

Air Pollution and Its Effect on Human Health: A Case Study in Dera Ghazi Khan Urban Areas, Pakistan

Muhammad Ajmal¹ Muhammad Ali Tarar¹ Muhammad Irshad Arshad^{2*} Allah Bakhsh Gulshan³
Muhammad Anwer Iqbal⁴ Farooq Tanvir⁵

1.Department of Sociology, Ghazi University, Dera Ghazi Khan, Pakistan

2.Department of Forestry, Range & Wildlife, Ghazi University, Dera Ghazi Khan, Pakistan

3.Department of Botany, Ghazi University, Dera Ghazi Khan, Pakistan

4.Department of Zoology, Ghazi University, Dera Ghazi Khan, Pakistan

5.Department of Rural Sociology, University of Agriculture, Faisalabad, Pakistan

Abstract

Presently, air pollution is a principal global health threats which is responsible for enhancing the chances for spreading of many chronic diseases. This problem occurred over past few decades due to fast growth in urbanization, industrialization and massive of vehicles volume in developed and under developed countries. The contaminated air leads the detrimental effects on the human health. Principal air pollutants are particulate matter, sulphur dioxide, nitrogen oxides, ammonia, carbon monoxide and ozone. When the level of these pollutants is increased at certain degree, the outcome may cause serious respiratory problems which lead to happening of deaths. In recent years, rapidly increasing population, economic and educational developments in the city brought a huge pressure of traffic. So, the current study was planned to determine the roots and examine the awful consequences of air pollution on the humanity health. Public opinions on exposure are severe in examining human reaction and adoption of concerned strategies. Hence, viewing people' perception is vital in establishing the plan of suitable managing actions. We arranged this study in Dera Ghazi Khan City to obtain the local people know-how of the existing air pollution situation and their postures towards measures to control of air pollution. Multistage sampling technique was applied for the selection of 120 respondents and data was collected by developing questioners. Most of the interviewees illustrated that air pollution is very hazardous for the people health and is responsible for the cause of many diseases.

Keywords: Air Pollution, Human health, Pollutants, Environment, Dera Ghazi Khan

1. Introduction

A growing ratio of the global populace residing in urbanized zones has created great pressures on local environments and enhanced air pollution. Air pollution is refers as any chemical, physical or biotic factors which are introduced by human activities that disturbs the natural features of the atmosphere. The industries, automobiles, power generation, motorized traffic, burning of solid fuels for cooking, burning fossils fuel in *brick kiln industries*, burning of municipal waste openly, heating, tobacco smoking, material for manufacturing of furniture, carpets, air conditioners, home cleaning and insecticides are main factors of man-made sources of air pollution (Tanimowo 2000; Brunekreef & Holgate 2002; Zell *et al.* 2010; IPCC 2014). Air pollution can induce both critical and long-lasting health consequences due to high concentration of pollutants like carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides and particulates in the air (Collirs Encyclopedia- I). In earlier, the first incident of chronic air pollution was occurred in *Meuse Valley, Belgium* from 1st Dec. to 5th Dec. in 1930 and caused 63 deaths and thousands more suffered with illness. The second episode was happened in Donora, Pennsylvania (USA) in 1948 (October 26-31) and created 20 deaths and another 6000 become sick from smog. The worst incident of air pollution in the history on anthropoid health were abundantly recognized as London great smog in 1952 having concentration 1600 $\mu\text{g}/\text{m}^3$ that was continued from 5th December to 9th December and killed more than 4000 thousands of people and more than 100000 people suffered with respiratory diseases (Ciocco & Thompson 1996; Nemery *et al.* 2001; Davis 2003). Currently, One out of eight deaths occurred due to air pollution in worldwide (WHO 2014).

Air pollution is recognized to impart to earth climate variations. There are different forms of air pollutes such as greenhouse gases, among them, CO₂ which is most significant and contributed round about 60% total GHG emission (Khan *et al.* 2011). Due anthropogenic activities, enhancement of CO₂ through vehicles exhaustion which trap heat energy from the sunlight in the atmosphere, discharge of pollutants from power generating plants which burn of fossil fuels such as coal and various manufacturing plants, thus contributing climate changes and global warming. From centuries, the level of carbon dioxide in the atmosphere was remained between 200 and 300 ppm and presently near to 400 ppm, and the concentration is yet increasing (EPA 2011). If such matter could not be sincerely watched and handled politely today, global warming and climate variations are probable more to happen in forthcoming centuries. Global warming/climate fluctuations may cause several health hazards, like utmost heat, drought, dispersion of vector-borne ailments, allergens, extremely inadequate air quality that may cause many respiratory diseases.

Pakistan is facing environmental challenges similar to various other countries in the world. The development in the industrialized sectors contributes successfulness, however due to increases the smoke, particulate matter and the effluents, resulted a harmful consequence on the environment. China has commenced the economic development for prosperity over various sectors like fast industrialization and developed industrial parks, which sharply increased the environmental pollution, especially air pollution. The pollutant degree level in Beijing and Shanghai was a shock to the China (SEPB 2013; Wang *et al.* 2015). Alike is the example with Pakistan, where fast population growth rate, urbanization, industrialization and energy demand has produced severe fears of environmental deprivation. Due to fast rising transport sector (15.57 million motor vehicles on road; GOP 2015-16), poor infrastructure, and greater consumption of low-quality oil which enhanced the level of particulate matters in atmosphere. The suspended particulate matter concentrations in the air are 2 to 3.5 times greater than the harmless perimeter in major cities. Furthermore, non-implementation of right rules of vehicle fitness by the concerned authorities, the level of air pollution has increased that could be signal of alarming. The ordinary lives of motor vehicles are somewhat long which contribute to heavy air pollution due to having their week engines which emits huge smoke. Moreover, two-wheeled vehicle (motorcycles and rickshaws) having two stroke engines, contribute to dangerous emissions due to inefficient in burning fuel (GOP 2014-15).

ENN (2002) reported that emissions of lead and carbon from vehicles are key air pollutants in Pakistani cities like Islamabad, Faisalabad, Lahore and Karachi. The deteriorating air situation in main metropolises can be believed as a signal of alerting due to having particulate matter 10. Currently, Karachi, Quetta, Lahore and Peshawar were declared among the polluted cities in Asia pacific by World Health Organization (WHO) (GOP 2015-16). Similarly, in big cities, vehicles discharged 20 times greater the volume of hydrocarbons, 25 times greater the mass of carbon monoxide and 3.6 times greater the volume of nitrous oxide as compared to United States (Jahangeer 2000). It is assessed by experts that vehicular emissions degraded the urban air quality from 60 to 70 per cent in Pakistani cities. The total registered motor vehicles in 2000 were 4.70 million while in 2015 it was increased up to 17.32 million (GOP 2015-16).

Smog is a well-known kind of air pollution that caused due to the effect of sunlight on the motor vehicles exhaust. In winter, the pollutants in the atmosphere condenses at lower levels because of delayed rainfall and cold and continuously dry weather situation created smog that spread throughout the Punjab province (GOP 2014-15; GOP 2015-16). In major industries and transport sector use of inferior quality oil has enhanced the air pollution. The waste material burning in cities has also speed up this issue. The public transportation has olden system that is also a one of the main reason of air pollution (ADB 2006). The impure air keeps pollutants like particulate matter, heavy metals, carbon monoxide, sulfur dioxide, nitrogen oxide, benzene, hydrocarbons and ozone that are dangerous to human health. They caused diseases like sore throat, asthma, cough, cancer and many other respiratory disorders (Brunekreef and Holgate 2002; Mishra 2003; Khan *et al.* 2011).

The rapidly rising population and economic growth in the Dera Ghazi Khan city is a major cause to increase the vehicles ratio, which are continually contributing smoke and toxic gases in the atmosphere and created many health issues for the residents. The kinds of motor vehicles are, motor cycle, motor cycle rickshaws and four wheelers. Motor cycle and motor cycle rickshaws are major contributor to air pollution. The trucks which come from *Sakhi Sarwar* (Stone crushing point) are over loaded with crushed stone released huge smoke when they pass through the city. As this city also is a junction of all provinces, a huge volume of four wheels vehicles traffic pass through it daily and released massive smoke. Keeping in view the problems of pollution, we designed this study with the aims to explore the socioeconomic characteristic of the respondents, air pollution causes and effects on human health and propose actions for its remedies.

2. Material and Methods

The study was conducted through random sampling method in Dera Ghazi Khan urban areas of Pakistan. It lies between 30.03° N, 70.38° E approximately. The yearly average minimum and maximum temperatures keep roughly 4.5°C in January and above 42°C in June. The primary data was collected by designing a pre-tested questionnaire. The first unit of the data comprised socio-demographic features (age, marital status, education and income). All age groups were involved for asking questions because to see how their views and conceiving varied owed to the age gap. The main questions of research include; what is the air quality in Dera Ghazi City? 2. What were the causes of air pollution in Dera Ghazi Khan City? What type of factories in Dera Ghazi Khan City? Did any member of your family fell ill? If yes, what was the disease? What are the remedies of air pollution according to your perception? Based on these research questions, a questionnaire was developed to gather the suitable data. During field survey, about 120 questionnaires (Hussain *et al.*, 2003) have been completed from the sample areas. We applied uni-variate analysis and the data was analyzed by applying SPSS software.

3. Results and Discussion

Socio-economic characteristics of the respondents were shown in Table 1. in terms of age, marital status, education and income. The results depicted that most of the respondents were between 18 to 35 (74.2%) years of age. The marital status of the respondents was, 47.5% were married, 46.5% were unmarried and 5.8% were separated. The education level of the respondents were observed that 20% were illiterate while primary were 9.2%, middle were 35.8%, matriculation were 25% and graduation and above were 9.2%. Regarding occupation of the respondents, 67.5% were private jobs, 26.7% were business man and 5.8% were govt. job. Incomes as reported by most of the respondents were mainly below 26,000 PRK (88 percent), see Table-1.

Table 1. General demographic information of the interviewees (N=120)

	Variables	Frequency	Percent
Gender	Male	120	100
	Females	0	0
Marital status	Single	54	46.7
	Married	55	47.5
	Separated	11	5.8
	Total	120	100
Age (years)	18-25	51	42.5
	26-35	38	31.7
	36-& above	31	25.8
	Total	120	100
Education level	Illiterate	24	20.0
	Primary	11	9.2
	Middle	43	35.8
	Matriculation	31	25.8
	Graduation & above	11	9.2
	Total	120	100
Occupation	Govt. Job	7	5.8
	Private Job	81	67.5
	Business	32	26.7
	Total	120	100
Monthly Income	10000-15000	31	25.8
	16000-20000	45	37.5
	21000-25000	30	25.0
	26000& above	14	11.7
	Total	120	100

All living beings are needed clean air for keeping their survival and health and a normal mature person required about 15 kg fresh air per day (day and night) (EPA 2009). Oxygen is essential element for the existence of all living things on this earth surface. Due to anthropogenic activities, the balance of the ecosystem is disturbed and created lots of problems like air pollution and is a key threat to developed and under developed countries in all over the world. Growth of urbanized populace and raise of magnitude of motor vehicles/ road transport in cities which caused heavy air pollution that is a serious jeopardize to human health and adjacent environment (WHO 2014). The pollutants that present in the atmosphere produce various kinds of human health problems by inhaling hazardous pollutants which are sources of many diseases. Air pollution created both prompt and prolongs effects on health issues. The quick respond affected the respiratory system that resulted acute bronchitis while the prolong effects caused the bronchial asthma, chronic bronchitis, respiratory allergies and lung cancer (Denny & Loda 1986; Bonita *et al.* 2006; Willis *et al.* 2010). In current study, we found that majority of the respondents (60.8%) perceived that air quality in Dera Ghazi Khan City is polluted and 45% responders confidant that air pollution was injurious to human health (Table 2). Our outcomes were somewhat in accordance with Anwar *et al.* (2012) who reported that 37% responders viewed that air quality of Bahawalpur City was poor. Similarly, Tanveer *et al.* (2015) viewed that about 70% respondents perceived that the air quality of the Gujrat City was poor. Similar findings were also reported by Munazza (2016) who stated that about 38% respondents perceived that outdoor pollution was considered as high health risks in Bahawalpur City. Our findings were also agreed with Nursan *et al.* (2014) and Bianco *et al.* (2008) who reported that outdoor air pollution was a basic threat to human health. Fresh air is believed to be a basic element for sustaining human health and wellbeing. The cardiac, respiratory cardiopulmonary and coronary diseases were caused by both indoor and outdoor air pollution that affects the people (Katsouyanni 2006; Maître *et al.* 2006). Peak pollution level can induce significantly raised the death rates (Nawrot *et al.* 2006). Long vulnerability to high intensity of temperatures can stimulate heat related ailments like heat cramps, heat stroke, heat exhaustion, syncope, and

finally death (Curriero *et al.* 2002; Schwartz 2004). In our study, about 41.7% respondents opined that factories/industries are the main reason of air pollution (Table 3). Our results were also in close agreement with Tanveer *et al.* (2015) who argued that 23% respondents viewed that industries were the key reason of air pollution in Gujrat City of Pakistan.

Table 2. Perception of respondents regarding air quality and satisfaction about air pollution is harmful for human health in Dera Ghazi Khan City

i. Perception of respondents regarding air quality

S. No	Factors	Polluted		Fresh		No reply		Total	
		F	P	F	P	F	P	F	P
1.	What is the air quality?	73	60.8	47	39.2	-	-	120	100

ii. Perception of respondents regarding satisfaction about air pollution is harmful for human health

S. No	Factor	Yes		No		No reply		Total	
		F	P	F	P	F	P	F	P
1	Are the air of the city is harmful?	54	45.0	40	33.3	26	21.7	120	100

Table 3. Respondents opinion regarding causes of air pollution in Dera Ghazi Khan city during 2013.

S. No	Factors	Yes		No		No reply		Total	
		F	P	F	P	F	P	F	P
1.	Traffic	64	53.3	56	46.7	-	-	120	100
2.	Factories/ Industries	50	41.7	70	58.3	-	-	120	100
3.	Burning of coal	86	71.7	34	28.3	-	-	120	100
4.	Smoke	110	92.7	10	7.3	-	-	120	100
5.	Dust	70	58.3	50	41.7	-	-	120	100
6.	Open air wastage	40	33.3	32	26.7	48	40	120	100

Overall about more than half 53.3% of the respondents believed that traffic was the main cause of air pollution (Table 3). When we examined about the role of different vehicles regarding pollution, the respondents viewed that pollution caused by motor cycle was 27.5%, cars was 25.8% and buses was 46.7% (Fig. 1). These finding were in accordance with Yasmin (2002) who reported that polluted air contained smoke and sulfur dioxide and caused many respiratory diseases in Gujranwala City areas. The main reasons were industries and burning plants that were emitted smoke and gases in the air. People suffered throat diseases (46% respondents), which were caused of fever mainly in children, 34% were facing lungs disease (asthma and Tuberculosis) and 20% were facing eye burning and skin disease due to furnaces in factories. Similar findings were also reported by BTRE (2005) who revealed that motor vehicle emission is a reason of respiratory and cardiovascular diseases in Australia. Our findings were also in lined with Tanveer *et al.* (2015) who revealed that 56.9% respondents perceived that traffic was major factor of air pollution, 70% believed that rickshaws were the cause of air pollution, 9% people supposed that trucks were responsible of air pollution and 11% respondents said that buses were the source of air pollution.

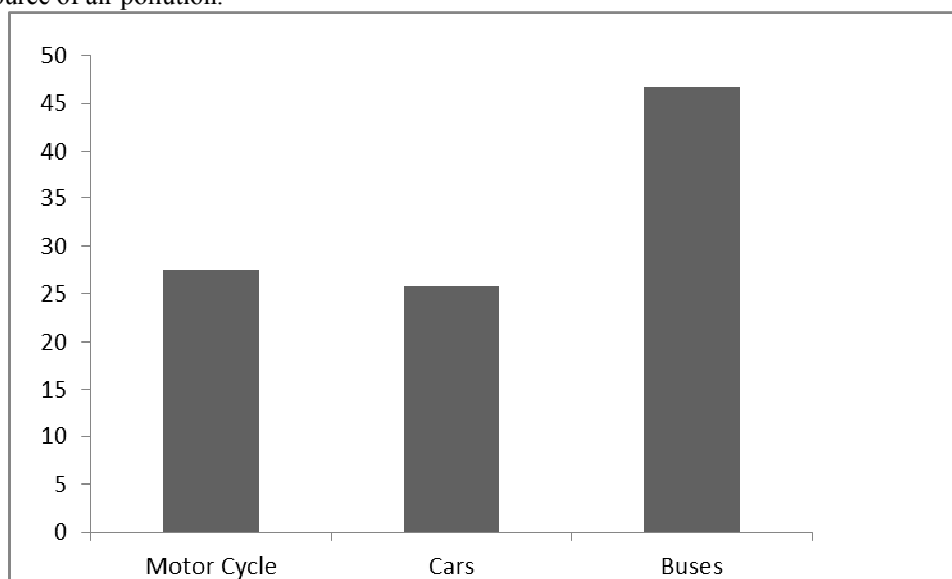


Fig.1. Different vehicles caused the air pollution as per respondent's perceptions.

About 92.7 % of the respondents agreed that smoke was the cause of pollution. Similarly, 58.3 percent respondents opined that dust was the cause of air pollution (Table 3). Our findings were also in line with Hussain *et al.* (2003) who reported that 80.8% respondents were well aware that dust was the cause of environmental pollution while 56.7% agreed that smoke is the cause of pollution. Similarly, Bonita *et al.* (1999) revealed that smoke was extremely hazardous for mankind and environment because it caused deaths of 4.2 million individuals every year in the globe. In Vaal triangle area of South Africa about 29% people affected with lower respiratory tract ailment and 66% people by upper respiratory tract ailment out of the total measured population (Terblanche *et al.*1992). In another research which carried out in the city areas of South Africa, it was assessed that ambient air pollution caused national mortality from different diseases like 3.7% from cardiopulmonary, 5.1% from bronchus, cancers of trachea and lung in adults about 30 years and older and also 1.1% from severe respiratory illness in children below age of five years (Norman *et al.* 2007).

In the current study, the main people health issues highlighted by responders as presented in Table 4 were sore throat diseases (19.2%), asthma (35.8%), allergy (24.2%) and cancer diseases (7.3%). According to Hussain *et al.* (2003), in Faisalabad major diseases perceived by the respondents were depression (65 %), throat diseases (75%), skin diseases (33.3%), Influenza (56.7%). Similarly, our results also alike with Altaf (1998) who revealed that 12.8% responders were affected by sore throat while 8% were suffered by lung diseases. Similarly, Anwar *et al.* 2012 reported that due to dust pollution, people suffered skin allergies was 29% and Asthma was 23% while nose, eye and throat irritation was 19%. They further reported that heart ailments were 4% and shortness of breath and respiratory infection was about 8%. Kamal *et al.* 2015 revealed that traffic police officers and rickshaw drivers normally undergo from severe head and respiratory signs when they spent daily time inside of dense traffic. Their study further showed that growing traffic pollution was not only linked with vital health threats for the workers in transport sectors but also for the populace. Anwar *et al.* 2012 reported that air quality have significant influence on the daily routine activities of peoples of the areas because air pollution is produced various severe health hazards due to having injurious chemicals released from diverse causes and its affects varies from individual to individual. Some face difficulty in breathing and others feel skin irritation. About 41.5% respondents' perceived respiratory diseases, 28.5% responders viewed skin diseases and mentally depression and 18.9% opined about eyes, nose and throat irritation was due to ample vehicles smoke and dust (Tanveer *et al.* 2015).

Table 4. Respondents opinion regarding diseases caused by air pollution in Dera Ghazi Khan City

S. No	Name of disease	Per cent of respondents agreed		Per cent of respondents disagreed		Total	
		F	P	F	P	F	P
1.	Asthma	43	35.8	77	64.2	120	100
2.	Allergy	29	24.2	91	75.8	120	100
3.	Sore throat	23	19.2	97	80.8	120	100
4.	Cancer	10	7.3	110	92.7	120	100

Table 5. Perception of respondents regarding to control of air pollution in Dera Ghazi Khan City

S. No	Factors	Yes		No		No reply		Total	
		F	P	F	P	F	P	F	P
1.	Improved road	55	45.83	45	37.5	20	16.66	120	100
2.	Use of high quality oil	58	48.33	40	33.34	22	18.33	120	100
3.	Proper disposing material system	45	37.5	57	47.5	18	15	120	100
4.	Proper sanitary system	43	35.83	65	54.16	12	10	120	100
5.	Greenery/Plantation	76	63.3	23	19.16	18	15	120	100

4. Conclusions and Recommendations

- i. Air is the necessity of human existence and a normal mature person required about 15 kg fresh air daily (day and night). Great load of automobiles emissions on roads are affecting severely air quality of the city. Air pollution creates diverse kind of disease like respiratory infections. In this study people perceived that proper maintenance of roads, used of high quality of oil, proper disposing and sanitary system, plantation and development of green places can control air pollution. Green places (parklands and resort area) act as a significant role in reducing the air pollutants from the atmosphere because greenery reduces the evil effects of pollution. The green places in the city can improve the air quality by surface assimilation of pollutants, dust particles and discharge of humidity, which can regulate the physical anxieties that are characteristic of the urban environs (Anwar 2008). The green areas act as an air cleaner and provide pollution free fresh oxygen for breathing with larger consumption to the citizen, aids in reducing stress and also raise intellectual development (Hong 2002; Sheikh *et al.* 2012; Katpar *et al.* 2016).

- ii. The air pollution issues affect every citizen, so it is the equal responsibility of public and private organizations for improving the quality of air in the city. It is also need of time that environmental pollution education curricula should be included at primary, secondary and degree level in the country. A combined struggle may also be carried out by all residents, planners, government organization and non-government organizations to educate general public through print media. Nowadays the electronic media is a significant means to generate awareness on air pollution environmental issues that created health hazards. They may also be educated regarding the benefits of physical activities like walking and bicycling, rather exploitation of cars which are hazardous to environment (Katpar *et al.* 2016). The awareness education regarding mitigating the air pollution can support to decrease the adverse effect which could help to make free pollution friendly environment on the earth and provide a healthier habitation to live on it (Huesemann 2003).
- iii. Motor vehicles rules and environment protection rules may strictly be applied by the concerned departments to control air pollution in the city.
- iv. The government should develop air pollution reduction strategies by involving all the stake holders to save the citizen from adverse effects of the air pollution in future.

References

1. ADB (Asian Development Bank) (2006). "Country Synthesis Report on Urban Air Quality Management for Pakistan". Asian Development Bank and the Clean Air Initiative for Asian Cities (CAI-Asia) Centre.
2. Altaf, S. (1998). "People's perception about the ill effects industrial pollution. A case study of Faisalabad District". *M.Sc. (Hons.) Agri. Thesis*, University of Agriculture, Faisalabad-Pakistan.
3. Anwar, M. M. (2008). "An Investigation of Public Parks and Life Quality in Karachi, Pakistan: Urban Ecology". VDM Publishing.
4. Anwar, M. M., Ahmed, M., & Asghar, F. (2012). Air Pollution as an Environmental Hazard; A Case Study Karna Basti of Bahawalpur, Pakistan. *Sindh University Research Journal-SURJ (Science Series)*, 44(3) 405-410.
5. Bianco, A., Nobile, C. G., Gnisci, F., & Pavia, M. (2008). "Knowledge and perceptions of the health effects of environmental hazards in the general population in Italy". *International Journal of Hygiene and Environmental Health*, 211(3) 412-419.
6. Bonita, R., Duncan, J., Truelsen, T., Jackson, R. T. & Beaglehole, R. (1999). "Passive smoking as well as active smoking increases the risk of acute stroke". *Tobacco Control*, 8(2)156-160.
7. Bonita, R., Beaglehole, R., & Kjellström, T. (2006). "Basic epidemiology". World Health Organization.
8. Brunekreef, B. & Holgate, S. T. (2002). "Air pollution and health". *The lancet*, 360 (9341)1233-1242.
9. Bureau of Transport and Regional Economics. (2005). "Health Impacts of Transport Emissions in Australia: Economic Costs". *Working Paper 63*, Commonwealth of Australia, 169 pages.
10. Ciocco, A., Thompson D. J. (1961). A follow-up of Donora ten years after: methodology and findings. *American Journal of Public Health and the Nations Health*, 51: 155-164.
11. Curriero, F. C., Heiner, K. S., Samet, J. M., Zeger, S. L., Strug, L., & Patz, J. A. (2002). Temperature and mortality in 11 cities of the eastern United States". *American Journal of Epidemiology*, 155(1) 80-87.
12. Denny, F. W., & Loda, F. A. (1986). "Acute respiratory infections are the leading cause of death in children in developing countries". *American Journal of Tropical Medicine and Hygiene*, 35(1) 1-2.
13. Davis, D. (2004). "Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution", New York: Basic Books.
14. EPA, U.S. (2009). "Final Report: Integrated Science Assessment for Particulate Matter". U.S. Environmental Protection Agency, Washington, DC.
15. EPA, U.S (2011). "The Link Between Temperature And Carbon Dioxide". CCDWeb@epa.gov: United Nation Environment Protection Agency.
16. GoP (2014-15). "Economic Survey 2014-15". Islamabad: Ministry of Finance, Government of Pakistan (GoP).
17. GoP (2015-16). "Economic Survey 2015-16". Islamabad: Ministry of Finance, Government of Pakistan (GoP).
18. Gulia, S., Nagendra, S. S., Khare, M., & Khanna, I. (2015). "Urban air quality management-A review". *Atmospheric Pollution Research*, 6(2)286-304.
19. Hong, Y. C., Lee, J. T., Kim, H., & Kwon, H. J. (2002). "Air pollution a new risk factor in ischemic stroke mortality". *Stroke*, 33(9) 2165-2169.
20. Huesemann, M. H. (2003). "The limits of technological solutions to sustainable development". *Clean Technologies and Environmental Policy*, 5(1) 21-34.
21. Hussain, S., Hassan, M.Z.Y., Mukhtar, Y. and Saddiqui, B.N. (2003). "Impact of Environmental Pollution on Human Behaviour and Uplift of Awareness Level Through Mass Media Among the People of Faisalabad

- City". *International Journal of Agriculture and Biology*, 5(4) 660–661.
22. Intergovernmental Panel on Climate Change. (2014). "Climate Change 2014–Impacts, Adaptation and Vulnerability: Regional Aspects". Cambridge University Press.
 23. Jahangers, M. (2000). "Environmental pollution. A nightmare by the year 2000". Kisht-e-Nau. University of Magazine.
 24. Kamal, A., Qamar, K., Gulfraz, M., Anwar, M. A., & Malik, R. N. (2015). "PAH exposure and oxidative stress indicators of human cohorts exposed to traffic pollution in Lahore city (Pakistan)". *Chemosphere*, 120, 59-67.
 26. Katpar, S., Khan, R., Siddiqui, R., Hussain, M., & Rehman, R. (2016). "Perceptions of medical students regarding dimensions of environmental wellness". *Journal of the Pakistan Medical Association*, 66(4) 373-377.
 27. Katsouyanni, K. (2003). "Ambient air pollution and health". *British Medical Bulletin*, 68(1) 143-56.
 28. Khan, A. N., Ghauri, B. M., Jilani, R., & Rahman, S. (2011). "Climate Change: Emissions and Sinks of greenhouse gases in Pakistan". In Proceedings of the Symposium on Changing Environmental Pattern and its impact with Special Focus on Pakistan.
 29. Maitre, A., Bonneterre, V., Huillard, L., Sabatier, P., & de Gaudemaris, R. (2006). "Impact of urban atmospheric pollution on coronary disease". *European Heart Journal*, 27(19) 2275-2284.
 30. Mishra, V. (2003). "Effect of indoor air pollution from biomass combustion on prevalence of asthma in the elderly". *Environmental Health Perspectives*, 111(1)71.
 31. Munazza, F. (2016). "Environmental Health Risk Perception among the Residents of Bahawalpur City, Pakistan". *International Research Journal of Environmental Sciences*. 5(3) 1-7.
 32. Nawrot, T., Plusquin, M., Hogervorst, J., Roels, H. A., Celis, H., Thijs, L. & Staessen, J. A. (2006). "Environmental exposure to cadmium and risk of cancer: a prospective population-based study". *The lancet oncology*, 7(2)119-126.
 33. Nemery, B., Hoet, P. H., & Nemmar, A. (2001). "The Meuse Valley fog of 1930: an air pollution disaster". *The Lancet*, 357(9257)704-708.
 34. Nursan, C., Muge, A. T., Cemile, D., Pinar, T., & Sevin, A. (2014). "Parent's knowledge and perceptions of the health effects of environmental hazards in Sakarya, Turkey". *Journal of Pakistan Medical Association*, 64(1) 38-41.
 35. Schwartz, J. (2004). "Air pollution and children's health". *Pediatrics*, 113 (3) 1037–1043.
 36. Schwartz, J. (2005). "How sensitive is the association between ozone and daily deaths to control for temperature?". *American Journal of Respiratory and Critical Care Medicine*, 171(6) 627-631.
 37. Shanghai Environmental Protection Bureau. (2013). "Shanghai Environment Bulletin". Available online:<http://www.envir.gov.cn/law/bulletin>.
 38. Shaikh, S. U., Rehman, R., Ezdi, L., & Shaheen, Z. (2012). "Selection of active life styles by male/female healthy young medical students". *Medical Channel*, 18(1) 9-12.
 39. Tanimowo, M. O. (2000). "Air pollution and respiratory health: What hope for the 21st century?". *Africa Health*, 22(2) 12-13.
 40. Tanveer, Z., Ilyas, H., Akhtar, S. N., & Shaffique, K. (2015). "Outdoor Air Pollution: A Case Study of Gujrat City". *Journal of Global and Scientific Issues*, 3(2)57-65.
 41. Terblanche, A. P., Opperman, L., Nel, C. M., Reinach, S. G., Tosen, G., & Cadman, A. (1992). "Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study". *South African Medical Journal*, 81(11) 550-556.
 42. Wang, R., Yang, Y., Chen, R., Kan, H., Wu, J., Wang, K., Maddock, J.E. and Lu, Y. (2015). "Knowledge, Attitudes, and Practices (KAP) of the Relationship between Air Pollution and Children's Respiratory Health in Shanghai, China". *International Journal of Environmental Research and Public Health*, 12(2)1834-1848.
 43. WHO. (2014). "Media Centre". Retrieved September 2016, from World Health Organization: <http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/>.
 44. Willis, H. H., MacDonald Gibson, J., Shih, R. A., Geschwind, S., Olmstead, S., Hu, J. & Moore, M. (2010). "Prioritizing environmental health risks in the UAE". *Risk Analysis*, 30(12) 1842-1856.
 45. Yasmin S. 2002. "Effect of Air Pollution on Human Health Caused by Factories and Furnaces in Gujranwala City". *International Journal of Agriculture and Biology*, 4 (1)81-83.
 46. Zell, H., Quarcoo, D., Scutaru, C., Vitzthum, K., Uibel, S., Schöffel, N. & Spallek, M. F. (2010). "Air pollution research: visualization of research activity using density-equalizing mapping and scientometric benchmarking procedures". *Journal of Occupational Medicine and Toxicology*, 5(1)1.