International Journal of Humanities and Social Science Research
www.socialsciencejournal.in
ISSN: 2455-2070
Received: 16-04-2022, Accepted: 01-05-2022, Published: 17-05-2022
Volume 8, Issue 3, 2022, Page No. 39-42

Perception of air quality surrounding the slum areas with special reference to Agra city: A geographical analysis

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Abstract
Outdoor and indoor air pollution is among the leading global risks for mortality and responsible for increasing risk for chronic diseases especially asthma in Agra. Community perceptions on exposure to outdoor as well as indoor pollution are critical in determining people's response and acceptance of related policies. Therefore, understanding people' perception is critical in forming the design of appropriate intervention measures. The aim of this paper was to establish levels and associations between perceived pollution and health risk perception especially related to asthma among slum residents. A cross-sectional study of 400 individuals was conducted in two registered slums and two non -registered slums across the North, South, East and West zones of Agra city. The perceived air pollution level and related health risks in the study community were low among the residents indicating the need for promoting awareness on air pollution sources and related health risks.

Keywords: perceived air quality, air pollution, perceived health risk, urban slum

Introduction
Moreover, people with low socioeconomic status such as those living in urban slums are more likely to live closer to roadways and polluting industrial facilities thus exposing them to greater levels of pollutants. They also have less access to health care thereby exacerbating any adverse health outcomes. Sources of outdoor air pollution in urban slums are mainly dust, burning of trash, vehicle and industrial emissions. Due to poor ventilation in these settings, outdoor air pollutants infiltrate into households raising levels of indoor air pollution. This combination of indoor and outdoor air pollution increases the burden of air pollution in deprived urban areas. In developing countries, indoor air pollutants are mainly released during the combustion of solid fuels used for cooking and heating. Households using such fuels are generally located in poor communities in rural areas and urban slums with poorly ventilated houses. Use of fuel like wood and kerosene also increases indoor air pollution. Air pollution is among the leading global risks for mortality and responsible for increasing risk for chronic diseases especially asthma in Agra. Community perceptions on exposure to outdoor as well as indoor pollution are critical in determining people's response and acceptance of related policies. Therefore, understanding people' perception is critical in informing the design of appropriate intervention measures. Community and individual level interventions for reducing exposure to air pollution are important means for improving public health and citizen participation. However, the effectiveness of these programs depends mainly on peoples' perceptions of exposure and risk for individual acceptance and action. Studies on risk perception have revealed it to be multi-dimensional with demographic, cultural and political characteristics playing a role in observed differences in perception.

Study Area
Agra is a million plus city as per the census 2011. City population reached to 15.7 lakh as per census 2011.Census 2011 envisages that about 56 percent of urban population of Agra city is slum dwellers. This is very pathetic situation where half population is urban poor. Slum population of Agra is 8.85 lakh as per census 2011. It comprises about 56 percent of total urban population of Agra. The average household size in slums is 6.8. The household size is higher to city average household size that is 6.4 during census 2011. Number of slums reported in Agra is varying across different agencies. As per DUDA (District Urban Development Authority), total slums found in Agra is 417 There are six areas where these slums are concentrated in Agra namely Lohamandi, Rakabganj, Bundu Katra-Gwalior and Deori Road, Tajganj, Shahganj and Trans-Yamuna area. In addition, there are quite a numbers of slums, which are scattered. Most slums in the city are characterized by poor sanitation, drainage, and water facilities. Housing structure is pucca (concrete) in most slums of Agra, unlike other cities. Access to basic services in each slum is a major determinant of health vulnerability. A large majority of these slums are situated along nalas (drains), railway lines or located near the main road having heavy vehicular movement as well as dust. Dust particles often referred as Particulate Matter (PM). These PM has various effects on human health. Respiratory and heart problems caused by inhalation of small particles. Coarse particles called PM10 can irritate eyes, nose and throat. Dust from roads, farms, riverbeds, construction sites and mines are types of PM10.

Methodology

The calculated size was 400 hundred households across the four zones of Agra city from both registered and non -registered slums. Each participant was clearly explained the purpose of the study and informed consent was taken. They were interviewed using pretested and predesigned questionnaire from house to house visits to generate specific responses from respondents about indoor and outdoor air pollution level and perceived associated health risk. Data about causes of outdoor and indoor air pollution was also collected to understand the pattern of air pollution in slum areas. The questions included options of yes/no. The data was entered and analyzed using SPSS.

Results and Discussion

Table 1 shows that Almost 80 percent of total surveyed slum respondents accepted that they are living in poor air quality areas. All surveyed slum dwellers of Bijlighar slum reported that surrounding air quality of their slum is very poor. About 60 percent of total respondents of Nunhai slum that reported that the air quality of surrounding of the slum is average.

Table 1: Perception of Air quality surrounding the slum area

Slum Name	Poor	Average	Good
Bijli Ghar (Central)	100.0	0.0	0.0
Nainara Jaat (South)	90.0	10.0	0.0
Nunhai (East)	40.0	59.0	1.0
R G Nagar (West)	95.0	5.0	0.0
Total	81.3	18.5	0.2

Although slum appeared to have poor air quality during the survey, as slum is located near the main road having heavy vehicular movement as well as dust. None of the respondents from the surveyed areas reported that air quality of surrounding the slum is good. It clearly appears that respondents are highly aware about the air quality of slum. It is also a fact that still slum are facing poor air quality due to their proximity to sources of air pollution.

Table 2: Causes of air pollution of the surrounding area of slum

Slum Name	Dust	Industrial/ Vehicle smoke	Garbage/sewer/ drains foul smell	Smoke from Garbage burning
Bijli Ghar (Central)	47.0	18.0	29.0	6.0
Nainara Jaat (South)	1.0	3.0	87.0	9.0
Nunhai (East)	49.0	45.0	1.0	5.0
R G Nagar (West)	0.0	1.0	96.0	3.0
Total	24.2	16.9	53.2	5.7

Data about causes of air pollution also collected to understand the pattern of air pollution in slum areas. Major reason of poor air quality is foul smell of garbage, sewer and drains. The foul smelly air mainly contains methane, hydrogen supplied, ammonia and many more gases. Some gases are toxic and some are non -toxic in nature. About 96 percent of total respondents of Rajiv Gandhi Nagar reported prime cause of poor air quality in their slum is foul smell of drain. Nainara jaat respondents also reported the same thing, although figure was 87 percent. Dust is second main important reason of poor air quality of slum. Dust particles often referred as Particulate Matter (PM). These PM has various effects on human health. Respiratory and heart problems caused by inhalation of small particles. Coarse particles called PM_{10}can irritate eyes, nose and throat. Dust from roads, farms, riverbeds, construction sites and mines are types of PM_{10}. About half of the total respondents from Nunhai and Bijlighar slums reported that reason of poor quality in their slum is dust. Industrial and Vehicular smoke is major issue in Nunhai slum, where about 45 percent of total respondents registered that smoke is second most reason of poor air quality of slum. Garbage smoke or burning smoke is not much reported cause of poor air pollution by slum dwellers. Less than 10 percent of total respondents recorded that smoke from burning garbage is major cause of poor air quality in slum.

Table 3: Perception of Air quality inside the household

Slum Name	Poor	Average	Good
Bijli Ghar (Central)	100.0	0.0	0.0
Nainara Jaat (South)	93.0	6.0	1.0
Nunhai (East)	38.0	59.0	3.0
R G Nagar (West)	92.0	6.0	2.0
Total	80.8	17.8	1.4

Household air quality is equally important as surrounding air quality of slum. Poor air quality inside the household has several ill impacts on health of dwellers. Children, elderly and women are highly vulnerable from poor air. Perception towards it is recorded through survey. More than 90 percent of total respondents of all the surveyed slums reported that air quality of household is poor except Nunhai slum, where only 38 percent respondents considered air quality of their house is poor. 60 percent of total respondents of Nunhai reported that air quality of their houses is average. Less than 2 percent of total residents from all surveyed slums considered air quality of their houses are good category. It is commonly perceived by slum dwellers that quality of air in the household is poor.

Table 4: Causes of air pollution inside households of slum

Slum Name	Dust	Smoke from Chulha	Smoke from Bidi/ Hukka/ Cigarette/	Foul smell Garbage/Drain/ Sewer
Bijli Ghar (Central)	21.0	28.0	22.0	29.0
Nainara Jaat (South)	1.0	0.0	1.0	98.0
Nunhai (East)	44.4	29.3	7.1	19.2
R G Nagar (West)	1.0	0.0	0.0	99.0
Total	16.8	14.3	7.5	61.4

Data about causes of air pollution inside the household is also collected to understand the pattern of air pollution within household. Major reason of poor air quality is foul smell of garbage, sewer and drains. About 99 percent of total respondents of Rajiv Gandhi Nagar reported prime cause of poor air quality in their household is foul smell of drain. Nainara jaat respondents also reported the same thing, although figure was 98 percent.
Dust is main important reason of poor air quality of households in Nunhai slum. About one third of the total respondents from Nunhai and Bijlighar slums reported that reason of poor quality inside household is smoke from chulha. As slum dwellers are still using cow dung cake, woods and organic material as a fuel for cooking. Smoke from Bidi, Hukka,Cigarette etc. is major air pollutant inside the households in Bijlighar slum, where about one fifth of total respondents registered that smoke from Bidi,Hukka,Cigarette etc. is third most important reason of poor air quality inside households. Dust is very less important reason of poor air quality inside the households in Rajiv Gandhi Nagar and Nainara Jatt.

Table 5: Does poor air quality cause Asthma?

Slum Name	Yes	No
Bijli Ghar (Central)	4.0	96.0
Nainara Jaat (South)	28.0	72.0
Nunhai (East)	3.0	97.0
R G Nagar (West)	3.0	97.0
Total	9.5	90.5

Poor air quality leads to ill health especially respiratory problems like Asthama, breathing issue, throat irritation etc. Question related to poor air quality and associated morbidity were asked from respondents during the survey. Shocking facts are found after analysis of data. More than 95 percent of total respondents from all surveyed slums answered that poor air quality has no relationship with Asthama. More than one fourth of total respondents from Nainara jaat slum registered that poor air quality causes Asthama. Poor knowledge related to air quality and related health consequences are matter of concern. Slum dwellers do not think that quality of air can affect their respiratory health.

Conclusion and Policy Recommendation

Almost 80 percent of total surveyed slum respondents accepted that they are living in poor air quality areas. None of them reported that air quality of surrounding the slum is good. It clearly appears that respondents are highly aware about the air quality of slum. But they lack awareness about the health implications of indoor air pollution. It is also a fact that slums are facing poor air quality due to their proximity to sources of air pollution. Major reason of poor air quality is foul smell of garbage, sewer and drains. The foul smelly air mainly contains methane, hydrogen supplied, ammonia and many more gases. Some gases are toxic and some are non -toxic in nature. Dust particles often referred as Particulate Matter (PM). These PM has various effects on human health. Respiratory and heart problems caused by inhalation of small particles. Coarse particles called PM10can irritate eyes, nose and throat. Dust from roads, farms, riverbeds, construction sites and mines are types of PM10. It is commonly perceived by slum dwellers that quality of air in the household is poor.
About 96 percent of total respondents of Rajiv Gandhi Nagar reported prime cause of poor air quality in their slum is foul smell of drain. Dust is second main important reason of poor air quality of slum. About half of the total respondents from Nunhai and Bijlighar slums reported that reason of poor quality in their slum is dust. Industrial and Vehicular smoke is major issue in Nunhai slum, where about 45 percent of total respondents registered that smoke is second most reason of poor air quality of slum. Less than 10 percent of total respondents

recorded that smoke from burning garbage is major cause of poor air quality in slum. Smoke from Bidi, Hukka, Cigarette etc. is major air pollutant inside the households in Bijlighar slum, where about one fifth of total respondents registered that smoke from Bidi, Hukka, Cigarette etc. is third most important reason of poor air quality inside households. Dust is not an important reason for poor air quality inside the households in Rajiv Gandhi Nagar and Nainara Jatt.

More than 95 percent of total respondents from all surveyed slums answered that poor air quality has no relationship with Asthma.

Community participation plays a crucial role for the development of slum and improvement of its environment. Self-help group (SHG) and resident welfare association (RWA) should be formed to resolve local issues and create new opportunities for employment and welfare. Slums are not dark spots of cities. They are bright spot, if managed properly. Intervention of Government and local bodies with community participation can change these darkspots into bright spots of the cities. Here it is suggested that at strategic places like the Bijilighar slum, its expansion should be controlled and gradually eliminated as it is situated near the Agra Fort which is a tourists place of international importance. The presence of a slum throws a negative picture on the development and planning of Agra city. Agra city is working hard to get the smart city tag by 2024.

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