International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182 ISSN Print: 2349-5979
Received: 08-01-2023, Accepted: 24-01-2023, Published: 10-02-2023
Volume 10, Issue 2, 2023, Page No. 11-13

Sources of air pollution and it's control in Dhaka city: A residents' perception analysis

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Abstract
To assess the public's understanding of the major sources of air pollution in Dhaka city, a face–to–face questionnaire survey was conducted in different location of Dhaka city in 2021. A total of 2500 man and women between 20-60 years of age participated in this survey. This study reveals that people who were under 40 years old with higher education level and international travel experience, had higher level of awareness of air pollution. According to this study the top three sources of air pollution were road constructions (30%), brick kilns and industries (29%) and vehicles (15%). The findings from this study suggest the need for the government to improve the awareness of the people regarding the sources of air pollution, especially to residents of urban areas with lower level of education to control the air pollution in Dhaka city more effectively and efficiently.

Keywords: air pollution, resident perception, source, Dhaka

Introduction
Air pollution shortens people's lives by an average of five years in Bangladesh, India, Nepal, and Pakistan [1]. The population of these countries accounts for around a quarter of the global number. In these four countries, pollution is now 44 percent more than it was 20 years ago [1] and air pollution can shave up to eight years off a person's life expectancy in some regions. Being a developing country, air pollution became one of the major concerns in the development process [1]. According to recent reports Dhaka's air ranks 4th worst in AQI [2]. Different sources are responsible for the air pollution in Dhaka city. Substantial quantity of several pollutants emitting through construction activity following expanded development process get mixed with air and cause air pollution [3]. Not only construction sites but also brick kilns and manufacturing industries, mining, and coal- and gas-fired power stations are also responsible for polluting the atmosphere [4]. The vehicle also causes air pollution. The transport sector burns most of the world's petroleum and is one of the largest sources of global greenhouse gas emissions. Besides all of these other sources are transboundary air pollution, household activities, waste burning etc. Since air pollution effects mass people and surrounding environment, in this research, people perception on air pollution in Dhaka city has been observed. Their perception about the main sources of air pollution and lastly some suggestions to reduce the air pollution has been taken from the respondents. And ultimately understand the people's perception regarding the air pollution issues of Dhaka city.

Methodology
Samples and participants
This study sampled randomly from residents of different locations of Dhaka city who were between the ages of 20 to 60 years old. The average age of respondents was 37 years old, and most were males (72%).

Survey method
Data were collected through face–to–face interviews following questionnaire survey. The questionnaire asked about demographic characteristics, and participants' perceptions towards air pollution. Demographic characteristics included age, gender, educational level, annual household income, travel experience. Questions were asked to find out the peoples' perception on the sources of air pollution and need for government policies to protect the environment. Sampling was done in different location of Dhaka city based on pollution category provided by previously published literature.

Quality control
Survey was collected by graduate and undergraduate students from the various universities, all of whom were thoroughly trained in the instrument and interview protocols. The principal investigators were readily available to answer any questions that would arise during data collection. The survey was pretested among members of the target group in order to ensure face validity and comprehension of the survey.

Statistical analysis
I used the statistical software SPSS 26.0 for the analyses. Descriptive statistics was used to summarize the characteristics of the participants. Chi–square test of independence was conducted to examine whether participants' age, gender, household income, household registration, and education level were associated with participant's beliefs about the sources of air pollution. A p–value of less than 0.05 was considered to be statistically significant.

Results
Characteristics of the participants

Table 1: Demographic Characteristics of Respondents

	Frequency	Percentage
Gender		
Male	1800	72
Female	700	28
Place of Residence		
Countryside	352	14.08
City	2148	85.92
Educational Level		
≤Junior high school	89	3.56
High School	311	12.44
College	869	34.76
University	1231	49.24
Average annual household income (BDT)		
≤20000	94	3.76
21000-30000	430	17.2
31000-40000	1189	47.56
Above 40000	787	31.48
Age		
20-40	1610	
Above 40	890	
Travel Experience		
Nationally	1601	64.04
Internationally	899	35.96

Residents' perception analysis has been done for knowing the sources of air pollution and its control in Dhaka City. About 2500 respondents' perception has been analyzed throughout the Research. From

2500 peoples male respondents' number was 1800 and female respondents were 700. Therefore, the number of male participators was higher (72%) than female participators (28%). Most of the respondents was from city which was 85.92% and the rest 14.08 percent was from countryside. The education level has been found as following; respondents below or passed junior high school was 3.56%, high school was 12.44%, college was 34.76% and university was 49.24% of the total surveyed people. From the respondents 3.76% people had average annual household income less than 20,000 BDT, 17.2% peoples' earing was from 21,000 to 30,000 BDT, 47.56% peoples' income was in the range of 31,000 to 40,000 BDT and 31.48% people earn above 40,000 BDT. From those 2500 respondents 1610 persons age was from 20 to 40 and 890 persons age was found above 890. Besides, 899 respondents had travel experience in abroad while 1601 respondents travelled within country. *Perception on air quality*

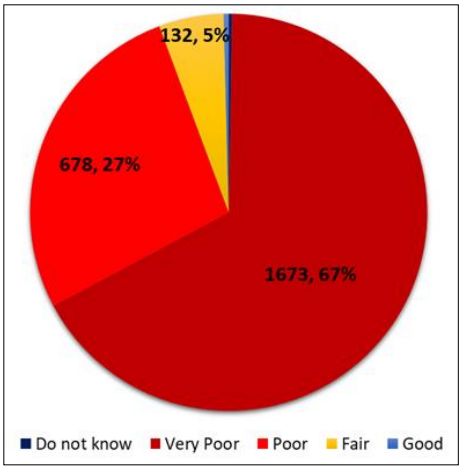

Fig 1: Perception of air quality in Dhaka city

Twenty thousand five hundred (2500) residents' perception has been considered for investigating the quality of air in Dhaka City. From this survey, 1673 people with the proportion of 67% opined that the air quality of Dhaka city is very poor. Besides, 678 people with percentage of 27% said that Dhaka's air quality is poor and only 5% (132 people) uttered that Dhaka have fair air quality.

Perceptions on sources of air pollution

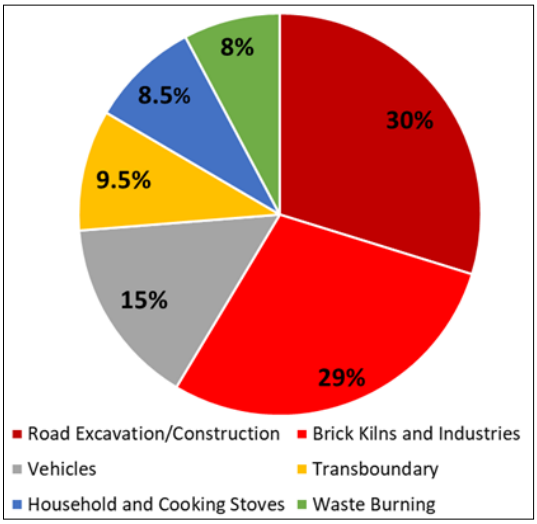

Fig 2: Perception of air pollution sources in Dhaka City

Regarding the sources of air pollution, 30% people agreed that the main source of air pollution was road excavation while 29% believed that main source is brick kilns. Fifteen percent (15%) people blamed vehicles for polluting the air and almost 10% people voted for transboundary pollution as a source of air pollution of Dhaka city. Besides, household sources and waste burning were selected by respectively 8.5% and 8% of the total respondents as main sources of air pollution in Dhaka city.

Table 2: Demographics vs. participants' beliefs about the sources of air pollution (P-Value in 95% Confidence level)

	Construction	Brick Kilns and Industries	Vehicles	Transboundary	Household	Waste Burning
Gender	.230	.199	.290	.190	.239	.290
Place of Residence	.001	.003	.001	.001	.01	.001
Educational Level Average annual	.003	.001	.003	.001	.002	.001
household income (BDT)	.123	.199	.180	.99	.165	.120
Age	.09	.05	.001	.05	.05	.05
Travel Experience	.04	.001	.04	.04	.112	.04

In this study the demographics vs. participants' beliefs about the sources of air pollution (P-Value in 95% Confidence level) has been observed. Based on the place of residence and educational level, the perception about different sources were significant to all categories. Bedsides, age category and who had travel experience, their perception were also significant in almost all categories except construction and household, respectively. Figure 3 shows the perception about suggestions to combat air pollution from Dhaka city. Most of the respondents suggested to introduce public transport followed by construction guidelines. A number of suggestions to reduce had been derived out from this study. Most of the people with a number of 1910 people suggested for introduce public transport. With that 1670 people also suggested that maintaining construction guidelines would help to reduce pollution at a greater extent. The third suggestion was to shut down of the brick kilns; said by 1342 people while 955 and 911 people also jointly proposed for shutting down of the coal plant and increasing budget to control air pollution. The other options were increasing public awareness voted by 894 people, controlling waste burning selected by 871 and introducing clean air act said by 567 people. Besides above mentioned suggestions 563 people also opted for maintaining household cooking standard to reduce the air pollution.

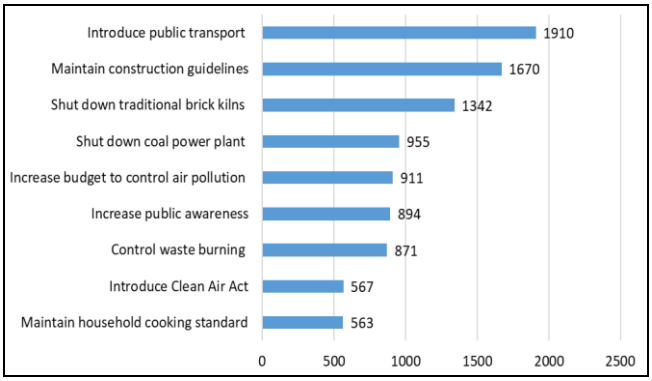

Fig 3: Participants' suggestion to reduce air pollution in Dhaka city

Conclusion

Air pollution is now a major concern for Dhaka city. A survey had been conducted for investigating the public's understanding of the major sources of air pollution in Dhaka city and factors influencing their perceptions of Dhaka's air quality status. In this study the sample size was 2500 between the age of 20-60 years and it has been found that people under 40 years old of age with higher education level and international travel experience, had higher level of awareness of air pollution. Most of the people (67%) opined that the air quality of Dhaka city was very poor and regarding the sources of air pollution respondents found out construction (30%), brick kilns and other industries (29%) and vehicles (15%) as top three (03) polluting sources. They suggested that introduction of more public transport could help to reduce the air pollution. Besides, a large number of people also suggested for maintaining construction guidelines to lessen air pollution in Dhaka.

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