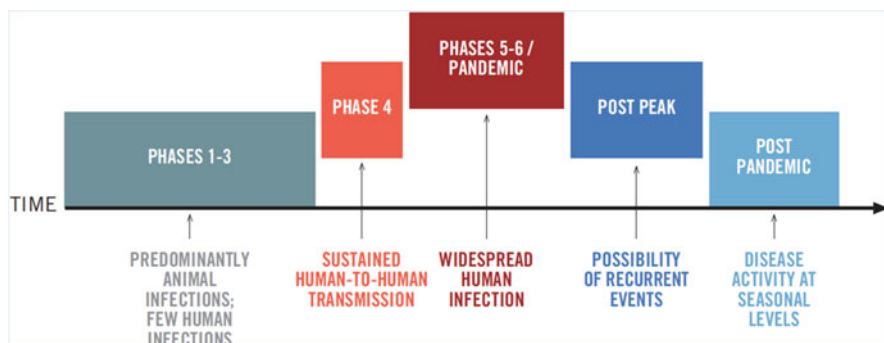
### 5.2.3 Incubation Period

The incubation period is the time between exposure to the virus and the onset of symptoms. The incubation period of SARS-CoV 2 on average is 5–6 days, but it can be as long as 14 days from the date of last exposure. The incubation period is used in deciding the quarantine/isolation period.

## 5.3 Phases of Pandemic

Pandemics are known to affect the large number of populations spanning across various nations at the same period of time. With the advent of globalization and rapid mass transportation systems such as air travel, the disease from one corner of the country can reach another corner or even to other countries in no time and can cause widespread outbreaks. WHO has defined various phases of infection with pandemic potential in 1999 for correlating with the mitigation measures to be adopted, which were revised in 2005. Any infection with pandemic potential has six phases as represented in Fig. 5.2 (World Health Organization 2010). It is very important to understand the phase of the pandemic in a country in order to mitigate the spread of the disease-causing agent.

In phases 1–3 of the pandemic, the transmission is either from organism to humans or there is a limited transmission from human to human. The probability of an established pandemic is uncertain in the first three stages of the pandemic cycle. The community-level outbreaks happen when the pandemic enters phase 4 which is characterized by sustained human to human transmission of an animal or human–animal virus. The probability of pandemic is medium to high in this stage.

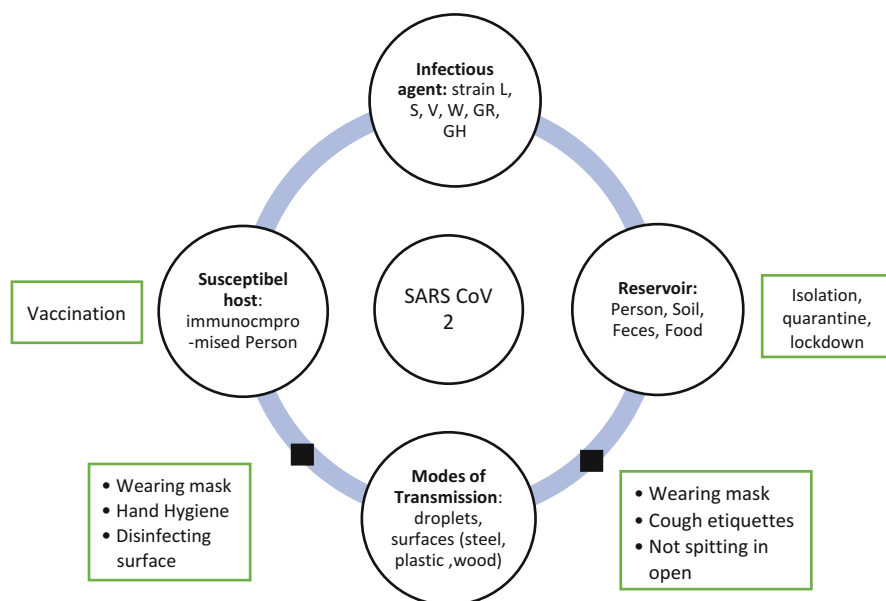


**Fig. 5.2** Phases of pandemic

Any country that suspects or has verified such an event should urgently report to WHO so that the situation can be jointly assessed and a rapid pandemic containment operation can be implemented if warranted. In stages 5 and 6, the probability of pandemic shifts from high to the pandemic in progress. Phase 6 is followed by the post-peak period in which there is the possibility of recurrence of events. If there happens recurrence of events after phase 6, there is the possibility that a new wave of infection has occurred. Following phase 6 the period is known as post-pandemic period. During post-pandemic periods many affected countries evaluate their response, revise their plans and look into the recovery rates. In India, Kerala declared the community transmission of COVID-19 infection on July 17th, 2020 in its two areas, Poonthura and Pulluvila and it was the first state in India to declare Community transmission of COVID-19 (In a first, Kerala CM confirms community transmission of COVID-19—India News—Hindustan Times [n.d.](#)).

#### 5.4 Strategies to Break the Transmission of SARS-CoV-2

Control of pandemic requires breaking the chain of transmission at multiple stages in the chain of transmission, to mitigate the spread of the infection. Some transmission break strategies are effective between reservoir and modes of transmission and others are effective to break the chain between modes of transmission and uptake of organism by the susceptible host as presented in Fig. 5.3.



**Fig. 5.3** Strategies for breaking chain of transmission

With the declaration of SARS-CoV2 as a pandemic, globally the strategies were being made to cut down the transmission of the virus. Some strategies were common to all the nations as issued by World Health Organization such as *wearing masks at public places, washing hands regularly, maintaining social distancing, not spitting in public places, home quarantine, isolation in COVID care centers or at home*. Some strategies were framed by countries as per their own burden of disease and ways of mitigating the spread. In view of the sudden spike in the number of COVID 19 cases globally, some interventions were introduced to break this chain of transmission. At the individual level interventions such as *wearing the mask at public places, washing hands regularly, maintaining social distancing, not spitting in public places, home quarantine* for the people having a history of travel were implemented. At community level, the interventions include screening for symptoms of COVID-19 among travelers especially from affected countries and quarantining of the individuals, closure of markets, worship places, schools and colleges, capping on the number of people attending social gatherings, closure of bars and restaurants, curfews, border closure, stoppage of all “non-essential” work and promoting work from home, stoppage of domestic and international travel, and so on (Social Distancing [n.d.](#); Strategies to reduce COVID-19 spread|Coronavirus COVID-19|CDC [n.d.](#))

1. *Wearing masks* in public places was advised as the strategy to prevent the spread of the COVID-19 infection. It also prevents one from contracting the infection from others. Different types of the mask such as N95, triple-layer, or cloth masks can be used depending upon the type of exposure. The health care workers usually wear N95 masks or triple layer masks depending upon whether they are involved in aerosol-generating procedures or not. N95 mask is recommended for aerosol generation procedures. For people who don't deal directly with the COVID-19 patients, it was recommended that they wear cloth masks. *Personal Protective Equipment (PPE)* is also used by health care workers who are involved in the care of COVID-19 positive patients in dedicated COVID care centers.
2. *Frequent handwashing* with soap and water or with alcohol-based rub is yet another measure that can be adopted at an individual level. It was recommended that whenever a person touches any surface he/she should wash their hands to kill the COVID-19 pathogen in his/her hands.
3. Maintaining a *social distance* of at least 2 m between two people can prevent spreading infection. When a person coughs or sneezes the droplets/aerosols generated can travel up to 2 m distance. In order to be sure that the other person doesn't come in contact with the droplets/aerosols it is advised to have a gap of at least 2 m between two people.
4. *Screening* for symptoms is the first strategy to mitigate the spread of COVID-19 infection. The people are screened for the risk factors of COVID-19 infection. Screening of symptoms starts at the entry point of any country or state. Screening involves measuring body temperature using thermal scanners to rule out fever, asking symptoms such as cough, sore throat, breathlessness, fatigue, and

so on. Those who were found to have any of the symptoms suggestive of COVID-19 infection are referred for testing. Those who do not have symptoms but have a history of travel to country/state/district with the high level of infection are quarantined for 14 days and are tested if he/she develops symptoms suggestive of COVID-19.

5. *Quarantine* was the first strategy adopted after the pandemic was declared. A 14-day quarantine period for all those who had a travel history from the affected countries or a history of high-risk contact with a positive patient was mandatory during in initial phases. The aim of quarantine is to restrict the movement of people suspected to have come in contact with the infected people. The institutional/home quarantine was applicable to all people who have the history of international traveling in the last 14 days (Quarantine period for COVID-19 mohfw—Google Search [n.d.](#)).
6. The *surveillance* and *contact tracing* of the people in community settings to find out the hidden cases proved to be the backbone of COVID-19 containment. The government of India issued guidelines to identify and classify contacts as early as possible for preventing the spread of transmission. A risk assessment was done to decide whom to test and whom to quarantine based on factors such as duration of contact (>15 min), proximity (<1 m), nature of exposure (droplets, body fluids, etc.) (Surveillance and Control [2020](#)). During the COVID-19 pandemic unprecedented large-scale use of technology has been promoted in digital contact tracing and surveillance (Berman et al. [2020](#)). To strengthen the surveillance and contact tracing the Government of India launched a mobile-based Application, *ArogySetuApp*, which is used for contact tracing and syndromic mapping, and self-assessment for COVID-19 infections. The application was also used to spread awareness of COVID-19 and to connect essential COVID-19-related health services to the people of India.
7. A *three-tier classification system* of hospitals was developed to manage COVID-19 patients COVID care centers to treat very mild, mild, and suspected cases; COVID health centers for clinically moderate level serious patients; and dedicated COVID hospitals for comprehensive care of the severe and critical patients (Covid-19 India: 3-tier classification of hospitals for diverse levels of infection|India News—Times of India [n.d.](#)). People were isolated for 17 days (10 days institutional isolation +7 days home isolation) once they come positive for COVID-19 infection. As the pandemic increased there was an increase in the number of positive cases, shortage of COVID care centers, and increased financial burden on the government, the government then issued guidelines for home isolation. Home isolation is another strategy where all suspects (waiting their test results) and confirmed cases of COVID-19 are separated from others for a similar period of 17 days as earlier in order to break the chain of transmission. A 24\*7 caregiver should be available to provide care at home. While providing care the caregiver should wear the mask, avoid touching their own face, nose, or mouth, practice hand hygiene, avoid direct contact with the patient or contact with body fluids, use triple-layer mask and disposable gloves, and above all the caregiver should self-monitor for symptoms (Ministry of



Health and Family Welfare, Government of India 2020). Initially, the area administration used to put quarantine sickers outside the home of those diagnosed as COVID-19 positive but due to the stigma associated with the disease and poster outside their houses, people stop coming for testing. Later on, the practice was stopped as the government wants to encourage more and more people to come for testing (Ministry of Health and Family Welfare, Government of India 2020).

8. Another strategy for breaking the chain of transmission of COVID-19 was to cordon the area from where the maximum cases are being reported. The government declared those areas as ‘hotspot’ areas. Initially, the districts where more than six positive cases were found were declared as hotspot districts. There was a restriction in movements of people in hotspot areas and no one was allowed to come out or move in that area. The government ensures doorstep supply of food, medicine, and essential items (What is a hotspot area? What can and can’t be done in a hotspot?|India News—Times of India n.d.). Later on, the hotspot areas were changed to *containment zones* which have smaller geographic area coverage, and further the containment zones were changed to *microcontinent zones*. The 3 km area from the containment zone is called buffer zone (Coronavirus: what is a COVID-19 containment zone and why is it created?|Hindustan Times n.d.). The basic idea of changing the hotspot districts to containment and microcontinent zones were to decrease the financial loss, people outside the containment zone can work their routine duties and psychological relief to the people regarding the magnitude of the disease burden
9. The Government of India issued guidelines for managing dead bodies. The staff handling dead bodies in the isolation areas, mortuary, ambulances, and crematorium/burial ground were well trained in the infection control practices. The health workers attending the dead body has to perform hand hygiene and ensure proper use of PPE and place the dead body in a leak-proof plastic body bag. Embalming of dead bodies was not allowed. Autopsies were avoided and to be done only in case of emergency. Viewing dead bodies for the last time by unzipping the face end of the bag only without kissing hugging or touching was allowed (Ministry of Health and Family Welfare 2020).
10. An incident was reported where around 26,000 people from 24 villages in Punjab were home quarantined after they attend religious congregation by the preacher came out to be COVID-19 positive (India’s “super spreader” home-quarantines 26,000 people in 24 Punjab villages—The New Indian Express n.d.). A similar ‘superspreader’ event was reported in Chandigarh, A north Indian Union territory where the primary case infected as many as 236 people (Mohindra et al. 2021). Avoiding/capping down the *social gatherings* was the major strategy to cut down the transmission by enabling more space for people (by capping the people) to move around and maintaining the social distance. The marriage ceremony has a capping of 50 people who can attend a marriage at one point of time (Not more than 50 people can attend wedding functions during the lockdown in Delhi: Arvind Kejriwal, India News Newslwionews.com n.d.). The various sports events which were witnessed earlier by thousands of spectators

have been made virtual just to avoid gathering in stadiums. (Italy going back to games with no fans in stadiums due to rising coronavirus cases—Sports News, Firstpost [n.d.](#), Spectating Spectator Sports: COVID-19 is dismantling stadium culture, one screen at a time—The Economic Times [n.d.](#)). The Tokyo Olympics which was supposed to happen in 2020, was postponed till 2021 in view of avoiding social gatherings (Tokyo Olympics postponed to 2021 due to coronavirus pandemic|Tokyo Olympic Games 2020|The Guardian [n.d.](#)). The Indian Premier League (IPL) was moved out of India and was held in the United Arab Emirates with no spectators in the stadium, due to rising cases of COVID-19 in India (IPL 2020 UAE Schedule: IPL Full Schedule, Time Table, Teams, Players List, Match Dates, Start Date, Latest News [n.d.](#)). The workplaces (multinational companies, information technologies, etc.) and schools were allowed to *work from home* (WFH). Some places where work from home could not be possible, Ministry of Home Affairs in coronavirus lockdown 2.0 guidelines allowed to work with 50% employees strength to reduce the number of people gathering at one place and maintaining the social distancing (Coronavirus lockdown 2.0 guidelines|IT companies can now work with 50 percent strength [n.d.](#)). The WHO released a document for making workplace COVID-19 free suggesting frequent cleaning of surface and objects, regular hand washing by the employees, contractors, and costumers ensuing facemask and displaying posters promoting respiratory hygiene avoiding face-to-face meetings unless it is an emergency (Occupational Safety and Health Administration [2020](#); WHO [2020a](#))

11. In hospitals routine Out Patient Departments (OPDs) were suspended to avoid large gatherings and only the emergency services were continued. In operation theaters, the routine working atmosphere was changed and health care workers were made to work under negative pressure to make the area less contaminated. Further, the fans, as well as the air conditioners, were also stopped in hospitals in order to control the spread of COVID-19.
12. The Indian Society of Heating, Refrigerating, and Air Conditioning Engineers (ISHRAE) issued *Heating Ventilation and Air conditioning (HVAC) guidelines* for the operation of air condition/ventilation system during COVID-19 pandemic (Agarwal et al. [2020](#))The guideline recommends using room air conditioners between 24 and 30 °C and relative humidity between 40% and 70%. For evaporative coolers, they must draw air from outside to ensure good ventilation and fans to be used with windows partly open. In the case of an exhaust fan facility, it must be kept running to exhaust air for better ventilation. The guideline further suggested using high-efficiency air filter (HEPA) filters for treating exhaust air from COVID-19 patient's area. The quarantine area needs to be well ventilated or a negative or neutral differential pressure needs to be maintained in those areas. The CDC issued guidelines for heating ventilation and Air conditioning (HVAC) systems during COVID-19. As per CDC guidelines, the HVAC system needs to run at maximum outside airflow for 2 h before and after occupied times in accordance with the industry standards. It was emphasized to increase the percentage of outdoor air, potentially as high as

100% (COVID-19 employer information for office buildings|CDC n.d.) The WHO has also issued guidelines for an HVAC system which promoted using natural ventilation, opening windows if possible and being safe. The guidelines discouraged the recirculation of air and in case, it is needed, regular cleaning of the filters is recommended. Further, it was emphasized to generate clean to less clean air movements by reevaluating the position of supply and exhaust air diffusers (WHO 2020a, b).

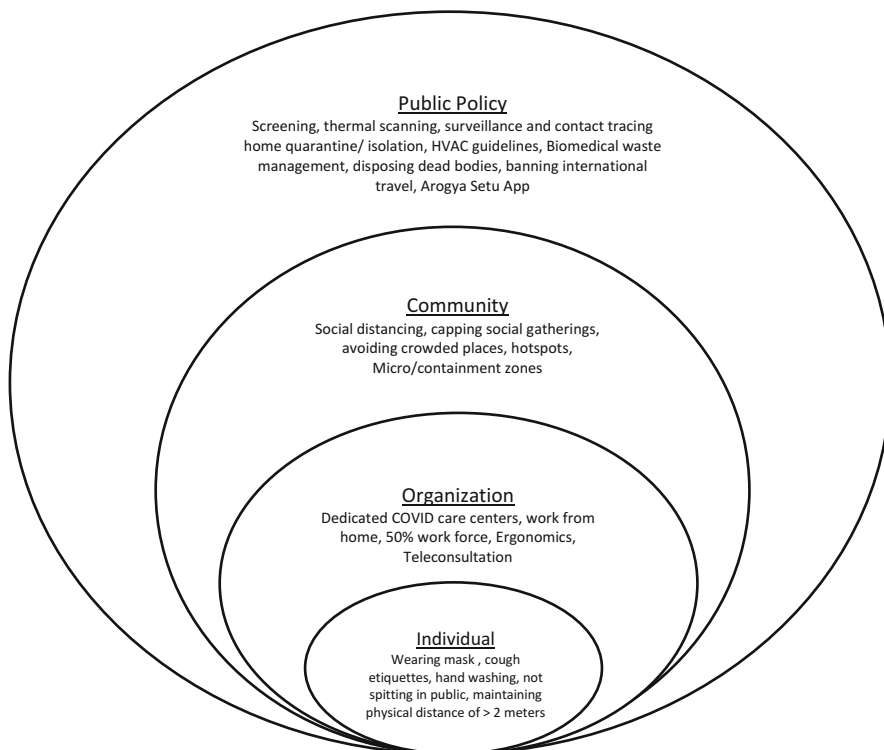
13. *Biomedical waste management* has proven to be the biggest challenge during this pandemic period. More biomedical waste has been generated in the form of one-time use masks as a preventive strategy to mitigate the spread of the COVID-19. The additional personal protective equipment (PPE) kits, kits for sample collection which include the Viral Transport Medium (VTM) and swabs sticks syringes and vial/vacutainers for collection blood samples, and so on have also added to huge amounts of biomedical waste. The biomedical waste generated needs to be disposed off properly in order to avoid indirect transmission of COVID-19 infection to other people. Appropriately using the PPE and other logistics can help in reducing biomedical waste generation. The WHO recommended the rational and appropriate use of PPE based on the risk of exposure and transmission dynamics of the pathogen (WHO 2020b). The Ministry of Environment, Forest, and Climate change published guidelines for managing waste generated during treatment, diagnosis, or quarantine of COVID-19 patients (NCDC 2020). These guidelines recommended the use of double-layered bags with mandatory “COVID 19 waste” labeling, regular disinfection of trolleys, stethoscopes, blood pressure measurement apparatus, walls, lockers, cupboards, refrigerators, railings, and so on, with soap and water, alcohol-based rub, or 1% hypochlorite solution whichever is available. Being an enveloped virus, the surface of the virus can be easily disrupted by using 60–70% alcohol-based antiseptic solutions rather than 100% alcohol-based antiseptic solutions. Waste masks and gloves in the general households should be kept in the paper bag for a minimum of 72 h prior to disposal as dry general waste after cutting to prevent reuse (Central Pollution Control Board 2020) (Fig. 5.4).

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## 5.5 Impact of Various Strategies on Different Spheres of People

No single mitigation strategy has impacted the lives of people during COVID-19 pandemic. Many times unplanned and newly introduced strategies lead to more harm/loss than benefit. The overall impact has been seen because of multiple strategies working together in order to completely cut down the ways of SARS-CoV-2 virus transmission in the community.

Due to the restriction in movements of the people during “lockdown,” there has been less plight of the vehicles on roads, rails, and in air, which has raised the air quality index of many cities which were having the worst quality of air index. Imposing lockdowns has disrupted the normal life of people also as it took away



**Fig. 5.4** Socio-ecological model for controlling the spread of COVID-19 infection

many jobs pushing them more into poverty. Lack of food and water supplies have pushed them more down in the nutrition graph. Hunger, lack of provision of medicines to the people of chronic disease, migration of people from cities to their home town leading to mishaps have contributed a lot to the total morbidity and mortality index which can be contributed to the ongoing COVID-19 pandemic. The curfews have disrupted the social life of the people. The screen time of the people has increased as their movements were restricted and were made home-bound due to lockdown. Lockdown has also resulted in an increase in psychological problems such as depression and anxiety disorders leading to suicide attempts/suicides.

**Work from home** (WFH) was started in many sectors to avoid gathering at workplaces. It was considered as a good way of protecting the office workers by cutting down the risk of getting COVID-19 infection. It has been seen that WFH has benefits of flexibility and agility in working arrangements, increased productivity, improved staff health, and wellbeing, attracted new talents, financial benefits, the convenience of doing work but at the same time, it has seen some consequences such as isolation, difficulty in monitoring performance, home distractions, potential burnouts, negative impact on mental health, and so on (Advantages and disadvantages of employees working at home in [businessinfo.co.uk](http://businessinfo.co.uk) n.d.).

**Virtual classes** have been seen as the future of the current education system. The children need not visit schools for education instead they can be educated at their respective homes. Mobile phones, computers, and a good internet connection are just needed for attending the virtual classes. Though it seems very fancy, but it has increased the screen time of the children to a large extent make them vulnerable to the harmful effects of non-ionizing radiations and leading to many cancerous growths such as gliomas, acoustic neuromas, meningiomas, and parotid gland tumors (Ahlbom et al. 2004). Further, the screen time has severely impacted the refraction of the users. Many places in our country are still where there is no good quality internet connection which has compromised the studies of children. In an incident in Kerala in June 2020, a girl committed suicide as she was unable to join the online class to carry on her studies in absence of logistics required to attend online classes (“I’m going”: Kerala girl commits suicide after missing online class—India News n.d.) Further, it has been found that children reported more distraction while attending virtual class than they used to have in the real class.

The healthcare system has been affected more because of the COVID-19 pandemic. It has changed the health care seeking behaviors of people. The direct contact between doctor and patient has been reduced very much. The technology has come into play for seeking medical consultation in the form of “teleconsultation” which can prove to be an advanced method of providing care to the patients. But the consequences such as lack of bonding between doctor–patient and scarcity of time for consultation cannot be denied. The service provided to the number of patients per day is recorded to be less than those when the OPDs were run physically.

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## 5.6 Mortality and Comorbid Conditions Associated with COVID-19

The diseases which were responsible for the major proportion of total morbidity and mortality and were considered to be of prime importance and emergencies are totally ignored during this COVID-19 pandemic due to the shutting down of normal OPD’s. The focus of the health care system has shifted more towards COVID-19.

In India, the overall mortality due to COVID-19 among COVID-19 positive patients was found to be 1.43% (MoHFWIHome n.d.). More than half of the deaths that have happened in India were above 60 years of age and 70% of the total deaths were among males (Ssentongo et al. 2020). COVID-19 has been found to be associated with many chronic diseases. A study found 2.25 times more risk of deaths among patients having cardiovascular diseases, 80% higher risk of deaths among patients suffering from hypertension, 1.5 times more in those having diabetes, 2 times among patients with congestive heart failure, and three times those having chronic kidney diseases among those who were COVID-19 positive (Analysis of existing comorbidities and COVID-19 mortality n.d.).

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## 5.7 Role of Vaccine

Vaccines have proven to be game-changer in managing infections. With the development of the first smallpox vaccine by Edward Jenner, the vaccines have moved a long way in managing different types of infections. Never in the history of vaccination, a vaccine has been made so quickly. Though WHO and different national health agencies have published infection prevention control guidelines yet people are waiting for COVID-19 vaccine. The various pharmaceutical companies have been trying hard to achieve the feat. Though certain pharmaceutical companies have claimed to develop the vaccine but the long-term profile of these vaccines is yet to be discovered (NCDC 2020). Another important aspect of a vaccine is its acceptability among the masses. Though the vaccine will be launched over a period of time but the psychological effect of vaccine such as the insecurity about long-term complications of vaccine, vaccine hesitancy, and acceptance in the community is the biggest challenge for the health care providers and the health agencies (MacDonald et al. 2015). For successful rollout of COVID-19 vaccine, the health care providers need to understand the vaccines hesitancy determinant matrix which includes contextual influences (arising due to historic, sociocultural, environmental, health system, economic, political), individual and group influences (personal perception, influence of the social/peer environment) and vaccine-specific issues directly related to the vaccine or vaccination such as vaccination schedule, cost reliability (WHO 2014).

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## 5.8 Success Stories

Implementing the containment strategies stringently has helped in reducing the number of COVID-19 positive cases the many countries. An emergency like a pandemic can be controlled when both government and people participate responsibly. Countries such as Taiwan, South Korea, New Zealand, and Australia have been able to successfully manage the spread of COVID 19 to the maximum extent. Taiwan tested and quarantined travelers from Wuhan, China, banned the export of surgical masks, and traced the mobile sim cards to ensure those who were given quarantine were actually abiding by the rules. Singapore adopted an aggressive approach to contact tracing by scanning people's Identity cards at the supermarket, built temporary bed spaces at breakneck speed to house COVID-19 patients. South Korea did excessive testing and employed real-time tracking of COVID-19 patients, offering cash payments to the citizens to ride out the economic turbulence. New Zealand moved swiftly to shut down the country in less than 3 weeks of its first case instituting "level 4 lockdown" which meant that people could interact with people within their home in an attempt to eliminate the virus all together with text messages to the people to explain what is expected of them (The best global responses to COVID-19 pandemic|Time n.d.).

## References

- “I’m going”: Kerala girl commits suicide after missing online class—India News [WWW Document] (n.d.). <https://www.indiatoday.in/india/story/kerala-girl-commits-suicide-for-missing-online-class-1684595-2020-06-02>. Accessed 7 Dec 2020
- About COVID-19/CDC [WWW Document] (n.d.). <https://www.cdc.gov/coronavirus/2019-ncov/cdcresponse/about-COVID-19.html>. Accessed 1 Jan 2021
- Advantages and disadvantages of employees working at home|businessinfo.co.uk [WWW Document] (n.d.). <https://www.nibusinessinfo.co.uk/content/advantages-and-disadvantages-employees-working-home>. Accessed 7 Dec 2020
- Agarwal B, Balig G, Bhambure JM, Garg V, Mathur J, Mittal R, Murthy V, Rajasekaran S, Shukla Y, Amitabha S (2020) ISHRAE COVID 19 guidelines for operation of air conditioning/ventilation system
- Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A (2004) Epidemiology of health effects of radiofrequency exposure. *Environ Health Perspect* 112(17):1741–1754
- Analysis of existing comorbidities and COVID-19 mortality [WWW Document] (n.d.). <https://www.news-medical.net/news/20201011/Analysis-of-existing-comorbidities-and-COVID-19-mortality.aspx>. Accessed 1 Jan 2021
- Berman G, Carter K, Herranz MG, Sekara V, Innocenti UO of R (2020) Digital contact tracing and surveillance during COVID-19. General and child-specific ethical issues. *Papers*
- Central Pollution Control Board (2020) Guidelines for handling, treatment and disposal of waste generated during treatment/diagnosis/quarantine of COVID-19 patients
- Chin AWH, Chu JTS, Perera MRA, Hui KPY, Yen H-L, Chan MCW, Peiris M, Poon LLM (2020) Stability of SARS-CoV-2 in different environmental conditions. *Lancet Microbe* 1:e10
- Coronavirus disease (COVID-19) [WWW Document] (n.d.). <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19>. Accessed 7 Dec 2020
- Coronavirus history: how did coronavirus start? [WWW document] (n.d.). <https://www.webmd.com/lung/coronavirus-history>. Accessed 7 Dec 2020
- Coronavirus lockdown 2.0 guidelines|IT companies can now work with 50 percent strength [WWW Document] (n.d.). <https://www.moneycontrol.com/news/business/coronavirus-lockdown-2-0-guidelines-it-companies-can-now-work-with-50-percent-strength-5147991.html>. Accessed 7 Dec 2020
- Coronavirus: what is a Covid-19 containment zone and why is it created?|Hindustan Times [WWW Document] (n.d.). <https://www.hindustantimes.com/india-news/coronavirus-what-is-a-covid-19-containment-zone-and-why-is-it-created/story-k2qHFXwUXqr4a17mQoPtuo.html>. Accessed 17 Jan 2021
- COVID-19 employer information for office buildings|CDC [WWW Document] (n.d.). <https://www.cdc.gov/coronavirus/2019-ncov/community/office-buildings.html>. Accessed 29 Dec 2020
- Covid-19 India: 3-tier classification of hospitals for diverse levels of infection|India News—Times of India [WWW Document] (n.d.). <https://timesofindia.indiatimes.com/india/3-tier-classification-of-hospitals-for-diverse-levels-of-infection/articleshow/75037735.cms>. Accessed 1 Feb 2021
- Eslami H, Jalili M (2020) The role of environmental factors to transmission of SARS-CoV-2 (COVID-19). *AMB Express*
- In a first, Kerala CM confirms community transmission of Covid-19—India News—Hindustan Times [WWW Document] (n.d.). <https://www.hindustantimes.com/india-news/in-a-first-kerala-cm-confirms-community-transmission-of-covid-19/story-zGoyjgiUYmP521n0xKLTCM.html>. Accessed 4 Dec 2020
- India’s “super spreader” home-quarantines 26,000 people in 24 Punjab villages—The New Indian Express [WWW Document] (n.d.). <https://www.newindianexpress.com/nation/2020/mar/28/indias-super-spreader-home-quarantines-26000-people-in-24-punjab-villages-2122724.html>. Accessed 1 Feb 2021

- Indian Council of Medical Research (2020) Strategy for COVID-19 testing in India
- IPL 2020 UAE Schedule: IPL Full Schedule, Time Table, Teams, Players List, Match Dates, Start Date, Latest News [WWW Document] (n.d.). <https://indianexpress.com/article/sports/ipl/ipl-2020-uae-live-updates-ipl-2020-new-schedule-time-table-teams-players-list-match-start-dates-news-update-6585020/>. Accessed 1 Feb 2021
- Italy going back to games with no fans in stadiums due to rising coronavirus cases—Sports News, Firstpost [WWW Document] (n.d.). <https://www.firstpost.com/sports/italy-going-back-to-games-with-no-fans-in-stadiums-due-to-rising-coronavirus-cases-8950421.html>. Accessed 30 Dec 2020
- MacDonald NE, Eskola J, Liang X, Chaudhuri M, Dube E, Gellin B, Goldstein S, Larson H, Manzo ML, Reingold A, Tshering K, Zhou Y, Duclos P, Guirguis S, Hickler B, Schuster M (2015) Vaccine hesitancy: definition, scope and determinants. *Vaccine* 33:4161–4164
- Ministry of Health and Family Welfare (2020) Covid-19: guidelines on dead body management, pp 1–7
- Ministry of Health and Family Welfare, Government of India (2020) Guidelines for home isolation of very mild/pre-symptomatic COVID 19 cases
- Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations [WWW Document] (n.d.). <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>. Accessed 4 Dec 2020
- MoHFWIHome [WWW Document] (n.d.). <https://www.mohfw.gov.in/>. Accessed 1 Jan 2021
- Mohindra R, Ghai A, Brar R, Khandelwal N, Biswal M, Suri V, Goyal K, Singh MP, Bhalla A, Rana K, Lakshmi PVM (2021) Superspreaders: a lurking danger in the community. *J Prim Care Commun Health* 12:1–4
- Mutambudzi M, Niedwiedz C, Macdonald EB, Leyland A, Mair F, Anderson J, Celis-Morales C, Cleland J, Forbes J, Gill J, Hastie C, Ho F, Jani B, Mackay DF, Nicholl B, O'Donnell C, Sattar N, Welsh P, Pell JP, Katikireddi SV, Demou E (2020) Occupation and risk of severe COVID-19: prospective cohort study of 120 075 UK Biobank participants. *Occup Environ Med*. oemed-2020-106731
- NCDC (2020) Guidelines for disinfection of quarantine facility for COVID-19, pp 24–26
- Not more than 50 people can attend wedding functions during lockdown in Delhi: Arvind Kejriwal, India News Newswionews.com [WWW Document] (n.d.). <https://www.wionews.com/india-news/not-more-than-50-people-can-attend-wedding-functions-during-lockdown-in-delhi-arvind-kejriwal-343857>. Accessed 1 Feb 2021
- Occupational Safety and Health Administration (2020) Guidance on preparing workplaces for COVID-19. *Osha* 35
- Oran DP, Topol EJ (2021) Prevalence of asymptomatic SARS-CoV-2 infection: a narrative review. *Ann Intern Med* 174(2):286–287
- Quarantine period for covid 19 mohfw—Google Search [WWW Document] (n.d.). [https://www.google.com/search?rlz=1C5CHFA\\_enIN906IN906&sxsrf=ALeKk02D-MWNUwf\\_WRv3rZsn5JELYcX0lg%3A1609293252028&ei=xN3rX9eXAbvSz7sP\\_tCyyA8&q=quarantine+period+for+covid+19+mohfw&oq=quarantine+period+for+covid+19+mohfw&gs\\_lcp=CgZwc3ktYWlQAz0ECAAQRzoLCAAQyQMqCBANEB46CAgAEAgQDRaEogcIIRAKEKABOgQIIxAnOgUIABDJAz0CCAA6CQgAEMkDEBYQHjoGCAAQFhAeOggIIRAWEB0QHIC\\_ZFiOiAFg54sBaAFwAngAgAGEAogB2w6SAQUwLjMuNpgBAKABAAoBB2d3cy13aXrIAQjAAQE&scient=psy-ab&ved=0ahUKEwjXiYHFzPtAhU76XMBHX6oDPkQ4dUDCA0&uact=5](https://www.google.com/search?rlz=1C5CHFA_enIN906IN906&sxsrf=ALeKk02D-MWNUwf_WRv3rZsn5JELYcX0lg%3A1609293252028&ei=xN3rX9eXAbvSz7sP_tCyyA8&q=quarantine+period+for+covid+19+mohfw&oq=quarantine+period+for+covid+19+mohfw&gs_lcp=CgZwc3ktYWlQAz0ECAAQRzoLCAAQyQMqCBANEB46CAgAEAgQDRaEogcIIRAKEKABOgQIIxAnOgUIABDJAz0CCAA6CQgAEMkDEBYQHjoGCAAQFhAeOggIIRAWEB0QHIC_ZFiOiAFg54sBaAFwAngAgAGEAogB2w6SAQUwLjMuNpgBAKABAAoBB2d3cy13aXrIAQjAAQE&scient=psy-ab&ved=0ahUKEwjXiYHFzPtAhU76XMBHX6oDPkQ4dUDCA0&uact=5). Accessed 30 Dec 2020
- Social Distancing [WWW Document] (n.d.). <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html>. Accessed 5 Dec 2020



- Spectating Spectator Sports: COVID-19 is dismantling stadium culture, one screen at a time—The Economic Times [WWW Document] (n.d.). <https://economictimes.indiatimes.com/news/sports/spectating-spectator-sports-covid-19-is-dismantling-stadium-culture-one-screen-at-a-time/articleshow/78588256.cms?from=mdr>. Accessed 30 Dec 2020
- Ssentongo P, Ssentongo AE, Heilbrunn ES, Ba DM, Chinchilli VM (2020) Association of cardiovascular disease and 10 other pre-existing comorbidities with COVID-19 mortality: a systematic review and meta-analysis. *PLoS One* 15(8):e0238215
- Strategies to reduce COVID-19 spread|Coronavirus|COVID-19|CDC [WWW Document] (n.d.). <https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/strategies-to-reduce-spread.html>. Accessed 5 Dec 2020
- Surveillance ID, Control D (2020) Guidelines for Covid-19 cases in community settings 19–26
- The best global responses to COVID-19 pandemic|Time [WWW Document] (n.d.). <https://time.com/5851633/best-global-responses-covid-19/>. Accessed 7 Dec 2020
- The six strains of SARS-CoV-2—ScienceDaily [WWW Document] (n.d.). <https://www.sciencedaily.com/releases/2020/08/200803105246.htm>. Accessed 1 Feb 2021
- The WHO just declared coronavirus COVID-19 a pandemic|time [WWW document] (n.d.). <https://time.com/5791661/who-coronavirus-pandemic-declaration/>. Accessed 1 Jan 2021
- Tokyo Olympics postponed to 2021 due to coronavirus pandemic|Tokyo Olympic Games 2020|The Guardian [WWW Document] (n.d.). <https://www.theguardian.com/sport/2020/mar/24/tokyo-olympics-to-be-postponed-to-2021-due-to-coronavirus-pandemic>. Accessed 1 Feb 2021
- What is a hotspot area? What can and can't be done in a hotspot?|India News—Times of India [WWW Document] (n.d.). <https://timesofindia.indiatimes.com/india/what-is-a-hotspot-what-can-and-cant-be-done-in-a-hotspot/articleshow/75059209.cms>. Accessed 17 Jan 2021
- WHO (2014) Report of the Sage Working Group on vaccine hesitancy
- WHO 2020a. Getting your workplace ready for COVID-19. World Health Organisation, pp 1–8
- WHO (2020b) Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19). World Health Organisation, pp 1–7
- World Health Organization (2010) Pandemic Influenza preparedness and response: a WHO guidance document