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# Impact of Climate: An Analysis of Transmission and Pattern of Infection of COVID-19 Pandemic with the Change of Weather with Special Reference to Ujjain District (M.P.), India

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**Abstract:** ***COVID-19 pandemic is spreading rapidly with more speedy transmission. In the month of March 2021, its infection is getting more dangerous in not only Ujjain district of M.P. but all over the India. Our study is although limited to a particular district of Madhya Pradesh India, but our results reflect almost all over the country. Authors have seen that corona virus may be more active during a particular transition season like other viruses. In the month of March 2021, all of sudden there was increase in number of active cases. The numbers of corona positive cases in March 2021 were found to be more than 4 to 20 times as compared to the month of February 2021. Data have shown that the disease occur more in males as compared to females. The average age of corona positive cases is 40-50 years. It seems that corona is temperature sensitive to some extent, and becomes more active during the transition season.***

**Keywords:** COVID-19, positive, transition, transmission, viruses

## 1. Introduction

COVID-19 has been a very long term pandemic since December 2019. Although, the disease was declared as pandemic after February 2020, India is one of the most affected countries of COVID-19. After one year of the origin of this disease there are 418460 active cases in India only. The disease was originated in Wuhan China in 2019 and was spread in more than 150 countries. To prevent the disease, governments of different countries followed a complete lock down for 2 to 3 months. The disease had taken lives of large number of people all over the world. However many vaccines are now available to prevent the disease, although none can provide complete protection from the disease. There are several modes of transmission suggested by various scientists from time to time.But as the time is passing, new characters of corona virus are appearing may be due to mutation. So no one is sure about the symptoms spreading, severity or preventive measures of the corona virus.

In present study authors have tried to find the correlation of corona with change of climate. Last year the outbreak of disease started in the month of March 2020 in India. It increased gradually specially in Mumbai, other parts of Maharashtra, Kerala, Delhi and other major cities of India. But then a decrease was observed after September 2020. After that the disease again showed a big outbreak in the month of March 2021. This was so called second wave of COVID-19. Is there any correlation of corona with the season, this yet to be establish. Many recent studies cited in the present study have suggested a correlation between weather conditions and the COVID-19 pandemic in a similar way to other viral infections such as influenza. However, several other studies have reported contradictory results showing that meteorological conditions may not in fact be associated with the COVID-19 expansion. Authors have also studied the effect of corona more on specific sex and age group.

## 2. Literature Survey

As Sasikumar K. et al. (2020) [1] mentioned that like other Asian countries, India is at the cusp of deadly transmission of COVID-19. Despite strict lockdown measures, the current COVID-19 infection counts shoot up to ~150,000 confirmed cases, with ~86,000 active cases and 4,500 deaths as on 28 May 2020. Maharashtra (Mumbai) alone accounts for 57,000 confirmed cases and 1,900 deaths (https://www.covid19india.org). India is the second largest populated country in the world with an average population density per km2 of 464 (https://www.worldometers.info). Respiratory droplets and contact routes are the fastest transmission modes of SARS-CoV-2; population density plays a significant role in its transmission (WHO, 2020) [2]. Moreover, large scale human migration and transportation can amplify localized outbreaks into widespread epidemics (Colizza et al., 2006) [3]. COVID-19 poses a serious risk to the travelling public because transmission of the emerging pathogens is facilitated by domestic and intercontinental travel (https://www.icao.int/Security/COVID-19/Pages/default.aspx).

Furthermore, airborne transmission of SARS-Cov-2 virus is possible through aerosols with carrier particles size of≤5 μm diameter (WHO, 2020)[4]. Coronaviruses, e.g., SARS-Cov-2 virus (100 nm diameters), need watery nuclei to travel through air, or it may bond with carrier particulate matters (PMs) like PM2.5 and PM10 in atmosphere (Silva et

al., 2014; Wong et al., 2010)[5],[6]. Pollutants like ozone, SO2, NO2, and PM have close relationship with infectious disease epidemiology. It is not only the pollution's impact on the immune system; the viruses may interact with the pollutants, allowing them to remain airborne for longer time and helping them make their way to the lungs. The coronavirus may remain infectious for 60 min in air after aerosolization (Pyankov et al., 2018) [7]. Based on the current increasing trend in COVID-19 cases and from the basic understanding of the viral infection spread, there is a strong possibility that SARS-Cov-2 may spread through air and thus require adequate control measures for further spreading of the virus (Morawska & Cao, 2020)[8]

Climate change has significant impact on zoonotic disease epidemiology (Naicker, 2011) [9]. Zoonotic infections are transmitted from animal to man (Pappas, 2011)[10], and their interactions are often considered as the potential source of epidemics by generating novel pathogens. Increased temperature and precipitation are predicted to have a greatest impact on the transmission of human infectious diseases like tick-borne diseases, tularaemia, anthrax, and vibriosis in Arctic (Waits et al., 2018)[11]. Temperature increases at a rate of 0.2°C/decade and predicted to touch 4°C by the end of 21st century (https://www.ipcc.ch/report/ar4/syr/). In the last decade, the Asian continent has experienced an exceptional number of unprecedented climate extreme events, e.g., severe heat waves in 2015, 2016, 2019, and 2020; the maximum local temperature is rising above 50°C, and the summer of 2013 was the hottest on record in eastern China. This increase in temperature, heat stress, and the frequency and intensity of heat waves may affect animal health by metabolic disruptions, oxidative stress, and immune suppression causing infections and release of the virus (Lacetera, 2019)[12].

The ancestor SARS-CoV-1 rapidly lost viability at higher temperatures and higher relative humidity (e.g. 38°C and relative humidity of >95%) (Chan et al., 2011)[13]. The in vitro stability of SARS-CoV-2 experiments has shown that the virus is highly stable at 4°C but is sensitive to heat (Chin et al., 2020)[14] and SARS-CoV-2 loses infectivity at normal core body temperature (37°C). However, small reductions at temperatures close to 37°C may substantially increase its viral stability (Kang, 2020)[15]. Some of these studies have considered only meteorological factors and others have included other important factors such as population density, which has been shown to be crucial in viral transmissions (Dalziel et al., 2018)[16]. The study by Baker et al. (2020)[17] used a negative relationship between humidity and transmission to conclude that even if there was a strong negative relationship between climate and coronavirus transmission, it would not have much impact on COVID-19 cases because the susceptibility population is high. In addition, different statistical and modelling techniques have been used in all these recent studies, which must be analysed very carefully. Therefore, in this systematic review we perform an in-depth analysis of the findings and the statistical and modelling methods used in all the recent studies that have reported different associations between climatic factors (humidity, precipitation, radiation, temperature and wind speed) and COVID-19 transmission.

## 3. Material and Methods

Authors have collected data of corona patients from the list declared by the CHMO of Ujjain district (M.P.) India. The lists of corona patients include sex and age of infected persons. The data is considered from 3rd February 2021 to 26th March 2021 i.e. 26 days in February month and 26 days in the month of March 2021. Following analysis was done using the above data:

1) Tabulation of list was done, separating males and females.
2) Ages of males and females were listed.
3) Average of ages of males and females was calculated.
4) Graphical representations of number and ages of males and females were done.
5) Calculation of Standard Deviation and Standard Error.
6) Analysis of correlation of the data obtained with change of climate or season or weather.

## 4. Results and Discussion

It was observed from the data that the corona active cases were least in the month of February 2021. Authors have collected data from CMHO, Ujjain district, M.P., India. From 3rdFebruary 2021 to 20th February 2021, highest number of COVID positive cases were 6 in a day and as low as 0. From 21st February there was little rise in number and maximum 13 COVID positive cases were reported on 28th February 2021. In the first week of March maximum of 20 cases were found, 2nd and 3rd week of March again showed a rise in COVID positive cases. The maximum number was approximately 30 till 3rd week of March 2021. From 23rd March 2021 to 26th March 2021, the numbers of COVID positive cases were approximately 45-86. A significant upsurge in COVID positive cases was observed during the 4th week of March 2021.

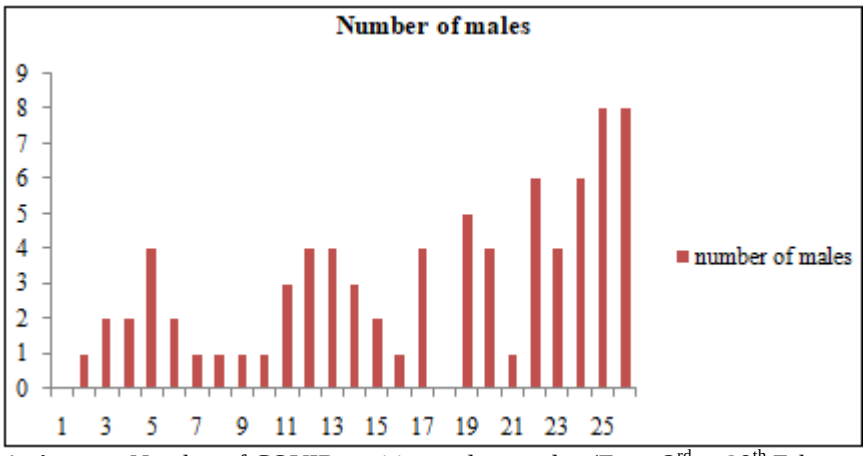


**Figure 1:** Average Number of COVID positive males per day (From 3rd to 28th February 2021)

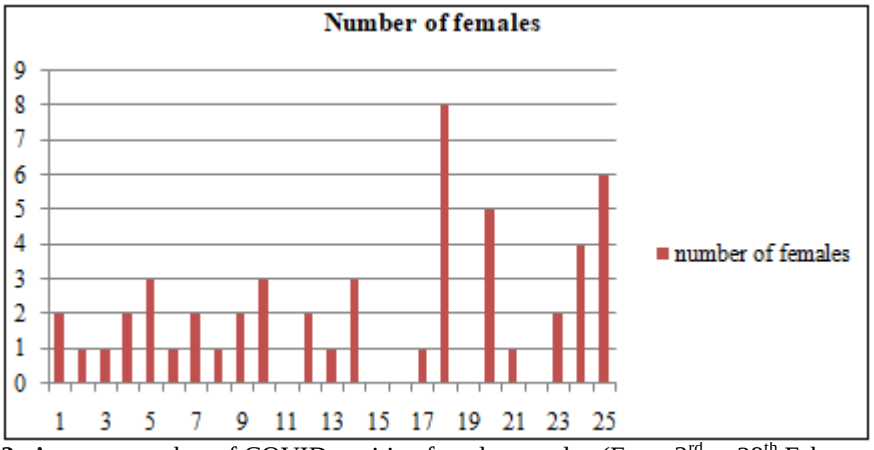


**Figure 2:** Average number of COVID positive females per day (From 3rd to 28th February 2021)

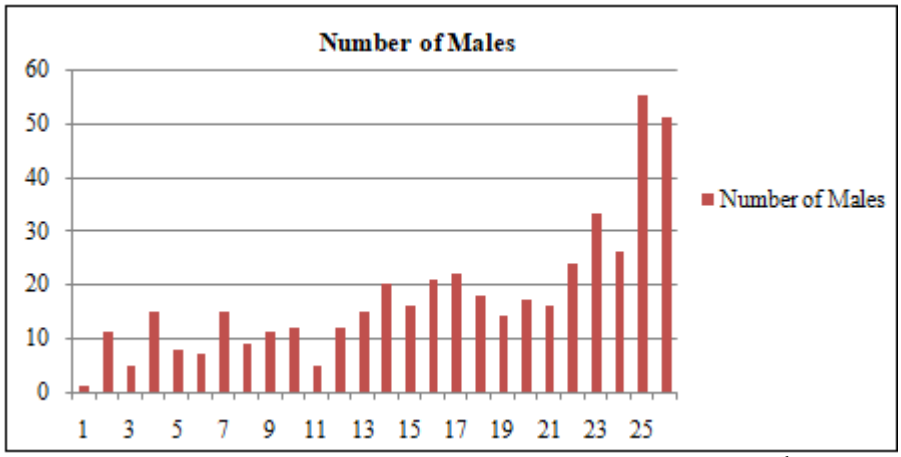


**Figure 3:** Average number of COVID positive males per day (From 1st to 26th March 2021)

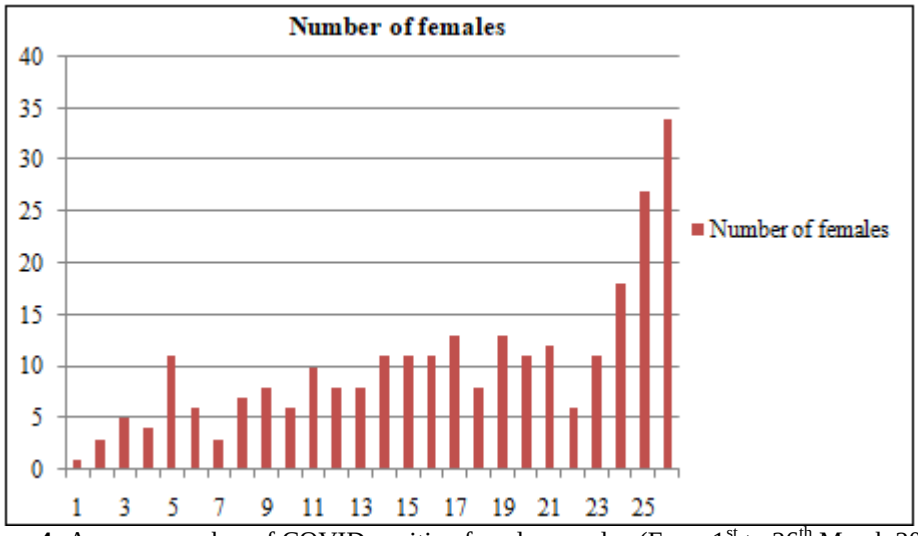


**Figure 4:** Average number of COVID positive females per day (From 1st to 26th March 2021)

Not only in Ujjain district, but the upsurge in COVID cases was observed in many parts of India. Last year in the month of February 2020, situation was under control but from middle of the March 2020 the COVID cases increased significantly all over India which resulted in lockdown in the country.

Several authors have concluded correlation between viral infections and climatic changes. Although there is some conflict among them but global warming, climate change, and extreme weather events have adverse impact on biodiversity, seasonality, and human incidence of many diseases (Singh & Sachan, 2010).[18]A warming at higher latitudes is expected to have implications on Avian influenza virus (AIV) ecology and also on the possibility of virus persistence in the atmosphere (Morin et al., 2018[19]). Increased temperature and precipitation are predicted to have a greatest impact on the transmission of human infectious diseases (Waits et al., 2018)[11].According to Sasikumar K. et al. (2020) [1]in India, the SARS-CoV-2 is most active at temperature ranges between 27°C and 32°C and humidity between 25% and 45%. Moreover, the daily COVID-19 counts have higher covariability (~65–85%) with local temperature; i.e., spread and growth of SARS-CoV-2 depend on local temperature rise. The combined temperature and humidity spectrum is highly significant for predicting the COVID-19 cases. The ancestor SARS-CoV-1 rapidly lost viability at higher temperatures and higher relative humidity (e.g. 38°C and relative humidity of >95%) (Chan et al., 2011)[13]. Redon A. and Aroca A. (2020)[20] published a review of the relationship between climate and the global expansion of COVID-19 suggests that weather conditions such as humidity, precipitations, radiation, temperature, and wind speed could play a secondary role in the transmission of the disease. There are too many contradictory findings to believe the opposite, although a great number of studies suggest that higher temperatures may help to stop the pandemic. In this regard, the existence of a bias towards negative associations between temperature and COVID-19 transmission because of previous experience with similar respiratory diseases cannot be discarded. Our results and analysis showed that rise in temperature has some relation with COVID-19 because positive cases increased when there was transition from winter to summer. With increase in temperature metabolic disturbances occur which may decrease our immunity and make the environment suitable for viruses (Lacetera, 2019) [12].

Authors have also gone through the average age and more affected sex in Ujjain district. Chandorkar S. and Shouche (2021)[21] suggested that the average age of infected persons is approximately 40-50 years. This study again confirms previous results. The average number of males affected in the month of February 2021 was 1.56 times more than females while in the month of March 2021, affected number of males was 1.72 times higher. As our data are showing that males are more infected as compared to females this is previously suggested by Chandorkar S. and Shouche (2021)[21]. This may be because movement of males outside the house is more for the sake of job and needs. It was also suggested that in India, care of children and old age people is taken more, since it was declared that the virus affects more in children and old aged people, so their movement may be restricted by the other family members.

## 5. Conclusion

Corona is spreading more with variety of symptoms. It seems that there is some relation with specific climatic conditions, so a downfall was seen from December 2020 to February 2021, but a second wave started in from the month of March 2021. During this period there is a transition from winter to summer in Ujjain (M.P.), so it is suggested that the corona virus may be temperature sensitive and becomes more active during the transition season. Although there are many contradictory studies, and more specific study is needed in this regard. There may be variations in results in different parts of India and other countries due to different climate, population density, culture and preventive measures taken by people.

## 6. Future Scope

A vast study is required on relation of climate and corona because all previous researches on viruses are not applicable for this particular virus.

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