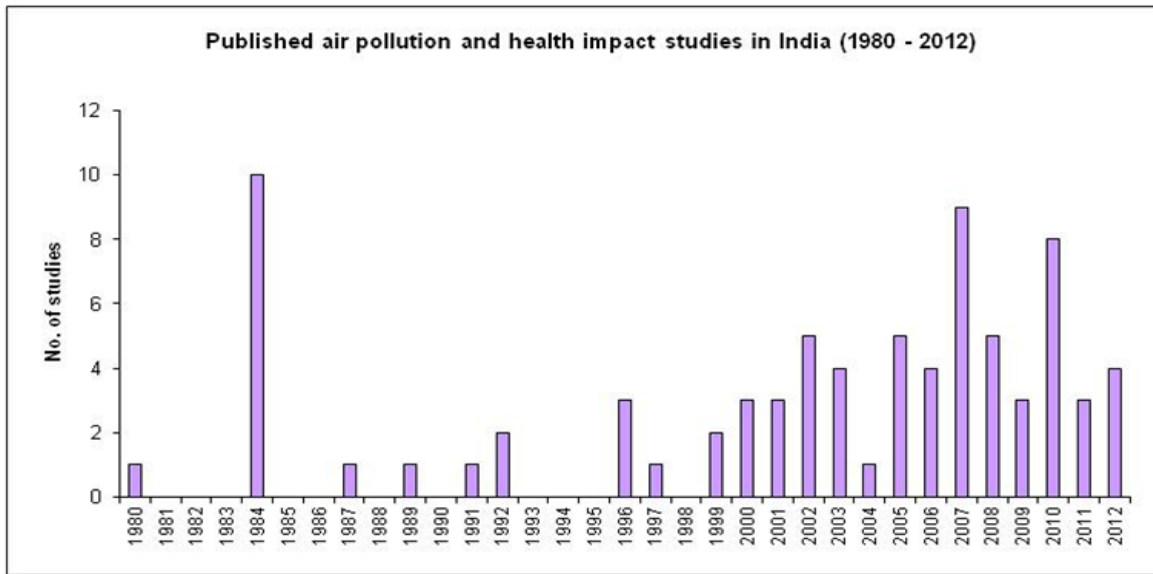


Air pollution and health impact evidences

1. India has its own health evidences

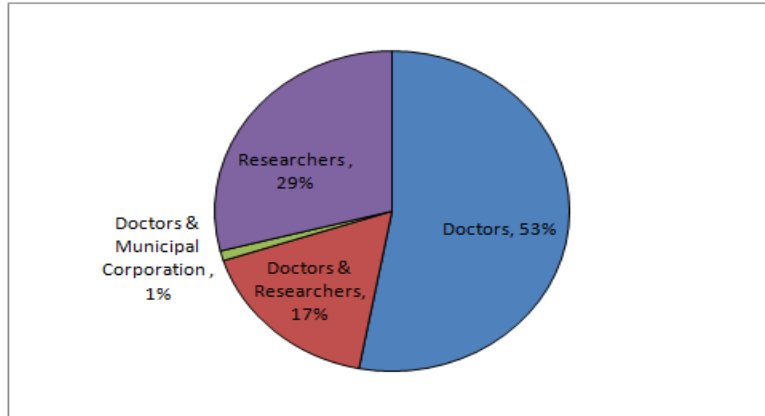
There are many studies across the world and also in India to prove that outdoor urban air pollution is a serious environmental risk factor that causes or aggravates acute and chronic diseases. CSE has tracked and reviewed around 80 studies in India of varying scale and scope to understand the emerging evidences.

- Indian cities have generated valuable local health evidences:** Over the last two decade consistent efforts have been made at local levels to assess the health impacts of air pollution. Even though the air pollution related health studies have started around the eighties, the subsequent decades have seen major spurt. More than 70 per cent of the studies have been done during 2000-12 that also coincides with the growing unrest in major cities over the polluted air and growing health scourge. Though most of these studies are small and local in nature they have generated very valuable data to convince that air pollution is a significant health risk. There are a few studies by the international agencies including the World Bank and Health Effects Institute. The studies are of different nature and scope. Large number of health studies on vehicular pollution: As much as 59 per cent of studies have focused on exposure to traffic pollution.



Source: CSE

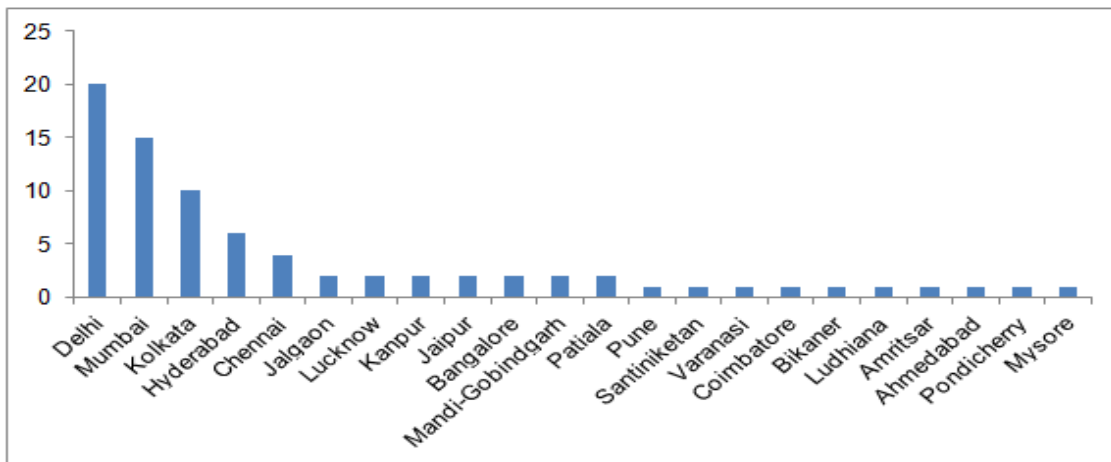
- Majority of studies in India have been done by the doctors themselves:** Most stunning finding is that most of the studies in India have been carried out by the doctors themselves – who understand our health and are concerned from what they are observing from their clinical experiences. This is a very encouraging trend that makes doctors the most important stakeholder. Their evidences have helped to move the policies. 53 per cent of the studies have been done by the doctors themselves; in 17 per cent of studies doctors are co-researchers and in 1 per cent doctors have teamed up with the municipal corporations. The remaining studies have been carried out by health researchers.



Source: CSE

- Both mega cities as well as smaller cities have tracked health effects of air pollution:** The mega cities also the most polluted during the eighties and nineties took the lead to study health effects. But as the pollution crisis spread to other cities more local level studies have happened in smaller cities and towns since 2000 – Bikaner, Amritsar, Varanasi, Puducherry, Mandi-Gobindgarh, Kanpur etc. This is an important development.
- Focus of research has kept pace with the changes in air quality trends:** While studies in eighties were predominantly focused on suspended particulate matter and sulphur dioxide as those were the key pollutants of concerns then, making up for 33 per cent of total studies each, in the subsequent years the basket has widened to include other pollutants – smaller particulates, NOx, ozone, VOCs etc. This clearly shows that Indian health community is aware of the multi-pollutant crisis.
- Nearly every year health studies have been published in major cities during the last decade:** The community has also been quite prolific. In the cities like Delhi, Kolkata, Hyderabad studies have been published almost every year during the last decade. Delhi has the maximum studies.
- Looking beyond lungs to other health effects:** Studies are dominated by the focus on respiratory symptoms. But in the recent years they have begun to include more diverse health end points – cardiac cases, cancer, mutagenic effects, etc. Though this investigation in India is still very nascent global studies have made more robust linkages with a wide range of health endpoints – diabetes, stroke, hyper tension, effects on brain, effects on fetus etc.

2. Delhi -- Mounting evidences



Source: CSE

Delhi has generated evidences quite consistently and with regularity over the last decade.

- **1999:** Effect of air pollution on respiratory system of auto rickshaw drivers (IJOEM1999)
- **2000:** Prevalence of chronic respiratory symptoms (VPCI 2000)
- **2002:** Air pollution and emergency room visits – Emergency room visits for asthma, COAD, and acute coronary events increased by 21.3 per cent, 24.9 per cent, and 24.3 per cent respectively (J N Pande et al, 2002)

Cytogenetic investigations on peripheral blood lymphocytes: The vehicular fumes found to be genotoxic (Int J Hum Genet 2002)

Children living in areas of high atmospheric pollution are at risk of developing vitamin D deficiency rickets (K S Agarwal 2002)

- **2003:** Significantly high incidence of eye symptoms and disorders in areas with high pollution levels (R Saxena et al 2003)

Traffic policemen and benzene exposure -- in Delhi, Dehardun, Haridwar, Saharanpur, Muzaffarnagar and Meerut) monitored for benzene exposure. Urinary phenol was very high in Delhi and Meerut policemen (Industrial Health 2003, 41)

Traffic controllers face the risk of exposure to benzene present in the ambient air as a component of fuel exhaust (Y Verma et al 2003)

Housewives and female workers being the most exposed groups (R K Prasad et al 2003)

- **2006:** Winter months have greater exposure risk (R Agarwal et al 2006)
- **2007:** People traveling in highly polluted areas and exposed to high level of air pollutants ...suffer from significantly high subclinical ocular surface disorders (IJOEM2007)

Symptoms such as redness, watering, irritation, strain, blurring (S K Gupta 2007)

Gaseous pollutants in spite of being lower than the standards, had significant impact on human health, especially during winter (G J Nidhi 2007)

- **2008:** The air pollution levels of ozone, NO₂ and RSPM increase respiratory disease related hospital visits by 24 per cent, 13 per cent and 3 per cent, respectively (G J Nidhi 2008)
- **2010:** 33 per cent of Delhiites have one or more respiratory symptoms; lung function impaired in 40 per cent of residents (CNCI/CPCB)

Lung function compromised in 43.5 per cent of school children of the urban area compared to 25.7 per cent of the control group. Respiratory symptoms were more prevalent in girls than in boys (S Siddique et al 2010)

Air pollution linked with ADHD: was found in 11 per cent of urban children in contrast to 2.7 per cent of the control group. Major risk factors included lower socioeconomic status, and PM₁₀ level. ADHD was more prevalent among boys both in urban and rural areas (Siddique S et al 2010)

- **2011:** Increase in respiratory ailments and hospital admissions due to PM, ozone and NO₂ pollution. Effects strongest among those individuals who spend a disproportionate share of their time out-of-doors. (Atmospheric Environment 2011). Vallabhshai Patel Chest Institute found high respiratory symptoms in high pollution areas. Now studying the ozone link.

Recent evidences

- In 2013 scientists from Jawaharlal Nehru University who had earlier reported decline in the level of toxins like polycyclic aromatic hydrocarbons (PAH) after the introduction of CNG programme and replacement of diesel buses now say based on their new evidences that its levels have gone up again due to rising number of vehicles. They conclude that a maximum of 39,780 excess cancer cases might occur due to lifetime inhalation and exposure to the PAH concentrations. AIIMS doctors have already reported this winter that cardiac and respiratory disease has already increased by about a quarter. More evidences from studies of University of California, Berkeley, in Delhi, show PM2.5 concentrations inside vehicles while travelling can be 1.5 times higher than the surrounding background air and ultra-fine levels about 8.5 times higher. The exposure to vehicular fumes in Delhi is among highest in the world.
- The World Allergy Organisation (WAO) Journal also published in 2013 reported high respiratory disorder symptoms in students residing in Chandni Chowk (66 per cent) in north Delhi, Mayapuri (59 per cent) in west Delhi and Sarojini Nagar (46 per cent) in south Delhi. Heavy traffic movement has been found to be the factor in the relative difference among the localities. WAO also alerts that allergic problems will increase further as air pollution increases.

International agencies

- **1997** – World Bank -- More deaths occur at younger ages in Delhi and because the impact of air pollution is greater at younger ages in Delhi than in Philadelphia (M L Cropper et al (1997)
- **2011:** Health Effects Institute study in Delhi: approx.0.15 per cent to 0.17 per cent increase in mortality per 10 microgramme per cubic metre PM10 (~0.3 per cent/20 microgramme per cubic metre). In Delhi where overall deaths are 100,000 annually even this increase can translate into 3000 additional premature deaths annually due to air pollution related diseases (HEI 2010)

Doctors have focused on the vulnerable sections

Studies have put a spotlight on the most vulnerable in our cities -- urban poor, children, elderly and those suffering from asthma, respiratory and cardiac ailments etc.

- **Urban poor:** More than quarter of urban population are officially classified as poor by the Planning Commission: Delhi based School of Planning and Architecture ranked respiratory diseases as the second largest cause of morbidity in urban slums of Delhi.
- **Children:** Children are especially vulnerable in our cities. This has serious implication as the future urban growth will see more young people in our cities. CNCI studies show respiratory symptoms in 32 per cent of children examined in Delhi, in contrast to only 18.2 per cent of the rural children and lung function reduced in 43.5 per cent school children in Delhi as compared to 25.7 per cent of control group. PM10 level associated with restrictive, obstructive and combined types of lung function deficits. Even Attention-deficit hyperactivity disorder (ADHD) has been noticed in children chronically exposed to high level of vehicular pollution (2010). ADHD 4.1 times more prevalent among school children of Delhi. PM10 was positively and strongly associated with ADHD prevalence. The impact of atmospheric pollution on vitamin D status of infants and toddlers in Delhi (2002).

Exposure to polluted air: How much we inhale

Researchers have looked not just at the effect of the ambient air quality – which is the quality of the surrounding air – but the actual exposure – how much we inhale in proximity to a source like traffic. Nearly 60 per cent of the studies are traffic exposure that include studies on occupationally exposed group like the traffic policemen, petrol pump worker and also roadside. These are the first indicators of how much we are exposed to on roads while traveling. Such evidences have serious implications for the road users, public transport users, walkers and cyclists.

- Dramatic evidence of how much we inhale while traveling in Delhi: A group of researchers from the University of California, Berkeley, have traveled in autorickshaws for 40 days, totaling 180 peak traffic hours, during the months of February and May on a fixed route in South Delhi in 2010. They measured the actual particle concentration inside the vehicle while moving with the traffic. They found commuters breathe far more harmful particles inside vehicles while traveling compared to the ambient concentration. The PM2.5 concentrations inside vehicles can be 1.5 times higher than the surrounding background air and ultra-fine levels about 8.5 times higher. In fact the short-term peaks during travel can go above 1000 microgramme per cubic metre – nearly 16 times the daily limit.
- Health Effects Institute estimated that people residing within 500 metre from roads are most exposed to vehicular fume. According to their estimates about 55 per cent -- more than half of Delhi's population live in the influence zone.

CSE perception survey of Delhi citizens on outdoor air pollution, health and the next steps

CSE carried out a rapid survey of the citizens' of Delhi on their perception of air pollution and health and the mitigation strategies in 2013. The respondents were fairly well distributed across all age groups. About 30 per cent of the respondents used cars and 8 per cent two-wheelers. The rest public transport. About 80 per cent of the respondents were non-smokers. About 88 per cent of the respondents lived within 500 meters from the road side. The survey has exposed overwhelming popular concern for air pollution.

The snap shots:

- The majority -- about 64 per cent have said air pollution is worsening and 26 per cent said it has remained the same.
- As much as 79 per cent have attributed the problem of air pollution to growing number of vehicles.
- As much as 77 per cent have identified vehicles as their closest source of pollution around their residences and offices. About 9.5 per cent have listed open burning, 5.8 per cent power plants, 4.8 per cent diesel generator sets.
- About 58 per cent respondents have shown awareness regarding the recent pollution episodes in Delhi.
- 74 per cent have said that air pollution cause respiratory problems and respiratory symptoms have increased in frequency during this winter. Majority have complained of multiple symptoms this winter. About 14 per cent have said this has increased school absenteeism amongst children
- Close to half have said that their doctors have mentioned air pollution as one of the causal factors.
- Close to one third of the respondents have said that they are aware of the new Global Burden of disease estimates.
- About 26 per cent know that the World Health Organisation and International Agency on Cancer Research have reclassified diesel emissions as class 1 carcinogen, putting it in the same class as tobacco smoking for its strong link with lung cancer.
- There was a strong support for improvement in public transport, walking and cycling. It is interesting that about 47 per cent have supported reduction in car numbers. About 62 per cent have said there should be restraint on diesel cars and SUVs on dirty diesel.