COVID-19 in India: Waves, Variants of Concern, Airborne Transmission

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The novel coronavirus disease (COVID-19), caused by SARS-CoV-2 in 2021, is a tsunami like coronavirus outbreak relative to the previous outbreaks involving older coronavirus or Swine flu (H1N1) or Spanish flu. With the number of COVID-19 cases now exploding worldwide, it is certain that transmission of SARS-CoV-2 is very high possibly airborne (aerosol droplet) and there are diverse spectrum of disease severity. The biological issues like a genetic susceptibility and variability in the response to the virus are still being elucidated. Controlling current rates of infection and combating future waves require a better understanding of the routes of exposure to SARS-CoV-2 and the underlying genomic susceptibility to this disease. How individuals respond to SARS-CoV-2 exposure is becoming better understood in a global sense, but differences in the vulnerability of individuals to infection and in the spectrum of COVID-19 symptoms remain to be understood. It is known that advanced age and pre-existing conditions (e.g. metabolic, cardiovascular, pulmonary, and renal diseases) render a person more vulnerable to severe COVID-19. However, a surprising observation emanating from the current pandemic is the rate of hospitalization of younger, ostensibly healthy individual especially in the newer waves in 2021. Is there a vulnerability index of COVID 19 for India? What makes some people more vulnerable than others to SARS-CoV-2? What role do gene networks play in determining or influencing efficiency of infection, the immune response to infection, or the severity of COVID-19 symptoms? Our understanding of genetic susceptibility to SARS-CoV-2 infection and the severity of COVID-19 is still in its infancy. In addition to the genomics research, attention needs to be paid to the spread of the virus and how it can be prevented in India by breaking the chain of transmission.

What makes some SARS-CoV-2 infected individuals extremely sensitive to the development of acute respiratory distress syndrome (ARDS) while others are asymptomatic. The impact of ACE2 gene and its protein on viral entry with TMPRSS as well as furin is well known. Genetic polymorphisms of either ACE2 or TMPRSS or furin can have impact on cellular invasion to facilitate rapid entry. Could it lead the virus bypass nose or throat and enter the lung or could it be more virulent are unanswered questions which are now being investigated. Variations in COVID-19 severity might be classified as (a) asymptomatic, (b) symptomatic but no hospitalization required, and (c) severely symptomatic with hospitalization urgently indicated. Elucidation of alleles of relevant genes associated with these three levels of severity to viral response might aid clinicians in dealing with possible future waves of this pandemic.

The second surge in India started very quietly from less exposed population clusters in some districts from where it’s rapidly spread to rest of India. Clearly in the second wave we are seeing a faster transmissible strain, but of unknown virulence. Currently the Indian variants of concern are being investigated by genome and public health experts to delineate if it’s an imported strain like UK, South African or Brazilian one or is a home grown mutant. The initial data suggested by Indian research agencies have identified a double mutant of E484Q and L454R strains. The public health strategy will still be the same. Worldwide more than a million sequences have been done and some have been designated as “Variants of concern”. CDC classifies them as B.1.1.7(British), P.1(Brazil), B.351(South African) American (California, New York), and Indian (B.1.617). SARS-CoV-2 variants bring concerns for increased spread and escape from both vaccine and natural infection immunity. Various factors driving SARS-CoV-2 variant evolution, include specific mutations, examine the risk of further mutations, and consider the experimental studies needed to understand the threat these variants pose. Plante et al. examine SARS-CoV-2 variants including B.1.1.7 (UK), B.1.351 (RSA), P.1 (Brazil), and B.1.429 (California). Some mutations can enhance virulence to make it more invasive as well as severity. Most have till date not been documented linked to severity but possible links with transmissibility can’t be ruled out.

Vaccine is the fourth pillar after the COVID appropriate behaviour of mask, distancing and sanitizing. The vaccine primary goal is to protect the most vulnerable from death and severe diseases. These are all early generation rapidly developed vaccines which are all in Emergency use authorisation (EUA) mode. India is part of the global alliance for vaccine and has risen above vaccine nationalism by exporting vaccine fulfilling its global obligations. We need to vaccinate all our vulnerable groups which can succumb to COVID19 independent of the age but must follow vaccine discipline. Even after vaccination with full doses we need to mask, avoid crowds or poorly ventilated spaces, distance and sanitize. Post vaccine COVID 19 needs investigation to study the phenomenon of immune escape or efficacy. Also the severity of the disease and phenotype of post vaccine COVID 19 needs to be studied. We should never unmask while speaking, when eating try to avoid public spaces in crowds but eat in safe zone and ensure that we don’t unmask as much as possible. We need to use safer masking strategies like doubling up, using mask braces, ensure its tight and well covered. There...
has to be zero tolerance for violators of COVID norms, behaviour and protocols and we need to have a single-minded determination to conquer and decontaminate this nasty virus. We need to be proactive to clear the virus from our environment using mind and body strategies and build a strong COVID free India.  

The contribution of aerosol exposure to the transmission of SARS-CoV-2 has been under scrutiny. Many global scientists have emphasized that infected individuals represent emission sources of aerosol generated by routine behaviours—such as breathing, speaking, singing, coughing, sneezing, and resuspension activity—all of which might be capable of transmitting disease.  

SARS CoV2 is a typical respiratory RNA virus which spreads via aerosol generation. As with any infectious respiratory disease, an infected individual can release aerosols and droplets containing SARS-CoV-2 by coughing or sneezing. The transmission efficiency of SARS-CoV-2 has proved to be high, with reported reproductive numbers greater than that of the 2009 H1N1 influenza virus.  

SARS-CoV-2 have virus-containing aerosols and droplets can lead to short-range airborne transmission (~6 ft). Such aerosols (<10-µm diameter) and droplets (>10-µm diameter) can promote infection through (i) deposition on surfaces and subsequent hand-to-mouth/nose/eye transfer and (ii) inhalation. While suspended airborne droplets can persist in the air for several minutes, the smaller aerosols do not rapidly settle and can persist for longer durations (~minutes to hours). Once airborne, the characteristics of aerosols generated by cough or sneeze are dynamic, notably decreasing in size due to evaporative loss of water depending on ambient humidity and temperature. The northern hemispheric, temperate reginal waves in winters and the tropical Indian wave in hotter, humid environments merits scientific scrutiny. The high transmissivity of the virus suggests that a low dose might be sufficient to infect an individual; however, such studies have yet to evaluate the infectious dose of SARS-CoV-2.  

Until scientific evidence emerges, it is useful for individuals to follow approaches that minimize their risk of infection by reducing their exposure level and duration of exposure. The combined use of masks and physical distancing can be effective approaches for decreasing exposure to airborne forms of SARS-CoV-2. Avoiding or minimizing the time in contact with these potential aerosol exposures would also be a critical parameter in lowering risk. Common approaches for mitigating airborne exposures include (i) identification of emission sources, (ii) prevention of viral shedding and inhalation exposure, and (iii) environmental controls. The key area of environmental controls leverages evidence of reduced exposures by improving ventilation, utilization of portable filtration devices, or other aerosol inactivation technologies, and cleaning practices to reduce exposure from resuspension. This topic of environmental controls is broad and complex and guidance prepared by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASRHA) and other recent papers focused on indoor ventilation and environmental controls.  

Masking is the primary face covering which offer protection from virus laden aerosol or droplets with the gold standard n95 mask capable of filtering more than 99% of airborne aerosols compared to filtration efficiencies of surgical masks (~75%) and cloth coverings (~67%) that afford inward protection against for aerosols sized between 0.02 and 1 µm. A range of face coverings is available—including N95 respirator masks, surgical masks, and cloth coverings, each offering different efficiencies for inward protection (i.e., PPE) and outward protection (i.e., source control) from virus-laden aerosol and/or droplets.  

There is a need to double mask and do innovation in design and filtration efficiency of cloth masks both for adults and children which will be the key and as important as vaccine development to prevent the spread of the virus. While promoting the use of face coverings by the public, it is also essential to ensure cleaning protocols prior to reuse, and to reinforce the importance of continued physical distancing to prevent individuals from having a false sense of security. The real threats of recurrent waves of the pandemic loom large and the key will be behaviour change and preventive strategies including vaccine, identification of vulnerable groups and avoidance of viral contamination.  

References  
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