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Health risks Zonation vis-a-vis air-born diseases in Bundelkhand region, India

[1]Abhimanyu Singh, [2]A. H. Khan, [1]Jamshed Zaidi, [1]Naveen Yadav, [1]Dheerendra Singh Chauhan and [1]Shree Ganesh

[1]Institute of Environment and Development Studies, Bundelkhand University, Jhansi, India
[2]Environmental Monitoring Division IITR-Lucknow, India

ABSTRACT

Environmental air pollution is the undesirable contamination related to the physical and biological components of the earth-atmospheric system to such an extent that normal environmental processes are adversely affected due to the anthropogenic activities. Various contaminants are passes into the troposheric atmosphere directly contact with earth that cause harm or discomfort to humans beings specially related to health risks as well as also damage the environment" which can come in the form of particulate matters (PM) as well as unburned smokes with varying degree of mixed harmful gases. Present study conduct on health risk related to air-born diseases due to environmental air pollutants existed in Bundelkhand region. The Data of different diseases in five districts of Bundelkhand region were collected from Medical College, Jhansi. During the investigation find out that maximum people are infected from the air pollution like Asthma, Pulmonary Tuberclosis, Bronchitis and Bronchial Asthma. the reducing the burden of these diseases in the poor sections and work place workers may be encourage for raise income levels in any way, which in turn will further help to reduce health inequalities especially in Bundelkhand region of Uttar Pradesh.

Keywords: Pollution, Environmental and Occupational health risk factors, Air - born diseases, Health risk zonation, Bundelkhand region,

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INTRODUCTION

Air pollutants has long been recognized as a potentially lethal form of pollution. Entry of pollutants into the atmosphere occurs in the form of gases or dust particles. Continuous mixing, transformation and trans-boundary transportation of air pollutants make air quality of a locality unpredictable. The growth of population, industry, number of vehicles and improper implementation of stringent emission standards make the problem of air pollution still worse [1]. The WHO/UNEP report [2] reveals that the air pollution problems in metropolitan cities of India as they are heading the list of the most polluted cities of the world. India has 23 major cities of over 1 million people and ambient air pollution levels exceed the WHO standards in many of them [3].

The single most important factor responsible for the deterioration of air quality in the cities is the exponential increase in the number of vehicles. Vehicular pollution contributes to 70 % of total pollution in Delhi, 52 % in Mumbai and 30 % in Calcutta [4, 5,6]. Pollution in these cities has associated serious to moderate health problems

due to high levels of total suspended particulate matter (TSPM), sulfur dioxide (SO_2) and lead The World Bank report, [7].

At least 500,000 premature deaths and 4 to 5 million new cases of chronic bronchitis are reported each year [2]. Further 4% to 8% of premature deaths on a global scale are due to exposure of high levels of particulate matter in ambient air[8]. Ambient air levels exceeding the WHO levels in 36 major Indian cities and towns results in 40 thousand premature deaths, around 19 million respiratory hospital admissions and sickness requiring medical treatment and also 1.2 billion incidences of minor sickness annually [9].

Despite the increasing evidence of negative impact of air quality on human health [10,11,12] not much data on ambient air quality, a prerequisite for health studies, is available for most of the medium size cities or towns in India, although a large population lives in these cities or towns.

Urban air pollution affects the health, well-being and life chances of hundreds of million men, women and children in Asia every day. It is responsible for an estimated 537,000 premature deaths annually with indoor air being responsible for over double this number of deaths. It is often the poor and socially marginalized who tend to suffer disproportionately from the effects of deteriorating air quality due to living near sources of pollution

The population residing in the vicinity, daily commuters and business people are always exposed to the traffic air containing various toxic pollutants such as nitrogen oxides (NOx), hydrocarbons, carbon monoxide, respirable particles, sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and volatile organic compounds [10].

Of the 3 million premature deaths in the world that occurs each year due to outdoor and indoor air pollution, the highest numbers are assessed to occur in India [13]. The Indian national ambient air quality (NAAQ) data demonstrate the increasing emissions of a range of air pollutants [14]. Annual average SO_2 concentrations range between 4 and 15 ppb in majority of the regions where measurements have been made and the concentrations range between 23 and 32 ppb in industrial belts and metropolitan cities. The annual average NO_2 concentrations ranged between 5 and 47 ppb, with high levels in metropolitan cities [14]. School going children are one of the most sensitive population subgroups to air pollution since they may received an increased dose of pollutants to their lungs compared to adults. Respiratory health is increasingly recognized as an important public health problem worldwide [15].

On the global sense, [16,10] also arrived at the same conclusion that transportation is the major culprit of air pollution accounting for over 80% of total air pollutants. This is a clear indication that vehicle emissions are a major source of ambient air pollution and must be controlled if acceptable air quality is to be assured. In addition, there are numerous health problems associated with high concentration of these pollutants. For example NO_2 is responsible for immune system impairment, exacerbation of asthma and chronic respiratory diseases: reduced lung function and cardiovascular disease [17].

Particulates are dangerous and are linked as facilitators in the development of lung cancer and increase rate of mortality [17]. An epidemiological study in US has shown that acute exposure to vehicle emissions over ten years period reduces lung function among tunnel officers . Pollution has become a local as well as a regional issue of big cities due to industrial centres and surroundings of transport routes, especially roads and highway [18]. The increasing development of human activities has given rise to a significant increase in atmospheric pollutants which may have an impact on human health [19]. Air pollution is one of the most serious environmental problems in India. In India, urban air pollution is the result of emissions from a multiplicity of sources, mainly stationary, industrial and domestic fossil fuel combustion, motor vehicles emissions and ineffective environmental regulations. Adverse effects of air pollution include an increase in cardiovascular and respiratory deaths among elderly people as well as increased hospital admissions for heart and respiratory diseases. It is well known that health effect associated with air born particles are depends on their toxicity. The extent to which air born particles penetrates into the human respiratory system is mainly determined by the size of the penetrating particles [20]. Although motor vehicles emit sulfur dioxide and other sulfur containing compounds, traffic sources typically make only small contribution to ambient concentration [21] whereas near most industries are also responsible for sulfur dioxide emission. The sulfur dioxide is known as major respiratory irritant since many years. The particulates are directly emitted into the atmosphere through natural and manmade (anthropogenic) processes including transportation, fuel combustion, industrial processes, land cleaning, wild fires and solid waste disposal . In urban conditions, small aerosol particles

are mostly emitted from combustion processes, i.e. car engines and industry. Urban aerosols have a higher proportion of vehicular emissions, which are in very fine size range. The larger particles correspond to the effects of human activities including road dust raised by vehicular motion, building activities and industrial emissions [22].Air pollution causes increased respiratory illness to the old and young, decreasing visibility, damage to plants and animals and has possibly catastrophic effects on the global scale. Problems due to air pollution crop up especially in urban areas and areas of high industrial activities which includes the rural areas were industrial development is encouraged. Another major cause of air pollution is the automobiles or vehicle pollution. [23]

A similar study confirms that there is a prevalence of chronic bronchitis and asthma in street cleaners exposed to vehicle pollutants in concentrations higher than WHO recommended guidelines, thus leading to significant increase in respiratory problems.

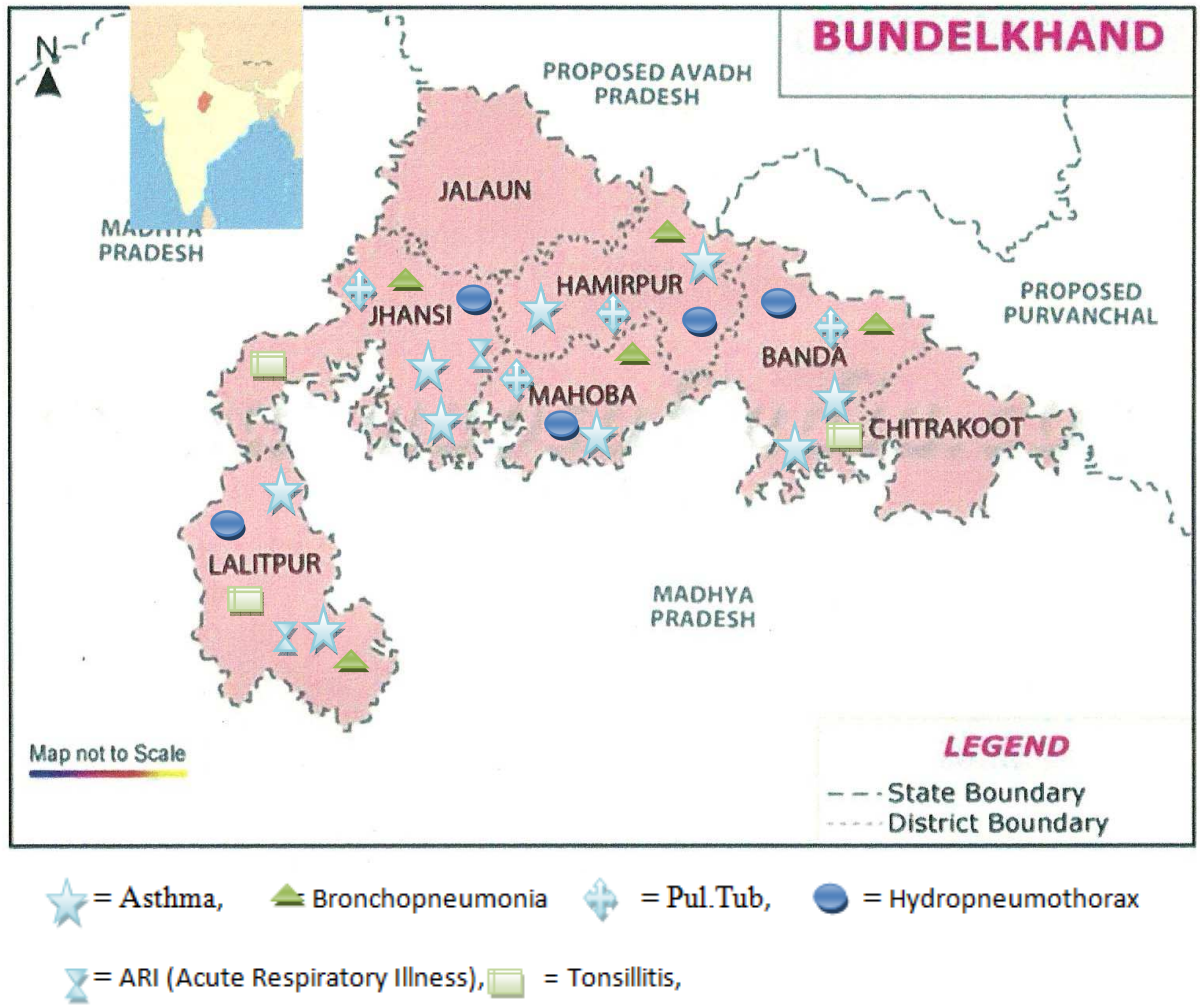

Fig. 1. Shows the locational and specific air-born diseases on human beings due to indoor and out door air pollutants in five districts of Bundelkhand region

Study area

Bundelkhand region is situated in central plains in India fall within the 23°20'N to 26°20'N latitudes and 78°20'E to 81°40'E longitudes comprises of 13 districts covering 7.08 million hectares (mha), out of which six districts comprising of 4.12 mha land area in Madhya Pradesh and seven districts comprising of 2.94 mha land area are in Uttar Pradesh. The districts in Madhya Pradesh are Sagar, Damoh, Datia, Panna, Chattarpur and Tikamgarh. In Uttar Pradesh, seven districts are Jhansi, Lalitpur, Jalaun, Hamirpur, Banda, Mahoba and Chitrakoot where some of the

specific air born disease are shown in Fig.1. The area is bounded by Vindhyan Plateau in south to river Yamuna in north, river Ken in east and rivers Betwa, Sindh and Pahuj in west.

Uttar Pradesh portion of Bundelkhand is recorded spatially very highly rural based settlement where over 80% population (except Jhansi city where more migratory population lives) is living in villages in an aerial extent . Against national scenario of rural/urban ratio of 2:6,where U.P. state has opposite this ratio as 3:8 depicting overall poverty in the state. Jhansi is the only growing urban area of the district by the same name. Overall population growth rate for 1991-01 in case of U.P in Bundelkhand region is found almost close to National population growth rate while high in case of Lalitpur and Chitrakoot but lower in case of Jalaun and Hamirpur based on census report.

Health Risk Factors :

Outdoor air pollutants:

In Bundelkhand region, a number of rock crushing unit (RCU), geo-granite mining, drilling and blasting operations are going on in large scale which generated huge amount of silica and other types of mixing dust. The other fine particles originated from Parichha thermal power plant Hiedel Diamond cement Industry and also brick manufacturing process units emits in the form of flyash, lime particulate matters and soil born dust respectively.

Particle size , density, chemical composition of the dust, duration of exposures and wind rose are the most important factors to determine the rate of deposition and its potential for adverse effect on human health and visibility[24]. The human respiratory can remove large particles(>10µm).Particles size has known as PM_{10} have a diameter less than 10 µm and when inhaled would penetrate beyond the larynx. The monthly variation of particulate matters TSPM (SPM and TSPM) around the crusher plants in geo-granite mining terraines are recorded between 387 µm/m^3 to 712 µm/m^3 from months January to June (2011-2012).The resultant observatory data of the five monitoring centers around the Parichha thermal power plant, where particulate matters are recorded specially flyash from the months January to June (2011-2012) range between 518 µm/m^3 to 902 µm/m^3 by the high volume sampler (HVS), while in scatter brick industries , TSPM ranges from 289 µm/m^3 to 367 µm/m^3 by the air monitors. All the value of TSPM amongst the geo-granite mining terraines, rock crusher unit (RCU), thermal power plant, diamond cement factory and brick industrial area were recorded above prescribed limit comparing to the National ambient air quality standard (NAAQS) about 100 µm/m^3 (CPCB notification Nov. 18-2009)

Indoor air Pollutants:

In the rural villages of the study area, most of the population still cooks with wood, biomass, dung, fossil fuels and crops residues based on using simple stove or open fires under conditions of limited ventilation leads to high exposes by indoor smoke as particulates matters, gases which affects the health risks particularly for women and newly born children and may be some extent to come mortality in stage. Uses of solid fuels where indoor smokes (ash) and gases effects range of potentially harmful to cause health problems related disease such as lung cancer, lower respiratory infection, chronic obstructive pulmonary, silico-tuberculosis, asbestosis and pneumoconiosis. These diseases take a long time for the development of those health risks.

From the above occupational and other risk by the outdoor and indoor air pollutants, the most prevalent health hazards among the work place and also outside peoples are imposing the health problems by the heavy noise machinery, auditory impacts non-auditory impact (loss of working efficiency), eye problems, skin problems respiratory problems like silicosis and other diseases recorded, in the study areas of Bundelkhand region.

MATERIALS AND METHODS

Data Collection Method:

Based on air-born diseases data collection from medical college, Jhansi of one year recorded (2012) which was used to study the health risk zonation due to environmental and occupational hazards relating to particulate matters (PM_{10}) and smokes including fly ash and also lime dust which severally affected in five districts in Uttar Pradesh of Bundelkhand region.

RESULTS AND DISCUSSION

During the investigation, some diseases find out in specific district of the Bundelkhand region in Uttar Pradesh which causes by air pollution. Asthma is a chronic, sometimes debilitating condition that has no cure. It due to anthropogenic activities for the infrastructure development and also vehicular pollutants

Air pollution may contribute to the development of asthma and other related diseases in previously healthy people. A respiratory irritant associated with the onset of asthma attacks, sulfur dioxide is produced when low grade coal are burned. Coal-fired power plants, particularly older plants that burn coal without SO_2 pollution controls, are the worst SO_2 polluters.

- **Particulate Matter:** This term refers to a wide range of pollutants in the form of dust, soot, flyash, diesel exhaust particles, wood smoke and sulfate aerosols -- which are suspended as tiny particles in the air. Some of these fine particles can become lodged in the lungs and could trigger asthma attacks. Studies have shown that the number of hospitalized people for asthma problems increases when the levels of particulate matter (TSPM) in the air rises. Coal-fired thermal power plants, factories and diesel vehicles are major sources of particulate pollution. Around 81 million people live in areas that fail to meet national air quality standards for particulate matter.
- **Nitrogen oxide (NOx):** A gas emitted from tailpipes and power plants, nitrogen oxide contributes to the formation of ground-level ozone and smog. It also reacts with other air pollutants to form small particles that can cause breathing difficulties, especially in people with asthma.

Air pollution a growing problem in developing countries including India where the burden of disease from TB is greatest.

Combustion-source air pollution affects resistance to infection via effects on airway resistance, epithelial permeability, and macrophage function . Studies suggest a specific role for fine particles less than 2.5 micrometers in diameter (PM2.5). PM-associated transition metals, e.g., iron, is thought to produce oxidative stress in the lung, hypothesized to be a common factor in a range of adverse effects .

Air pollution from outdoor sources, such as motor vehicles, industry, and neighborhood-level solid waste burning, is associated with increased morbidity and mortality from respiratory infections in children and adults .

People in urban areas of developing countries are exposed to the highest levels of outdoor air pollution in the world, which each year impose an estimated burden of hundreds of thousands of deaths and millions of years of healthy life lost from cardiovascular disease, selected respiratory diseases, and lung cancer . If however, air pollution exposure increases the risk of infection, illness, or death from TB, then the attributable burden of disease would be even greater.

Some of the common and specific diseases of the study area is summarized below:

- In Jhansi district of Bundelkhand region, a number of common diseases like bronchopneumonia, caryngobronchililiatis, pulmonary tuberculosis, asthama and abscess toncillars are recorded (Table1,Fig.2).
- In the area of Lalitpur district, the specific diseases such as pleural effusion as well as erythroplakia (age group 31-40 years) and pneumothorax (age group 1-10 years) are occur in most of the people worked in geo-granite mining terraines (Table 2,Fig.3)
- The diseases like bronchial asthma, aspiration, pulmonary sinusitis are mostly occur in the age group from 10-50 years where as hydropneumothorax occur in age of 60-70 year old people (Table.3, Fig.4)
- From the data records, most of the people are affected by the bronchopneumonia, caryngobronchiliatis, pulmonary tuberculosis, hemothorax, tonsillitis, aspiration and lower lobe pneumonia (Table 4, Fig. 5). These diseases occure by the outdoor and indoor air pollutant mostly in the mining workers and also satellite villages around the factories in Mahoba district in U.P.
- In Banda district of Uttar Pradesh in Bundelkhand region, most of the specific disease like upper respiratory tract is affected by the smoke from the burning solid fossil fuels and biomass burning for various purposes used.

Table 1: Showing various air born diseases in human beings by the risk factors of indoor and outdoor air pollutants in Bundelkhand region in Jhansi district U.P. (2012)

S. No.	AGE (Years)	MALE %	FEMALE %	TOTAL PARCENTAGE (%)OF PEOPLE AFFECTED	DISEASES
1	1-10	8	2	10	Asthma, Bronchopneumonia, Caryngobronchiliatis, Bronchiolotis, ARI
2	11-20	12	18	30	Bronchopneumonia, Asthma
3	21-30	14	16	28	Bronchiolitis , ARI, Abscess toncillars
4	31-40	12	8	20	Pul.Tub, Bronchopneumonia, ARI
5	41-50	14	8	22	Pul.Tub, Asthma
6	51-60	19	21	30	pneumonia,Pul.Tub, Asthma
7	61-70	22	18	40	pneumonia,Pul.Tub, Asthma, Bronchiolitis

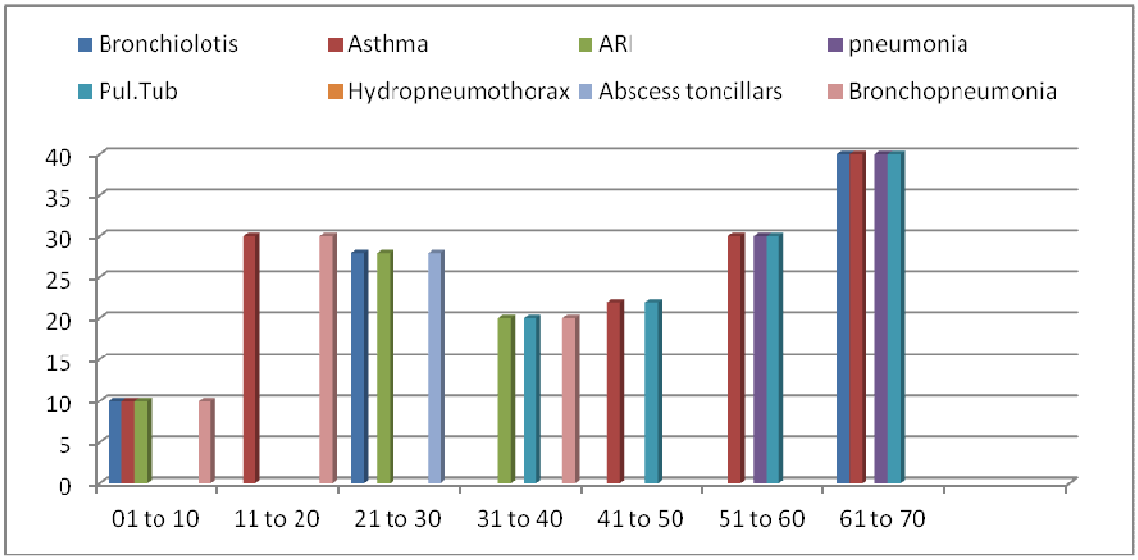

Fig 2: Showing various diseases in defferent age group affected by air pollutants in Jhansi district Bundelkhand region of U.P.

Table 2: Showing air-born diseases in human beings by the risk factors of outdoor and indoor air pollutants in Lalitpur district Bundelkhand region of U.P. (2012).

S. No.	AGE (Years)	MALE %	FEMALE %	TOTAL PARCENTAGE (%)OF PEOPLE AFFECTED	DISEASES
1	1-10	13	3	16	ARI, Pleural effusion, bronchopneumonia, ,P.Sinusitis, pneumothorax,bronchiolitis
2	11-20	2	3	5	bronchiolotis , ARI , Asthma, Pul.Tub, P.Sinusitis,DNS,Mumps
3	21-30	10	4	14	Aspiration ,DNS, Pul.Tub, P.Sinusitis
4	31-40	9	1	10	Pul.Tub,spur,Erythroplakia, P.Sinusitis
5	41-50	3	1	4	Pneumonia , Pul.Tub
6	51-60	7	1	8	spur,Pul.tub
7	61-70	3	0	3	Pneumonia ,Pul.Tub

Table 3: Showing various air born diseases in defferent age group of sex ratio by the risk factors of indoor and outdoor air pollutants in Hamirpur district, Bundelkhand region of U.P. (2012)

S. No.	AGE (Years)	MALE %	FEMALE %	TOTAL PARCENTAGE (%)OF PEOPLE AFFECTED	DISEASES
1	1-10	6	1	7	ARI, Asthma
2	11-20	4	2	6	Asthma, ARI, Bronchitis, P.Sinusitis
3	21-30	2	2	4	Lower lobe, Pneumonities, Bronchial Asthma
4	31-40	4	3	7	P.sinusitis
5	41-50	1	3	4	Aspiration
6	51-60	2	1	3	P.Sinusitis, Hydropneumothorax
7	61-70	N.A	1	1	Hydropneumothorax

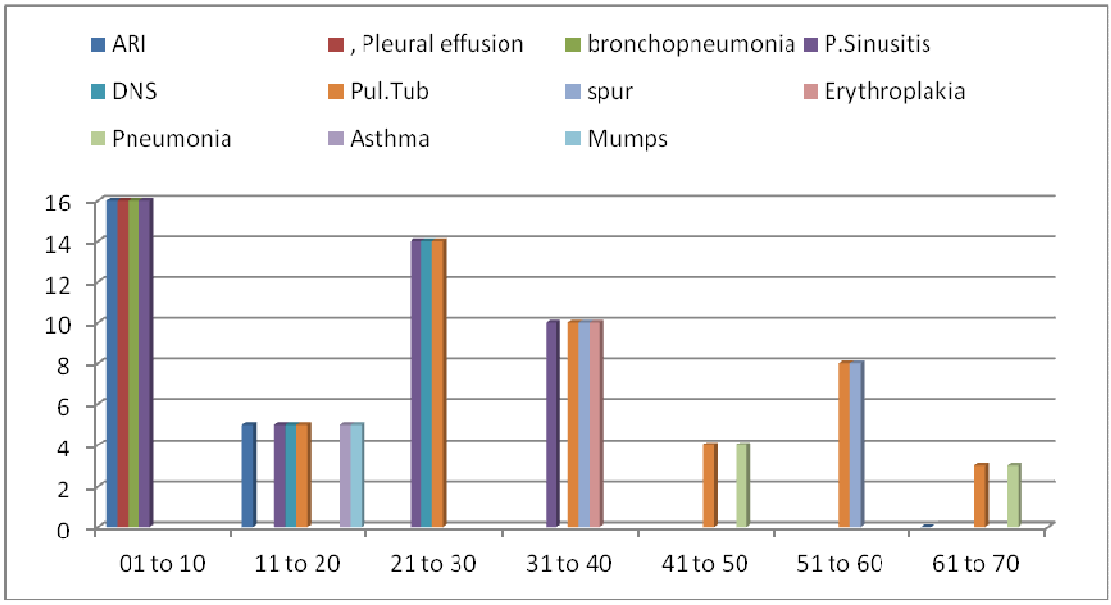

Fig 3: Showing various diseases in defferent age group affected by air pollutants in Lalitpur district Bundelkhand region of U.P.

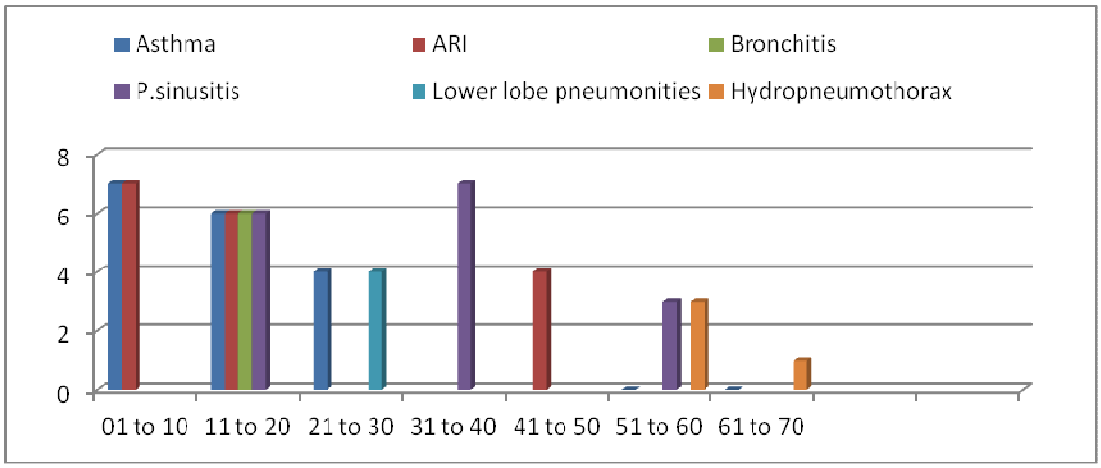

Fig4: Showing various diseases in defferent age group affected by air pollutants in Hamirpur district Bundelkhand region of U.P.

Table 4: Showing various specific diseases caused by the risk factors outdoor and indoor air pollutants in Mahoba district, Bundelkhand region of U.P. (2012)

S. No.	AGE (Years)	MALE %	FEMALE %	TOTAL PARCENTAGE (%)OF PEOPLE AFFECTED	DISEASES
1	1-10	12	1	13	ARI, Bronchopneumonia, Caryngobronchiliatis, Bronchiolotis, Pul.Tub
2	11-20	8	1	9	Tonsillitis, DNS, Abscessperitonsillar, Pul.Tub
3	21-30	2	3	5	AC.Bronchitis, P.Sinusitis, Pul.Tub
4	31-40	4	2	6	Hemothorax
5	41-50	6	3	9	CH.Bronchitis, Upper respiratory, Pul.Tub
6	51-60	5	1	6	Aspiration,Pneumonia,P.Sinusitis,Lower Lobe pneumonia,Pul.tub
7	61-70	2	1	3	Aspiration,Pul.Tub
8	71-80	4	0	4	Pneumonia,Pul.Tub
9	81-90	1	1	2	Aspiration,Pul.Tub

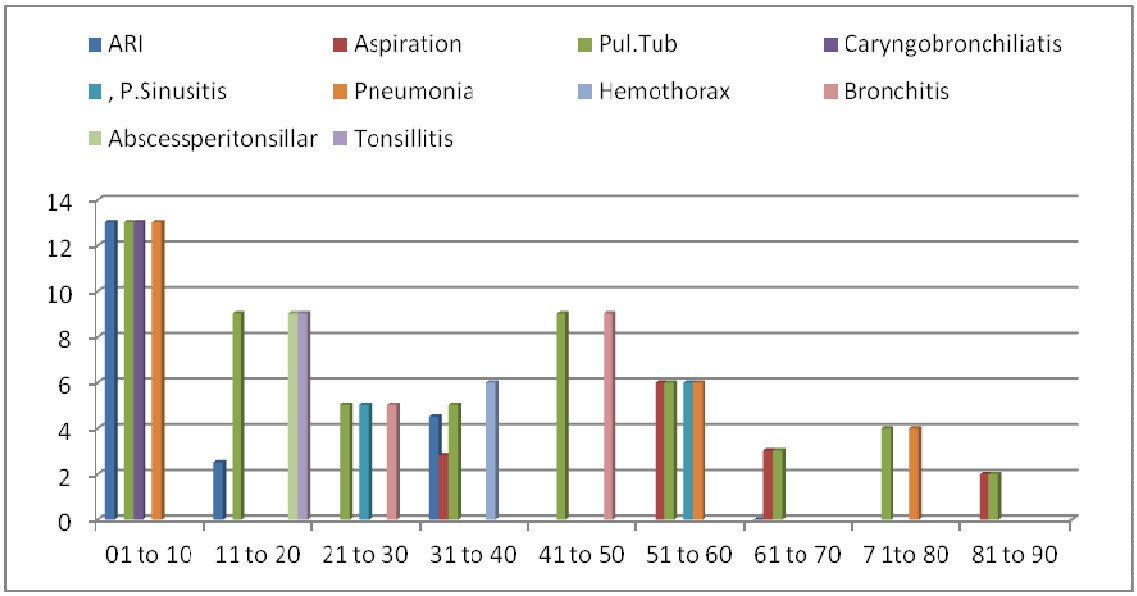

Fig 5: Showing diseases due to pollution in Mahoba district Bundelkhand region of U.P.

Table 5: Showing various diseases in different age group of sex ratio in the Banda district by the risk factors of air pollutants in Bundelkhand region region of U.P. (2012)

S. No.	AGE (Years)	MALE %	FEMALE %	TOTAL PARCENTAGE (%)OF PEOPLE AFFECTED	DISEASES
1	1-10	2	1	3	Upper respiratory tract, bronchopneumonia, Bronchial Asthma
2	11-20	1	1	2	Pul.Tub, ch. tonsilitis
3	21-30	-	2	2	Pul.Tub, spur
4	31-40	1		1	Pul.Tub
5	41-50	-	1	1	Pul.Tub
6	51-60	-	-	-	-
7	61-70	2	1	3	Pul.Tub, Bronchitis

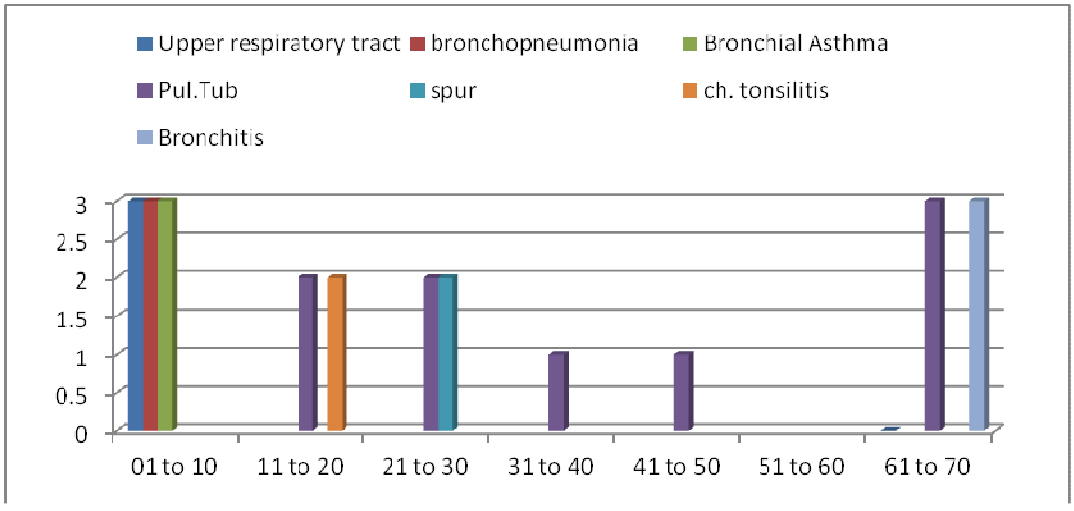

Fig 6: Showing various air-born diseases caused by the risk factors of particulate matter pollution that affects different age group of the people in Banda district in Bundelkhand region of U.P.

CONCLUSION

Environmental policy for the reduction of the health risk specifically in Bundelkhan region of Uttar Pradesh is necessary and it should be informed by the best and most complete information to the peoples in relation on the health effects depends upon the air pollution level. New research efforts should address health outcomes of regional relevance, such as Tuberculosis and childhood respiratory illness. Since tuberculosis is endemic in many districts of Bundelkhand region even a small increase in risk factors could translate into a large attributable burden. Research on outdoor air pollution and tuberculosis seems warranted.

Among older adults, long-term exposure to nitrogen dioxide and fine particulates matters was mostly associated with hospitalization for community-acquired pneumonia. Air pollution has been shown to exacerbate respiratory diseases such as asthma and other chronic disease. However, it may also increase the risk for pneumonia by impairing the function of pulmonary alveolar macrophages and epithelial cells.

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