

## **Influential Factors of Air Pollution Awareness in Isfahan, Iran**

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**ABSTRACT:** The main objectives of the present study are to both evaluate the level of awareness about air pollution and examine the determinants, likely to affect this awareness. As a result, it discusses influential factors on air pollution awareness, presenting findings from a case study, conducted in the city of Isfahan, Iran, wherein 400 individuals have been selected via proportional random sampling and the data has been collected by means of a questionnaire, provided by the authors, the validity of which has been confirmed by a panel of experts. As for the assessment of the questionnaire's reliability, this study has used Cronbach's alpha to find out that it has been beyond 0.7 for all variables. The data have been analyzed, using descriptive and inferential statistics, such as the extent of mean, standard deviation, the coefficient of variation, correlation analysis, and regression analysis. Results from the latter show that level of education, level of using information sources, membership, motivation, and participation could explain 50% of the variations in the level of awareness concerning air pollution.

**Keywords:** Environmental awareness; air pollution; environmental participation; influence factors

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### **INTRODUCTION**

Today, the world faces various environmental problems like climate change, ozone depletion, and global warming, many of which come from an irresponsible behavior toward the environment that is heavily influenced by general attitude (Majumder, 2017). Worldwide, one of the major environmental matters endangering the health of living organisms is air pollution. Solids, liquids, or gases that enter the atmosphere due to human activities or natural resources progressively shift down

and get centralized in the breathing zone, harming humans, animals, and plants' health (Dimitriou & Christidou, 2007; Tamjidi et al., 2018). According to World Health Organization (WHO), as much as 11% of the mortalities around the world were caused by air pollution in 2012 (WHO, 2016). Therefore, many cities around the world face this serious problem. With a population of more than 1.7 million and an area of 493.8 km<sup>2</sup>, Isfahan is one of the biggest megacities in Iran, which has become one of the most polluted areas due to a large number of vehicles and major industries working in it (Jafari et al., 2017).

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Today, as human beings are considered the main culprit for air pollution, more attention is being paid to social sciences (Yazdanparast et al., 2013). The main central point in this issue is to put an emphasis on the fact that current quality, including future quality of the environment, depends on environmental awareness as well as eco-friendly attitudes and behaviors (La Trobe & Cott, 2000; Lahiri, 2011; Aminrad et al., 2013; Segarra-ona et al., 2013).

Awareness is distinguished as being “awake, alert, informed, etc.” (Newhouse, 1990). Environmental awareness refers to the existence of knowledge about the natural environment a person or a society possesses. It also appears as the ability to detect phenomena, their dependence on each other, and their reason or potential effects, not to mention certain environmental actions. It is indeed the ability to understand both the governing nature of mechanisms and the limitations of their usage as well as the limitations and abilities to identify environmental problems (Piekarskil et al., 2016). Nonetheless, the source literature still could not define this term with only one globally and generally granted definition (Dakcko, 2010). These constituents have been measured, using respective methods by social scientists. Several studies have shown that awareness and attitude are connected to each other and that the latter is linked to the behavior (Aminrad et al., 2013; Cokcaliskan & Celik, 2017; Bhartiya, 2017; Singh, 2017).

Environmental awareness and values that persuade a particular action or commitment are not only established but also projected environmental behavior. The fact that poor environmental behavior can decline environmental quality has attracted the attention of researchers and policymakers (Meia et al., 2016). However, some studies (Kollmus & Agyemian, 2002; Steg et al., 2014) have found neither a direct nor a strong relation between awareness and pro-environmental behavior. In the field of environmental management, awareness is

well known as the early phase of learning process of eco-friendly behaviors (Kamaruddin et al., 2016). In fact, many processes overlap one another to make human behaviors, hence, an environmental-friendly behavior is impressed by internal and external factors like environmental awareness as an external factor (Sharma, 2017).

Since environmental awareness can significantly affect the environmental friendly behavior and environment quality, it is necessary to identify air quality awareness and its predictive and impressive factors. It is said that processing different inputs leads to our awareness of the environment, surrounding us. In other words, acquiring awareness requires obtaining all pieces of information we are exposed to right away (Kamaruddin et al., 2016). Therefore, it can be stated that the differences between individual and socioeconomic characteristics may be the main reason for the variations in awareness among the people. Some previous studies have found that age (Aminrad et al., 2011; Kim et al., 2012), gender (Shobeiri et al., 2007; Hassana et al., 2010; Bhartiya, 2017; Kaur, 2017), and level of education (Aminrad et al., 2011; Kim et al., 2012) belong to individual characteristics of air quality awareness determinants. Besides, socioeconomic characteristics may also play a considerable role in shaping awareness. To some extent, there is little literature on air pollution awareness in such fields as membership, place or physical environment, and income as socioeconomic characteristics. On the other hand, there are many studies that claim having a strong influence of communication channels and sources on awareness. It is said that information sources and communication channels availability have enhanced the awareness concerning air pollution and its effects (Majumder, 2017).

All told, present study aims at evaluation and examination of the level of air pollution awareness. For this purpose, it investigates the determinants of air pollution awareness,

focusing on individual and socioeconomic characteristics. It also examines the significance of the relation between air pollution awareness and participation in environmental protection. Furthermore, it identifies behavioral patterns as well as predictive and impressive factors since they can extremely affect both the quality of environment and the efficiency of environmental strategies and environmental behavior. In other words, identifying changes in the attitudes and behavior of the public enables policymakers to take actions to improve public behavior (Meia et al., 2016). The present study makes an attempt to find out and examine the willingness to undertake environment-friendly actions by people, who live in Isfahan, based on their priority needs for the reduction of air pollution problems.

#### **MATERIALS AND METHODS**

Isfahan is the capital of Isfahan Province, located at 32°38' 30"N latitude and 51°38' 40"E longitude. The third biggest city of Iran, it has an annual average rainfall of 121.1 mm and an average temperature of 16.2°C. Based on 2011 eadcount in Iran, with a population of 1,756,126, Isfahan was the second most populous urban area in Iran (Assari et al., 2017), having attracted a large number of people thanks to its industrialization since 1970's, which has resulted in its population growth by four times during the last four decades. There is a special condition in Isfahan with regard to its pollution: most days of the year, the city is clean while air inversion occurs in 263 days. The large number of vehicles and industries could be the main causes of Isfahan air pollution; therefore, 78% of the air pollution can be attributed to vehicles and industry, each in turn entailing the entry of significant amounts of toxic gas and solids into the air (Momeni, 2012).

The present study used the Cochran's formula and stratified sampling method, having selected 400 respondents from the target population, including all people

living (1,756,126 persons) in Isfahan as the study sample.

The research was carried out, using a questionnaire as data collection instrument, which included 45 closed-ended questions. It was developed based on literature review, hypotheses, and interviews. The questionnaire was validated by a panel of experts, with pre-tests given to 30 individuals. Cronbach's alpha method was used to calculate the reliability of the fact that its amount was over 0.7 for all variables. The questionnaire was consisted of three sections, namely "Demographic and Socioeconomic information", "Awareness", and "Participation". The first part included 7 questions, wherein demographic variables including age, gender, level of education, and socioeconomic variables, all obtained on the basis of literature reviews, were employed. The scale of educational level was assessed as the following: middle school graduate or less, high school graduate, college graduate, and a university graduate or more. As for monthly income, being an economic variable, it was assessed based on the following scale: less than IRR 10.000.000 (USD 250), between IRR 10.000.000 and IRR 20.000.000, and more than 2000.000 IRR (500 USD). Level of motivation for solving air pollution problems and membership of any kind of governmental or non-governmental associations were evaluated as social variables. The level and the type of information sources and media applied by the citizens to give information about air pollution were also assessed. All responses were represented in a scale of 1 to 5 (from very much to very little, respectively) and using the five-point Likert scale, an analysis got reclassified in which 3 (fair), 4 (much), and 5 (very much) were high, while 1 (very little) and 2 (little) were low. The "Awareness" section included 21 questions, addressing three sub-topics of awareness including air pollution perception, consequence of the air pollution, and responsible factors for air pollution. The first

section had five questions (1-5) which measured “perception”, while questions 6 to 12 dealt with the second part of awareness, i.e., “consequence of the air pollution”. Finally, the last nine questions of awareness evaluated “factors responsible for air pollution”. Responses were given, using the following scale of one to five: “5: I am sure it is right”, “4: I think it is right”, “3: I do not know about it”, “2: I think it is wrong”, and “1: I am sure it is wrong”. The items, related to air quality awareness, were then reclassified for analysis, wherein 1 (very poor) 2 (poor), and 3 (fair) were regarded as poor, whereas 4 (good) and 5 (very good) were good. This sub-topic of awareness was used as a dependent variable for the study.

The next part of the questionnaire, which included 16 questions, focused on “Participation”, in which Likert’s five-point scale was employed, from very much (or 1) to very little (5). Using the five-point Likert scale, participation was reclassified as a dichotomous variable for the analysis wherein 3 (fair), 4 (much), and 5 (very much) were regarded as much and 1 (very little) and 2 (little), as little. This variable was used as an independent variable for the study. And, the last part involved a question “how much do you think each of these items can help to manage air pollution?”, being comprised of 19 factors that can reduce air pollution problems. It was designed to consider respondents’ priority about ways of air pollution management, employing a five-point scale from 1 (i.e., very much) to 5 (i.e., very little).

The Statistical Package for the Social Sciences (SPSS version 19.0) was employed to study the collected data, which got analyzed, using descriptive and inferential statistics, such as the extent of mean, standard deviation, the coefficient of variation, correlation analysis, and stepwise regression analysis.

## RESULTS AND DISCUSSION

As mentioned above, awareness about air quality was assessed with three indicators: air pollution perception, awareness about air pollution consequences, and awareness about responsible factors for air pollution. Results from the analysis implicitly showed the level of perception. Regarding perception, the majority of the respondents, i.e., 52.75% of them, had a poor perception, while the perception of the remaining 47.25% was good. Items 6 to 12 included awareness about air pollution consequences. A slightly higher percentage of the respondents (51%) belonged to low level of awareness, whereas the remaining 49% had high awareness about air pollution consequences. As for awareness about responsible factors of air pollution, the respondents replied to items 13 to 21. Almost more than half of them (50.75%) had a poor awareness, while 49.25% were well aware of responsible factors (Table 1). Results indicated that awareness about air pollution among respondents was almost at a poor level since most of them, 212 (53%), had a poor awareness about air pollution. Table 1 shows the descriptive statistics for each indicator.

**Table 1. Respondent's Awareness about air pollution**

Respondent's Awareness	Poor		Good	
	N	%	N	%
Air Pollution perception	211	52.75	189	47.25
Air Pollution consequence	204	51	196	49
Responsible factors for air pollution	203	50.75	197	49.25
Total Respondent's Awareness	212	53	188	47

The study population included 400 subjects, above 18 years of age, who answered the questionnaire about air pollution. Table 2 shows the descriptive statistics of variables, according to awareness about air pollution. The age group between 26 and 35 that enjoyed the lion's share among the various age groups (containing 33.75% of all respondents within the sample) was more aware, while age group equal or beyond 46 years, the least represented group with only 19.75% of all respondents, showed the worse awareness. Female respondents had higher proportion (59.65%) and awareness (60.63%), compared to the male ones. Also, respondents who were more aware of

air pollution had higher education (52.12%), more income (37.25%), and use of air quality information (56.91%). They also had greater membership (62.76%) as well as more motivation (62.23%) and participation (77.35%) (Table 2).

Table 5 lists the information sources of air quality in the order of their priority and based on the study results. TV (CV = 0.269), Internet and social media (CV = 0.401), and unofficial sources, i.e., friends, acquaintances, people, etc. (CV = 0.515) are on top of the list. Meanwhile, non-governmental environmental organizations and groups (CV = 0.720) remain at the lowest priority, owing to their highest coefficient variation.

**Table 2. Descriptive statistics of variables, according to awareness about air pollution**

Variables	Good		Poor		Total	
	N	%	N	%	N	%
Age(years)						
18-25	38	20.21	51	24.05	89	22.25
26-35	71	37.76	64	30.18	135	33.75
36-45	49	26.06	48	22.64	97	24.25
46 <	30	15.95	49	23.11	79	19.75
Gender						
Male	74	39.36	88	41.5	162	40.35
Female	114	60.63	124	58.49	238	59.65
Level of education						
Middle school graduate or less	10	5.31	32	15.09	42	10.5
High school graduate	38	20.21	19	8.96	57	14.25
College graduate	42	22.34	69	32.54	111	27.75
University graduate or more	98	52.12	92	43.39	190	47.5
Income						
10.000.000>	19	4.75	12	5.66	7	3.72
10.000.000 -20.000.000	73	18.25	34	16.03	39	20.74
20.000.000<	149	37.25	77	36.32	72	38.29
Missing	159	39.75	89	41.98	70	37.23
Level of using information sources						
Low	81	43.08	152	58.96	206	51.5
High	107	56.91	87	41.03	194	48.5
Membership						
No	118	62.76	91	42.92	209	52.25
Yes	70	37.23	121	57.07	191	47.75
Motivation						
Low	71	37.76	112	52.83	183	45.75
High	117	62.23	100	47.16	217	54.25
Participation						
Low	48	22.64	84	44.68	132	43
High	164	77.35	104	55.31	268	57
Total	188	47	212	53	400	100

**Table 3. Priority of respondents' sources for reception of air quality information**

Statement	Mean	Std. Dev.	CV	Priority
TV	4.19	1.13	0.269	1
Internet and social networks	3.09	1.24	0.401	2
Unofficial sources (friends, acquaintances, people, etc.)	2.99	1.54	0.515	3
Radio	2.71	1.48	0.546	4
Traffic monitor air pollution	2.83	1.38	0.579	5
Signs, posters and brochures in the city	2.83	1.38	0.579	5
Newspaper	2.42	1.55	0.64	6
Non-governmental environmental organizations and groups	2.04	1.47	0.72	7

**Table 4. Respondents' priorities about air pollution management**

Statement	Mean	Std. Dev.	CV	Priority
Establishment of subway facilities	3.7	0.64	0.172	1
Improving the quality of public transport	3.69	0.64	0.173	2
Increasing public transport	3.65	0.69	0.189	3
The use of less polluting fuels (standard fuel)	3.58	0.7	0.195	4
Development of special bike path	3.59	0.75	0.208	5
Security for cycling and hiking riding	3.56	0.77	0.216	6
Public awareness and information about air pollution and its consequences	3.46	0.81	0.232	7
Public culture and education	3.46	0.82	0.236	8
Legislation to stop air pollution measures	3.41	0.83	0.243	9
Old cars	3.43	0.87	0.253	10
Elimination of urban industries	3.39	0.91	0.268	11
Government efforts to optimize fuel consumption	3.25	0.96	0.295	12
Banning the construction of new plants within the city	3.28	1.07	0.326	13
Fining polluting factories and industries	3.28	1.07	0.326	14
More green spaces	3.15	1.03	0.326	15
Relation of single-seat cars and pollution	2.95	1.12	0.379	16
Stop signs in contaminated areas of the city	2.91	1.13	0.388	17
Restrictions on the number of vehicles	2.8	1.12	0.379	18
Charging more taxes to help stop air pollution	2.45	1.31	0.534	19

**Table 5. The relation between level of awareness and other variables**

Variables	Correlation "r"
Age	0.080
Gender	-0.221
Level of education	0.252**
Income	0.026
Level of using information Sources	0.299**
Membership	0.251**
Motivation	0.297**
Participation	0.266**

P value was taken from the bivariate analysis \*\* (P<0.01)

Table 4 lists the respondent's opinions about methods of air pollution management in order of their priorities, based on the study results. Totally, the items related to developing public transportation are on top of the list, while creating prohibitions and

offenses are in the bottom, due to their highest coefficient variation.

The Spearman's Rho test was used to observe the relation between each variable and awareness. It only explained the strength of the relations and whether there was any

significant relation between the level of awareness and other variables. Results from the bivariate analysis showed that education, the sources of air quality information, membership, the level of motivation, and participation were significantly associated with air pollution awareness.

Regression analysis explained the variations in the employed adoptions. Table 6 summarizes results from regression analysis of the level of awareness about air pollution. To explain air pollution awareness, the stepwise multiple linear regression was used, the results of which

for the level of air pollution awareness show that level of education, level of using information sources, membership, motivation, and participation could explain 50% of the variations in the level of air pollution awareness (Table 6). According to the results, shown in Table 6, the following model is estimated in order to explain the level of awareness about air pollution, where Y indicates the dependent variable that represents the level of awareness about air pollution.

$$Y = 151.45 + 7.87X_1 + 1.36X_2 + 0.149X_3 + 0.256X_4 + 2.67X_5$$

**Table 6. Regression analysis, explaining the variation of variables, according to air pollution awareness**

Description	Label	B	t
Constant		151.45	16.28
Level of education	X <sub>1</sub>	7.87	4.57
Level of using information Sources	X <sub>2</sub>	1.36	2.49
Membership	X <sub>3</sub>	0.149	1.96
Motivation	X <sub>4</sub>	0.256	2.55
Participation	X <sub>5</sub>	2.67	17.24
F=97.53	R <sup>2</sup> =0.500		R <sub>2</sub> adj=0.495

Analyzing the study results showed that individual or social awareness about air pollution was conditioned by several variables, like the level of education. It was also found that the respondents, well aware of air pollution, were more educated, which was consistent with results of previous studies (Aminrad et al., 2011). Certain studies showed that individuals with lower levels of education had poorer air quality perception (Semenza et al., 2008; Kim et al., 2012).

In the present study, non-significant results were observed between air pollution awareness and some variables such as age, gender, and income. However, several studies have reported a significant association between awareness about air pollution and these variables, e. g. one study found that older respondents were generally more aware than younger ones (Aminrad et al., 2011). Also, the results showed that gender was not significantly

associated with awareness about air pollution, in contrast to many other works, which have suggest that gender is a significant factor affecting the awareness of environmental pollution, being higher among females than males (Hassana et al., 2010; Bhartiya, 2017; Kaur, 2017). Some studies showed that levels of household income were associated with the degree of perceived air pollution (Kim et al., 2012).

Other studies proved the importance of media for transferring information about the environmental problems (Piekarskil et al., 2016; Majumder, 2017; Cokcaliskan & Celik, 2017). In this light, the present research tried to examine the relation between air pollution awareness, on one hand, and level of using information sources and communication channels, on the other. It found that, as expected, this factor was significantly associated with awareness about air pollution. Moreover, the study identified television, Internet, and

social media as the most commonly cited existing sources of information.

It also found the significant association of air pollution awareness with respondents' membership as well as their motivation to solve air pollution problems. In contrast, a study about awareness to environmental pollution in Turkey showed that membership in the environmental associations was not an impressive feature on awareness for environmental pollution (Karatekin, 2014).

The study also examined the association between participation and air pollution awareness, showing that less participation in a community was associated with poor awareness about air pollution after controlling individual-level effects. There are several studies to claim that the people's participation depended on their level of awareness (Aminrad et al., 2013; Cokcaliskan & Celik, 2017; Bhartiya, 2017; Singh, 2017). Environmental awareness is a strategy to foster a positive attitude and an interest in positive environmental behavior (Karatekin, 2014). One study found awareness as a reason behind lack of participation. The present study, however, found a significant relation between air pollution awareness and participation.

Since recognizing people's attitudes and behavior could help government and policymakers know the public behavioral pattern (Meia et al., 2016), respondents' opinions concerning the priority of air pollution management methods were taken into consideration. Most people believed that development of public transportation could be considered as an effective way to reduce this problem. It was claimed that even contentment of public transportation was one of the physical and environmental attributes that could affect air quality perception (Kim et al., 2012).

Expectedly, there were some considerable limitation concerning the present study: e.g. it did not study a larger number of social aspects of awareness

about air pollution and community-level characteristics (such as place, physical environment, and community-level socioeconomic characteristics) due to the limited availability of data. Despite these limitations, the present study had several strengths. It provided reliable information and results thanks to its use of a large-scale population-based data, representative of an urban community.

## **CONCLUSION**

The present research has been conducted to find out the level of awareness about air pollution as well as its relation with some individual, socioeconomic, and other variables of the sample groups. The findings of this research revealed that respondents' awareness level was not acceptable since most of them were not aware of the consequences of air pollution as well as its responsible factors. It was concluded that the residents' high level of awareness might be due to their level of education, membership, use of media, motivation, and participation.

A small number of our participants were members of governmental or non-governmental organizations. So, it may be inferred that either they did not get enough scope for membership or they were reluctant and did not perceive its importance. The study also found a positive relation between air pollution awareness and the use of information sources and channels, showing that TV, the Internet, and social media played the most important role in attracting people's attention.

According to research findings, there was a significant relation between awareness and participation for reduction of air pollution. Accordingly, the required information about air pollution which not only causes awareness but promotes a positive attitude towards air pollution reduction must be recognized and prepared for people so that it can boost their participation for better air pollution management.



According to our respondents' opinion, one strategy to overcome air pollution is to provide public transportation in a better way. The use of less polluting fuels (standard fuels), secure cycling and hiking, and improvement of public awareness about air pollution and its consequences are other possible solutions, extracted from the present article's survey.

Finally, it can be stated that in order to deal with air pollution problem, one should take some actions that require more substantial attention such as environmental education at school and college levels, environmental campaigns, and other environmental plans participated by both governmental and non-governmental organizations. Also, media should provide the best explanation for air pollution and its problems, effectively communicating and transferring them to people through effective way, trying to dramatically make people aware and inspire them to do activities for reduction of air pollution. It should also cause the public to prioritize their participation in air pollution reduction plans.

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