Correlation Between Climate Variables and the COVID-19 Pandemic in the Twin Cities, MN

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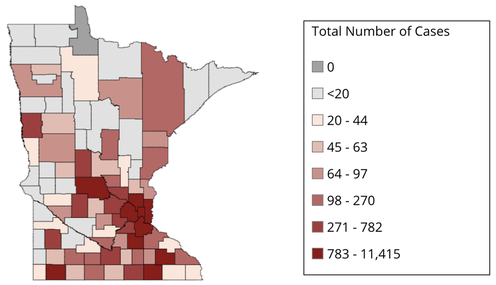
Introduction and Background

Changing climate conditions has a major impact on public health, especially the transmission of infectious diseases such as COVID-19. COVID-19 is a novel virus that spreads through respiratory droplets produced through coughs, sneezes, or talks by an infected person (cdc.org).

Inspired by the research project done in New York City by M.F Bashir et al. (2020) where minimum temperature and average temperature are correlated with the spread of COVID-19, this study examines climate variables and COVID-19 cases in the Twin Cities, which comprise of these seven counties: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. The first confirmed COVID-19 case took place in Ramsey County on March 6, 2020, and as of June 23, 2020, there are 21,056 confirmed cases in the Twin Cities.



Images courtesy of cdc.org

Materials and Methods

Data Collection

Dataset for COVID-19 (March 1, 2020 to June 23, 2020) is taken from the Minnesota Department of Health, and climate data is taken from the National Weather Service, USA. The climate variables studied are maximum temperature, minimum temperature, and average temperature.

Data Analysis

This study applies the methods used in the M.F Bashir et al. (2020)'s study. It assumes the datasets are not normally distributed, and therefore Kendall and Spearman correlation tests are used to examine the correlation between confirmed COVID-19 cases and climate variables.

The purpose of these tests is to investigate the possible association between number of cases and climate variables. Ranking the data is carried out automatically using computer software and built-in functions in Python 3. Variables are separately put in order and are numbered. Correlation coefficients take the values between -1 and +1. Positive correlation signifies the ranks of both the variables are increasing. Negative correlation signifies that as the rank of one variable is increasing, the other variable is decreasing.

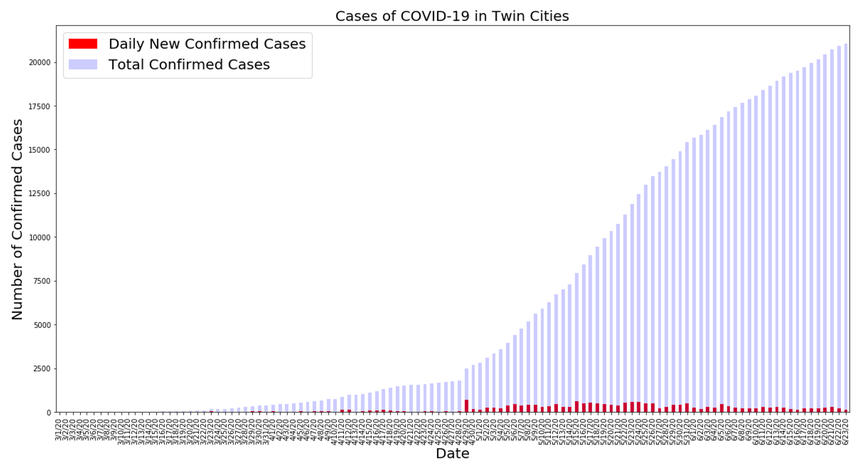


Figure 1: COVID-19 cases between March 1, 2020 - June 23, 2020

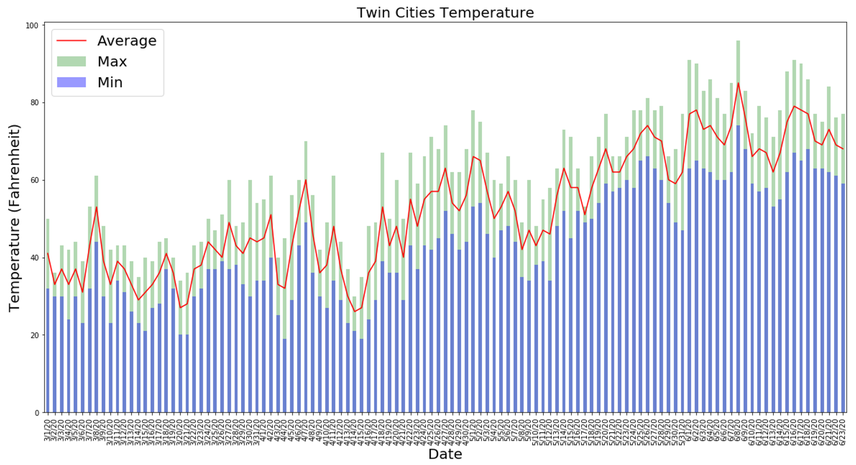


Figure 2: Temperatures between March 1, 2020 - June 23, 2020

Spearman Test Results Climate Variables	New Cases	Total Cases	Mortality
Temperature Maximum	0.635346	0.847144	0.850868
Temperature Minimum	0.672516	0.852532	0.853602
Temperature Average	0.665501	0.864644	0.867439

Figure 3: Spearman Correlation Test Results

Kendall Test Results Climate Variables	New Cases	Total Cases	Mortality
Temperature Maximum	0.425093	0.648431	0.658541
Temperature Minimum	0.440734	0.655067	0.662451
Temperature Average	0.439947	0.670842	0.680942

Figure 4: Kendall Tau Correlation Test Results

Results and Discussion

Results from both Spearman and Kendall correlation tests indicate there are positive correlations between the COVID-19 and climate datasets. Average temperature is significant for total cases and mortality, and minimum temperature is significant for new cases.

Despite strong evidence of association between climate variables and COVID-19 in the Twin Cities, this study has limitations. First, COVID-19 is an infectious disease that was not tested prior to this time frame and is influenced by many factors not mentioned in this study, such as social distancing, accessibility to healthcare, and personal hygiene and health conditions. Second, it is important to note that temperatures naturally increase during the studied time frame. Therefore, more studies are needed to further assess and compare correlation results when temperatures naturally decrease after June 23rd, 2020. Lastly, this study only examines maximum, minimum, and average temperatures. Other climate indicators such as humidity, wind speed, air quality, and precipitation need to be assessed in order to fully capture the correlation between climate variables and COVID-19 pandemic.

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Acknowledgements

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