Seasonal Variation and COVID-19 Pandemic in Nepal

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The World Health Organization has declared the novel coronavirus (SARS-CoV-2) Covid-19 as a pandemic as it has spread globally. Understanding severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) global dispersal pattern, it is important to know the environmental parameters within which the virus survives. There is adequate evidence in epidemiological and biological aspects to prove human beings are prone to viral pathogens such as Middle East respiratory syndrome coronavirus, respiratory syncytial virus, and influenza virus in cold weather. Apart from the influence of seasonality, other factors that might impact the rate of virus spread includes the effectiveness of infection control practices, individual behavior and immunity, and emergency preparedness levels of countries. This viewpoint highlights the potential influence of weather conditions, seasons, and non-climatological factors on the geographical spread of cases of COVID-19 across the globe.

INTRODUCTION

The coronavirus is a new kind of virus, classified into subfamily alpha, beta, gamma, and delta coronaviruses. The human coronaviruses (HCoVs) are of two types; alpha coronaviruses (HCoV-229E and HCoV-NL63) and beta coronaviruses (HCoV-HKU1, HCoV-OC43).¹ The outbreak of the virus is recorded in the past in various years. The first outbreak by the SARS-CoV virus causing Severe Acute Respiratory Syndrome (SARS) was recorded in the year 2002 during the fall, the second outbreak was in south Arabia in Autumn 2012 caused by the new MERS-CoV virus causing Middle East Respiratory Syndrome (MERS). The third one turned into a COVID-19 pandemic caused by the SARS-CoV-2 virus that emerged in China in the Autumn 2019² and has spread across the world during early 2020, with unforeseen consequences.¹ MERS and SARS did not spread widely or fast enough to show seasonality¹ whereas, the beta coronaviruses (OC43 and HKU1) spreads more in the winter.¹ As the novel Coronavirus is an emerging virus, the new pathogen has exhibited high human-to-human transmissibility nationally and internationally³ it is hard to conclude the seasonality. Even though, it is being predicted the cases will surge back in autumn or winter if coronavirus favors winter like its cousins.¹ Beyond

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social measures and biomedical research, it is important to assess the seasonality of the epidemic to inform strategies, with limited available data in a short period.

**DISCUSSION**

Viruses are sensitive to heat. High temperatures inactivate viruses, resulting reduction in the number of active viruses. The viral transmission has been suggested to be lower at higher humidity and temperature. In the same way many respiratory viral infectious diseases caused by the human respiratory syncytial virus (RCV), influenza virus, and human coronaviruses show seasonal fluctuation and rampant during winter. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) can be transmitted through aerosols, large droplets, or direct contact with secretions (or fomites) as an influenza virus. Respiratory Syncytial viruses (RSV) are transmitted by the droplet transmission and have clear seasonal rhythms as cases of influenza and several types of coronaviruses that surge in the winter. The influenza virus and RSV survive better in the environment whether it may be surface or aerosol in low humidity and low temperature. Whereas, relative humidity and high humidity the aerosol transmission is reduced reducing the virus’s survival in an aerosol. In addition to this, during winter, humidity, and the speed of air movement decreases favoring the spread of respiratory infections.

SARS-CoV-2 is an emerging virus that causes respiratory and gastrointestinal infections. The SARS-CoV-2 virus is spreading strikingly fast in comparison to the SARS-CoV and the MERS-CoV. The average incubation period for viral infection is 5–6 days with the extension of 14 days including the symptoms as fever, coughing, and shortness of breath, and diarrhea. Also, the severe condition leads to pneumonia, acute respiratory syndrome, kidney failure and even death. The patient with COVID-19 in severe and critical conditions closely relates to the features of SARS and MERS.

The viral transmission seems slower at higher humidity and temperature, but the behavior of coronavirus is still under investigation. The survival and transmission of the SARS virus include temperature, humidity, and wind speed. Virus transmission is regulated by several factors, including climatic conditions (such as temperature and humidity), and population density, the same applies in SARS-CoV-2. Behavioral patterns and travel history of humans are also related to the transmission of the virus. The human factors as lack of physical distancing, low immunity, high transmissibility increase the probability of climatic influence on transmission.

Other significant variables include population density, societal composition, socioeconomic structures, and government policy, and surface life and the number of tests.

Among the five weather variables, temperature average seems significantly correlated where temperature minimum, temperature maximum, humidity, and rainfall were not significantly correlated. Additionally, COVID-19 cases in Jakarta is seemed due to human behavior i.e. human mobility and population density. The epicenter of COVID-19 Wuhan, the mean temperature has dropped from 18.2°C to 13.4°C in October to November and humidity remained between 73.12% to 77.58%. The findings overlapped with SARS onset in Guangzhou in 2002, where the temperature was between 13.8°C to 15.8°C and humidity between 69.05% to 78.91%. Furthermore, based on this finding the temperature between 13–19°C and humidity between 50% and 80% seems suitable for the survival and transmission of the coronavirus. Lower rainfall and reduced relative humidity provide a good opportunity for the transmission of respiratory pathogen infections, including coronavirus.

Similarly, from January to March, China and Italy share a similar environment but the infections spread was more in Italy as cold weather week lasted longer. The highest rates were found in places having mean March monthly temperatures roughly
between 40°C to 120°C and with relative humidity roughly between 60% to 85%. Besides large-scale studies from 21 different countries including France, Italy, Germany, Iran, Spain, Malaysia, Australia, United Kingdom, and United States of America, states that decrease in temperature spreads the disease. Conversely, the weak correlation between COVID-19 spread and atmospheric temperature between 26.00 ± 1.66°C and 33.38 ± 1.43°C, suggests Covid-19 likely to be nonseasonal. However, the possible cofactors for the spread of the pandemic are the median population age and the air pollution. Similarly, low relative humidity (from 61% to 85%), low-speed wind (from 6 km/h to 11 km/h), and high atmospheric pressure (from 1016 mbar to 1026 mbar) induce atmospheric stability facilitating the spread of the virus. During the outbreak of COVID-19 in China, the temperature tends to be an environmental driver as with a rise in temperature the transmission rate dropped, leading to a decline in infection rate and outbreak duration. Until a vaccine is successfully launched, human beings need to be prepared for a continuous battle against the newly emerged virus.

**SCENARIO OF NEPAL**

Nepal is located at latitude 28.394857N and longitude 84.124008 E. It lies in the northern hemisphere in the Asia region with a population density of 203 per Km². Nepal has a diverse climatic condition varying from place to place depending on its geographical characteristics. In the Terai region, winter temperatures range from 70°C to 20°C, while in mountainous areas, hills and valleys, winter temperatures fall below freezing. The Kathmandu valley has a nice climate with winter temperatures of between 20°C - 120°C. The major cities of Nepal above one lakh include Bharatpur, Dharan, Birgunj, Biratnagar, Patan, Pokhara, and Kathmandu the highest with 1,442,271 population. A recent survey done in Kathmandu valley reports, among the participants more than one-quarter of the participants were not wearing the mask, 27.34% were found to have used the mask inappropriately, only 20% of the hospitals were found to have maintained social distancing and 80% of the hospitals have arranged soap or sanitizer but unavailability of handwashing facilities with soap or sanitizer in the public places.

As we entered six months of the pandemic, there seems more cases increasing day by day. Unlike other Coronavirus, SARS-CoV-2 is also an emerging virus that causes respiratory infections. In addition to this, decreased temperature and humidity favor the formation of aerosols in winter. As we are entering the winter month from October and lasts till November when the temperature falls and humidity increases creating a favorable environment for the virus to expand. Furthermore, less exposure to sunlight decreases the Vitamin D levels weakening the immune system thus winter can be a crucial time to upward tick. Human behaviors are an important driver of the pandemic. So, to halt the spread of the virus the proper practice of using a face mask, hand hygiene, and maintaining physical distancing is utmost.

**CONCLUSION**

Although various studies hypothesize on seasonality of Covid-19, the spread of the novel coronavirus and seasonal variations in humidity, temperature, rainfall, and other environmental variables are under study. The evidence is emerging but is inconsistent. It is too early to jump to any conclusion about the seasonality of coronavirus. Furthermore, research is required to examine.

**RECOMMENDATION**

As the infection rate is increasing day by day in Nepal how SARS-CoV-2 will behave in the upcoming days is the burning issue. Efforts should therefore focus on the adoption of effective preventive measures such as wearing masks and practicing physical distancing will be important in communities to curtail the spread of the disease.
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