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IMPACT OF DIWALI FIRECRACKERS ON AIR QUALITY IN INDIA AND ITS EFFECT ON THE HEALTH

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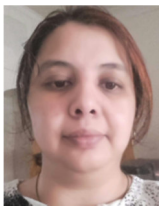
ABSTRACT

Air contamination happens when unreasonable amount of substances including gases, particulates, and organic atoms enter earth's environment. It might cause maladies, hypersensitivities and even demise of people. Air Pollution is worst in India and is likely to result in more deaths. The top five causes of deaths worldwide are CVD, COPD, lower respiratory infections, and lung cancer. The objective of the paper is to highlight the air pollutants in India and their effects on health. As Delhi is the capital of India, so the focus of research was more on Delhi and Haryana from 2012 to 2018.

KEYWORDS: ***Air Pollution, Diwali, Cardiovascular disease, Immune system, asthma, India.***



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INTRODUCTION

There were 7 million deaths in 2012 (WHO, 2015) because of air contamination, Fig1 showing the deaths due to air pollution in 2016. Nine out of 10 individuals on the planet inhale contaminated air. Recently, the air contamination status in Delhi has experienced numerous adjustments as far as the levels of toxins and the control estimates taken to diminish them. The database of the World Health Organization in September 2011 shows that Delhi has the most extreme Particle pollution (PM10) value of nearly 10-times at 198µg/m^3. The contamination due to vehicles was observed to be related to indoor and open-air contamination in Delhi[1]. Contaminated air has a negative effect on humans, influencing various distinctive frameworks and organs. It shows intense respiratory contaminations in young and constant bronchitis in grown-ups, lung infection, and asthma. Change in vaporous and particulate air toxin fixations have a checked and close transient relationship with unfavourable results[2].

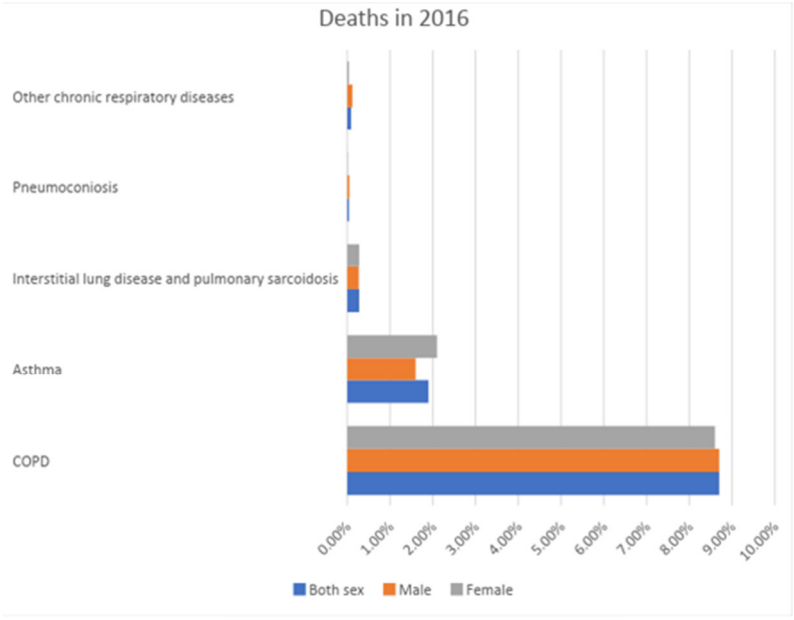

Figure 1
Comparison of female and male deaths from Asthma and COPD

Air toxins are delegate suspended particulate issue (dust, exhaust, fog, and smokes); vaporous contaminations (gases and vapors); and scents. PM10 smaller than 10 microns (10µm) is generally dangerous. PM2.5 happens due the build-up of vaporous poisons, likely to be, SO_2, sulfur trioxide, carbon monoxide; nitrogen mixes, (nitric oxide and NO_2), and alkali; organic mixes (hydrocarbons); volatile natural mixes; polycyclic sweet-smelling hydrocarbons and halogen subordinates (aldehydes); and rotten substances[4]. Air pollution impacts on the resistance of the body, which the one which acts as barrier in the host against the illness[3]. TSPM: Stands for Total Suspended Particulate Matter and one would get when a high-volume mass concentration is done on a channel substrate. RSPM is a small portion of TSPM which is inhaled by people through their respiratory framework and considered as a particulate issue with their breadth (streamlined) under 2.5 micrometres.

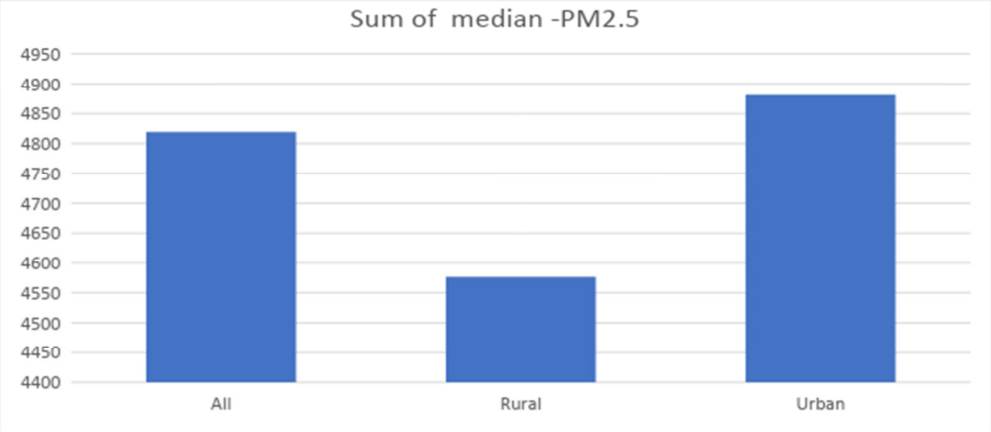

Figure 2
Study of pollution levels in rural and urban areas in 2016

Types of Pollution

1) Air Pollution – It is brought about by destructive gases and smoke. Hurtful gases incorporate oxides of Carbon, Nitrogen and Sulfur. There are two sorts of air contamination.
   a) Outdoor Pollution-Sources for open air contamination incorporates both normal and artificial where characteristic contamination incorporates timberland fires, oxides of sulfur and nitrogen lightning strikes and particulate issue. Artificial incorporates consuming of powers, for example, coal, oil, control stations, ventures and vehicles.
   b) Indoor contamination – Air inside the house or in place of business is allude to as indoor air contamination and is increasingly risky then Outdoor contamination as we invest most energy in the house or in office. Wellspring of indoor contamination incorporates tobacco smoke, pesticides be utilized, family unit items and for the most part the materials utilized inside the house making, for example, formaldehyde and leads.
2) Noise contamination- Noise contamination or then again Sound contamination have the hurtful impact of clamour on human and creatures. Machine, transport, uproarious music is the real reason for sound contamination.
3) Water contamination—It is the tainting of water bodies like lake, waterways, groundwater and seas because of human exercises. It happens when the waste water get blended with common water making it dangerous, contaminated for drinking, and water system reason.
4) Land or Soil Pollution: It is the contamination in which arrive is loaded up with mechanical waste or garbage.

Effects of Air pollution on health

Respiratory diseases in Delhi from 2012 arose to 5 million. Chronic Obstructive Pulmonary disease has been increased from 2016 and is of great concerned as the ambient air quality is getting worse. There has been rise of COPD cases from 28.1 million cases to 55.3 million cases in 2016 and an increase in prevalence from 3.3 % to 4.2%[6]. It also has side effect on heart making an increase in Cardiovascular disease [5]. About 2000 patients for the age group of 18-70 years was tested suffering from COPD in Ludhiana district, and surrounding areas of Moga, Jalandhar, Machhiwara, and Ferozpur. Air pollution in Punjab is highly concerned affecting young people with COPD. Outdoor air pollution has also become leading cause of cancer. Most of the effect of pollution is creation of hole in the ozone layers which protects us from harmful Ultraviolet rays emitted by the Sun, and it may cause skin cancer and cataract [7].

MATERIAL AND METHODS

The data were searched thoroughly in Google search and PubMed. Data were obtained from World health Organization (WHO), Central Pollution Control Board (CPCB), PPCB (Punjab Pollution Control Board), and Data.gov.in.

RESULTS

India is at 7th position among the 20 most contaminated countries of the world as shown in Fig 3. Anand Vihar, R.K Puram, and Punjabi Bagh are found to be the most contaminated regions of Delhi and Amritsar. As shown in Fig 18-24. Punjab was found to have the most contaminated air. Air Quality Index was found to be higher in these regions. Although the Air Quality Index (AQI) has improved in 2017, still is higher. Odd-Even campaign done in 2016 and was found that in April (15-30) NO2 increased in Anand Vihar. The average PM2.5 and PM10 were found to be higher during the odd-even periods when compared to the pre-trial days 15. The RSPM value has increased from 2013-2016. It shows that PM2.5 decreased in 2017 in the month of October as per the data available from PPCB for Vinod Milk Chilling center, Amritsar; but shows an increase from May-Oct and decreased from Jan-March and remains the same in April. Muzaffarnagar shows the higher value of PM2.5 in Uttar Pradesh and Jahangirpuri and Anand Vihar shows high PM2.5 value on Diwali Day 2018 at 6:00 PM.

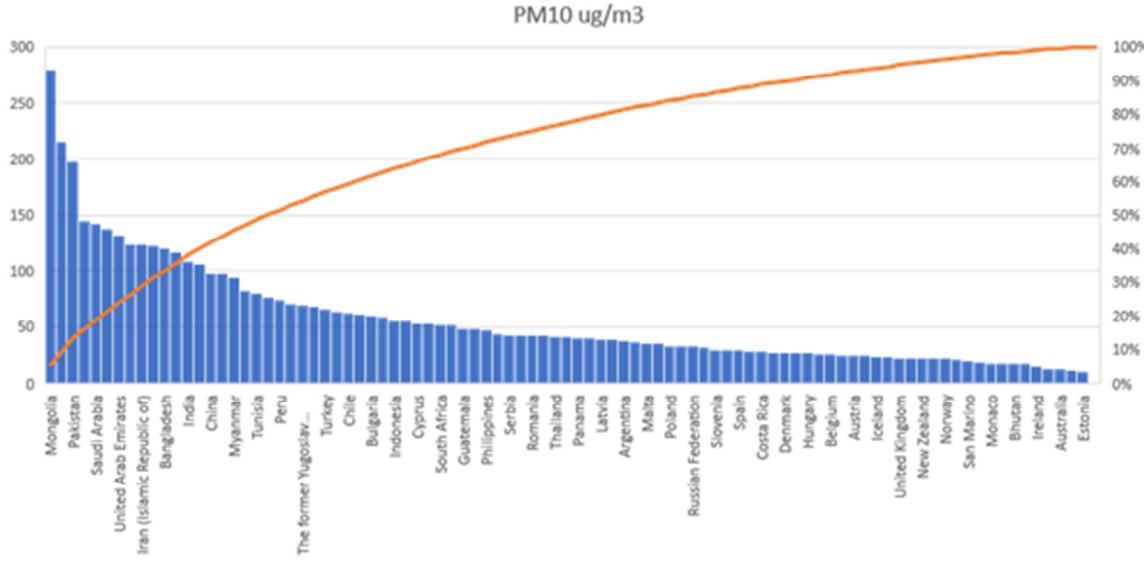

Figure 3

Position of India in the list of highly populated countries in the world.

Air Pollution in Haryana on Diwali Day

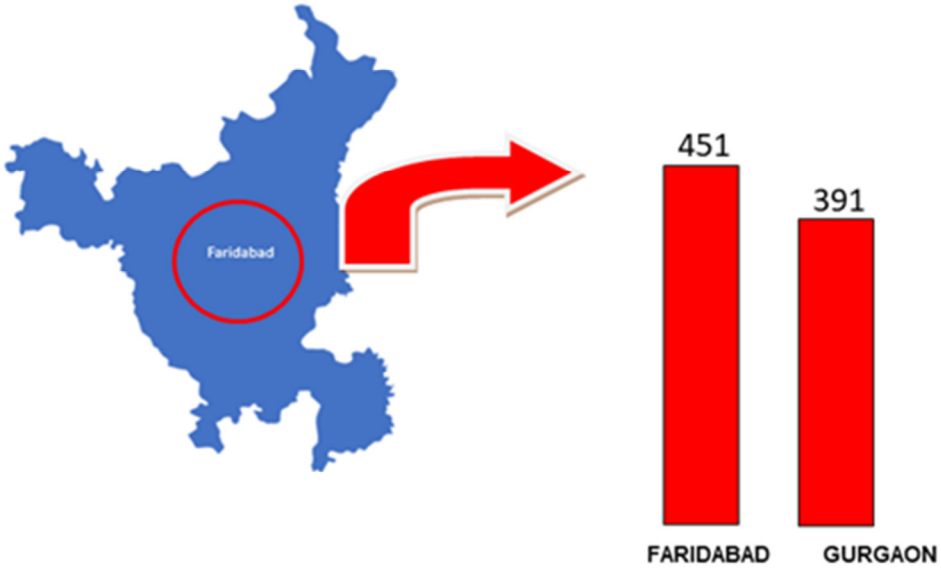

Figure 4
Haryana is more polluted specially Faridabad Town with high AQI Value in 2018 as compared to previous Diwali [11].

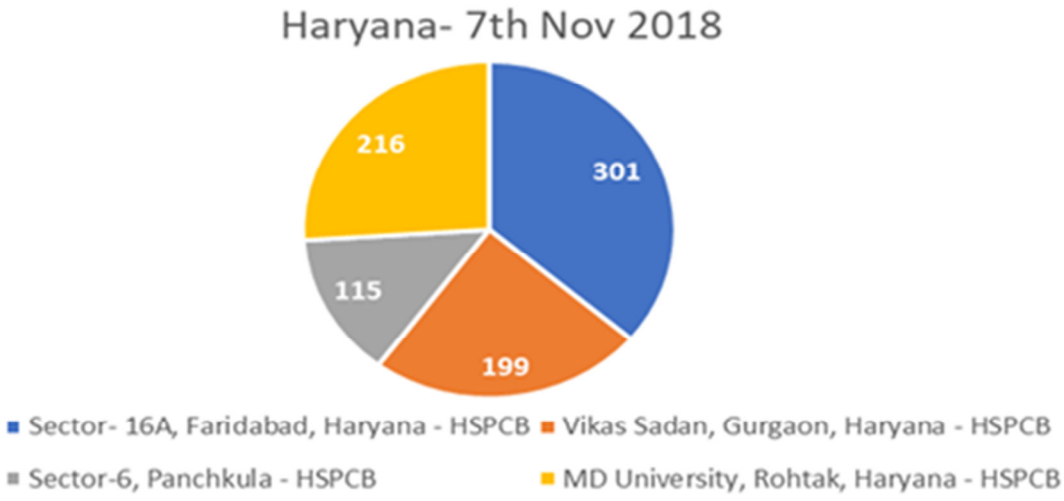

Figure 5
Faridabad sector showing high AQI Index

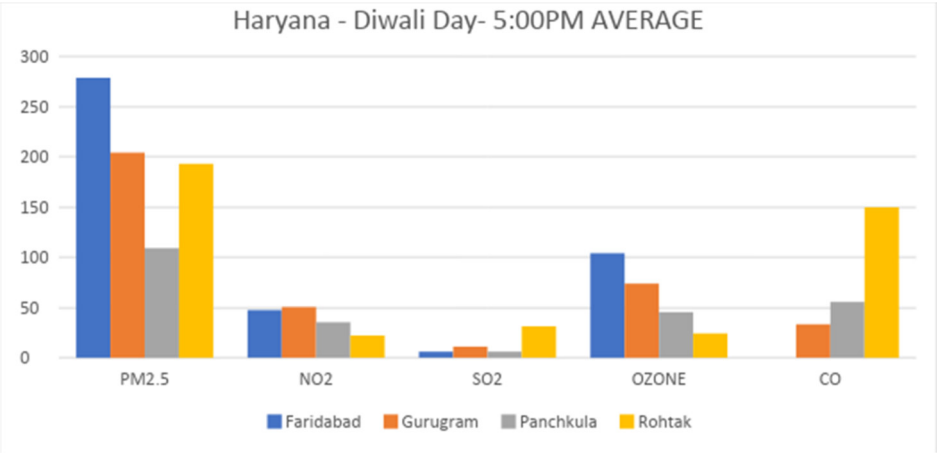

Figure 6
Cities of Haryana showing pollution levels with respect to different pollutants [11].

Air pollution in Punjab

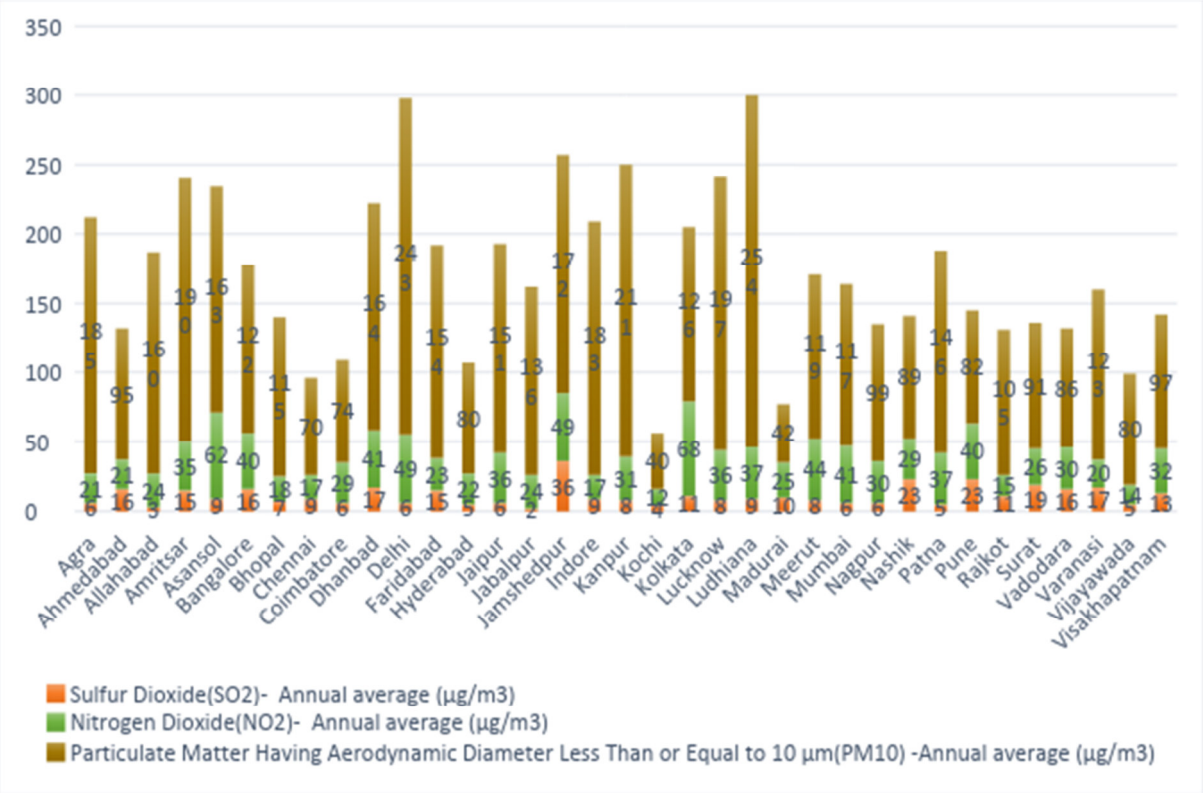

Figure 7
Values of PM10, SO_2, NO_2 in different cities of India

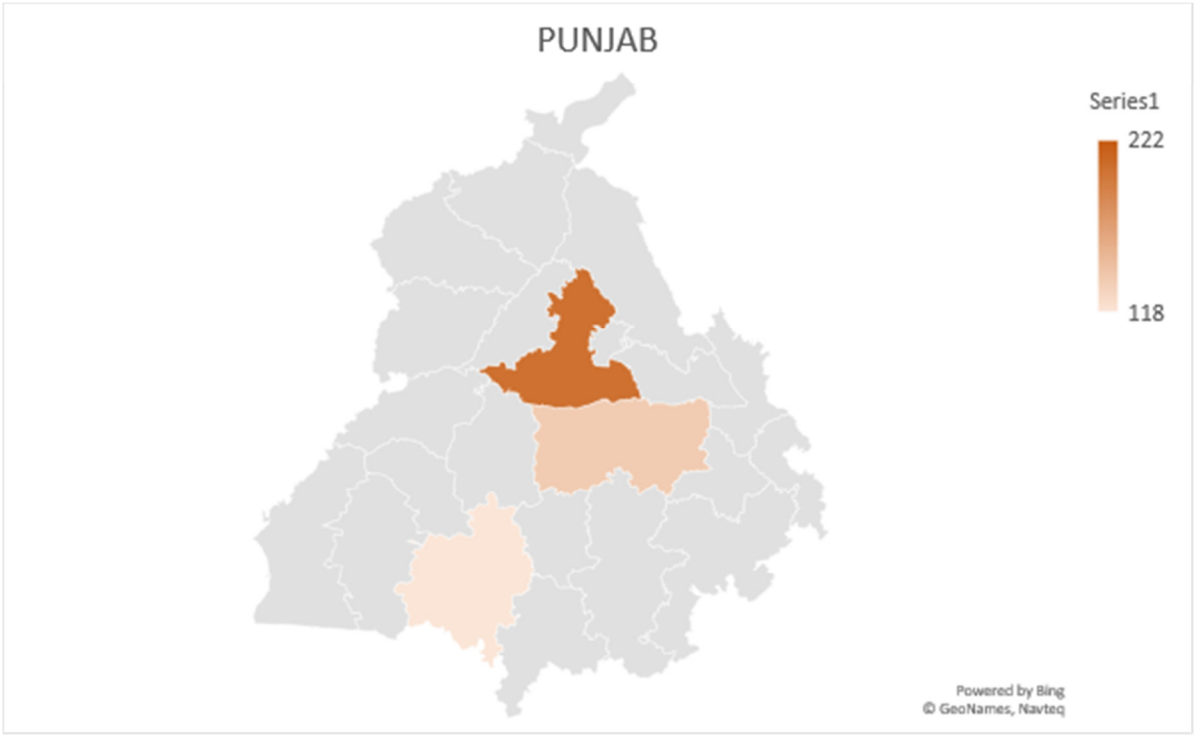

Figure 8
Diwali day Punjab Mandi Gobindgarh at high value of PM2.5 222 and less of all is Bathinda with PM2.5 value of 118.

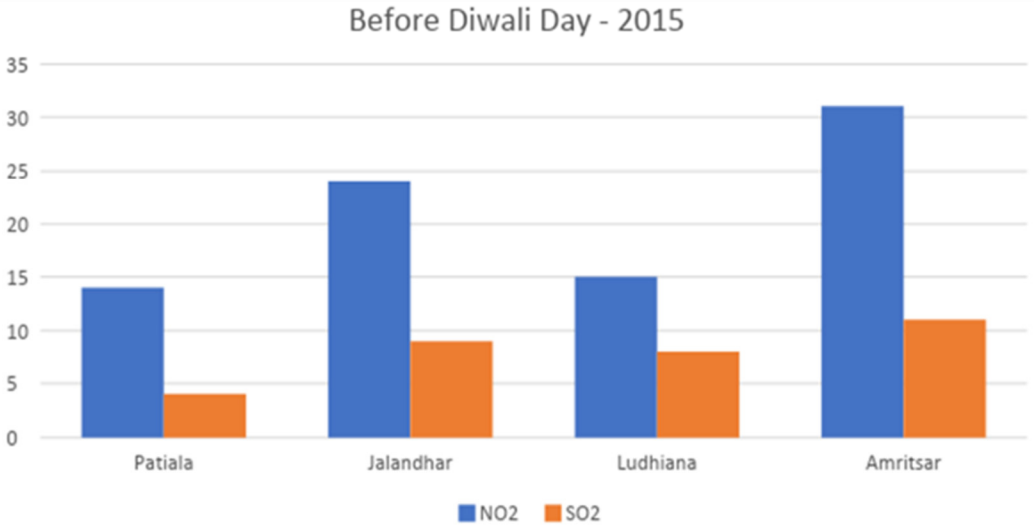

Figure 9
Values of NO_2, SO_2 in different cities of Punjab before Diwali day

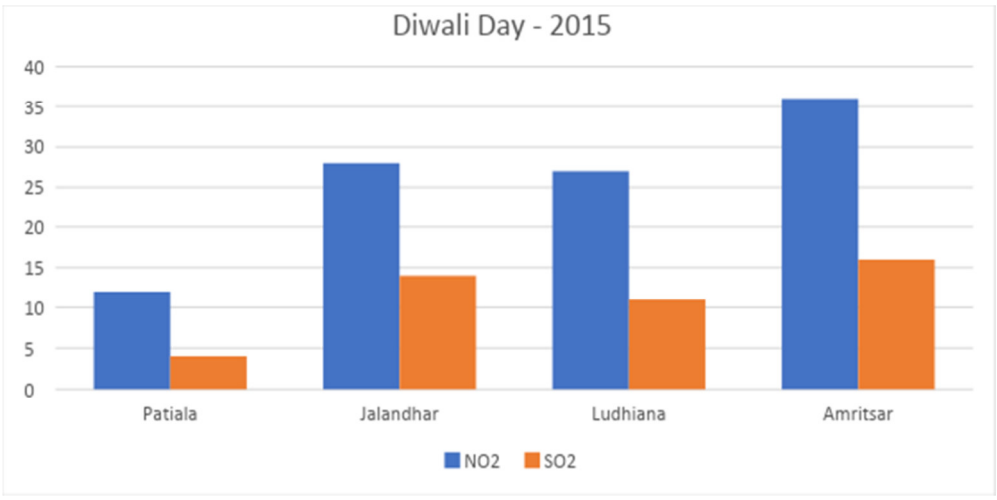

Figure 10
Air pollution in 2015 in Punjab

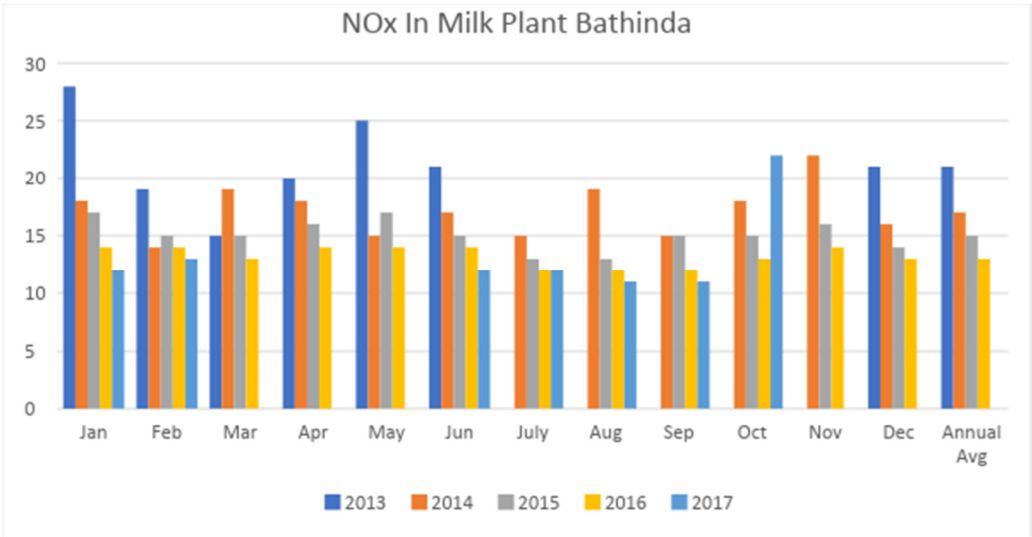

Figure 11
Value of NO2 in Milk Plant Bathinda

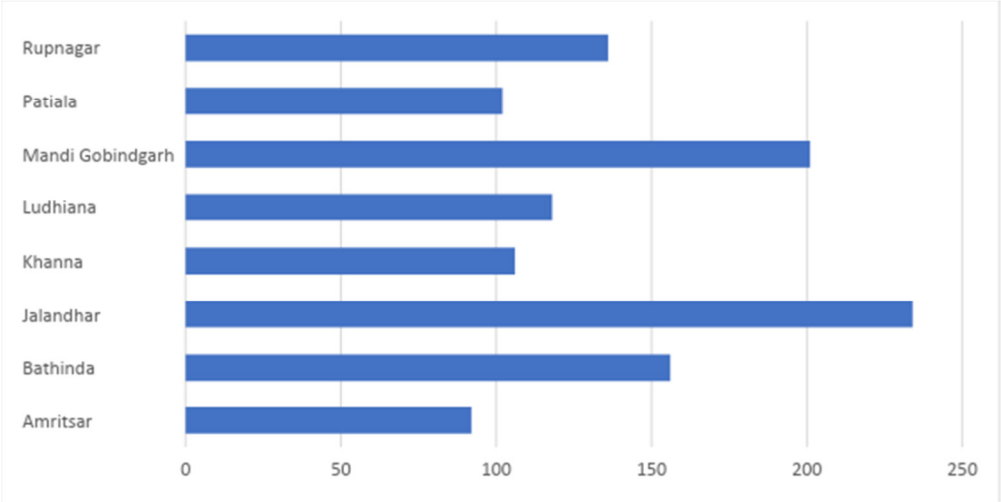

Figure 12
Air quality on 13th Nov 2018 in Punjab Mandi Gobindgarh and Jalandhar the highly polluted areas

Air pollution in Karnataka

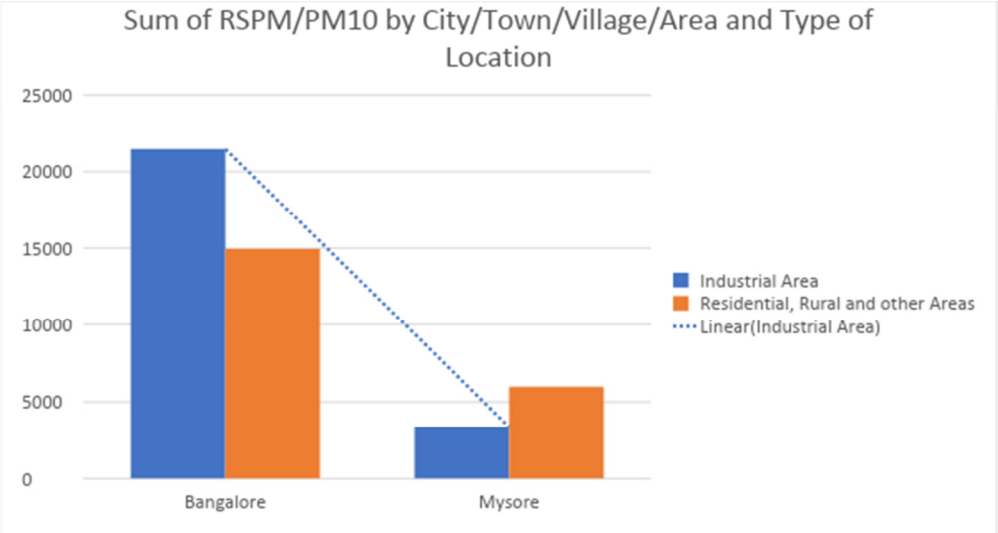

Figure 13
2015 shows Bangalore more polluted than Mysore

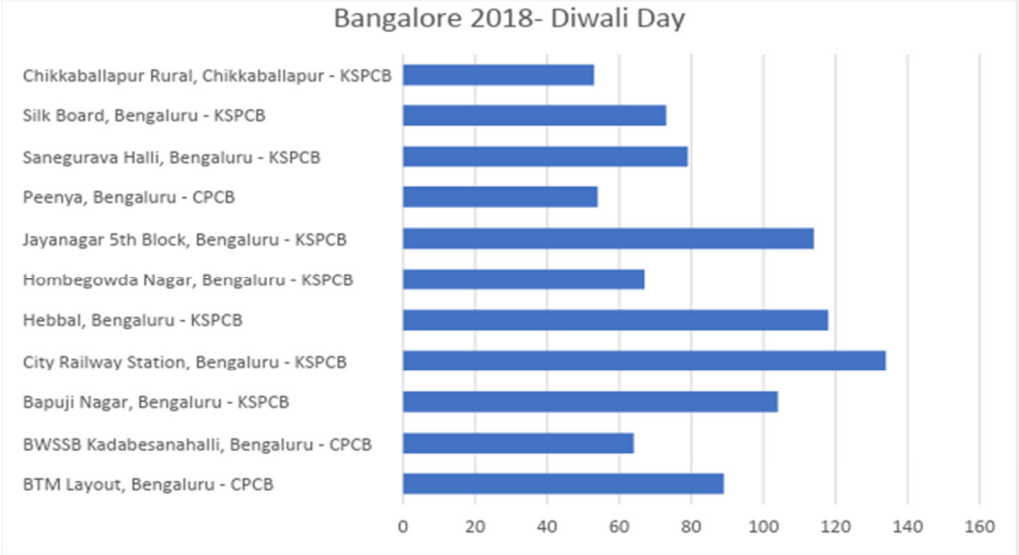

Figure 14
AQI index of Bengaluru City Railway Station on Diwali Day.

The basic dimensions of PM will have damaging effects on the hearing ability of the nationals in Bangalore and may result in a gigantic weight on the general wellbeing framework. Likewise, if this influences the talented youthful human asset, it would represent a risk to the city's economy that is developing exponentially. It is essential that the administration tends to the issue of wellbeing effect because of air contamination by holding fast to stringent proportions of contamination control. There is a requirement for more extensive research and distributions in the zone of air contamination and its consequences for wellbeing. Specifically, the advancement of an important and far reaching proof base would prepare India with the capacity to take educated activities.[14]

Air pollution in Delhi

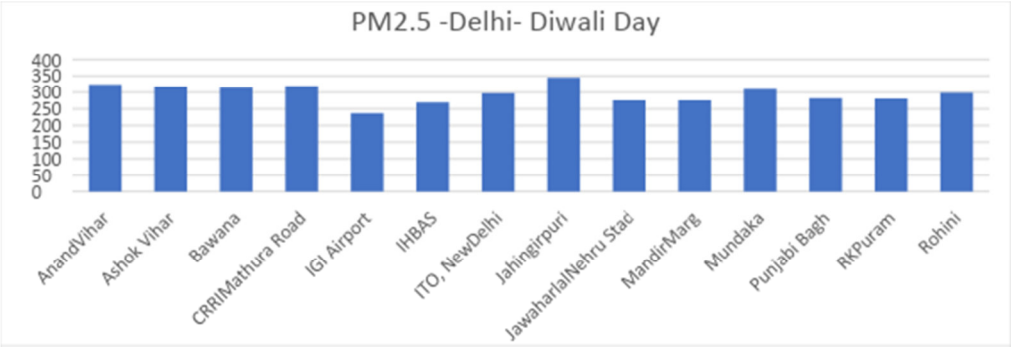

Figure 15
AQI value in Delhi

Diwali Day in Delhi

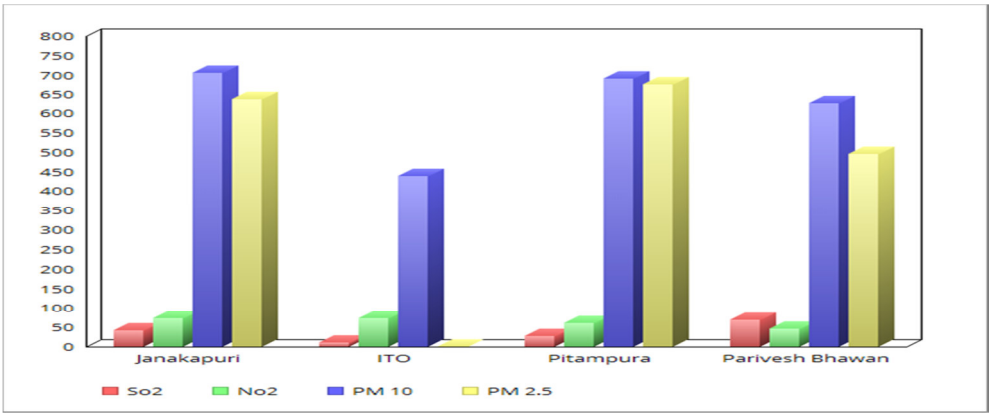

Figure 16
Air Pollution on Diwali day in various areas of Delhi in 2017

On Diwali Day PM10 value was high in Janakpuri as compared to ITO, Pitampura and Parivesh Bhawan. PM2.5 is higher in Pitampura. The So2 conc. And PM10 and PM2.5 increases as compared to pre-Diwali day.

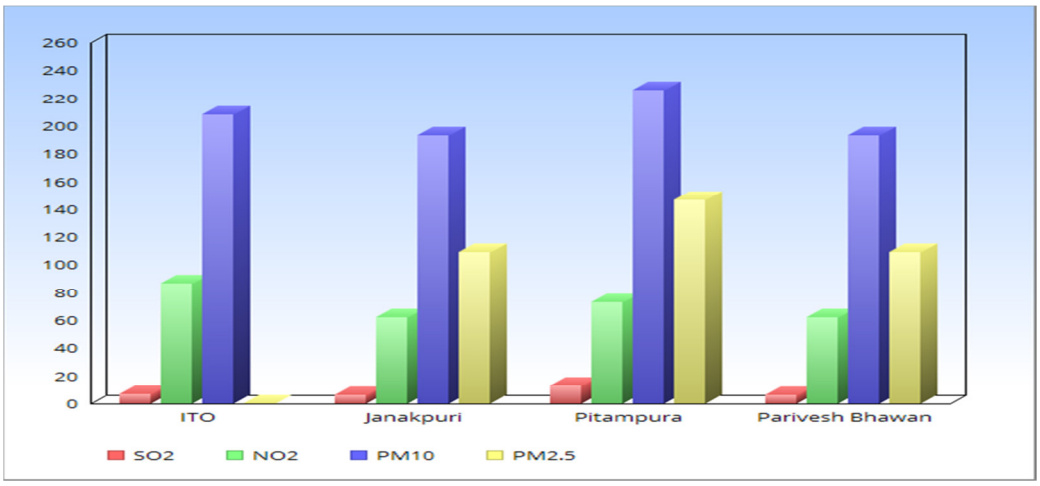

Figure 17
Air Pollution Pre-Diwali Day in various areas of Delhi in 2017.

On Pre-Diwali day the value of PM 10 was noticed higher in Pitampura.

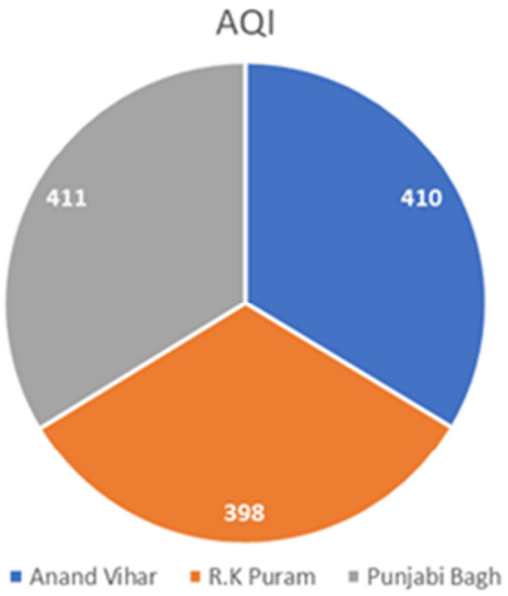

Figure 18
Air Quality Index 2017 in Anand Vihar, RK Puram and Punjabi Bagh

Air Quality Index in 2017 is higher in Delhi as compared to Faridabad, Varanasi, Lucknow, Jaipur, Kanpur, Patna, Muzaffarpur, Agra and Jodhpur.

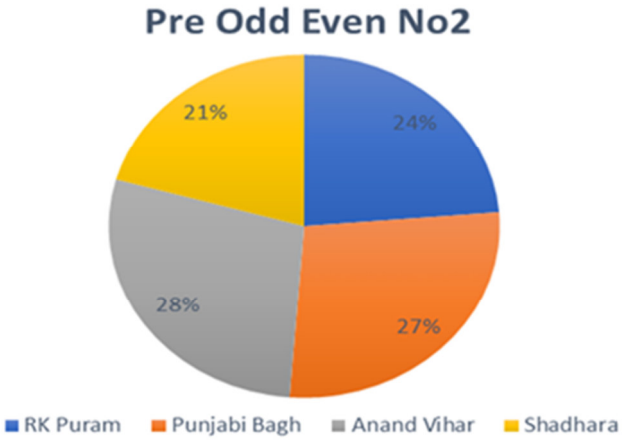

Figure 19
NO_2 values in pre-odd even day

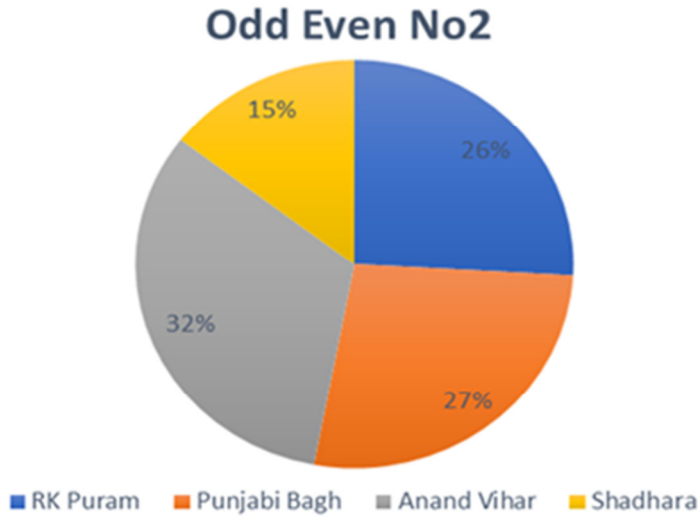

Figure 20
Odd Even (April 15-30) NO_2 Conc in 2016. In R.K Puram, Punjabi Bagh, Anand Vihar and Shadhara

During Odd- even in Delhi NO_2 conc. Was found to be higher in Anand Vihar.

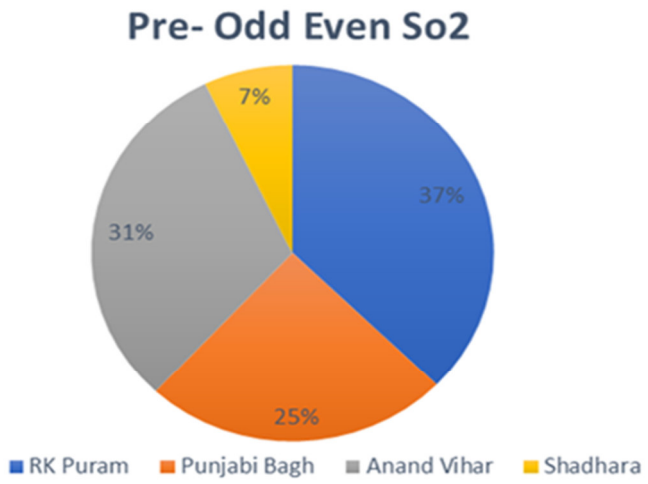

Figure 21
Values of SO_2 in pre odd-even

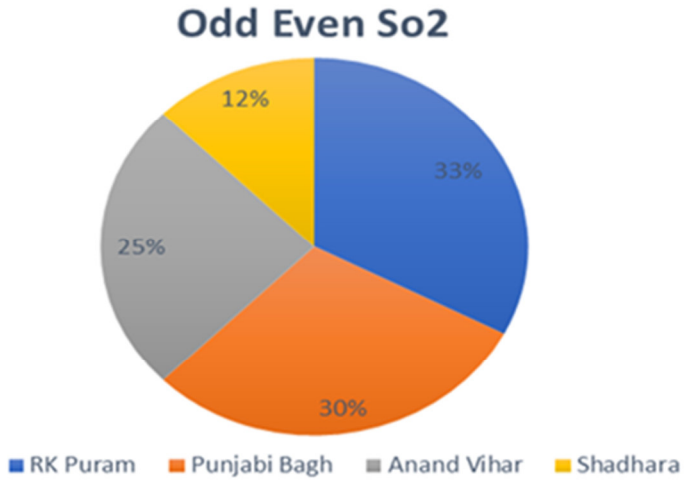

Figure 22
Odd Even SO_2 Conc. In R.K Puram, Punjabi Bagh, Anand Vihar and Shadhara

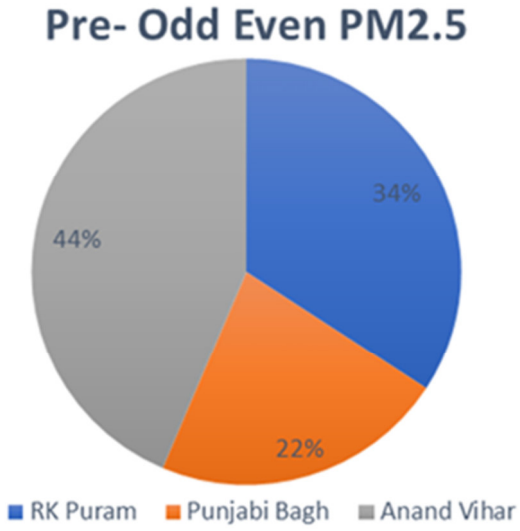

Figure 23
Value of PM2.5 in RK Puram, Punjabi Bagh and Anand Vihar

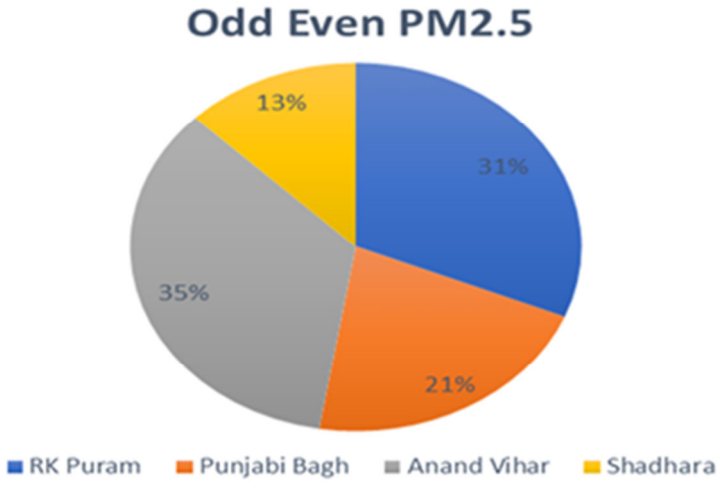

Figure 24
PM2.5 value in RK Puram, Punjabi Bagh, Anand Vihar and Shadhara

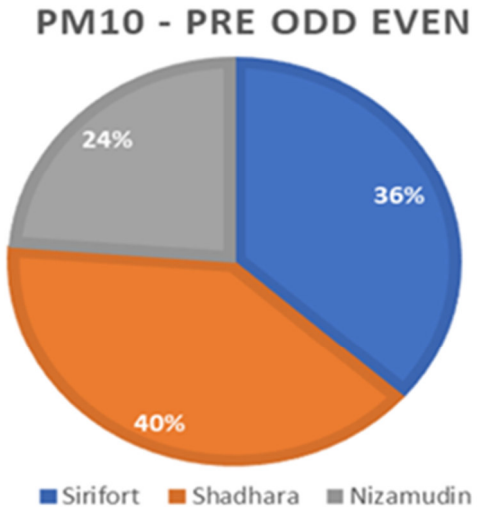

Figure 25
PM10 value in Pre odd-even

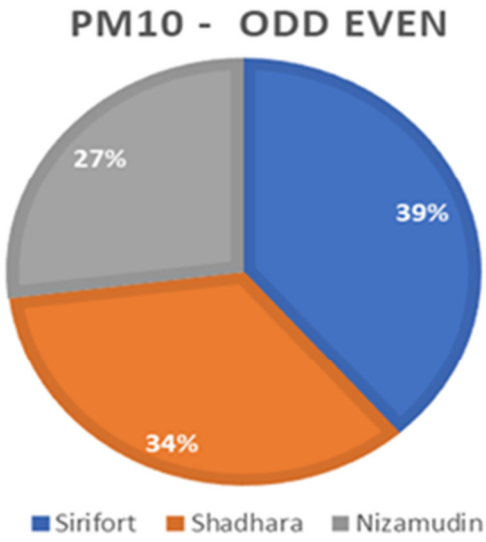

Figure 25a
PM10 value in odd-even

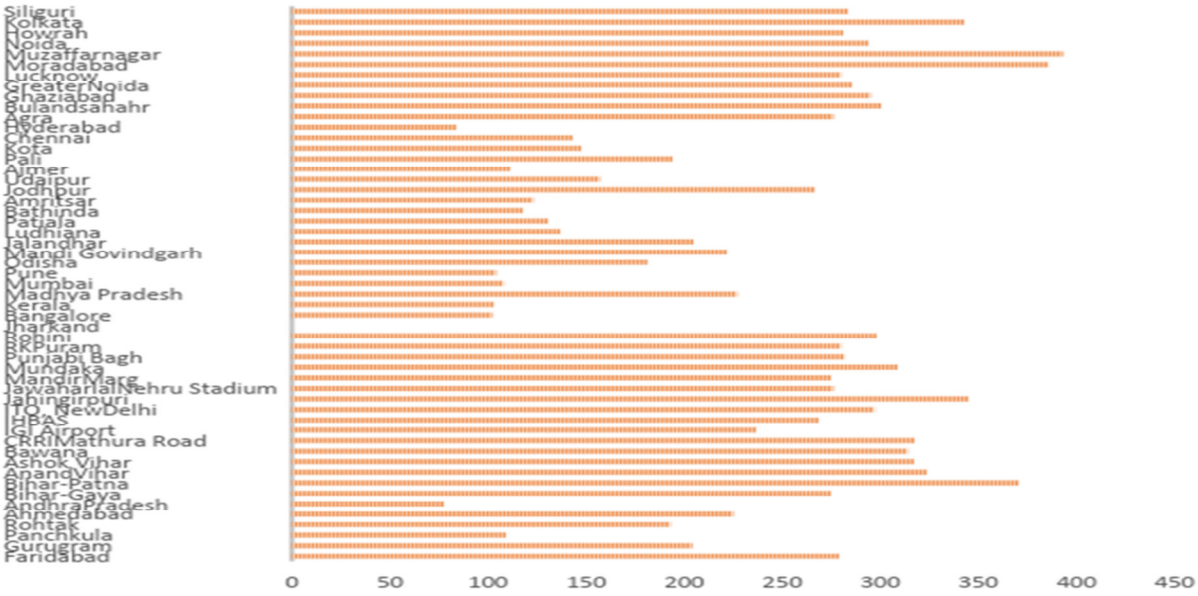

Figure 26
PM2.5 of various cities in India

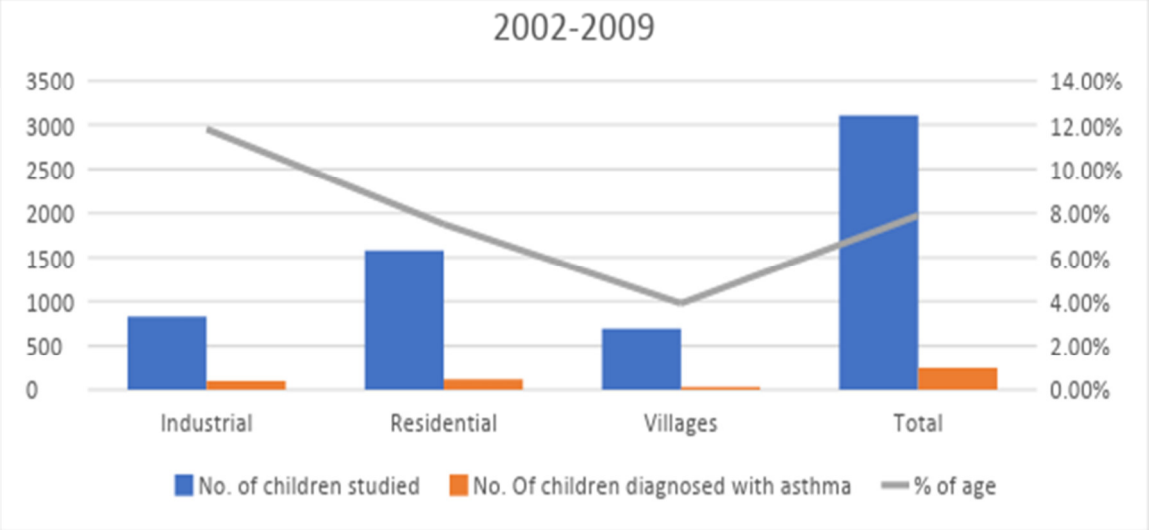

Figure 27
Asthma cases among children in different sectors of Delhi.

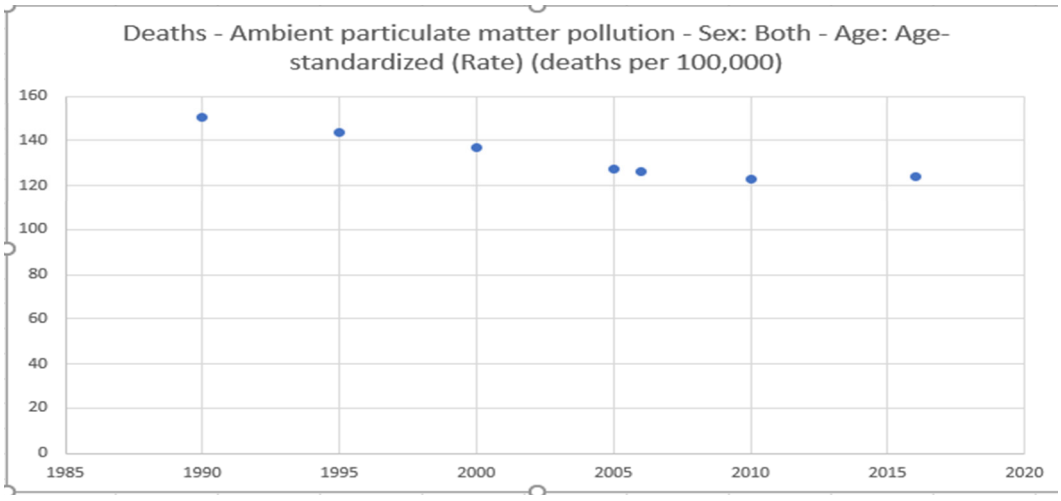

Figure 28
Death rate as a result of Air Pollution in India in 2016

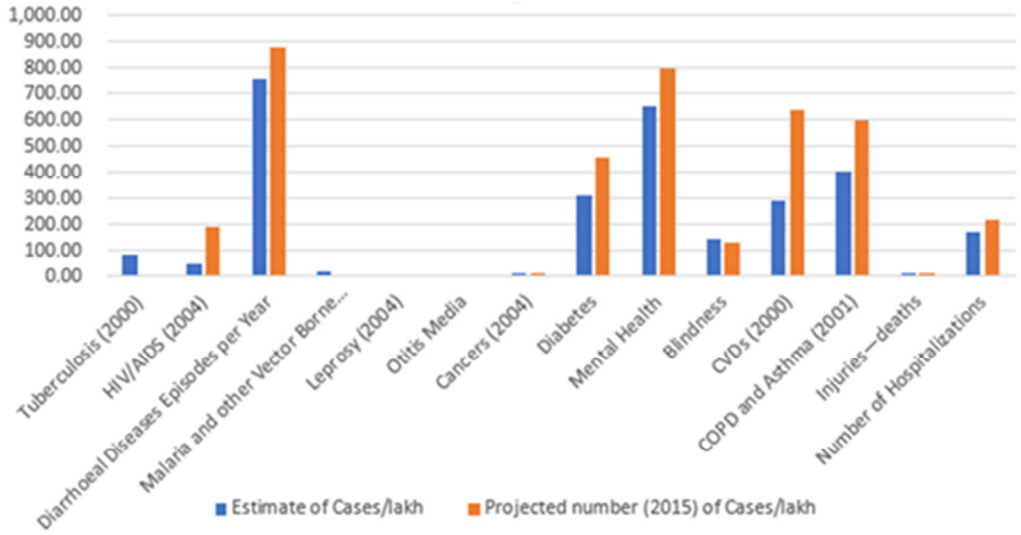

Figure 29
COPD death cases were more in 2016

DISCUSSION

The concentration of NO_2, SO_2, PM10 increases during Diwali day in a study done from 2002-2007 [8]. Similar results have noticed an increase in concentration of SO_2, with respect to PM 10, PM2.5; however, the concentration of NO2 was found to be lesser on Diwali day when compared to pre-diwali day in various areas of Delhi. In research done in 2006-2008, it did not show considerable variation in concentration of NO_2[9]. Comparison of data of 5th Nov 2017 and 5th Nov 2018, shows that PM2.5 value was higher in Punjabi Bagh. Anand Vihar ranks high PM2.5 value for 05 Nov 2018 from Punjab, Faridabad, Uttar Pradesh, etc. Agra seems to be highly polluted at 9 AM than 05 Nov 2018 at 6:00 PM and there was an increase in PM2.5 value in Panchkula and Ahmedabad. Day time PM2.5 should have been decreasing as other cities except for Kanpur for which data was not available but Agra shows high PM2.5 value. This year before diwali PM2.5 and NO_2 value was increased when compared to previous diwali day in the areas of Delhi such as Anand Vihar, R.K Puram, and Punjabi Bagh. These areas are quite unsafe for people to breath as there aremore risk in developing heart disease, COPD and cancer diseases. PM10 value for Anand Vihar is more than RK Puram and Punjabi Bagh in April, October and November data. Anand Vihar, Jahangirpuri is found to be the more polluted area of Delhi [10]. In Apr PM10 value is more cause of pollution whereas in Oct and Nov the main cause of pollution is PM2.5. Most of the pollution is from the residential area as compared to the industrial area in 2015. PM2.5 is higher as compared to PM10 value on Diwali Day. Pollution by tobacco smoking and traffic was mostly affecting the health of children [12]. There seems to be a correlation between PM2.5, NO_2, SO_2, CO and PM10; however, the correlation between PM2.5 and NO_2 was found to be 0.50 and that of PM2.5 and PM10 was found to be 0.68 as shown in Fig 30.[13-15]

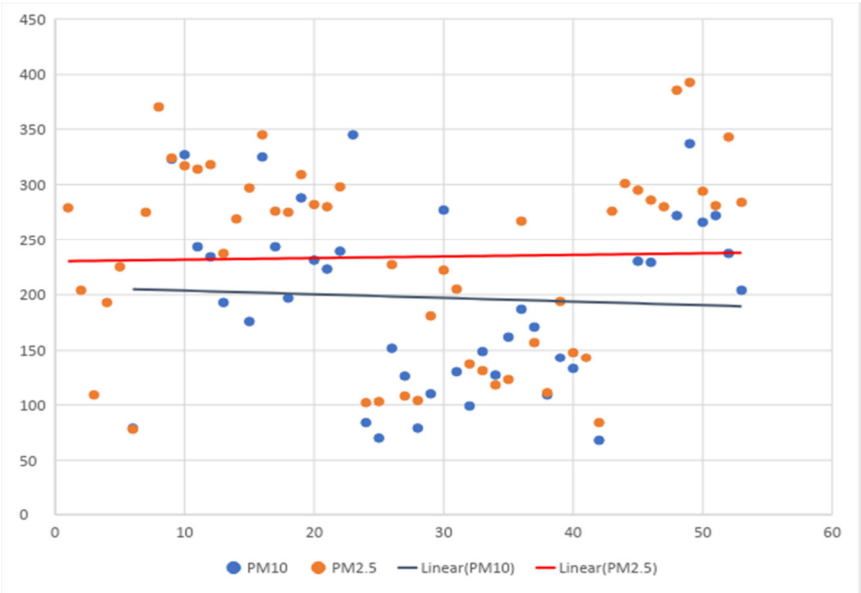

Figure 30
Correlation between PM2.5 and PM10

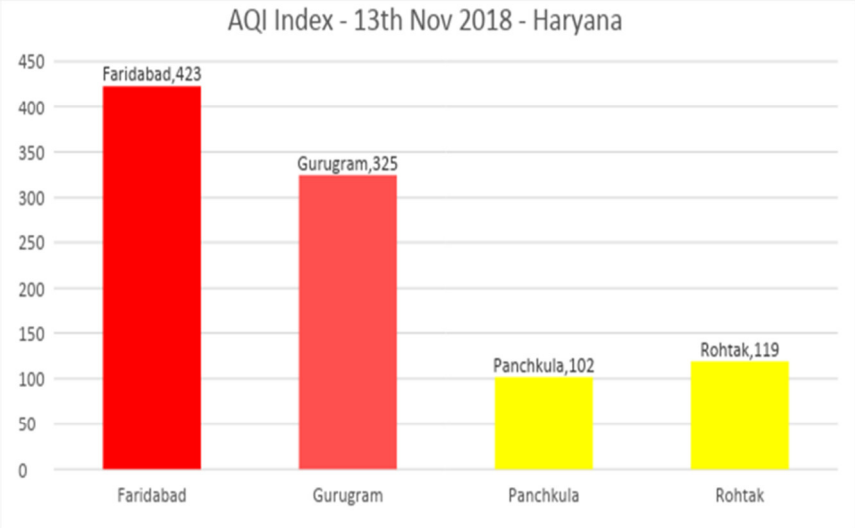

Figure 31
AQI index of polluted areas in Haryana [11]

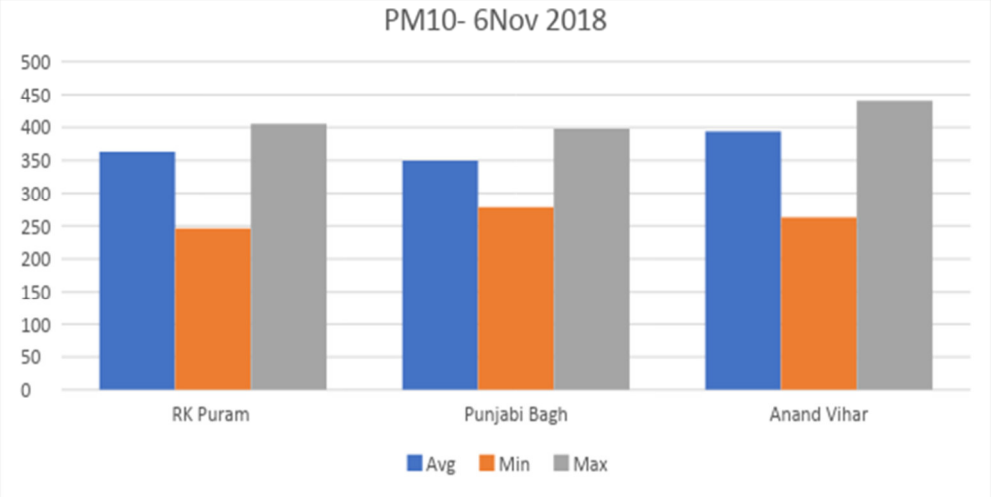

Figure 32
Comparison of pollution in different cities of Delhi [11].

CONCLUSION

This research shows that Delhi, especially Ashok Vihar, Wazirpur, Jahangirpuri, Anand Vihar, RK Puram, and Punjabi Bagh, UP mainly Muzaffarnagar, Greater Noida, Haryana mainly Faridabad are quite unsafe for people living. In Punjab Mandi Gobindgarh and Jalandhar are most polluted areas. There was a rise in respiratory cases in Anand Vihar which is considered as the most polluted area in Delhi. The highest AQI index on Diwali day was found to be in UP and on next day in Faridabad. Air pollution is the biggest problem in India in the three states Delhi, UP and Haryana and it is cause of respiratory, cardiovascular disease and skin cancer.

AUTHORS CONTRIBUTION STATEMENT

Manuscript was thoroughly checked by three authors namely Menu Kesheri, Swarna Kanchan and Ajay Mishra.

CONFLICT OF INTEREST

Conflict of interest declared none.

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