

The Effect of Temperature and Humidity on the number of cases and deaths of COVID-19 all over the world

The gaps in the number of cases and the number of deaths among various countries (despite taking similar preventive measures) have left us in a fog. Certainly, various factors can affect the rapid or the slow spread of SARS-CoV-2 among different populations, but why don't we consider the effect of temperature and humidity on the spread of SAR-CoV-2?

By the effect of temperature and humidity, SARS (severe acute respiratory syndrome) was resolved in china in July 2003, and its structure is very similar to that of SARS-CoV-2.^[1,2]

Also, cold temperature and low humidity decrease immunity, leaving the body more susceptible to viral infections.^[3] For example, the rate of seasonal influenza increases and causes more mortality rates in countries with lower temperatures and humidity.^[4,5]

For these reasons, researchers have studied the effect of temperature and humidity on the spread of SARS-CoV-2. And because it's hard to create real-world conditions in a lab, researchers have used different methods.

In a recent study, researchers examined the effect of temperature and humidity on the daily number of new cases and new deaths in 166 countries,^[6] and they found a negative relationship between them.

They collected the data of the daily meteorological conditions (average wind speed, average temperature, and average dew point) of the 166 countries—including all countries with COVID-19 infections all over the world except China—as of March 27, 2020.

Then, they collected the daily number of new cases and deaths in these countries (from the start of the pandemic in each country until March 27, 2020).

By the following equations, the researchers calculated the mean temperature and also the mean relative humidity for each country.

$$\text{The mean temperature} = \frac{\text{Sum of the daily average temperature in each country}}{\text{Number of observed days}}$$

$$\text{And, the mean relative humidity} = \frac{\text{Sum of the daily average relative humidity in each country}}{\text{Number of observed days}}$$

In this descriptive analysis, the researchers used a log-linear GAM (generalized additive model) to study the relationship between the mean temperature and the mean relative humidity and the daily number of the new cases and the deaths in these countries.

In their statistical equation, the researchers controlled the following confounders to increase the accuracy of the study:

- **Wind speed**
- **The median age of the national population**
- **The Global Health Security Index**
- **The Human Development Index**
- **Population density**

The study also included sensitivity analysis:

- The researchers excluded the countries with less than 100 cases until March 27, 2020.
- They included the countries which announced their first case before March 17, 2020 (ten days at least before March 27, 2020).
- They examined the effect of the Human Development Index and the population density.

Results:

The increase in the temperature and humidity is inversely proportional to the number of cases and deaths in the 166 countries:

- The increase in the temperature by one degree Celsius (1 °C) reduced the daily new cases by 3.08% and the daily new deaths by 1.19%.
- The increase in the relative humidity by one percent (1%) reduced the daily cases by 0.85% and the daily new deaths by 0.51%.
- There is no significant difference between the previous (or general) results and the results after applying the sensitivity tests.

Another study, published on May 3, 2020, studied the effect of the change in temperature on the new cases of “COVID-19” in 21 different countries and 16 different French administrative regions.^[7]

In this study, the researchers also found a negative relationship between the increase in temperature in these countries and the rate of spread of COVID-19—especially at the beginning of the infection.

Actually, researchers haven’t known the major reasons for these results yet. Higher temperatures and humidity may enhance immunity, decrease the survival time of the virus on the surface, or even cause the droplets to evaporate faster.

To summarize:

Not only can temperature and humidity have a noticeable effect on the spread of COVID-19, but it can also influence the mortality rates among populations.

However, the rapid spread of SARS-CoV-2 is more vigorous than any other factor. So, taking our preventive measures is necessary for everyone to overcome the spread of COVID-19.

References:

- 1- <https://jech.bmj.com/content/59/3/186>
- 2- <https://pubmed.ncbi.nlm.nih.gov/32275259/>
- 3- <https://www.mdpi.com/1660-4601/17/5/1633>
- 4- <https://www.pnas.org/content/116/22/10905>
- 5- <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1000316>
- 6- <https://www.sciencedirect.com/science/article/pii/S0048969720325687#bb0080>
- 7- <file:///C:/Users/dell/Downloads/biology-09-00094.pdf>

About the author:

Sara Ahmed is an Oncology and Hematology Clinical Pharmacist and freelance medical writer at [Kolabtree](#).