

Association of environmental factors with the transmission of COVID-19 in various districts of Jammu Division (Union territory of Jammu and Kashmir, India).

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Abstract

The present study aims at evaluating the effect of environmental factors (Temperature, humidity, Wind) on the transmission of the COVID-19 in different locations of Jammu Division of Jammu and Kashmir, India. The timeline opted was the fall of 2020 (From 5th September 2020 to 5th November 2020). Descriptive statistical measures of all the variables were calculated and Pearson correlation was used to study the association between the variables versus daily number of cases. Significant moderate positive correlation was observed between temperature versus daily number of cases (r -value 0.589, $P < 0.05$), again significant positive correlation was observed between relative humidity versus daily number of cases (r -value 0.339, $P < 0.005$). Similarly, statistically significant positive association was observed between wind speed versus daily number of cases (r -value 0.645, $P < 0.05$) in cumulative analysis of the data under study. This investigation can provide an important input for mitigating the transmission of COVID-19 in Jammu and may help the administration and policymakers to amend the policies accordingly.

Key Words: *Environmental factors, daily number of cases, COVID-19 transmission*

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I. Introduction

Severe Acute Respiratory Syndrome (SARS) (2002-2004), H1N1 influenza (2009), Middle East respiratory syndrome (MERS) (2012-2020), the African Ebola virus epidemic (2013-2016), the Zika fever (2015-2016) and Avian influenza (2008-2014) are the six major pandemics and epidemics that hit the globe between 2000 and 2019. But none among them impacted so many countries simultaneously in such a short span of time as did the COVID-19. Climatic conditions (Temperature, air quality and relative humidity), dense population and health care quality are among the factors that affect the spread of viruses. [1,2] Literature suggests that the SARS outbreaks were inversely associated with the temperature.[3,4,5] Due to the weather dependence of viruses, the primary concern should be to understand the relationship between different parameters of weather and the transmissibility of the COVID-19. There are several studies which have already reported the effect of environmental factors on COVID -19 spread.[6,7] The main factors that affects the SARS virus are the optimal temperature, humidity and wind velocity.[8] Literature revealed that high temperature and humidity decreased the transmission of influenza.[9, 10, 11, 12] Dry air and respiratory droplets of influenza virus which are more stable in low temperature are key in spreading infectious disease.[13, 14] Evidences clearly marked the dependence of virus spread on the climatological parameters. Temperature, Air quality, survival period of the virus, transmission rate and virus life on the surfaces and in the air are some of the parameters that do affect the spread of the virus. Rise in temperature and decrease in COVID-19 prevalence has also been reported. [15] It becomes need of hour to study the COVID-19 prevalence during the time when temperature is falling down. The quick spread of a respiratory disease influenza outbreaks in winter conditions is already known in literature [16, 17] The weak immunity of hosts in cold weather can also not be ignored as it can make virus more susceptible to effect the host.[18, 19] Therefore the analysis of weather parameters on COVID-19 spread is of prime importance to ensure the disease free survival of human beings. In the present study correlation of the weather parameters and daily cases of COVID-19 have been investigated in various districts of Jammu. The study is conducted keeping in view the prime importance of weather transition on the transmission of viruses.

II. Methodology

Study Area and Data Collection

Locations of the study area chosen were in and around Jammu city (J&K, India). Districts chosen were Jammu, Rajouri, Reasi, Ramban. These fall in coordinates between **32.73°N 74.87°E to 33.25°N 75.25°E**. Based on the population projection report (2019), for India and states by National Commission on Population, the total population of Jammu and Kashmir is 1,32,03,000. Parameters taken into account for weather analysis in the present study were Temperature ($^{\circ}$ C), Relative Humidity (%) and Wind Speed (Kmph). The data related to weather parameters was recorded from India Meteorological Department of Agricultural Meteorology Division (www.imdagrimet.gov.in). The daily observations of confirmed COVID 19 cases during the same timeline of the respective districts was documented from www.covid19india.org. Statistical studies were performed to determine the association between weather parameters and no. of daily confirmed cases.

Data Analysis

The data was analyzed using SPSS (Statistical Package for the Social Sciences) version 25. The descriptive statistical measures of all the variables were calculated. Pearson correlation was used to study the relationship between temperature, relative humidity, wind speed versus daily number of cases. The linear regression analysis was done between temperature, relative humidity, wind speed versus daily no. of cases in all four districts under study (Jammu, Rajouri, Ramban, Reasi).

III. Results and Discussion

Descriptive statistics of the weather data indicates (Table 1) maximum temperature of 36.0° C and minimum temperature of 21.5° C during the study period. In addition to that 35% was the lowest recorded relative humidity and 96 % was the maximum. The lowest wind speed recorded was 0 Kmph and highest recorded value of wind speed was 2.4 Kmph.

Table 1: Descriptive statistical measures of variables (Temperature, Relative Humidity, Wind Speed and daily number of cases for all the four districts together)

Variables	Minimum	Maximum	Mean	Std. Error
Temperature ($^{\circ}$ C)	21.5	36.0	29.791	0.2517
Relative Humidity (%)	35	96	71.17	1.410
Wind Speed (Kmph)	0.0	2.4	0.523	0.0545
Daily number of Cases	0	490	54.69	7.230

Table 2 depicts the descriptive statistical measures of all the variables district wise. It is observed that District Jammu has highest number of daily cases (Minimum: 83, Maximum: 490) whereas Reasi showed the least no. of cases (Minimum: 0 & Maximum: 46).

Table 2: Descriptive statistical measures of variables (Temperature, Relative Humidity, Wind Speed and daily number of cases in all the four districts)

		Minimum	Maximum	Mean	Std. Error
Jammu	Temperature ($^{\circ}$ C)	29.8	36.0	32.851	0.3009
	Relative Humidity (%)	72	96	84.70	1.088
	Wind Speed (Kmph)	0.8	2.4	1.241	0.0477
	Daily number of Cases	83	490	173.54	17.721
Rajouri	Temperature ($^{\circ}$ C)	27.5	32.6	30.392	0.2622
	Relative Humidity (%)	82	92	87.68	0.384
	Wind Speed (Kmph)	0.0	1.7	0.370	0.0581
	Daily number of Cases	0	63	22.70	2.903
Ramban	Temperature ($^{\circ}$ C)	21.5	28.6	25.951	0.3435
	Relative Humidity (%)	35	57	47.38	0.822
	Wind Speed (Kmph)	0.0	1.9	0.262	0.1238
	Daily number of Cases	1	48	10.46	1.489
Reasi	Temperature ($^{\circ}$ C)	26.4	32.4	29.970	0.2772
	Relative Humidity (%)	51	75	64.92	0.990
	Wind Speed (Kmph)	0.0	1.9	0.066	0.0655
	Daily number of Cases	0	46	12.05	1.860

All the three variables showed statistically significant positive correlation with daily no. of cases in the cumulative analysis (Table 3). There is a significant moderate positive correlation between temperature versus a daily number of cases (r-value 0.589, $P < 0.05$). Similarly, there is a significant moderate positive correlation between relative humidity versus the daily number of cases (r-value 0.339, $P < 0.05$). A statistically significant positive correlation was observed between wind Speed versus the daily number of cases (r-value 0.645, $P < 0.05$).

Table 3: The relationship between temperature, relative humidity and Wind Speed (Kmph) versus Daily number of Cases in Cumulative analysis

Variables		Daily number of cases
Temperature (°C)	Pearson Correlation (r value)	0.589**
	P Value	0.000
Relative Humidity (%)	Pearson Correlation (r value)	0.339**
	P Value	0.000
Wind Speed (Kmph)	Pearson Correlation (r value)	0.645**
	P Value	0.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 4: The relationship between temperature, relative humidity, Wind Speed (Kmph) versus daily number of cases in each district (Jammu, Rajouri, Ramban, Reasi)

Variables		Jammu	Rajouri	Ramban	Reasi
		Daily number of Cases	Daily number of Cases	Daily number of Cases	Daily number of Cases
Temperature (°C)	Pearson Correlation (r value)	0.447**	0.798**	0.418*	0.429**
	P value	0.005	0.000	0.010	0.008
Relative Humidity (%)	Pearson Correlation (r value)	-0.575**	0.403*	0.005	0.176
	P value	0.000	0.013	0.978	0.297
Wind Speed (Kmph)	Pearson Correlation (r value)	0.516**	0.027	0.173	-0.109
	P value	0.001	0.876	0.369	0.574

** Correlation is significant at the 0.01 level (2-tailed).

Table 4 highlights the relationship between temperature, relative humidity and Wind Speed versus daily number of cases in each district. A significant positive correlation was observed between temperature versus a daily number of cases in all the four districts. The Pearson correlation in each of the four district was observed, in Jammu the r-value was found to be 0.447, $P < 0.05$; in Rajouri the r-value 0.798, $P < 0.05$; Ramban the r-value 0.418, $P < 0.05$; Reasi the r-value 0.429, $P < 0.05$. The results shows that there was a negative and very weak relationship between relative Humidity versus the daily number of cases in Jammu the r-value -0.575, $P < 0.05$. In the rest of the three districts positive correlation was observed. In Rajouri, the r-value was 0.403, $P < 0.05$. However, no significant relationship was observed between relative Humidity versus the daily number of cases in district Ramban where the r-value was 0.005, $P > 0.05$ and Reasi the r-value found was 0.176, $P > 0.05$. It was observed that there was a very weak relationship between wind speed versus the daily number of cases. In Jammu the r-value was found to be 0.516, $P < 0.05$. The rest of the three districts depicts no significant correlation. In Rajouri the r-value was 0.027, $P > 0.05$; in Ramban the r-value was 0.173, $P > 0.05$ and in Reasi the r-value was found to be -0.109, $P > 0.05$.

Fig 1: The relationship between temperature and daily number of cases in all the four districts

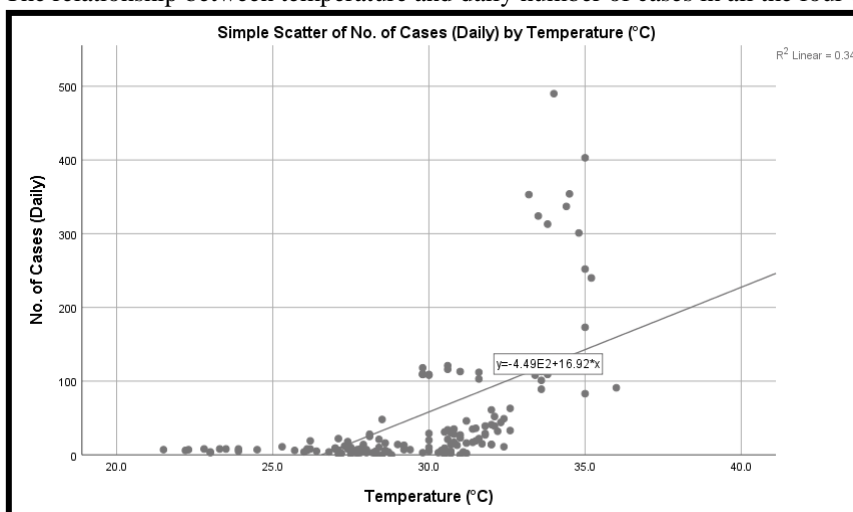


Fig 2: The relationship between wind speed and the daily number of cases in all the four districts

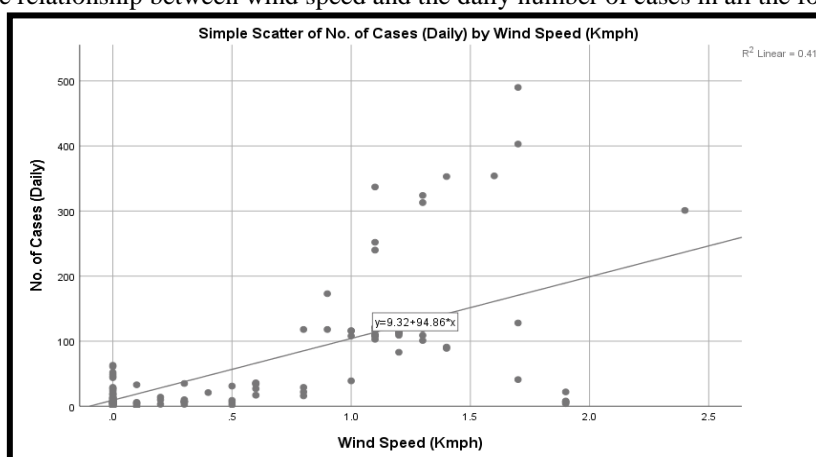


Fig 3: The relationship between relative humidity and Daily number of Cases in all the four districts

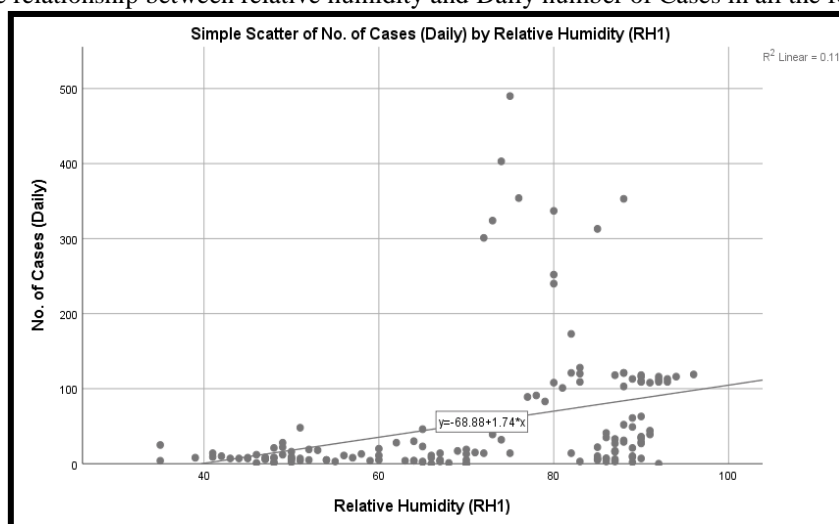


Fig. 1 showed the relationship between temperature and daily number of cases in all the four districts. The coefficient of determination (r^2) was found to be 0.347. Fig. 2 showed the relationship between wind speed and the daily number of cases in all four districts. The coefficient of determination (r^2) was found to be 0.416. Fig. 3 represented the relationship between relative humidity and the daily number of cases in all four districts.

The coefficient of determination (r^2) was found to be 0.115. Results of the present study showed a mysterious decline in COVID-19 cases in Jammu division in the month of October.

Our studies are in line with the reports of Deccan Herald, Oct 11, 2020 which also reported that October has witnessed a decrease in the average number of daily cases, from a peak of over 1,600 daily Covid-19 cases in mid-September to just 600-odd daily fresh cases in October, Jammu and Kashmir has witnessed a dramatic decline in coronavirus infection numbers over the last few weeks. [20] According to HT, Nov. 01, 2020 there is a decrease in fatalities by 38% as compared to September and 10% as compared to August. [21] Similar positive sign is reported in our study in the four districts of Jammu Division (Jammu, Rajouri, Ramban, Reasi). The cases are reducing and the curve is flattening. As per Reports of Times of India, Nov. 01, 2020, October witnessed the first monthly fall in COVID-19 infections since its outbreak in the country. Death toll in October was less than that recorded in August when 28,859 people had succumbed to the virus across the country. [22]

There is a decline in COVID-19 cases in Jammu as reported by CrossTown News, October 08, 2020. This decrease in the cases might have changed the trend of the virus in the early October, Principal GMC Jammu Dr Nasib Chand Digra. [23] Similar results were observed in our study and it is concluded that despite of the decline in temperature the cases are not shooting up. There is also no such reason that cold weather can kill the virus or other diseases. The normal human body temperature remains around 36.5°C or 37°C regardless of the external temperature. The improvement can be due to interruption of transmission after a spur as the transmission gets interrupted when people are already infected. Moreover as far as Jammu Division is concerned, a total of 10,419 samples were taken on September 08 and this no. increased to 13,135 on September 13. But on Oct 08, only 8492 samples were taken which is a considerable decline. [20] Further, it is reported in Daily Excelsior, 11th Oct 2020 that the low positive cases of COVID-19 in J&K is only due to reduction in sampling. [24]

The only way to control the transmission is to increase the testing samples. The people are also reluctant to go for testing due to taboo being created in the society. Getting lesser no. of COVID-19 positive cases in this scenario is not a bigger accomplishment as this will go up if remain uncontrolled. The sudden decline in the no. of cases might have generated a wrong notion among people about the improvement of situation. There is a strong need to change the casual behaviour of the people and administration towards the deadly COVID-19 as with the same trend the situation may slip out of the hands and there is a danger of huge spike in the coming time.

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