

Refinement of AQI Due to Amid Lockdown

By

Shashank Raj Pradhan

*Dissertation submitted in partial fulfillment of the requirements of the degree
MBA Hospital and Health Management*

Academic year, 2018-2020



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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled “ ***REFINEMENT OF AQI DUE TO AMID LOCKDOWN***” and submitted by **Shashank Raj Pradhan** Enrollment no. 0823 under the supervision of **Dr. Monica Chaudhary** for award of MBA Hospital and Health Management of the University carried out during the period from ____17/03/2020__ to __16/03/2020____ embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Signature

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I am grateful to almighty for giving me the strength to successfully finish my work and for sustaining my efforts which many a time did oscillate.

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Abstract

Air is the major component of the Environment and for this, it is necessary for the air to be fresh. Air is the constant pressure that we can feel easily and always but we cannot see. Breeze is the word used when the air flows with speed and pressure. Without air, Earth would be just like the planets other than earth in the solar system. Plant-animal are interdependent to each other for survival since plants produce oxygen in their respiratory system and animal produce carbon dioxide.

And as we know carbon dioxide important for plants and oxygen for animals. However, manmade contributions in the ecosystem made no longer an air a fresh that leads to **air pollution**.

AQI is the parameter to evaluate the pollution level in which there are various concentration to measure like ozone, nitrous oxide, particulate concentration in which PM2.5 concentration (particulate) play a major role in affecting the pollution level. Higher the AQI value greater the air pollution. As we all know we are facing a pandemic situation of COVID-19.

Due to this pandemic, India has taken a big step to conduct a lockdown from mid of March. This pandemic no doubt brings a bad condition in economy, health, etc. But during this condition, we come with a drastic change in the pollution level that must be marked. Here we are comparing the AQI level of the city those are almost every time in a year are at the stage of high AQI level.

We compare the data with 2019 of the months in which during study lockdown is there. For more clear result we did the comparison of cities with completely followed lockdown policy or partial. Since the city with complete lockdown policy have more effect in the change of AQI level.

As a result, there is a decline in the air pollution level by 55.60% in India. The aim of this study is to show that pollution already exists as a major issue in society. As corona is on the focus because it is so contagious, but pollution is a slow poison too. Preserving the environment is in our hands and we expect the society to take this issue also into consideration in present and after

lockdown. This will help us to fight with corona also and make our health system better. It is also obvious that after the opening of lockdown this increased level of pollution condition again start. But now we have a chance to decrease it or to stop an abrupt increase in pollution level.

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List of Abbreviations

COVID-19	Coronavirus disease 2019
AQI	Air Quality Index
WHO	World Health organization
SAFAR	System of air quality of weather for casting and research
WAQI	World air quality index
CAC	Clean Air Act
NAAQS	National Ambient air quality index Services
PM2.5	Particulate matter concentration 2.5
Conc.	Concentration
SDG	Sustainable Development Goal
BSES	Bharat stage emission standard

BS	Bharat stage
QP	Quartile percentile

1. Introduction

Air is the basic need of people for their survival. Without air, Earth has become like other planets of a solar system. An observable effect of air, we can feel throughout nature and by swaying plants and animals. Breeze word is usually used for the air when airflow with speed and pressure.

At all the time we cannot see the air, but we can feel it. We all need air for oxygen respiration. Air is a fundamental mental building block apart from which we all cannot survive. Animals and Plants are dependable to each other for respiration since plants produce oxygen which is the need of animals, and animals produce carbon dioxide which is the need of plants. However, man-made contributions in the ecosystem, environment such as industrial work, deforestation, vehicle fuels etc. polluting the air and leads to **Air pollution**.

PEOPLE in Indian cities usually affected by harmful air pollution that is much far for breathing cleaner air. Due to these air pollutions, this will cause a variety of adverse health problems among our population. According to WHO this has been observed that the air we breathe is dangerously polluted; every 9 out of 10 people are breathing polluted air. All over the world, this will kill 7 million people every year. Over 1.2 million death are occurred in India due to air pollution every year. This included outdoor as well as indoor air pollution. Indoor pollution including cooking, vapor materials of building, tobacco, smoking, etc. Outdoor pollution includes vehicle fuel, industry, deforestation etc. The health problem due to air is serious, One-third of death due to stroke, lung cancer, and heart diseases are due to air pollution even having an equivalent effect of smoking, tobacco.

Yes, this is also a fact that Air pollution is not so easy to escape from it. But we must take a serious action on it. Microscopic elements are slowly get penetrated the lungs by slipping inside and will damage the lungs, brain, heart.

Today we are facing the pandemic which has a direct effect on lungs, which become worse part of our body system since we all are already in danger condition by inhaling polluted breath that makes our lungs already weak. This is a crucial time that we must take action Since related to Air pollution during pandemic one interesting thing we have noticed.

An observation we see during this hard time of Pandemic COVOID-19 that there is much improvement of Air quality index that is the main parameter to evaluate the air pollution.

AQI is a national system that is used to measure the air quality. It is managed by the US Environmental protection agency. In India, Air quality systems are under the government agencies like SAFAR (System of air quality of weather forecasting and research), WAQI (World air quality index). AQI runs from 0 to 500. Higher the AQI higher the air pollution level.

AQI look for 5 major air pollutant that is regulated or controlled by CAC: particle pollution, the concentration of carbon-monoxide, concentration of sulfur oxide, concentration of nitrogen oxide, ground-level ozone.

1.1. How AQI calculated

Different countries use different methods to calculate, report, evaluate the AQI level.

Table 1: AQI measure according to the US National Ambient air quality index. (NAAQS)

Colour	Level of Health Concern	AQI Values
Green	Good	0 to 50
Yellow	Moderate	51 to 100
Orange	Unhealthy for sensitive groups	101 to 150
Red	Unhealthy	151 to 200

Table 2: AQI measure according to India.

AQI	Remark
0-100	Good
101-200	Moderate
201-300	Poor
301-400	Very Poor
401-500	Severe

Table 3: Health implication due to the AQI level.

Air Quality Index		
Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	100 to 151	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health warnings of emergency conditions. The entire population is more likely to be affected.
Hazardous	301 to 500	Health alert: everyone may experience more serious health effects.

By using various equation AQI system that is governed under governed policy will calculate the AQI of day and update in their system.

$$I_p = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}}(C_p - BP_{Lo}) + I_{Lo}.$$

Where I_p = the index for pollutant p

C_p = the truncated concentration of pollutant p

BP_{Hi} = the concentration breakpoint that is greater than or equal to C_p

BP_{Lo} = the concentration breakpoint that is less than or equal to C_p

I_{Hi} = the AQI value corresponding to BP_{Hi}

I_{Lo} = the AQI value corresponding to BP_{Lo}

As we know today or at present, we are suffering from a pandemic COVOID-19 that was a big challenge for our health. And to prevent the upswing in the transmission of this COVOID-19. India came with the decision to lock down the country, in which there is strict restriction in human mobility, no gathering of people, the college, school, office is closed, all of them enforce to do their work from home.

This is all to encourage the social or physical distancing only for our safety. Even where needed they are also imposed a curfew. In between this, there is an interesting observation of sudden change in the environment. There is a drop in the air pollution. As we know air pollution is one of the major problems in India since it will have an adverse effect on health. After going through the Air quality data, we have seen that within a month the PM2.5 AQI was decreased by 55-60%. Among all specie of AQI, PM2.5 plays a major role in the AQI level that is the reason why only PM2.5 concentration has been focused on this. These changes are mainly seen in an industrialized area, metro cities due to more traffic since they are more prone to pollutions.

We can give an approximation that this will lead to an improvement in the mortality rate by preventing a maximum of 23 lakh premature death due to pollution on an annual basis. Also, the lowering in pollution may help in treating or identifying COVOID -19 patient as the drop in pollution give a sharp, clearer image by satellite in the country so it will help to take aggressive measure in the virus transmission.

If we take the data for example of a city Delhi since it is the most polluted area, we observe that there is a declination of about 14% in PM2.5 concentration initially after lockdown. This was also observed that the more change in the pollution was seen in the city where there is strictly the lockdown has been followed.

Also, there is one observation during this hard time of COVOID-19, this lockdown amid has reduced the water pollution level due to less discharge of pollutants in water. As SDG GOAL 6 CLEAN WATER AND SANITATION and its target no. 6.3 which depicts IMPROVE WATER QUALITY, WASTEWATER TREATMENT & SAFE REUSE, this lockdown has effortlessly made it possible to a great extent itself.

We are more focusing on the area those are industrialized, more prone to traffics since they are the standards for controlling or regulation of pollution and after lockdown also only these are the main parameter in changing the environment pollution. Yes, this is also a fact that this

improvement of air quality was uncommon, the pollution after lockdown will again go high but we can control it by various measure so that it should not reach the peak level

1.2. Brief history of controlling Emission

EFFORTS TO CONTROL EMISSIONS

India embarked on a formal emission control regime in 1991. Here is a brief history of the country's efforts to cut vehicle emission.

1991-92: The first stage of mass emission norms came into force for petrol vehicles in 1991 and in 1992 for diesel vehicles.

1995: From April 1995, the government made fitment of catalytic converters compulsory in new petrol-fuelled passenger cars sold in the four metros of Delhi, Calcutta, Mumbai and Chennai, along with the supply of Unleaded Petrol (ULP). Availability of ULP was extended to 42 major cities and now it is available across the country.

2000-01: In 2000, passenger cars and commercial vehicles met Euro I equivalent India 2000 norms. Euro II equivalent Bharat Stage-II (BS-II) norms were in force from 2001 in four metros—Delhi, Mumbai, Chennai and Kolkata.

2002: The first auto fuel policy was announced in

August 2002. It laid down the emission and fuel roadmap up to 2010. As per the policy, four-wheelers in 13 metro cities moved to BS-III emission norms from April 2005 and the rest of the country to BS-II.

2010: BS-IV for 13 metro cities was implemented from April 2010 and the rest of the country moved to BS-III. It has now been extended to more than 50 cities.

2014: The second version of the fuel policy—Auto Fuel Policy 2025—was submitted to the oil and gas ministry. It lays down the emission and fuel roadmap up to 2025 and envisages BS-IV roll out across the country by 2017 in a phased manner, with BS-V emissions in 2021 and BS-VI from 2024. The proposal is yet to be accepted by the government and notified.

Bharat stage emission standard (BSES)

Emission standard conducted by the Government of India. The main purpose of this mission is to regulate the air particulate from various emission sources. These standards and timeline of implementation are set by the Central Pollution Control board and the Ministry of Environment and Climate change.

the Petroleum Ministry of India, in consultation with public oil marketing companies, decided to bring forward the date of BS-VI grade auto fuels in NCT of Delhi with effect from 1 April 2018 instead of 1 April 2020. In fact, Petroleum Ministry OMCs were asked to examine the possibility of the introduction of BS-VI auto fuels in the whole of the NCR area from 1 April 2019. This huge step was taken due to the heavy problem of air pollution faced by Delhi which became worse around 2019. The decision was met with disarray by the automobile companies as they had planned the development according to a roadmap for 2020.

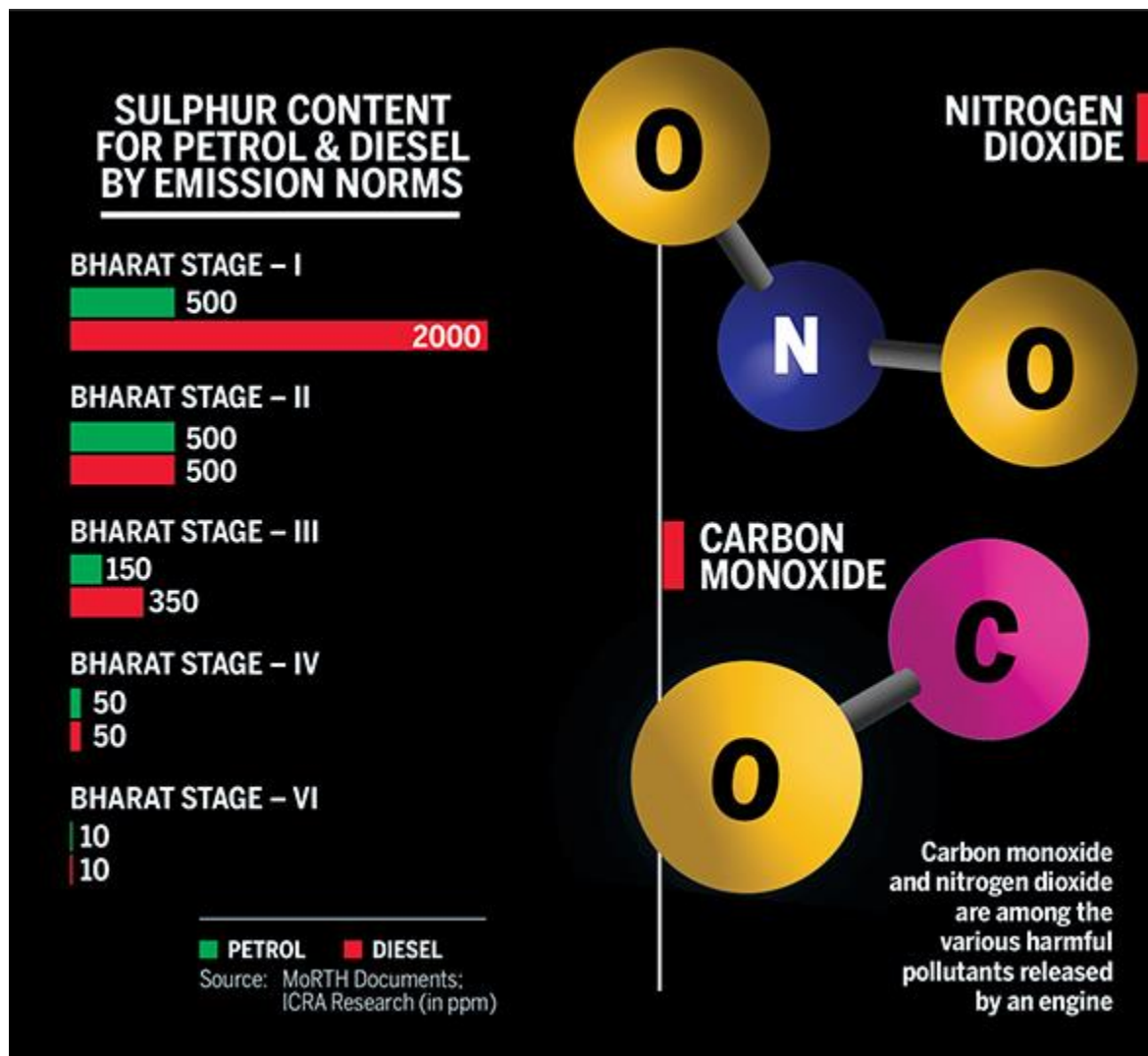


Figure 1: Sulphur and nitrogen oxide content in all 5 stages of BSES

In 2016 Government announces that they have skipped the BS-v norm altogether and adopt BS-VI norm by 2020. Norms help in improving air pollution by various technology.

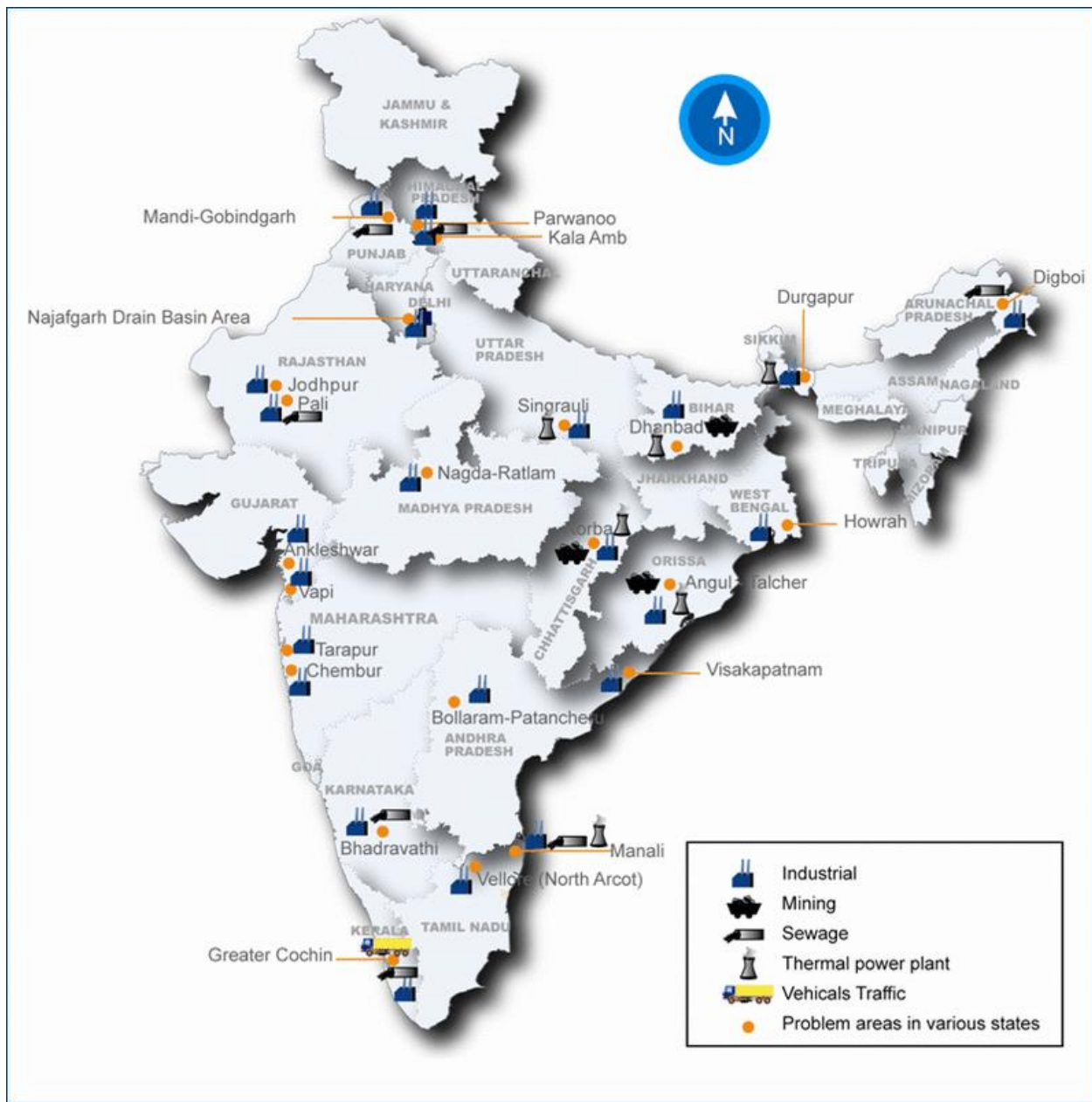


Figure 2: Major cities having Causing factor of increased air pollution

The basic cause of air pollution has shown in the figure in different states with specifying different cities. These are Industrial, Mining, Sewage, Thermal PowerPoint, Vehicle traffic.

2. Rationale of the Study

COVID-19 cases in India cross 2.5 lakh and death toll crossing more than 9000. More than 200 countries and territories are reported with novel coronavirus pandemic. This pandemic situation has a direct impact on the economy, health system, mortality rate of India, life expectancy rate of India etc. This COVID-19 has a drastic effect on the human body. And this may there for a longer time. So to handle we have to protect our health by decreasing the factor causing health problems that can be controlled that is **air pollution**.

Amid lockdown, there is a drastic change in the environment that may help to build our human immunity or help by protecting our body with air pollutants. This report provides information on-

- Effect of lockdown on the AQI level.
- Impact on the environment.
- How to maintain this change.
- Change in the AQI level in various cities.

3. Aim

To study the impact of Lockdown in AQI.

4. Objectives

1. To study the impact of lockdown in the AQI level.
2. To compare the AQI level in the city with different lockdown policy.
3. To compare the AQI level with the previous year.
4. To provide suggestions to maintain the AQI level.

5. Literature review

5.1. Air Quality Monitoring

Concentration of various pollutant along with harmful gases were analyzed in different cities based on past NAQI data. And thus, monitor the cause of increased AQI level in those cities. Important indicator they take to know the cause is-

- Vehicles
- Industrial waste
- Anthropological sources

In the review report of a survey, "AQI Monitoring" conducted by **Humaib Nasir, Kirti Goyal, and Dolonchapa**, they measure all various type of pollutant AQI levels than with the consideration of cause in that city they came with their result. They mainly focus in the area where-

- Vehicles-
Maximum % of pollutants from vehicles cause air pollution are SPM and CO₂ with 60-70%. Vehicles without cleaning release much pollutant material that is dangerous to health.
- Industrial waste and thermal station power
Maximum % of pollutants causing air pollution are SPM and SO₂ with 65-70%.
- Other anthropological sources
Various sources like incinerator, stoves, burning up of crop from farmers, refrigerator material, nuclear weapon, landfills deposited, forest fire, etc. have also a great effect on air pollution.

Under these indicators then they will compare the AQI level of various cities and came with the result that

- SO₂ concn. Is low in Hyderabad and highest in Chennai.
- NO₂ concn. Lowest in Kanpur and highest in Delhi
- SPM is very critical in various cities.

5.2. 21-Day lockdown in India dramatically reduces air pollution

In a review report on “*21-day lockdown effect on air pollution*”, by various authors, says there is main decrease in the type of pollutant of AQI are-

- PM_{2.5}
- NO₂
- CO₂

They mainly focus on the two cities Lucknow and Delhi. The air quality index is taken in two phases

- 1st phase before lockdown
- 2nd phase after lockdown

Both the phase is of 21 days. To understand the influence long term range of atmospheric pollutants at both monitoring zones, the air mass back trajectory analysis also performed. After analyzing all the indicators as mentioned they came with the result that there is more declination in the air pollution in Delhi city when compared to Lucknow city.

Limitation- They have not taken more than 2 cities. And only take 21 days observation. Not focus on secondary pollutants. Not give solution of condition after opening lockdown.

5.3. Air pollution: Its magnitude and effect on health

The review report of Air pollution: its magnitude and effect on health have examined the effect of air pollution in the respiratory system and associated morbidity. Study conducted by the Central Pollution Control board. The study shows the effect of season and indoor and outdoor pollution.

It also focused on the cause of air pollution. Mentioned the recommendation on how to control it.

Result shows within three months during 2019 there is an abrupt increase in air pollution due to which there is 1.7 times higher rate of prevalence in the respiratory systems.

In Delhi city, this study has been examined

36% in Delhi against 9.5% in the controls, was the prevalence of hypertension, and this is correlated to PM_{2.5} and PM₅ (pollutant). Delhi had significantly higher levels of chronic headache, eye irritation, and skin irritation.

6. Methodology

6.1. Research Questions

1. What is the effect of lockdown is AQI?
2. How much variation is there in pollution change in 2019 and 2020?
3. What is the impact of lockdown in the environment of various cities?

6.2. Research Design- Descriptive Study

- **Type of Data-** Secondary Data (Secondary Review)
- **Time duration-** The study was carried for Two months that is from March to April of 2019 as well as 2020.
- **Sample size-** Data of 23 cities has been taken. Since they are coming under the most polluted area in India.
- **Data Collection Tool-** Data was collected by World Air Quality Index (WAQI) Project. And by government lockdown policy by the news, media, and government announcement.
- **Data Analysis Tool-** MS Excel
- **Data Collection**
 - ✓ We are focusing in the industrialized area and an area with more traffics. Since these are the major cause of increased pollution levels. And stoppage or decreased in any of these activities will definitely give drastic changes in the effect of air pollution. Then compare it with 2019. In a study, we have taken 2-month March 2020 (a month lockdown started).
 - ✓ For more confirmation of the result, we compare the area those are completely following a lockdown policy with a partial one. For this, we take one parameter to compare that is the hotspot area during the study period. Hotspot area is the area where there are more than 10 patients within a week. And after this, the policy of lockdown will be followed strictly. That will have a major impact on traffic.

7. Data Analysis:

According to Indian Air Quality Index, the descriptor category is there which help us to give the scale or range for health effects on pollution

We see the two main models in this.

Firstly, compare the area pollution affect or PM2.5 AQI concentration in a time period (comparison with 2020 to 2019 year) of the month of February to April.

Secondly, we compare the case with the control area. Here, the cases are of hotspot area during the study period and the control of corona free area during the study period, followed by lockdown due to COVOID-19.

We use a statistical method following a normal distribution that helps to measure the median of the data that we collect for analysis of the AQI level of India.

Since the median is what that separates higher half from the lower half of a data sample, whatever it is a sample or a probability distribution

And, in a skewed distribution, the median is often the better measure of central tendency for a data set, it may be thought of as the "middle" value.

We can measure the median by using a different strategy for even and odd data.

Median in relative with width class, sample size the basic step for the statistical method followed by the normal curve distribution.

$$median = l + \left(\frac{n}{2} - f_c \right) c / f_m$$

For even data

$$median = \frac{\frac{n}{2} + \left(\frac{n}{2} + 1 \right)}{2}$$

For odd data

$$\text{median} = \frac{n + 1}{2} \text{th observation}$$

The median of the data help to assist the comparison of the Pm2.5 AQI level with the last year. Here are the various cities as shown in fig.

Interpretation

It clearly shows that from day 1 of lockdown there is much decrease in air pollution and continuously maintain in the city of Bengaluru. It is the city where the air pollutant cause such as industries work, traffic that increases vehicle fuel emission. Due to which it is difficult to control the pollution level. But this lockdown has a great impact on this. Thus, by maintaining we can make our environment, health better

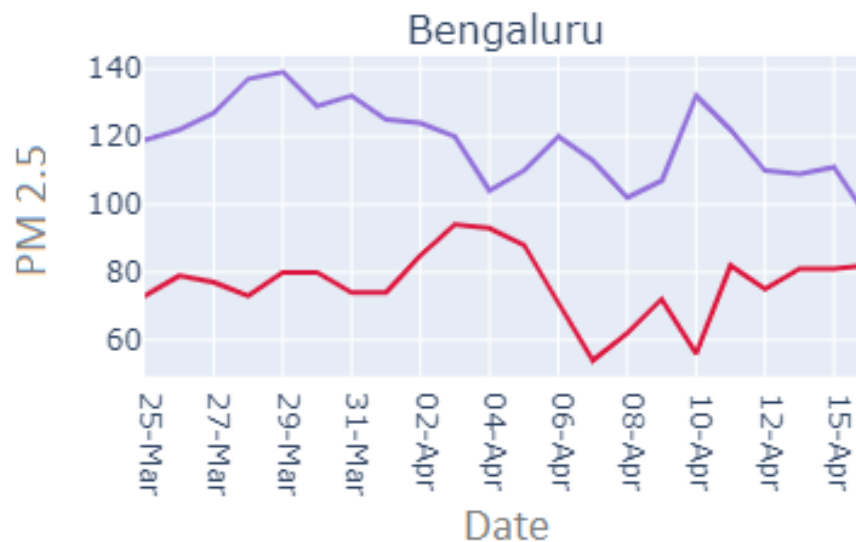


Figure 3: Comparing AQI level of Bengaluru city

Interpretation

Pollution level in 2020 during lockdown is much less than that of 2019 during the same month. But there is one more observation that in mid-April there is an increase in pollution. And study shows that during mid-April due to fewer numbers in case in Muzaffarnagar the lockdown policy was not as much followed due to which there is as much close to normal situation as before lockdown. That clearly indicates that to control pollution is totally in our control and if we want, we can.

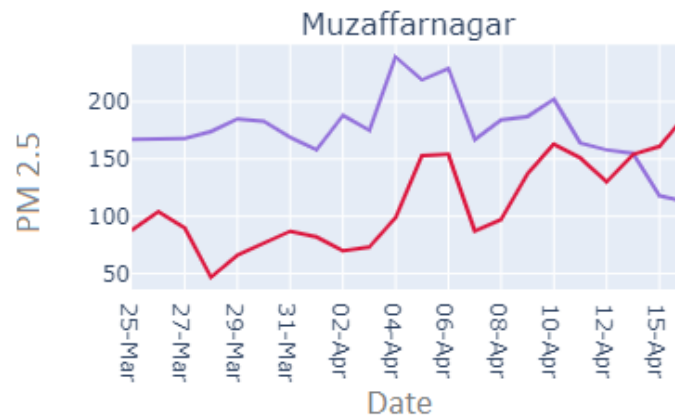


Figure 4: Comparing AQI level of Muzaffarnagar city

Interpretation

It is an industrialized city where mostly the AQI level is at a high level but there is much declination during lockdown that is a good indication and if we maintain this will no doubt improve the health of the human.

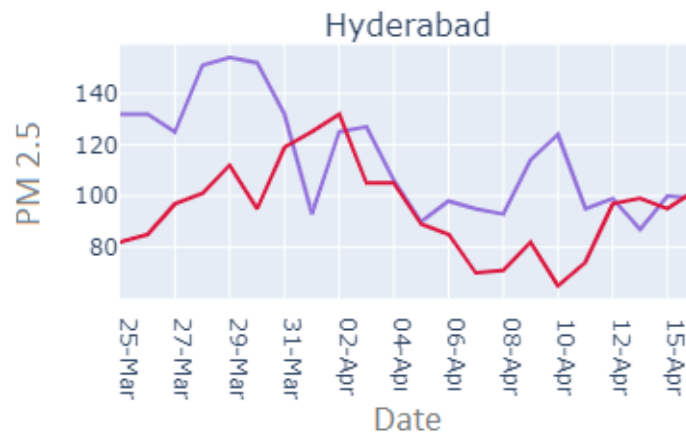


Figure 5: Comparing AQI level of Hyderabad city

Interpretation

Delhi is the city where the pollution level is drastically increased for 3 years. Even the red alert has announced many times. The government made many policies to decrease the pollution but will achieve that goal. But this lockdown has a greater impact on pollution as shown in fig.6. But after opening of lockdown precaution should be taken to maintain it

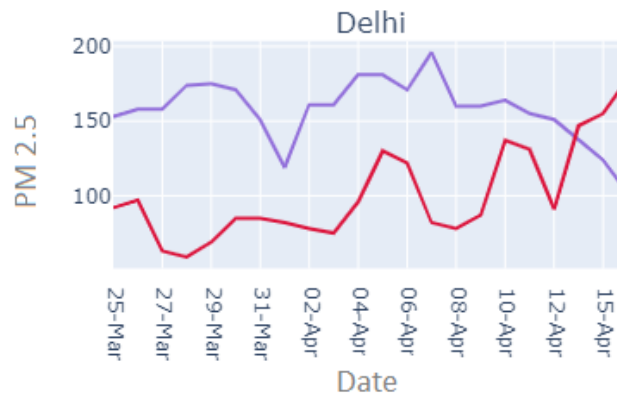


Figure 6: Comparing AQI level of Delhi city

Interpretation

A sudden change of pollution has been observed that is a good indication. Not as much but little changes (declination) in AQI level was observed as shown in fig.7

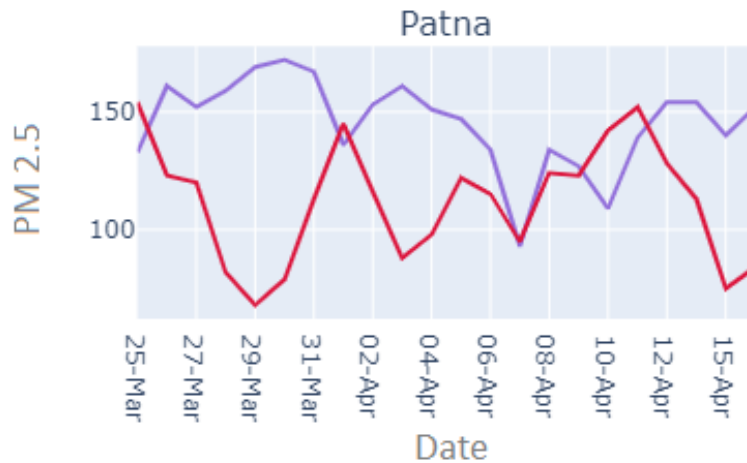


Figure 7: Comparing AQI level of Patna city

Interpretation

Fig. shows clear declination of the AQI level of pollution. Particulate pollutant concentration has been taken as indicator measure

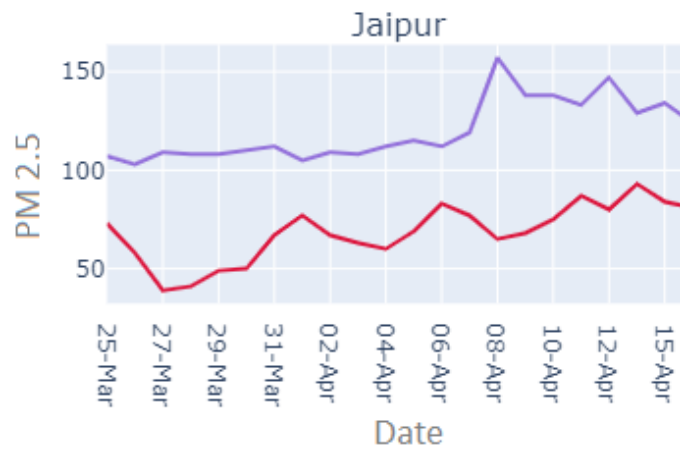


Figure 8: Comparing AQI level of Jaipur city

Interpretation

Fig. shows a clear declination of the AQI level during the period of 2 months in march April and compare with 2019.

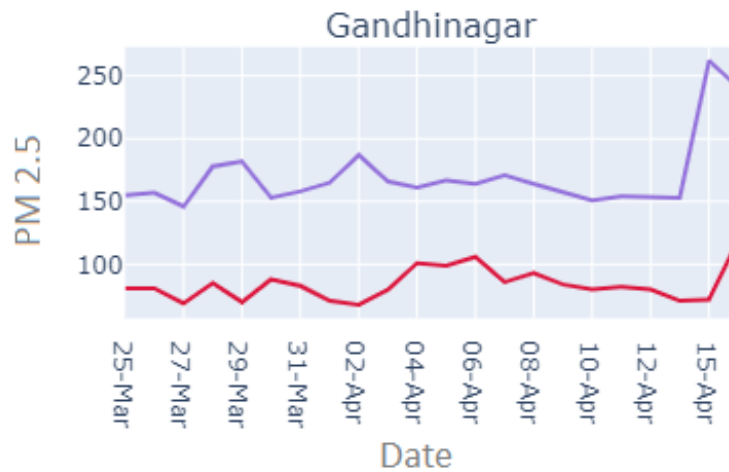


Figure 9: Comparing the AQI level of Gandhinagar city

Interpretation

Less than 100 PM_{2.5} indicates a good Air pollution condition that is due to the lockdown. Should maintain to improve the health condition.

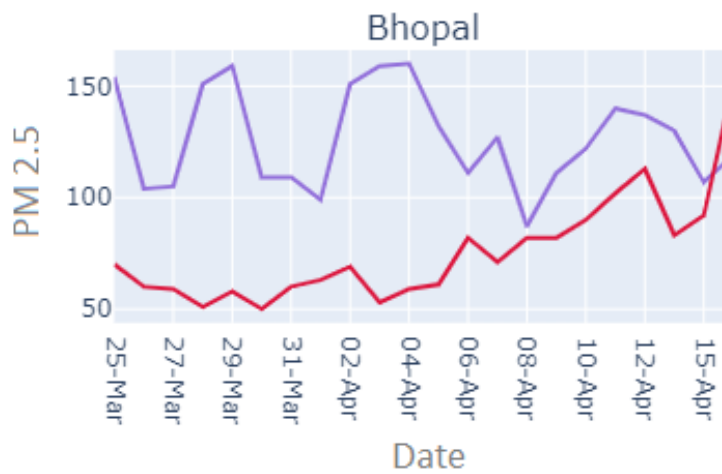


Figure 10: Comparing AQI level of Bhopal city

Interpretation

Both the cities show little declination of AQI (PM_{2.5}) level

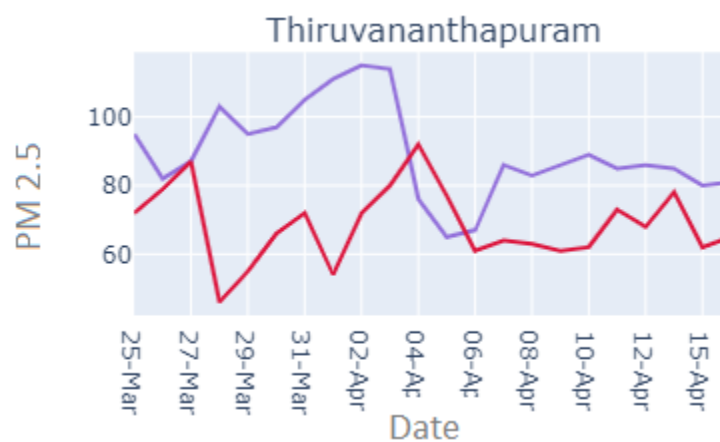


Figure 11: Comparing the AQI level of Thiruvanthapuram city

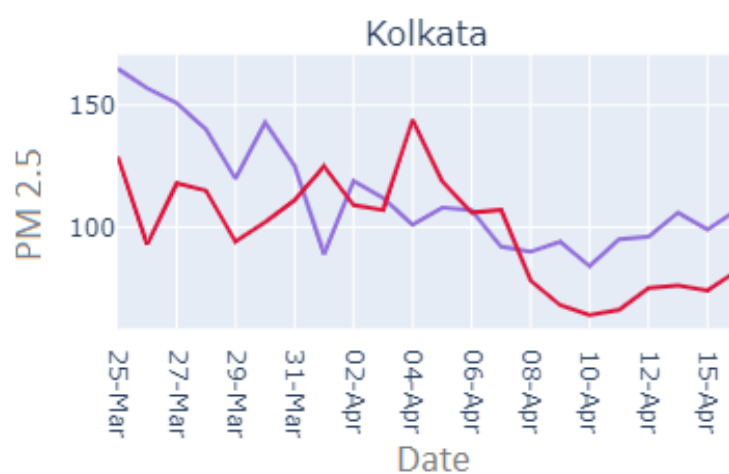


Figure 12: Comparing the AQI level of Kolkata city

Interpretation

Declination in the AQI level was shown during the lockdown period of 2020 in both the cities.

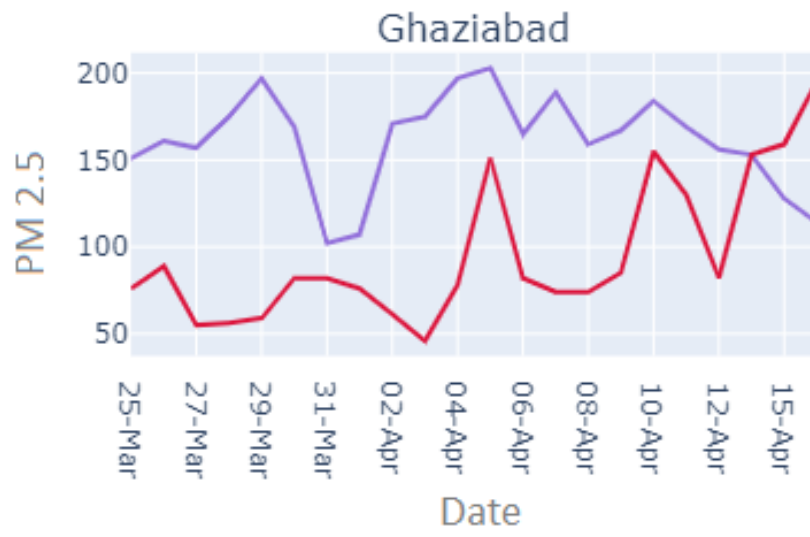


Figure 13: Comparing the AQI level of Ghaziabad city

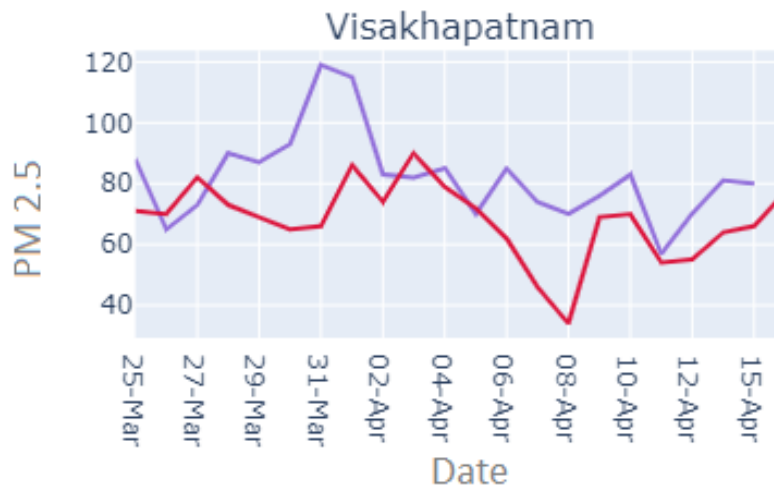


Figure 14: Comparing the AQI level of Visakhapatnam

Interpretation

Drastic change in the AQI level has been shown in the figure of both the cities.

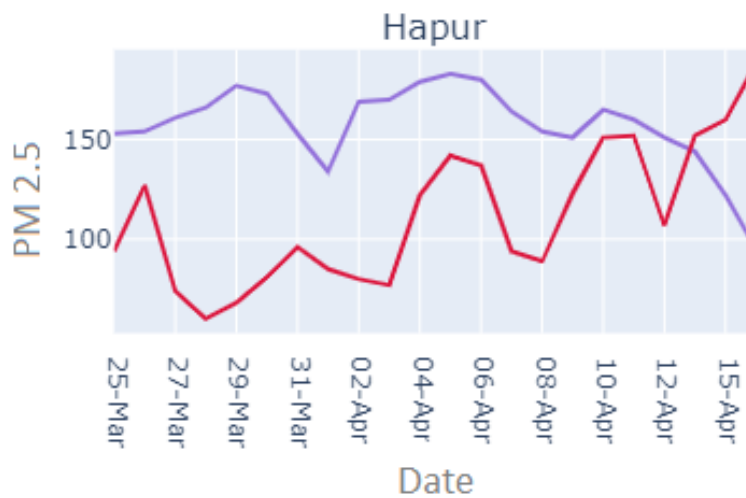


Figure 15: Comparing AQI level of Hapur city

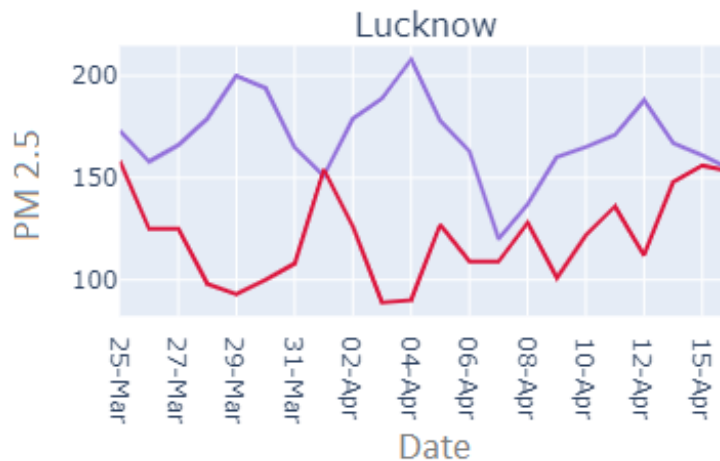


Figure 16: Comparing the AQI level of Lucknow city

By measuring Maximum, minimum, and median for data of all we are come with the box plot graph, with the help of graph we observe the distribution of standard variation in 2019 and 2020. We see only the lockdown period (during the study) that is, March to April for a clearer result. And this gives an indication of larger variation for pollution in the lockdown period for 2020.

We can say that the mark in the graph are not overlapping by which we can make a conclusion that with a confidence interval of 95%, the true median will change or differ.

An important thing to note that even the area where there is not a proper lockdown policy or people are not following due to less number in cases of COVOID-19, which lead to less

restriction or prohibition for gathering, working due to which traffic is there and does not have much variation in pollution when compared to the AQI level with 2019.

As shown in table 2, City are shown with their number of COVOID-19 Hotspots area during the study period.

Maximum - The number of hotspot areas is more than 50% of their total area in the city.

Moderate - The number of hotspot areas is between 25% to 50% of the total area.

Minimum - Number of hotspot area is 25% or less than 25% of the total area

Table 4: City with their respective COVOID-19 hotspot area count

CITY	HOTSPOT	CITY	HOTSPOT	CITY	HOTSPOT
Bengaluru	Maximum	Muzaffarnagar	Maximum	Kolkata	Moderate
Bhopal	Maximum	New Delhi	Maximum	Gandhinagar	Minimum
Delhi	Maximum	Trivantampura	Maximum	Ghaziabad	Minimum
Hyderabad	Maximum	Vishakhapatnam	Maximum	Hapur	Minimum
Jaipur	Maximum	Chandigarh	Moderate	Lucknow	Minimum
Mumbai	Maximum	Chennai	Moderate	Patna	Minimum

We are using a boxplot graph as shown in fig 17, since they are the standardized way of displaying the data analysis. We came up with five summaries from the data that are (minimum, 1st quartile Q1, median, third quartile Q2, and maximum).

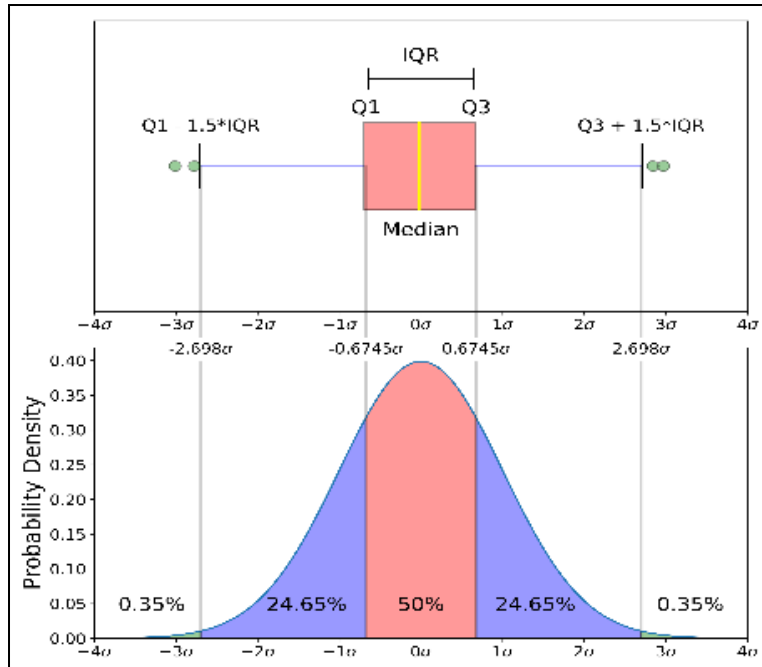


Figure 17: Distribution curve made boxplot curve

A middle number between the smallest number is the 1st Quartile. ($Q1/25$ th Percentile).

Median is the middle value of the data set. ($Q2/50$ th Percentile).

The middle number between the median and the highest number is the third quartile. ($Q3/75$ th Percentile). As shown in fig.

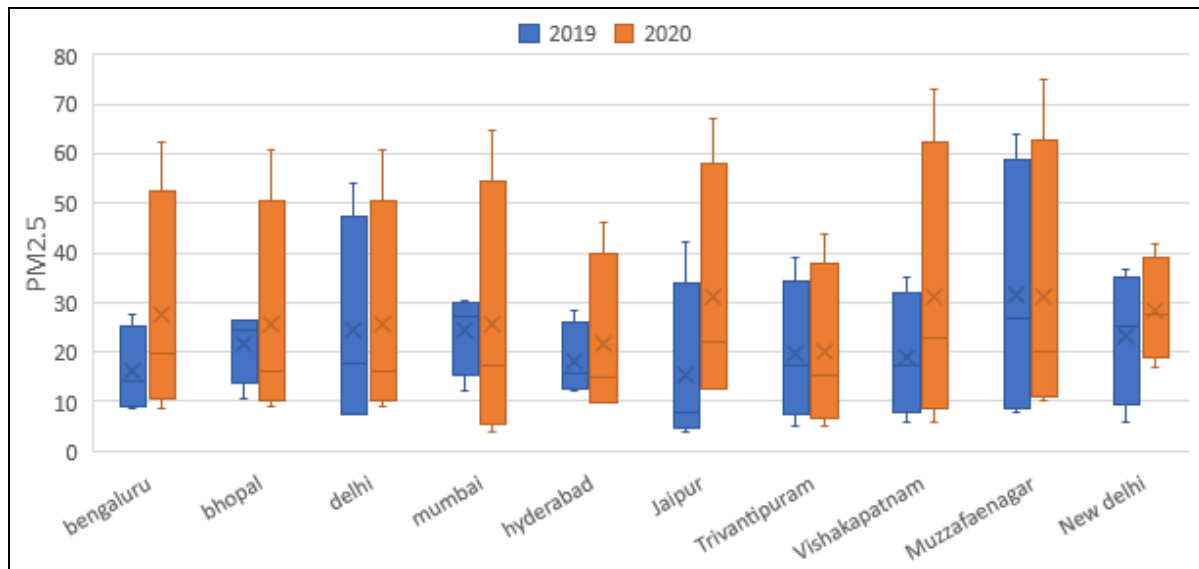


Figure 18: Monthly variation of Air quality of different city and comparison with last year

The next step is to compare the change in variation of pollution level in lockdown period of 2020 in India and compare it with 2019 as shown in Fig

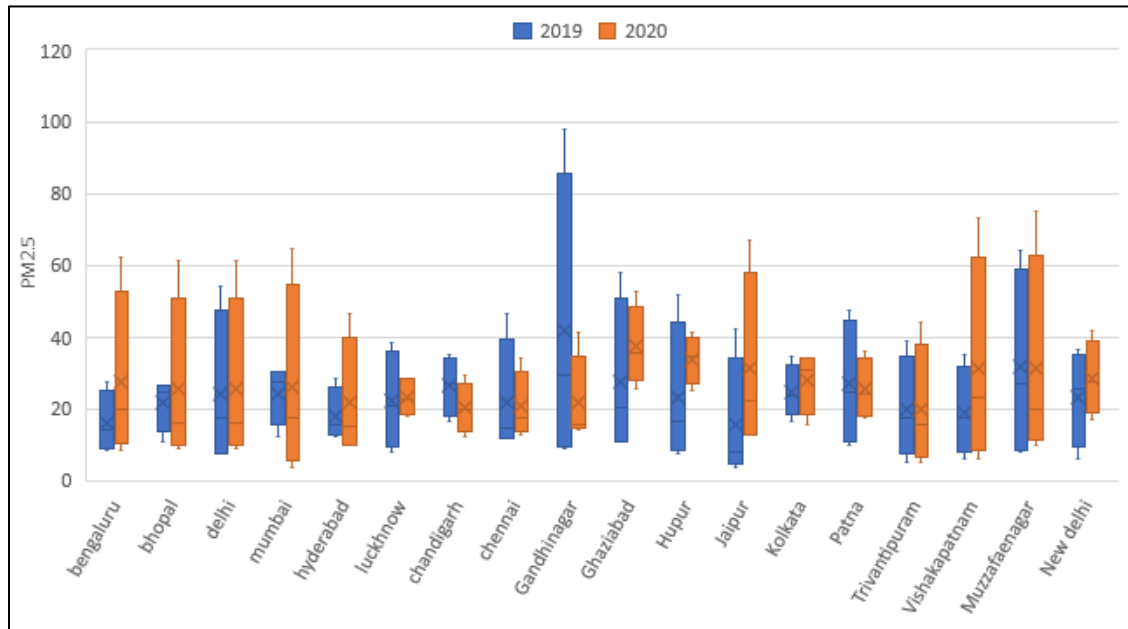


Figure 19: Monthly variation in Air quality of city with maximum hotspot area and comparison with last year.

Then, for better clarification or understanding of what we do, we separate the city concerning the hotspot declared for COVID-19 in the city during the study period. More number of hotspots in the city indicate much strictness in lockdown gives result in less gathering, thus indication for a larger drop in the AQI level. As shown in fig

8. Various causes of increased Air pollution

Pollution refers to any particle that is out of place or in other words when toxins, containment, any other chemical substitutes come in the environment and disrupt their function.

Our atmosphere contains 78% Nitrogen oxide and 21% oxygen. Pollutants come in the form of

- carbon monoxide (CO)
- and carbon dioxide (CO²)
- sulfuric compounds like sulfur dioxide (SO²)
- methane, radioactive decay, or toxic chemicals.

Causes

- Human Activity (Manmade)



Combustion of fuels, petroleum, industries are the major cause of pollution. This is the reason why air pollution is less in some regions like rural areas and high in urban areas. In larger open areas these particulate that are emitted from the big industries or other human activities that are man-made when added to the air have a warming effect and also be hazardous to health

- Dust and Wildfires

Dust during fire events is the worst one and has a noteworthy effect on the atmosphere. It has been measured that 80% during wildfire emitted the particles are of dust or soil. Have a greater impact on the environment cause a serious problem in the health of the human body.



- Animal and Vegetation

Animal digestion leads to the emission of methane and greenhouse gases that has an adverse effect on the environment. In some regions, animal vegetation like black gum, poplar, willow tree, and oak are emitted a great amount of VOC, especially in summer days. They combine with the normal gases of environment like nitrogen houses, Sulphur oxide and form low lying seasonal hazes in rich zones.



- Fossil fuel emission

Various fossil fuels like coal, petroleum other factories materials, their combustion is the



Major cause of air pollution. They are generally generated from plants, manufacturing facilities like factories, industries, waste incinerators, burning fuel heating devices, furnace. Even providing air conditioning will lead to a certain amount of emission which has a direct impact on increasing air pollution. Most of the Study has shown 21% of total greenhouse gases, gas emission, and electricity produce another 25% emission. Transportation generated 14%.

- Waste

This garbage is contained 40-50% of Carbon mass that clearly indicates that by burning trash the main gas emitted is Carbon dioxide which is a serious problem for health.



LOCKDOWN AFFECTS ON GANGA

An IIT BHU professor stated that one-tenth of the pollutants in the Ganga comes from industries nearby Hotels & other sources, with all of these Shut the Quality of water has improved by 40% to 45%. There is a 34% reduction in Faecal Coliform and a 20% reduction in biochemical oxygen demand. After a long time, the Water Quality of the river has become good for RITUAL SIPPING (ACHMAN). Also due to less pollution, the South Asian River Dolphin has been spotted by local people

Ganga before lockdown start



Ganga River after a month of lockdown start



9. Result and Discussion

As we mainly focus on PM_{2.5}AQI concentration because they play a major role in effecting the pollution. AQI is an elementary and treasure, easy tool for the data interpretation for the pollution effects on health or in the environment. As we see in Fig. 1 and 2 there is the decline of the AQI level in 2020 compared to 2019 in most of the cities of India. In 2020 especially from march there is a sharp decline. And these are the month of 2020 when there is lockdown due to a pandemic COVOID-19 has been start.

For more clarification or confirmation, we conduct observation via the boxplot graph as shown in Figures 3 & 4 shows a specific 2 months variability. That was observed, more in 2020. And more specifically in the area where the lockdown is strictly followed that is the city with more COVOID-19 hotspot area. By these all observations, we can see there are many declinations in the AQI level and PM_{2.5} concentration that is far good for the Indian people. And, the drop in the water pollution these both are high achievement of us.

Through various observations, we came with this result that after lockdown there is much reduction in the pollution level of the environment. There is an approximate 55-60% reduction in the pollution level for metro cities and a 20-30% reduction in the city with less industrialized or less prone to traffic after lockdown. And a 40-45% improvement in water pollution.

After undergone various causes that emit some hazardous gases that have a large effect on health, ecosystem, or environment. This will clearly show why there is not a big issue of raised air pollution in rural areas when compared to the urban area.

Many of the causes are easily be controlled if we take a step. This work of control the pollution or maintaining the improved level of AQI level after a lockdown was not only part of government this will only be done successfully if each and every person will decide to take this step.

Also, we have seen how this air pollution has an adverse effect on health. air we breathe is dangerously polluted; every 9 out of 10 people are breathing polluted air. All over the world, this will kill 7 million people every year. Over 1.2 million death are occurred in India due to air pollution every year. This included outdoor as well as indoor air pollution.

Controlling the environment pollution has a greater impact on declination in morbidity as well as mortality rate. That will be a great achievement for the health system of India. Air pollution has a great effect on the morbidity rate when compared to the mortality rate. Since the polluted particulate matter or hazardous gases are slowly penetrated into the respiratory system and in a very slow, steady way get to damage the lungs vessels, muscles.

And in this case, the patient with already immune-compromised get suffer. There is time in Delhi when a red alert has been announced for air pollution that was the worst situation for health. After lockdown the pollution level decrease, this is the right time to maintain it for protecting the environment and health of the body.

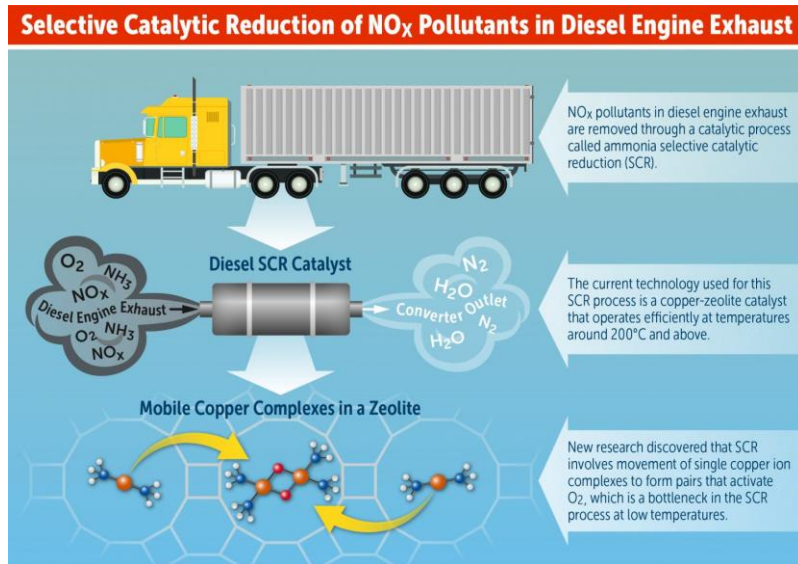
10. Recommendation

Since, after lockdown open, there is an abrupt increase in-crowd, traffic, industrial work for that we must take a necessary stand to maintain this environment that is much more favorable for our health. These are –

- To understand that from where the pollution comes from:
So that pollutant-free if possible, the vehicle can be made to reduce exhaust fumes that are the major cause of increasing pollution. Pollution control Awareness is the first step to maintain an improved AQI level.



- Enforce stricter emission standards.
- Retrofitting of heavy vehicles, cabs.



- Subsidies for electric vehicle.



- Cutting speed limit in polluted motorway areas.



- Focus in waste reduction and increase incineration- Technologies for the management of Incineration ashes



- Training to driver for pollution awareness



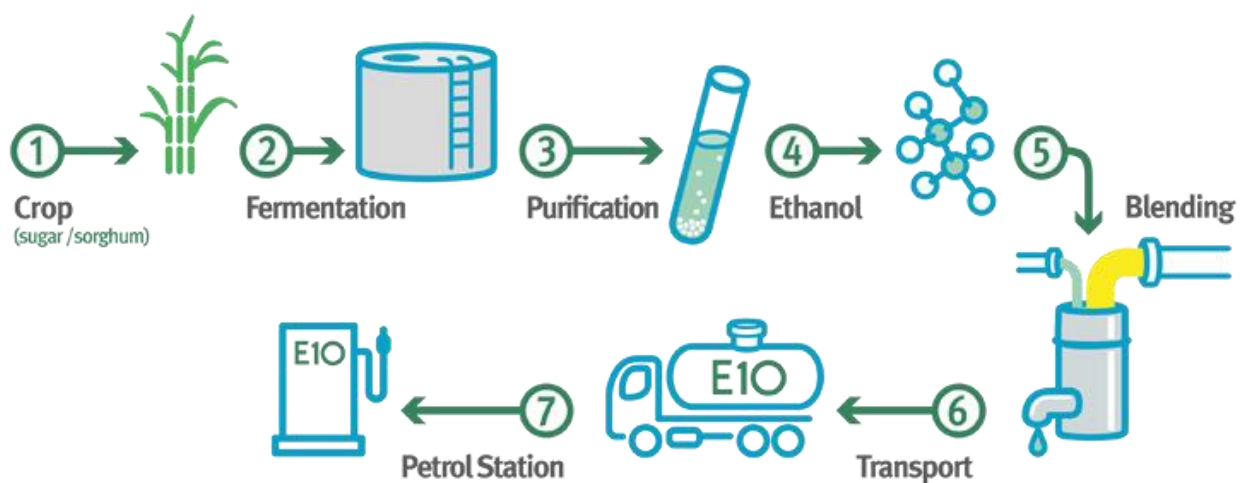
- Encourage active travel where possible.
- Routinely testing or service of vehicle



- Stop having campfire in city
- Planting as much as possible and care for trees.



- Become a champion for clean air, by reporting any concern you encounter.
- Reduce the number of car trips.
- Odd-even system must be followed in the places of higher AQI.
- Also promote traveling by public convenience.
- Renewable fuel and clean energy production



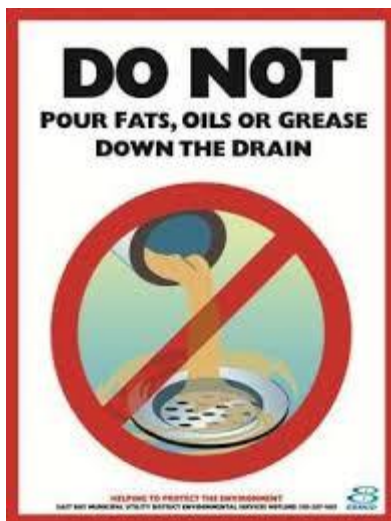
- Use less plastic



- Reuse items



- Do not throw oil, chemicals, medicines in water, soil.



- Use environmentally friendly detergents.

11. CONCLUSION

After observing, analyzing, or evaluate the data set, we scrutinize the lockdown effect on the environment of India especially the air quality which has major benefits in our social, physical, mental health. We observe that such type of step that is lockdown has a drastic effect on the environment. We came up with the result that after lockdown there is about 55-60% declination in the air quality level of India when compared with 2019. Even the area where people are following lockdown partially also have some drop in pollution.

The change in environment was mainly seen in the area of more industrialized, the city prone to traffic. And that is the reason for the higher mortality rate in these areas due to pollution.

According to the Health Benefits Institute, there are 24000 to 36000 death on a monthly basis due to air pollution which is, much large in magnitude than the death due to COVOID-19 in India (during the study period). This will be averted by that much declination in the environment and furthermore also if we maintain it. Even air pollution also has an adverse effect on morbidity, effect on daily lifestyle main effect in the internal organ of the body that is Lungs. And the pandemic COVOID-19 also has the same target so to reduce the risk in the future we must take a step to maintain this level of air quality.

In the end, our estimation on averted in many deaths is not based on real mortality data but the focus is that due to COVOID-19 we are already suffering a major problem, and this will not easily end. But by maintaining the air quality level we can hold the spread of respiratory infection, due to infection also it will make a positive effect on the environment. So, after lockdown, it is our own duty to preserve the environment so as to reduce the burden of pollution.

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