

Research Article (Open access)

A Survey on Effects of Air Pollutants on Commuters Using both Public and Private Transport

Subodhika Vohra*¹, Tapasya Sharma¹, Isha Raheja¹, Anuradha Shukhla², Manisha Gaur³

¹Environment Management and Sustainable Development, Department of Resource Management and Design Application, University of Delhi, India

²Chief Scientist, Environmental Science Division, CRRI-CSIR India

³Doctoral Researcher, Environmental Science Division, CRRI-AcSIR, India

ABSTRACT- Transportation-related pollutants are one of the largest contributors to unhealthy air quality. Delhi, the capital of India, is one of the most significant polluted urban areas in the world. Given the high traffic volume combined with heterogeneous traffic composition ranging from non-motorized vehicles to two-and-three wheelers, cars, buses and trucks; it is pivotal to understand whether the commuter can associate the everyday symptoms of sickness to the level of pollution caused by the various modes of transport. In this study, a survey was conducted to assess the effects of air pollutants on commuters using public and private transportation. The finding of the study revealed that commuters face health problems like headache, fatigue/drowsiness, nasal congestion, eye irritation, nose irritation, sneezing, skin irritation, respiratory problems and throat irritation. Maximum commuters also opined that cancer and respiratory morbidity are the major long term health effects of transport-related air pollution.

Key-Words: Air pollution, Commuters, Health effects, Pollutants, Transport, Urban area

-----IJLSSR-----

INTRODUCTION

Air pollution is exacerbating as countries are becoming more industrialized. One of the serious environmental concerns of India is air pollution where majority of the population is exposed to poor air quality. The Central Pollution Control Board suggested that with rapid urbanization of the Indian cities, the population living in the cities is expected to increase manifold in the next two decades ^[1]. As a result of rapid urbanization in India, there has been a tremendous increase in the number of motor vehicles. The vehicle fleets have even doubled in some cities in the last one decade.

This increased mobility, however, is a huge cost to the cities. As the number of vehicles continue to grow and the consequent congestion increases, vehicles are advancing to become the major source of air pollution in urban India.

According to World Health Organization, traffic adds to a range of gaseous air pollutants and to suspended particulate matter (SPM) of different sizes and composition. Emissions of primary particles from road transport account for up to 30% of fine particulate (less than 2.5 μm in aerodynamic diameter or PM 2.5) in urban areas. Other emissions related to road transport (such as those from re-suspended road dust, and wear of tyres and brake linings) are the most important source of the coarse fraction of PM (2.5–10 μm in aerodynamic diameter or PM10–2.5). Road transport is also the main contributor to emissions of nitrogen dioxide and benzene in cities ^[2].

There is need for strict control due to increasing concern for air toxics and climate modification caused by exhaust emissions. Unfortunately, investigation needs to be done seeing vehicular emissions as a vital environment hazard, since it may shorten the

Corresponding Address

* Subodhika Vohra

Dept. of Resource Management and Design Application

University of Delhi

Email: vohrasubodhika@gmail.com

Received: 07 November 2015/Revised: 16 December 2015/Accepted: 30 December 2015

life-span of exposed people. Research on vehicular air pollution has also indicated that the depletion of the ozone layer is largely due to pollution from industries and the use of automobiles [3].

Vulnerability to air pollution can cause serious illnesses, including asthma, chronic obstructive pulmonary disease (COPD), cardiovascular disease, diabetes, and lung cancer [4]. Other health impacts of transportation-related air pollutants are fatigue, headache, sneezing, skin irritation, chronic bronchitis, cardiovascular disease, pneumonia and emphysema, long term effects on mortality and morbidity and childhood cancer [5]. In India, the urban transport demand is met by an array of modes of transportation like the high income group avails private mode of transportation e.g. cars, the middle-income and lower- income group hinge on public transport services and 2-wheelers and non-motorized modes such as walking and cycling [6].

The aim of this study was to assess the comparative risk associated with exposure to traffic pollution when travelling via different public transport modes i.e. metro, buses, auto rickshaw and trains and private vehicles using questionnaire survey.

MATERIALS AND METHODS

Study area

The study was conducted in New Delhi having the coordinates 28.6139° N, 77.2090° E. The state was divided into 5 zones, namely North Delhi, South Delhi, East Delhi, West Delhi and Central Delhi. One locality was selected from each of these zones based on convenience sampling. The following were the localities selected:

- North Delhi- Pitampura
- South Delhi- Lajpat Nagar
- East Delhi- Karkardoma
- West Delhi- Janakpuri
- Central Delhi- Mandi House

Sampling

Sample: The sample consisted of the commuters using public and private mode of transportation i.e. metros, trains, buses and auto rickshaw and private cars.

Sample size: The sample size was 125. 25 commuters were selected from each category namely bus, metro, train, auto rickshaw and private cars distributed among the identified different zones of Delhi.

Sample selection: The sample was selected using the convenience sampling technique.

Questionnaire survey

The data was collected using structured questionnaire. Further, statistical methods were used to correlate the survey responses and the values monitored using the equipment's.

Method: Localities under the five zones of Delhi were identified. Places well connected to all the modes of transportation and having high footfall were selected based on the convenience as limited resources were available. Seeing the scenario of each locality, the people were asked to fill the questionnaire. In the study, people were identified near the metro stations, bus stands and auto stands. People using private transport were identified in the nearby houses. The people willing to be a part of the study were approached and were asked to fill in a short questionnaire. The sample is equally divided among the five identified localities in the different zones.

RESULTS AND DISCUSSION

Table 1: Socio demography of respondents

	Variables	Frequency (N=125)	Percentage (%)
Gender	Male	62	49.6
	Female	63	50.4
Age	25-35	43	34.4
	35-45	32	25.6
	45-55	35	28
	55-65	15	12
Occupation	Service	44	35.2
	Housewives	17	13.6
	Business	6	4.8
	Students	58	46.4

A questionnaire survey was conducted using sample size of 125 commuters to assess the impact of air pollution on their health. Table 1 show that there was a fair representation of both the genders in the sample. Also the respondents were emblemized from all the age groups i.e. 25-65 years which gives a good representation of the population. The majority of the respondents were students, i.e. 46.4 %, followed by serviceman, housewives and businessman respectively. The majority (66.4%) of the commuters are non-smokers. 6.4% of the commuters were former smokers.

Travel information of commuters

Table 2: Travel information of the commuters

Variables	Frequency (N=125)	Percentage (%)
Distance covered in a day		21.6
10-20 km	27	
20-30 km	43	34.4
30-40 km	42	33.6
more than 40 km	13	10.4
Type of fuel used		
Petrol	27	21.6
Diesel	13	10.4
CNG	29	23.2
No fuel (electric)	50	40
Any other	6	4.8
Frequency of using transportation		86.4
Everyday	108	
3-4 times a day	17	13.6

In this study, equal numbers of respondents were selected from five categories namely- car, metro, auto/cycle, train and bus. Table 2 highlights that the majority of the commuters travel 20-40 km daily. 10.4% of the commuters travel more than 40 km in a day. Table 2 also shows that the majority (40%) of the commuters indicated that the vehicles used by them for transportation run on electricity. 23.4 % of the vehicle were CNG based followed by petrol (21.6%) and diesel (10%). The majority (86.4%) of the respondents were regular users of transportation i.e. they use transportation every day. None of the respondents reported that they use transportation rarely or occasionally.

Duration of exposure to exhaust

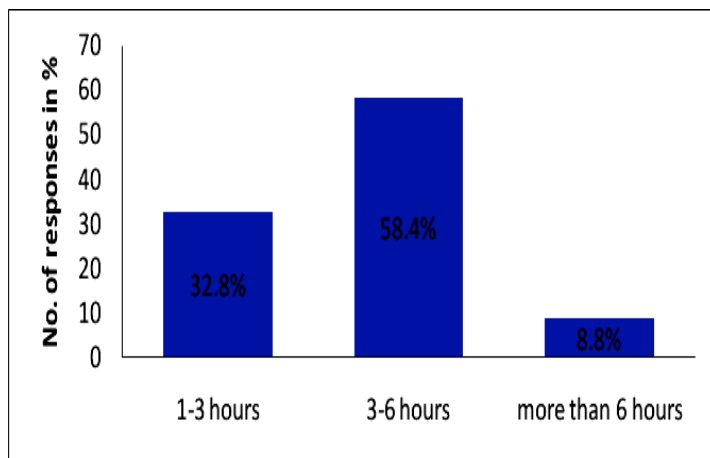


Fig. 1: Duration of commuter exposure to exhaust

Fig. 1 shows that majority (58.4%) of the commuters remain exposed to the exhaust for 3-6 hours in day. 8.8 % of the commuters remain exposed to the exhaust for more than 6 hours in day. Based on the survey, as shown in Fig. 4, Majority (58.4%) of the commuters do experience traffic congestion ‘sometimes’ on the stretch they travel. 30.4 % of the commuters experience traffic congestion ‘everyday’ on the stretch they travel. It was seen that out of the people car and auto rickshaw (N=50) majority of the commuters do not turn off the vehicle on red lights or during traffic jams. Only 28% of the commuters switched off their vehicles on red lights or during traffic jams.

Traffic fumes while travelling

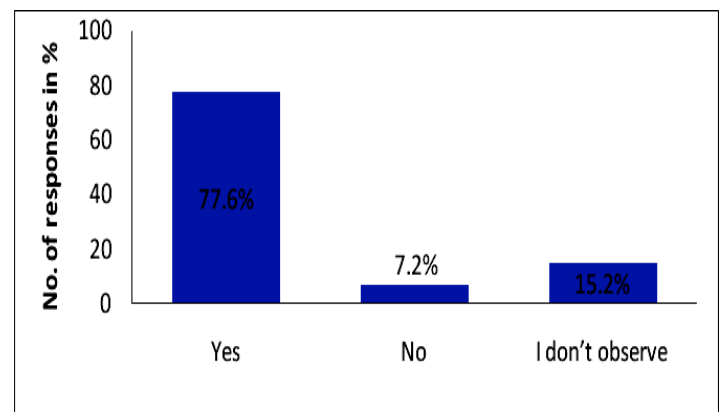


Fig. 2: Responses to exposure to traffic fumes

Based on the survey, Figure 2 shows that majority (77.6%) of the commuters get annoyed by the traffic fumes while travelling. A minuscule numbers of commuter highlighted that they do not get annoyed by the traffic fumes (7.2%) or they do not observe any traffic fumes while travelling (15.2%).

Mode of transportation which has the maximum exposure to fumes

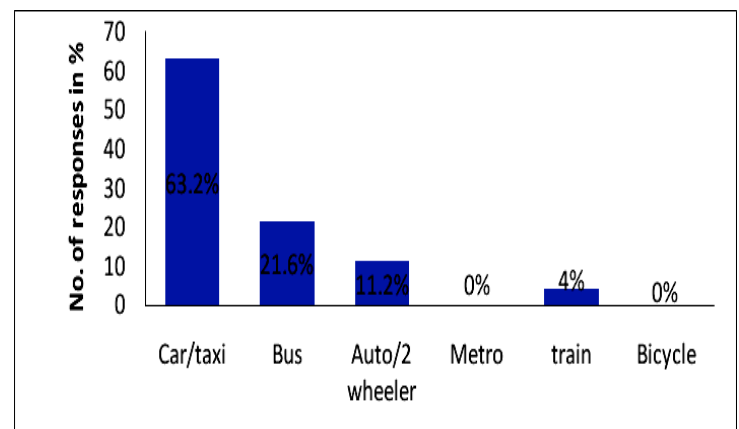


Fig. 3: Mode of transportation and exposure to fumes

Fig. 3 elucidates that majority (63.2 %) of the commuters stated that car/taxi has the maximum exposure to fumes, followed by bus (21.6%), auto/two wheelers (11.2%) and train (4%). None of the commuters stated metro or bicycle having maximum exposure to fumes.

Public transportation as a solution to reduce the air pollution

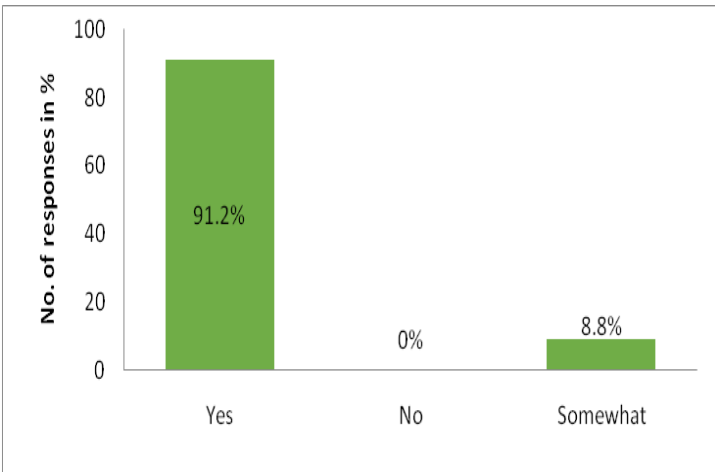


Fig. 4: Perception towards public transportation as a solution to the air pollution

Figure 4 shows that most of the commuters i.e. 91.2 % believed that public transportation/car pool is a solution to reduce the air pollution. This shows that the commuters are aware about the advantages of using public transportation and its usefulness to reduce air pollution.

Better mode of transportation

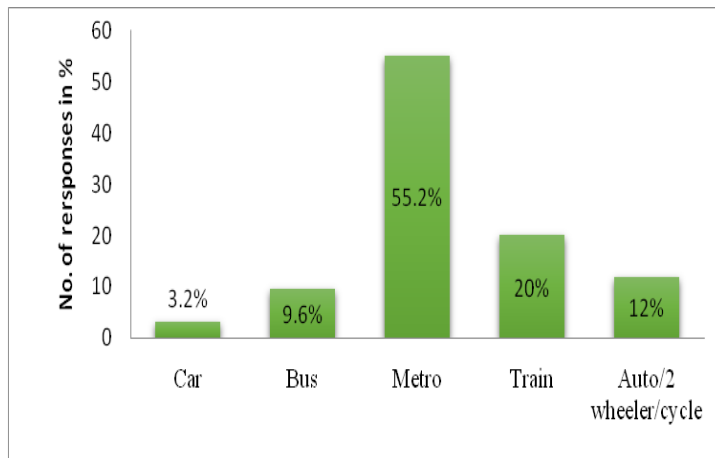


Fig. 5: Perception towards better mode of transportation in view of environmental impact

Fig. 5 clearly shows that more than half of the respondents i.e. 55.2 % stated that metro is the better mode of transportation keeping in view the environmental impact followed by train (20%), auto/two wheeler/cycle (12%), bus (9.6%) and car (3.2%). When asked about the impact of traffic emissions on the health of the commuters, a predominant number of commuters (81.6%) reported that traffic emissions have impacted their health. None of the commuters stated that traffic emissions have not impacted their health. Though a few number of commuters were ambivalent about the impact of traffic emissions on their health.

Health problems caused due to vehicle fumes

Table 3: Perception towards the health problems caused due to the vehicle fumes

Health problems	Quite (%)	often	Sometimes (%)	Never (%)
Eye irritation/Watery eyes	86.4		13.6	0
Nose irritation	77.6		21.6	0.8
Throat irritation	53.6		41.6	4.8
Nasal congestion	89.6		10.4	0
Vomiting/Nausea	32		46.4	21.6
Cough/Sore throat	68		27.2	4.8
Hearing loss	15.2		23.2	61.6
Respiratory problems	64.8		35.2	0
Skin irritation	67.2		23.2	9.6
Sneezing	74.4		25.6	0
Headache	96		4	0
Visibility reduction	12		27.6	60.4
Fatigue/drowsiness	91.2		8.8	0

Table 3 brings out important information related to health problems caused due to vehicular fumes. The majority of the commuters face health problems like headache (96%), fatigue/drowsiness (91.2%), nasal congestion (89.6%), eye irritation (86.4%) nose irritation (77.6%), sneezing (74.4%). Other health problems that are quite often faced by commuters are: skin irritation (67.2%), respiratory problems (64.8%) and throat irritation (53.6%). The following are the major health problems which are sometimes faced by the commuters due to traffic fumes: vomiting (46.4%), throat irritation (41.6%) and respiratory problems (35.2%). The following are the major health problems which are never faced by the commuters due to traffic fumes: hearing loss (61.6%), visibility reduction (60.4%).

Long term health effects of transport-related air pollution

Table 4: Perception towards the long term health effects of transport-related air pollution

Long term health effects	Yes (%)	No (%)	Maybe (%)
Respiratory morbidity	75.2	4.8	20
Cardio vascular morbidity	34.4	8	57.6
Death	13.6	70.4	16
Cancer	76	8	16
Pregnancy outcomes	56	20	24
Male infertility	6.4	71.2	22.4

Table 4 elucidates that the major long term health effects of transport-related air pollution as stated by the commuters: Cancer (76%), Respiratory morbidity (75.2%), Pregnancy outcomes (56%), and Cardio vascular morbidity (34.4%). Major health issues like male infertility and death were not thought of being the long term health effects of transport-related air pollution.

CONCLUSIONS

The majority of the vehicles used by the respondents were CNG based followed by petrol and diesel. Majority of the commuters remain exposed to the exhaust for 3-6 hours in a day. Majority of the respondents were regular users of transportation i.e. they use transportation every day. The majority of the commuters do experience traffic congestion ‘sometimes’ on the stretch they travel. The majority of the commuters stated that car/taxi have the maximum exposure to fumes, followed by bus, auto/two wheelers and train. Most of the commuters believed that public transportation/car pool is a solution to reduce the air pollution. More than half of the respondents stated that metro is the better mode of transportation keeping in view the environmental impact followed by train, auto/two wheeler/cycle, bus and car. A predominant number of commuters reported that traffic emissions have impacted their health. The majority of the commuters face health problems like headache, fatigue/drowsiness, nasal congestion, eye irritation, nose irritation, sneezing. Other health problems that are quite often faced by commuters are skin irritation, respiratory problems and throat irritation. Maximum respondents opined that cancer and respiratory morbidity are the major long term health effects of transport-related air pollution.

REFERENCES

- [1] Central Pollution Control Board (Status of the Vehicular Pollution Control Programme in India), 2010.
- [2] Krzyzanowski M, Dibbert BK, Schneider J. (Health effects of transport-related air pollution), 2005.
- [3] Ojolo SJ, Oke SA, Dinrifo RR, Eboda FY. (A survey on the effects of vehicle emissions on human health in Nigeria). *Journal of Rural and Tropical Public Health*, 2007; 6: 16-23.
- [4] Wargo L, Alderman N. (The Harmful Effects of Vehicle Exhaust: A Case for Policy Change), 2006.
- [5] Zuurbier M. (Minute ventilation of cyclists, car and bus passengers: an experimental study). *Environmental Health*, 2011; 8 (2): 48-52.
- [6] The Automotive Research Association of India (Emission Factor development for Indian Vehicle), 2007.