Air pollution: Impact on children's health: Knowledge into action

Paramesh Haralappa*

Paediatric Pulmonologist and Chairman of Lakeside Education Trust, Bangalore, India

Abstract

Environmental pollution is the major health care burden globally. Nearly 70% is from air pollution and 70% of non-communicable diseases are from air pollution. Allergic Airway diseases are the earliest onset non communicable chronic respiratory diseases all over the world. Historically there is enough evidence to prove that air pollution is the main cause for morbidity and mortality from air pollution and change in the demography of the place. Even though respiratory system is the main organ to take the brunt of the air pollution from suspended particles, tobacco smoke and Ozone other system are also involved like Cardiovascular system, Central nervous system, Behaviour problems, Stroke and Cancer. To mitigate the problems we need scientific proofs to convince the policy makers and bureaucracy. Doctors are the major link between scientist's technocrats, researches with society. Policy makers, with social and service organisations for sustainable development. Some of our work on environmental issues on health are helpful in taking action by authorities in the past 4 decades on 1) Lead poisoning, 2) Outdoor air pollution on traffic police personnel, 3) Air pollution with change of demography of our city on children respiratory health, 4) Banning tobacco smoke in public places, 5) Reducing the usage of bursting fine crackers, 6) Banning heavy back pack on school children to protect spinal health.

Keywords: Air pollution, Rapid urbanisation, Lead poisoning, Tobacco smoke, Firecrackers, Spinal health

Accepted on July 29th, 2020

Introduction

Air pollution, global warming and climate change which are interrelated and are the defining issues for the health system in the 21st century. Air pollution kills 6.5 million people every year which is 3 times more than those due to HIV, AIDS, Tuberculosis, and Malaria all put together [1]. It is the major psycho-socioeconomic health care burden.

Children are more vulnerable to air pollution due to the following reasons:

a) Their lung has highest surface area.

b) They breath more air relative to their body weight.

c) They have more physical activity.

d) There is 5 times more deposition of particulate matters during activity.

e) Their small calibre airways favour the deposition of the particles [2].

Historical background of air pollution

The 13th and 17th century environment crisis were due to air pollution by increased urban population, increased density of population and change in the use of fuel from woods to coal. In the year 1733 Dr. John Arbuthnot in his scientific paper noted the bad effect of poor air quality of cities on lungs, higher death rate on urban infants from the sulphurous steam from the use of fossil fuel (Coal) [3]. Further observation of early air pollution on frequency of sinusitis in Briton through the ages shows from C.T. scanning of skulls reveals that- During Bronze age, Iron age before finding fire and cooking of food the incidence of sinusitis was only 0.5 per cent. In Romano-British age where cooking was outside it shot up to 3 per cent. With the increased civilization in Anglo-Saxon age cooking inside the house without chimney it shot up to 7 per cent. In medieval age with finding of chimney to let the smoke outside the incidence dropped to 3.5 per cent [4].

Over the year in India the non-communicable diseases from air pollution are increasing from 30 to 55 per cent while communicable diseases are decreasing from 61-33 per cent in 26 years between 1990 to 2016 [5].

Impact of air pollution on children health

Air pollution includes both outdoor and indoor pollution both are interrelated and affects from womb to tomb. The Air Quality Index (AQI) measures 7 pollutants like- 1) Suspended particulate matter (spm) 10and 2.5µ 2) Sulphur-di-oxide, 3) Nitrogen di-oxide, 4) Carbon Monoxide, 5) Ozone, 6) Ammonia, and 7) Lead.

It is the SPM 2.5µ of the fine particle which has the devastating effect on health, it measures 3 per cent the size of the hair and is a mixture of solids and liquids floating in the air and can travel many hundred kilometres. The major component of SPM is- Sulphates, Nitrates, Ammonia, Sodium Chloride, Black Carbon, Mineral dust and water. These particles can cross the alveoli interstitium and enter the blood stream and circulate all over the body and produce inflammatory process which has been proved by radio isotope studies [6]. No doubt it is the respiratory system that tract takes the major brunt from air pollution.

Impact on respiratory system

Upper respiratory tract

• Allergic rhinitis, otitis media, sinusitis conjunctivitis, sleep disordered breathing, chronic cough, Anosmia.

Lower respiratory tract

• Under five wheezes in children [7,8] Bronchiolitis, Bronchitis, Asthma, Chronic obstructive pulmonary diseases, lung cancer. Fixed airway obstruction in foetus from placental thrombotic coagulopathy syndrome with prematurity, small for date children [9].

Parenchymal respiratory system

• Pneumonias, Interstitial pneumonitis, Fibrosis.

Non-pulmonary diseases

• Coagulopathy

• Cardiovascular diseases and increased blood pressure

• Stroke

• Cancer

• Insulin dependent diabetes

• Obesity

Central nervous system

• Autism

• Dementia

• Alzheimer's disease

• Cognitive performance

Behaviour problems on polluted days

• Increase crime rate

• Impaired judgement

• Worst test score on polluted days

• Reduce the productivity in work

Our Research Work: Knowledge into Action

Doctors are the service-oriented health care teacher ' s supervisors and investigators. They are the strongest link to mitigate the air pollution, global warming, and climate change between scientists, researches, technocrats with society, policy makers, service, and social clubs to move forward for action.

Lead poisoning from air pollution

Lead poisoning occurs from ingestion, inhalation and absorbed through skin. 86% of the lead in the atmosphere is from automobile emission from leaded petrol, the lead concentration in the air is directly proportional to the volume of the traffic. Children absorb 50% of lead in comparison to adults who ingest 10 to 20% of lead. The lead level in the tissues, cord blood correlates with the lead level in the air [10].

Lead affects gastrointestinal tract with colic, peripheral and central nervous system, decreases the intelligence quotient (IQ), Convulsions, coma and death depending on the blood level. We did a study in Bengaluru from Lakeside Education Trust with George Foundation of USA. Our study on 863 children with 25 new-borns cord blood showed 4.6 percent of the children had lead level over 10µg/dL While we were using 0.59G/L of lead in petrol at that time. Following the studies, we organised an International Conference on lead poisoning for 3 days in Bengaluru which created a great impact on the public policy makers and perseverance of the people involved in lead poisoning in bringing a legislation in banning the leaded petrol in the year 1999.

Impact of outdoor air pollution on traffic police personnel

The traffic police who stand on the police cusecs to guide the motor vehicles over 8 hours a day take the brunt of the outdoor air pollution. We evaluated in detail including pulmonary functions the 1045 traffic police personnel and 1160 non traffic police personnel between 1994 to 1998 after obtaining the permission from the commissioner of police. The traffic police people suffer more than non-traffic people as shown in Table 1.

Table 1. *Health issues of traffic v/s non traffic police personnel.*

Disease	Traffic police n-1045% of illness	Non-Traffic police n-1160% of Illness
Chronic Cough	30%	14.40%
Breathlessness	7.80%	3.60%
Asthma	10.70%	4.00%
Wheezing	13.80%	2.92%
Conjunctivitis	1.40%	-
Urticaria	1.20%	0.15

If the traffic police personnel live 20 km away from the center of the city with high pollution their symptoms are 50% less [11]. These data were forwarded the ministry of environment, forests Government of India and to the commissioner of police. In the parliament it is recommended the use of facemask to all traffic police personnel in the year 1999. And in the year 2015 better face masks to curtail SPM 2.5µ is given to all traffic police personnel by the government.

Impact of air pollution with demographic change of our city

The authors study on 20000 paediatric patients in the hospital-based data between 1979 to 2009 in 3 decades on allergic airway diseases in the city of Bengaluru has shown asthma is increased from 9% to 25.5% [9] as shown in Figure 1.

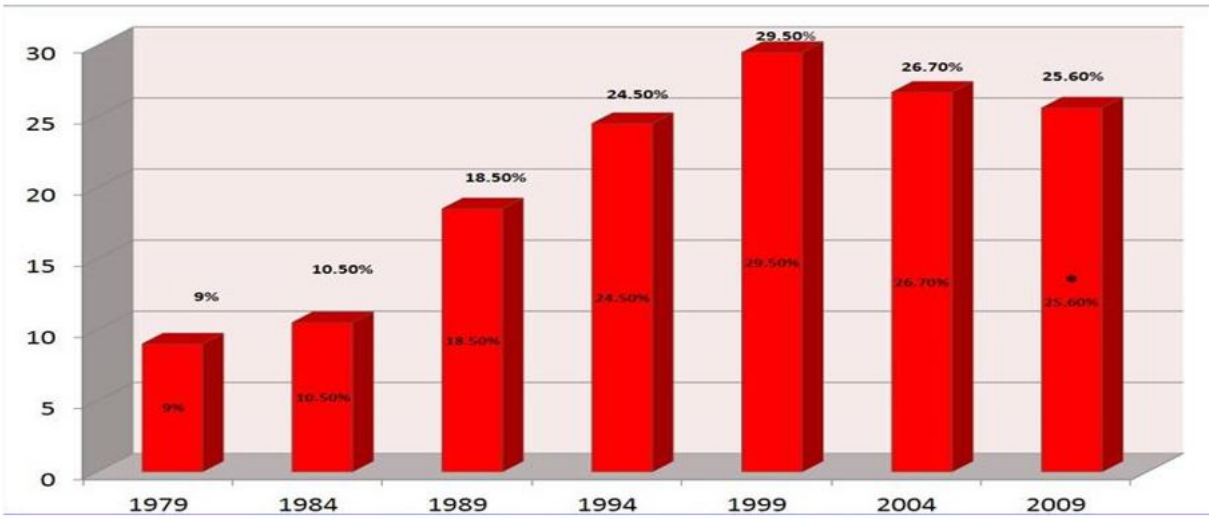

Figure 1. Prevalence of asthma in children in urban area.

It is also observed that children of heavy traffic school area suffer more from asthma, it further increased in children of low socio-economic population [12]. Another community study was done by the author between 1994 to 1999 in evaluating the urban and rural children in the age group of 6 to 15 years as a comparison to find out the prevalence of asthma. Urban children suffer more than rural children [13] as shown in Figure 2.

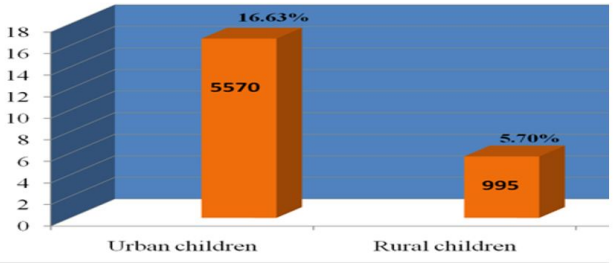

Figure 2. Comparison of urban v/s rural children: Prevalence of asthma.

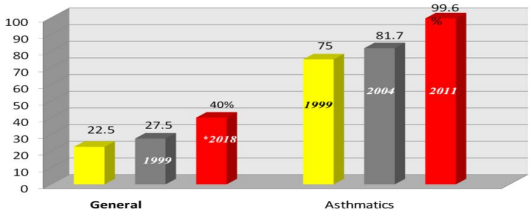

Figure 3. Prevalence of allergic rhinitis.

Allergic rhinitis is increased in prevalence in general paediatric patients by 22.5% to 40% between 1994 to 2018 in persistent asthmatics the prevalence is 75% to 99.6% between 1999 to 2011 [12] as shown in Figure 3. The chronic cough (cough over 2 weeks duration) is increased from 8% to 21.25% in 18 years period between 1999 to 2017. These children have higher incidence of other comorbidities like sleep, disordered, disturbed breathing, conjunctivitis, and laryngeal dyskinesia [14] as shown in Figure 4.

Figure 4. Incidence of other comorbidities.

It is observed that the most common cause for chronic cough is airway allergic diseases. In the year 1999 lower airway allergy asthma now in 2017 it is upper airway allergy; allergic rhinitis is the predominant cause [15]. The increased airway allergic diseases are mainly from early and increased exposure to triggers from air pollution and increase in viral respiratory infections rapid urbanisation along with losing the threshold of protection by depriving the protective germs in our environment, changing in our traditional food habits and adopting to the western life style of living [16]. These studies of 3 decades recommended and were utilised by Bhurelal committee headed by the retired supreme court justice to formulate guidelines and issuing a circular in the year 2004 to clean up the megacities in India and pay attention to school environment to reduce the air pollution.

Banning tobacco smoke in public places

Tobacco smoke is an important indoor pollutant both in active and passive smokers. The grim reality is that it affects all systems of human body. Maternal smoking causes, low birth weight, small for gestation age, increase infant mortality, decrease lung function, increase lower respiratory infections and poor response to asthma medicines [13,16]. Our epidemiologic study in the Tobacco smoking habits of urban

3078 children in the age group of 10-17 years is 41%, rural 2194 children is 21.8%, rural farm working women smokers is 2%, farm working men 28%. The reason to start smoking on 1500 high school children revealed that- Peer pressure 29%; curiosity 18%; pleasure/ pastio-19%; frustration-12%; state synebal-10%, relieve tension 8%; concentration-5% and others -2% [17].

Further our study proved that if one person smokes in the house there is 3-fold increase in asthma prevalence from 8% to 22.8% [12]. These data were presented to our chief minister of our state through our local member of legislative assembly on World Environment Day. The tobacco smoking in public places is banned in the state of Karnataka in the year 2001. This measure leads to banning all over India through supreme court judgement in the year 2003.

Restricting the usage of firecrackers to reduce air pollution

Asthma visits to emergency soon is increased by 100% during Diwali festival of 3 days where people burst firecrackers to celebrate, where the sulphur-di-oxide level in the air will increase 200 times more than recommendation of W.H.O. Our data on correcting the blasting of cracker causing air pollution and increase prevalence of asthma and fire injuries, and education of society through media, school pollution control board resulted in Supreme Court judgement on 31st July 2017 not to burst crackers in silent zone. Absolute ban on use of chemicals which creates colours like strontium, chromate, Lithium, Antimony, Mercury, Arsenic and Lead [18]. In the year 2018 further orders were issued to burn crackers of certain decibels for 2 hours between 8 pm-10 pm during Diwali festival and between 12 midnight to 2 pm during Christmas and New year celebrations.

Air pollution and school heavy back packs impact on spinal health.

Air pollution produced obstructive airway disease causing barrel chest, elevated shoulders, turtle neck, shoulder angulations and will lead to change in spiral curve, pain in shoulder and neck pain, leaning forward, balancing problem, this spinal problems will lead higher morbidity and mortality in late adult life. The heavy school bag causing great burden on children spinal health hence, these issues were propagated in professional, social media with high-end awareness [19]. The department of education Government Of India passed the order as on Nov 2018 in ordering that the school bag should not weigh more than 10% of the body weight of the child. We do recommend yoga practice to all children in school which help in asthmatics to avoid changes in the chest wall, spinal health and decreases the stress and usage of medicine [20]. We the members of the environment and child health group of Indian Academy Of Paediatrics always work for our better environmental health for our future generation [21].

Conclusion

Air pollution is the major source for increased incidence of non-communicable diseases. Allergic respiratory illnesses are the earliest onset non communicable diseases which are the major psycho-socio-economic health care burden globally. With our studies of 4 decades on environment pollution on human health and with good professional and social connection with all the stake holders one can aim to implement the mitigating increases to reduce the air pollution and related health impact.

Post corona pandemic lockdown for nearly 3 months, mother earth has cleared up the anthropogenic mess on air, water, soil, sound pollution on human health with randomised multinational observed environmental health. It is time we all work out for sustainability to keep the mother earth's smile by reducing air pollution, global warming, and climate change by the end of this century. Let us all support our children Licy priya Kangujam and Greta Thunberg in their endeavour to convince our global leaders.

Conflicts of Interest

The authors report no conflicts of interest in this work.

References

1. Landrigan PJ, Fuller R, Acosta NJ, et al. The Lancet Commission on pollution and health. Lancet. 2018;391(10119):462-512.
2. Ratageri VH, Paramesh H. Environmental health of children: Time to translate knowledge into action. Indian J Pediatr. 2018;85:282-283.
3. Arbuthnot J. An essay concerning the effects of air on human bodies. J Tonson. 1733.
4. Peter Brimblecombe. The Big Smoke (Routledge Revivals): A History of Air Pollution in London since medieval times. Great Britain at the University Press, Cambridge. 1987.
5. National Health Profile GOI-2018.
6. Nemmar A, Hoet PM, Vanquickenborne B, et al. Passage of inhaled particles into the blood circulation in humans. Circulation. 2002;105(4):411-414.
7. Paramesh H. Pediatric asthma: New answers to old issues. Austin J Pulm Respir Med. 2017;4:1053.
8. Jedrychowski W, Perera F, Maugeri U, et al. Effect of prenatal exposure to fine particles and postnatal indoor air quality on the occurrence of respiratory symptoms in the first two years of life. Int J Environ Health Res. 2008;2(3-4).
9. Valentino SA, Tarrade A, Aioun J, et al. Maternal exposure to diluted diesel engine exhaust alters placental function and induces intergenerational effects in rabbits. Part Fibre Toxicol. 2015;13:39.
10. Paramesh H, Sameerareddy. Lead Poisoning in children urban scenario, 10th Asian Congress on Peadiatrics Taipei, Taiwan. 2000.

11. Paramesh H. XI National symposium on Environmental Health from BARC-2002.
12. Paramesh H, Pulmonary clinics of India. Academy of Respiratory medicine June 2014;217-227.
13. Paramesh H. Epidemiology and Asthma in India. Indian J Pediat. 2002;69:303-312.
14. Paramesh H, Mohanty NC, Kumar R, et al. Airway Disease Education & Expertise (ADEX) NEXT Working Group Recommendations-Persistent (Chronic) Cough in Pediatric Practice. 2017:230-243.
15. Paramesh H, Reshmi C, Cherian E. Changing spectrum and causes for chronic cough in children Helsinki: Finland June 17-06-2017 EAACI TPS -27, No 09A316 .
16. Paramesh H. Current scenario of air pollution in relation to respiratory health. Curr Sci. 2019;116(8):1289-1292.
17. Paramesh H, Cherian E. Tobacco smoke as an indoor pollutant on children health 2nd International Conference on Environment and Health Bangalore 2000.
18. Paramesh H. Emergency room visits for acute wheezing in children during Diwali festival 5th Environment and Children Health international conference INCHES Bangalore 2010.
19. Paramesh H. Straighten up Bangalore! - Healthy city initiative organised by CAMHADD of U.K at R.V Institute of teachers training Aug 2008.
20. Somasekhar AR, Paramesh H, Mallikarjun AH, et al. Effect of pranayama on adolescent asthma, Karnataka Paediatr J 2010;24.
21. Paramesh H, Paramesh RC, Koshy RG. COVID-19 Lockdown: Impact on environmental health ENRICH Bulletin of Environment and child health group of Indian academy of paediatrics April-June 2020.

Correspondence to:

Paramesh Haralappa

Paediatric Pulmonologist and Chairman Lakeside Education Trust

Bangalore,

India

Tel: +919845022689

E-mail: drhparamesh@gmail.com