# Statistical evaluation of selected air quality parameters influenced by COVID-19 lockdown

## Introduction

This study wanted to understand how the air in Chittagong changed during the COVID-19 lockdown. They focused on different things in the air like dust (PM10), tiny particles (PM2.5), and gases (NO2, SO2, CO). The goal was to use numbers to figure out how the air quality changed during the lockdown because of the pandemic. The hope is that this information can help people who make decisions about the environment and development find a good balance.

## Body

### Statistical Methods and Their Advantages

* 1. Trend Analysis (Mann-Kendall Test and Sen's Slope Method):

These methods work well even if there are some strange values or if things don't follow the usual pattern. This is important when we're trying to understand how air pollution changes over time.

* 1. Descriptive Statistics:

Descriptive statistics, including mean concentrations and standard deviations, serve as an effective means of summarizing central tendencies and variability in pollutant concentrations.

* 1. Principal Component Analysis (PCA):

PCA aids in identifying clusters of variables that influence air quality, contributing to a clearer understanding of the interplay between different pollutants. PCA helps us find groups of things that affect air quality. It makes it easier to see how different pollutants work together.

* 1. Factor Analysis:

Factor analysis helps us find hidden factors that influence the Air Quality Index (AQI). It helps us understand what really affects the quality of the air."

### Application of Statistical Methods

* 1. Trend Analysis:

The Mann-Kendall Test and Sen's Slope Method are like detectives used to find out if there are any clear patterns in pollutants during the COVID-19 lockdown. They help us see if the air quality got better or worse during that time.

* 1. Descriptive Statistics:

Descriptive statistics giving us a full picture of average pollutant levels, how much they vary, and what values are allowed. This helps us really get to know the data and understand what's happening.

* 1. PCA and Factor Analysis:

Principal Component Analysis and Factor Analysis are like special tools that help us understand the complicated world of air quality. They point out important groups and hidden factors, making it easier to understand all the information together.

### Alternative Methods

* 1. We can use linear regression is one way to do it. But, we need to be careful because it might get influenced by unusual values. On the other hand, the Mann-Kendall Test and Sen's Slope Method are sturdy options, especially when the data doesn't follow the usual pattern.

### Results and Visualization

* 1. Trend Analysis:

It is noticed that PM2.5, PM10, and AQI went down over time, showing that the air got better. But, NO2 went up unexpectedly, so we need to look into why that happened.

* 1. Descriptive Statistics:

The average amounts of pollutants during the lockdown were much lower compared to the dry and wet seasons. This big difference tells us that fewer human activities had a real impact on making the air better.

* 1. PCA and Factor Analysis:

When they grouped the pollutants together, we saw that PM2.5, PM10 were the main things affecting the air quality. This shows us how important these tiny particles are for the overall air quality.

* 1. Visualization:

Visualizations, including trend graphs, scatter plots, and factor loading plots, bar chart have been utilized to enhance the interpretability of the findings.

## Alternative Methods

While the selected methods align with the research objectives, alternative methods such as linear regression for trend analysis and cluster analysis for pollutant grouping could be explored in future studies. These alternatives may offer complementary perspectives and enhance the robustness of the analysis.

## Conclusion

In conclusion, using different statistical methods helped us really understand how the COVID-19 lockdown affected air quality in Chittagong. We found that things like dust in the air went down, and the overall air quality got better. This information is super important for making decisions about the environment. But, they didn't have a lot of data during the lockdown.

This detailed analysis doesn't just add to what scientists know about air quality. It also shows how important it is to make smart decisions that balance development and taking care of the environment.