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Original Article

Public Awareness and Behavioral Patterns During Smog

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ABSTRACT

Smog is also an alarming signal for health problems in Pakistan especially in the city Lahore. **Objective:** To find out how the general public feels about smog. **Methods:** The study was conducted by surveying Lahore residents who drive. This was a survey-based study which included 100 subjects using any vehicle as a mode of transportation. **Results:** Generally, 2% people used cycle, motorbike 62%, car 13% and public transport 23% but during smog people shifted from bike to public transport and rate of car users were also increased from 13% to 25%. In this survey, 58% of the people came to know about smog through TV channels. Most of the respondents had the symptoms of chest tightness, eye irritation, breathing difficulty. This study revealed that 85% of vehicle users took preventive measures such as kept themselves hydrated (18%), worn mask (58%) and driven less (9%); which kept them away from hospitals during smog. **Conclusions:** It was anticipated that motor bike, car and public transport users had more knowledge about the causes of smog but none of cycle user was aware that sulfur and nitrogen compounds were the cause of smog ($p<0.001$). Thus, Pakistan needs to implement future countermeasures for smog.

INTRODUCTION

One form of air pollution that has a high concentration of particulate matter (PM) in the atmosphere is smog. It results when Secondary pollutants are formed when fuel combustion emissions from automobiles and industries react with sunlight in the atmosphere. Photochemical smog is caused by the combination of primary emissions and pre-formed secondary pollutants [1]. The term "smog" describes the air pollution caused by a combination of smoke and fog. It is used to characterize the diverse range of automotive or industrial origin that spans several nations. There are two recognized types of smog: photochemical smog and sulfurous smog. Sulfurous smog, sometimes referred to as an unhealthy amount of sulfur oxides in the air, commonly known as "London smog," is a byproduct of burning fossil fuels that contain sulfur, such as coal. "Los Angeles smog," often referred to as photochemical smog, is primarily seen in urban areas with high car usage. Nitrogen oxides and hydrocarbon vapors released by cars and other vehicles cause this kind of smog. These pollutants then react photochemically in the lower atmosphere. Smog has reached to alarming level, but it can be reduced by implementing and following government polices related to improve the environmental condition [2]. A thick layer of smog envelops urban areas in the winter, when air density and temperature combine to produce a hazy cloud of smoke and fog; this decreases visibility and causes a host of illnesses [3]. South Asia's most urbanized country is Pakistan, where Lahore stood at

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32nd among most populous cities of the world and 2nd largest city in the country growing at a rate of 4% annually as well as regarded as the most polluted city of the country. Previous studies revealed that urban cities are often overwhelmed by smog in the world due to the excessive rise in automobiles, deforestation, expeditious urbanization, and unabated growth of industries, where Lahore cannot be ignored [4]. Smog is a warning indication of the fast escalation of many deadly health conditions, such as asthma, allergies, infections of the eyes and respiratory tract, and diseases of the heart that cause early death [5]. Previous research in Lahore found that systolic and diastolic blood pressure were significantly higher in school-aged children who were exposed to high levels of air pollution [6]. In addition to endangering life on Earth, smog has a negative impact on flora and fauna. Pollutants at ground level in smog not only stunt plant growth but also harm food crops including cotton, rice, tomatoes, and wheat [7]. To monitor the quality of air, In Pakistan both on federal and provincial levels the Environmental Protection Agencies (EPA) are present. The ambient levels of PM2.5 and PM10, which are highly concerning, are 10 µg/m3 and 20 µg/m3, respectively, according to the World Health Organization (WHO) recommendations. When it came to ambient particle matter (PM2.5 and PM10), the Pakistani federal EPA turned to the National Air Quality Standards in 2010. These standards set suggested mean levels that were higher than the ones set by the World Health Organization (WHO). Reports of air pollution in Lahore, Pakistan, continue to exceed the limits set by the World Health Organization and the National Ambient Air Quality Standards (NAQS). It is due to the fact that only around 1% of the industries in our countries report their emissions, excessive rise in automobiles and deforestation [8]. Although, research on public opinion regarding environmental events have been recently accelerated. In case of dangerous environmental issue such as smog, the public awareness is mandatory, because the consequences may be more dreadful if people take irrational measures due to a lack of relevant knowledge .

The goal of this study was to investigate the public perception about smog by conducting a survey of residents living in Lahore city.

METHODS

A cross-sectional study was conducted in the low-vision clinic at Hayatabad Medical Complex in Peshawar. The study duration was from June 2019 to December 2019. The study aims to assess the level of satisfaction of people with low vision with the provision of low-vision services. Moreover, to compare the satisfaction level of people with low vision concerning the degree of vision impairment, the study was approved by the ethics committee of AS&RB Khyber Medical University Peshawar and the Pakistan Institute of Community Ophthalmology, ensuring adherence to societal norms and confidentiality of participant information. The IRB No. was168/HEC/B&PSC/19. All low-vision adults diagnosed and their guardians, aged 18 and younger, who gave consent, attended the clinic for their second visit and onwards were included in the study. Patients too ill to participate in an interview or did not want to be interviewed were excluded from the study. According to OPD records patients attending LV clinic was averaging 5 per day, which makes a total of 125 per month. Average 2nd visit patients were almost half of 125. Thus, the sample size for the study was 125 individuals with Low vision for 2 months data collection. An interviewer-administered, pretested, and validated questionnaire (PSQ-18), was used to collect data from patients. Non-probability convenient Sampling technique was used. Likert's five-point rating scale was used for measuring satisfaction with different components of LV services. Responses were gathered into one of five categories. Points were awarded for each response. Those marking 'Highly satisfied' about the services were given 4 points; respondents marking 'Satisfied' were given 3 points; those marking 'uncertain/not applicable' were given 2 points; and those who were 'Highly Dissatisfied' from services were given 1 point; respondents marking 'Highly Dissatisfied' were given zero points. All the responses were then summed up and graded. Those respondents with a score of 81–100 was considered fully or highly satisfied; respondents with a score of 61–80 was grouped as partly satisfied; moderately satisfied were those respondents with a score of 41–60. Those with a score of 21–40 was labeled as “not satisfied." Finally, highly dissatisfied respondents were those with a score of less than 20 points [5]. Data from questionnaires were pre-coded and entered into SPSS (Statistical Package for Social Sciences version 20 software) for analysis.

RESULTS

85% people did not enroll in hospital due to smog. Among them 58% wore mask, 18% kept them hydrated and 9% avoided to drive. 13% people were encountered with hospital and among them 8% wore mask, 3% kept themselves hydrated and 2% drove less. 85% people did not enroll in hospital due to smog. Among them 58% wore mask, 18% kept them hydrated and 9% avoided to drive. 13% people were encountered with hospital and among them 8% wore mask, 3% kept themselves hydrated and 2% drove less (Figure 1).

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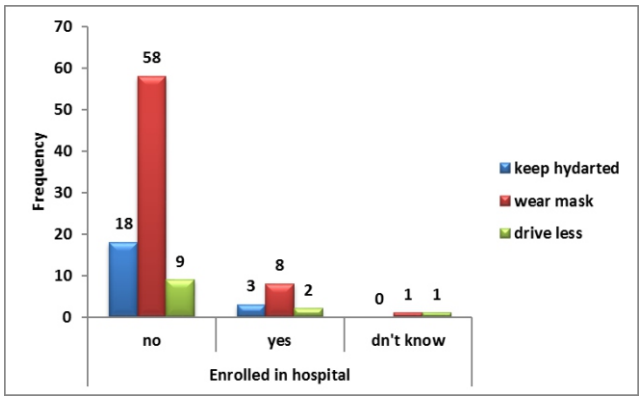

Figure 1: Cross-tabulation of preventive measure taken and enrolled in hospital

People's perceptions of the severity of the smog pollution in Lahore were primarily dependent on their subjective opinions and judgments. Furthermore, since logical reasoning or extrapolation was not necessary throughout the experiment, people in various places may be more or less aware of this issue. Opinion of 50% people had shown that quality of atmosphere was better, 22% people said that it was worse while 28% gave their idea that it was same as before. According to 41% people in this study, environmental condition was better due to the environmental policies implemented by the government. 6% people had given their opinion that environment was getting better but this was not due to the environmental policies. While 3% people had no idea about the environmental policies. 22% people said that the environmental condition was worse. 17% gave their idea that environmental policies are implemented by the government but there was no as such effect on the atmosphere yet that's why the condition is still worse. In view of 5% people, environmental condition is worse and there is no effect of environmental policies implemented by the government. 20% people had given their idea that satisfactory policies were being implemented but the condition was same as before (Figure 2).

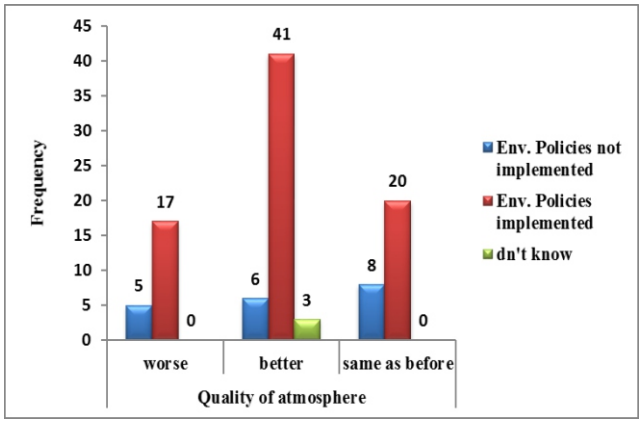

Figure 2: Implementation of environmental policies and quality of atmosphere

Pie chart in figure 3 had shown that in idea of 58% people, television was a major source through which they become aware about smog. According to 15% people, newspaper was the source of information about smog. While 6% and 3% people become aware by family and friends respectively. While 18% people were become aware through some other sources.

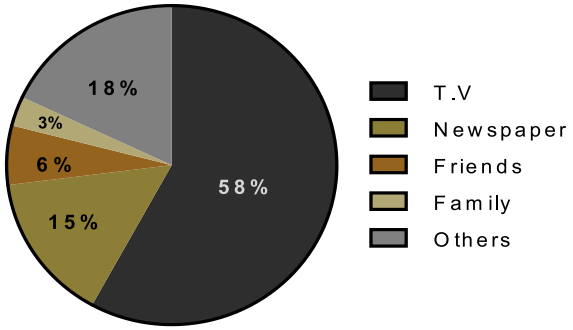

Figure 3: The ways for respondents to access smog information

In the present study to analyze the awareness about smog, population was categorized on basis of mode of transportation. Generally, 2% people used cycle, motorbike 62%, car 13% and public transport 23% as shown in figure4 (a). But during smog people switched to public transport and used 34% motorbike, 4% cycle, 25% car, 34% public transport and 3% were those individuals who used none of all above vehicles as shown in figure 4 (b). Mostly people shifted from bike to public transport and rate of car users were also increased from 13% to 25%

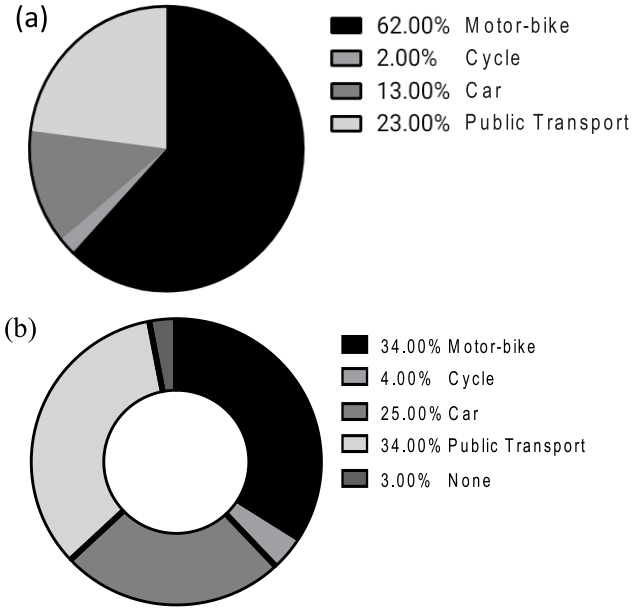

Figure 4: Percentage of mode of transportation. (a) Without smog (b) During smog

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Motor bikers, cycle, car and public transport users had all above problems, but the rate of breathing and other problems was high in motor bikers as shown in figure 5.

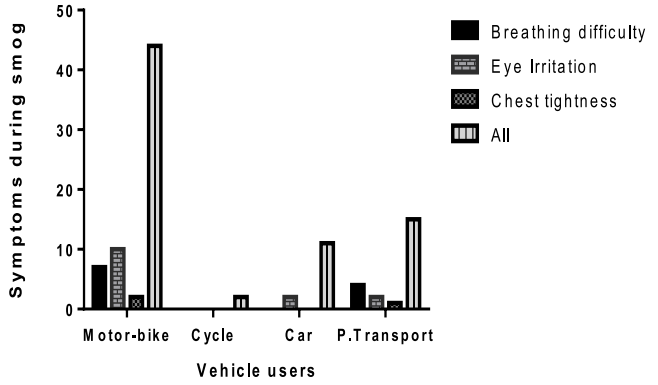

Figure 5: Appearance of symptoms among the vehicle users

According to the survey's findings, the majority of participants were aware that haze was mostly caused by air pollution. In this evaluation it was anticipated that motor bike, car and public transport users had more knowledge about the causes of smog. But none of cycle user was aware that sulfur and nitrogen compounds were the cause of smog.

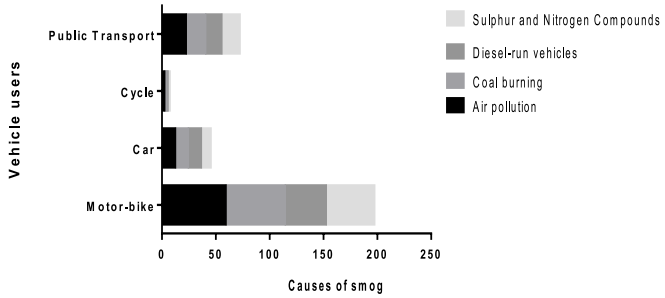

Figure 6: Recognition regarding the main cause of smog

DISCUSSION

A survey-based study was conducted in Lahore to investigate the awareness of smog pollution among the vehicle using population of Pakistan. According to our survey, most of the respondents considered air pollution to be the major cause of smog followed by coal burning energy projects, diesel running vehicles and lastly sulfur, and nitrogenous compound. Camposeco-Negrete in 2013 also reported that meteorological conditions, human activities, industrial gas emission, vehicle emission, and coal fire plants emission are the primary cause of heavy smog [10]. Another study indicated thermal power to be the main contributor of air pollution [11]. In this survey, 58% of the people came to know about smog through TV channels. A study by Yang *et al.*, in 2017 concluded that main stream media (TV, newspapers) are the main source for dissemination of information related to smog [12]. The preferred mode of transportation by participants during normal weather conditions and smog was also observed. As shown in two comparative pie charts, about 62% of the people who used motorbikes during normal weather conditions switched to public transport during smog and the percentage of motorbike users reduced to 34%. In a similar study, most of the respondents chose public transportation during smog. (77.67%) [11]. As per Anderson *et al.*, particulate matter air pollution is the thirteenth main cause of death according to the World Health Organization, and it is responsible for almost 800,000 annual premature deaths [13]. In the present survey, most of the respondents had the symptoms of chest tightness, eye irritation, breathing difficulty. Sixty percent of those who participated in the survey, they took precautions and continue to do so while haze is present. Fewer than 20% of people who participated in the 2015 study by Laumbach *et al.*, altered their eating habits to deal with extreme pollution [14]. Another study by Martinez-Gonzaled *et al.*, suggested a change in the diet to protect their health against air pollution [15]. Improvement in the quality of atmosphere due to the implementation of government policies was suggested by 41 study subjects. Contrarily, 17 participants opined that the quality of atmosphere worsened. Although government policies are implemented but are not followed by people properly. This study revealed that 85 people took preventive measures which kept them away from hospitals during smog. Despite taking preventive measures, 13 people were taken to the hospital. The success of Japan in alleviating smog can be attributed to efficient, safe and extensive public transport networks which helped to reduce city traffic congestion and the vehicle exhaust. Similar strategy should be employed and reinforced in Pakistan to save the citizens from the menace of smog ethically [16]. Increasing car parking tickets and decreasing fares of public transport will allow people to use public transport for their commute [17]. Another strategy to minimize dust and other pollution is to restrict the burning of household trash in the cities, construction sites, and workplaces [16]. Developed countries have constructed smog towers which not only consume smog filled air at nano level but also convert carbon from smog particles into diamond. Pakistan needs to implement such countermeasures for smog [18]. During the months of October through December, coal-fired brick kilns would be closed per section 144, which also prohibits burning of agricultural leftovers and refuse [19]. There are also restrictions on Narcotics buying. After the implementation of Prime Minister 10 billion trees project, reduction in level of smog this year, has been observed [20].

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CONCLUSIONS

The study sums up that vehicle users who take preventive measure like wearing masks during smog are at lesser risk of getting affected from worse effects of smog. Number of serious ailments resulting from smog can be decreased by taking such preventive measures. Switching ourselves to public transport from personal ones can make a big difference in improving quality of atmosphere as smog results from fuel used in vehicles. The implication of environmental policies set by government and public awareness of smog and similar issues through TV channels and print media plays a crucial role in overcoming such environmental issues. This study emphasized on the probable causes of smog.

Authors Contribution

Conceptualization: NH, BNK
Methodology: NH, BNK, RMA
Formal analysis: NH, BNK, AB, RMA
Writing-review and editing: NH, BNK, MTM, EAA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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