

Air Quality and Respiratory Diseases

Introduction

Air pollution has been a growing problem during the last years around the world, not only for Global Warming implications, but also for its consequences regarding public health. According to the World Health Organization (WHO), there has been a reported increase in the number of deaths associated to respiratory problems or diseases related to the air pollution.

In several studies, the principal pollutants that have been identified as responsible of the respiratory diseases are carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM10), volatile organic compounds (VOC) and ozone (O₃).

The aim of this study was to identify the correlation between the respiratory emergencies and two of these pollutants, O₃ and PM10.

Hypothesis

The air quality has an influence over respiratory disease emergencies (RDE) in Mexico City. We believe ozone (O₃) is the contaminant that causes most damage in people's health as it is the pollutant that fluctuates most and the one that usually detonates environmental contingencies when the threshold is surpassed. As PM10 (Particulate Matter under 10 micrometers) is dangerous because of its small size, it is also considered to lead to respiratory diseases.

Within Mexico City, more industrialized municipalities (Iztapalapa, Iztacalco, and Gustavo A. Madero) should show a higher level of pollution, therefore more cases of respiratory diseases.

Resources:

The data used for this analysis (the air pollution and the health emergencies, respiratory diseases) was obtained from the API "Datos Abiertos" (<https://datos.gob.mx/>) and several databases. More details on main Jupyter Notebook.

The analysis was conducted by Python libraries and the use of other tools as Jupyter Notebook and Excel.

Methodology

The data for the pollutants was analysed (Pollutants_Analysis_and_Insights.ipynb) and segmented by city and subsequently by municipality, in order to deparure the data. The data was segmented in reduced csv files containing only the data mentioned before.

The number of RDE was obtained by cleaning the data from emergencies of Mexico, from 2010 to 2016. The data was treated in the same manner as the pollutants data. The cvs files were named according to each municipality and combined into a single file for further analysis.

Analysis

The analysis of the pollutants in the air was made with the databases obtained from the sources of "Datos Abiertos". The data obtained correspond to the pollutant readings per minute since 2001. The measures of the O₃ and PM10 levels, were extracted by city and later the data from Mexico City was separated by municipalities. Then the data was plotted to see the behavior of these two pollutants through time. The municipalities with missing data were dismissed, for the purpose of this analysis. Treatment of the data in order to plot it is also shown in full Notebook.

The emergencies data was obtained from 2010 to 2016, which was the most recent data available; and was separated by city and later was deparured to keep only the respiratory diseases and finally organized by municipality. The data was treated as the pollutants data, in order to clean the plots and define if there was any relation between the pollutants and the number of RDEs.

Once RDEs and the pollutants data were clear, they were plotted through time, to see if there was a correlation between them.

Results

One of the principal considerations that we took before analyzing the number of RDE data, was the season of the year. There is an observed seasonality of respiratory emergencies, with a marked increase during the months of September to December.

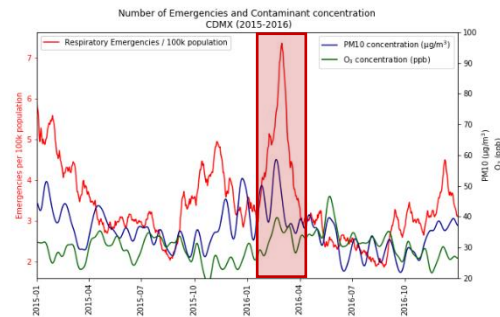


Figure 1. The figure shows the level of the pollutants (Green – Ozone, Blue – PM10) and the number of Respiratory Diseases Emergencies (Red – RDE) through time.

Nevertheless, during 2016, there is a peak in the number of RDEs and the pollutants (figure 1), that doesn't behave the same way as previous years. By reviewing the dates where these peaks appear, they corresponded to the environmental contingency that lasted for more than one month.

Once the data of the level of pollutants and RDE was plotted through time and per municipality, no relation was observed between the number of RDEs and Ozone concentration. However, there is a positive relation between the number of RDEs and PM10 concentration, albeit not a linear one. The relation cannot really be linear due to the seasonality of certain RDEs that are not related to pollutant concentration.

Discussion

The first problematic finding was the missing data from some municipalities expected to be contaminated, due to the fact that not all the stations around the city monitored all the pollutants, and not all the stations were in operation every year. The stations located in Gustavo A. Madero (GAM), Magdalena Contreras and Tláhuac do not have any records of air pollutants. This raises concern, since GAM is been reported as one of the most polluted municipality by local news several times. Tlalpan, which was the second municipality with a higher level of O₃, was analyzed comparing the number of RDE and levels of O₃ and PM10. Not a strong effect of Ozone was observed, although it was expected.

After a deeper analysis comparing the municipalities with a higher level of PM10 with the number of RDEs, it is clear that during the time the environmental contingency was declared in 2016, PM10 concentrations increased significantly, and also a clear increase in the number of RDEs is observed.

Conclusions

The overall data for Mexico City from 2010 to 2016 shows that there is not a clear relation between the O₃ levels with the number of RDEs. Nevertheless, when the municipalities were analyzed alone, Venustiano Carranza and Cuauhtémoc municipalities show a certain correlation between the numbers of RDE with the PM10 levels, especially during the big contingency of 2016.

Perspectives

As further analysis data from less serious illnesses, meaning not deriving into a medical emergency or hospitalization should be looked at.