Investigation of Knowledge, Attitude, and Practice of People in Kermanshah, Iran, toward the Effects of Traffic Noise Pollution on Human Health

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Background & Aims of the Study: One of the most important harmful factors in big cities is noise, and traffic is regarded as the most important source of noise pollution. Therefore, this study aimed to investigate the level of knowledge, attitude, and practice of people in Kermanshah, Iran, regarding the potential effects of noise pollution on their health.

Materials and Methods: A researcher-made questionnaire was used to collect data from 340 respondents residing in 34 identified stations in the city that were considered urban areas. The questionnaire sought information about knowledge, attitude, and practice level of people in Kermanshah, Iran, regarding the effects of traffic noise pollution on human health in spring 2017.

Results: According to the results, 3.57% of the participants believed that mass media notification could be effective in controlling noise pollution (relatively high and positive); however, only 3.27% of the respondents utilized sound control methods (poor level of performance). Furthermore, 5.21% of the cases highlighted the effectiveness of the first floor of the buildings as a noise reduction factor for other blocks in a building complex (low level of awareness).

Conclusion: Citizens in Kermanshah, Iran, obtained a low level of awareness and performance about the effects of noise pollution; however, they had a much higher and better attitude toward this issue. Accordingly, educational programs should be implemented to increase their levels of awareness and performance.

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Background

Over the past three decades, environmental pollution has become an important concern across the world. Meanwhile, noise pollution of cities in most countries is considered a comprehensive and global problem, which is an important criterion for determining the quality of life in cities (1). The environmental noise pollution level is rapidly increasing due to the rapid increase in human activities, such as
transportation, industrialization, and urbanization (2). According to the World Health Organization (WHO), noise is considered the third most hazardous environmental type of pollution (3). Sources of noise can include roads, railways, aviation, education, construction, public works, and recreation (2). The noise caused by traffic is considered one of the most important sources of noise pollution, which unconsciously affects human health (4). The traffic noise pollution in urban areas has become a major environmental problem not only for large cities but also for small cities (5). In Europe, traffic noise is the second highest environmental problem affecting health after air pollution (6). The results from a survey conducted in Stockholm indicate a significant relationship between traffic noises and sleep parameters, such as sleeping quality and awakening (7). In a study conducted in Varassa, India, the level of noise in the city was alarming, and 85% of the people complained about traffic noise (8). In recent years, investigations on noise pollution in Iran have been considered and studied periodically, especially in large cities. Studies by Iranian researchers show that noise pollution is a serious environmental and health problem in urban areas; moreover, in many commercial and industrial areas, the noise level is higher than the standards of the Design of Experiments (9).

Jafari et al. investigated noise pollution levels in Isfahan, Iran. This descriptive cross-sectional study was conducted on the 19 most congested areas throughout the city. The mean noise levels in the city at a.m. and p.m. were 74.6±2.78 and 72.6±4.43 dB, respectively, which was both higher than those in the noise guidelines proposed by the Iranian environmental protection organization (10). Furthermore, Safari Variani et al. conducted a cross-sectional study in 2010 to assess the sound level in Qazvin, Iran. The main streets and intersections in the city were considered the measuring stations. According to the results of the total measuring stations, 63% of the noise level was higher than the standard level recommended for residential and commercial areas; however, 24% of the noise was at the standard level (11).

In a general classification, the effects of sound pollution can be placed in both the auditory and non-auditory classes. Non-auditory effects that are less studied are a result of exposure to sound as a stressor that causes behavioral changes, whereas the auditory part affects the inner ear and hearing impairment (12). Based on WHO (2011), the noise among environmental stressors has the highest impact on general health (13). Studies show that exposure to noise can lead to increased blood pressure. The noise causes the secretion of adrenaline, noradrenaline, cortisol, and endocrine hormones, which cause cardiovascular disease (14). Fatigue, lack of self-esteem, decreased work capacity, interpersonal disorders, and some of these effects may lead to an increase in accidents, disruption of communication in the classroom, and disruption in the performance of the course (15).

Air pollution and traffic-induced noises are the priority and important priorities of governments, private sectors, and people around the world considering controlling and fighting this environmental pollution (16). Therefore, researchers have always been interested in investigating the level of knowledge (awareness), attitude, and practice (performance) (KAP) of people in a particular population regarding a particular topic (17). With this background in mind, since no study has investigated the KAP of people in Kermanshah regarding noise pollution so far, the present study aimed to assess the people's awareness about noise pollution, attitude towards noise pollution control, and their performance in protecting their health in Kermanshah, Iran. It is hoped that the results of this study will be used in urban planning to improve the quality of life in the future.
Materials & Methods

Study area
This study was conducted in Kermanshah, which is the largest city and capital of Kermanshah Province with a population of 1,093,833 in 2016 and an area of 93,389,956 m² (18). The city is located at 34° 18′ 51.01″ North latitude and 47° 03′ 54.00″ East longitude in the neighborhood of Iraq (Figure 1).

Study design and sample
This cross-sectional study was conducted to investigate the KAP of the Kermanshah population considering noise pollution. In this regard, areas with different uses in Kermanshah, including residential, commercial, residential-commercial, recreational, industrial, and military were considered in this study. Based on the population of Kermanshah, as well as Cochran formula (Equation 1), 340 participants were selected randomly from 34 different stations. Table 1 tabulates the specification and classification of each area. Based on the predesigned area of the city, 10 questionnaires were assigned to each of these areas.

\[ N = \frac{z^2 \cdot p \cdot (1-p)}{d^2} \]

Eq. (1)

Where \( N \) signifies the study population size, \( Z \) indicates the value of the normal variable of the standard unit, \( P \) presents a proportion of the population with a certain trait, \( q \) is a proportion of the population without a certain adjective \((1-p)\), and \( d \) indicates the amount of error allowed or the percentage of error.

To evaluate the validity and reliability of the researcher-made questionnaire, 10 questionnaires were distributed among environmental

| Areas          | Stations                                      | Number of questionnaires |
|---------------|-----------------------------------------------|--------------------------|
| Residential   | Farhangian                                    | 10                       |
|               | Maskan                                        | 10                       |
|               | Kaviyani Bus Terminal                         | 10                       |
| Commercial    | Eslam abad gharb Terminal                     | 10                       |
|               | Sajad Boulevard                               | 10                       |
|               | Dowlat Abad                                   | 10                       |
|               | Dadgostari Suburb                             | 10                       |
|               | Maskan Market                                 | 10                       |
|               | Azadi Market                                  | 10                       |
| Recreational  | Dowlat Abad Market                            | 10                       |
|               | Ojaq Crossroads                               | 10                       |
|               | Arg Shopping Center                           | 10                       |
|               | Shahed park                                  | 10                       |
|               | Laleh park                                    | 10                       |
|               | Zanbaq Park                                   | 10                       |
|               | Kouhestan (Mountain) Park                     | 10                       |
| Treatment     | Taleqani Hospital                             | 10                       |
|               | Shohada Hospital                              | 10                       |
|               | Imam Reza Hospital                            | 10                       |
| Industrial    | Makan                                         | 10                       |
|               | Dizel Abad                                    | 10                       |
|               | Payam Noor University                         | 10                       |
|               | Health University                             | 10                       |
| Educational   | Razi University Social Sciences Campus         | 10                       |
|               | Farhangian University                         | 10                       |
|               | Naft Square                                   | 10                       |
|               | Azadi Square                                  | 10                       |
|               | Emam Khomeyni Square                          | 10                       |
| Squares       | Maskan Square                                 | 10                       |
|               | Ferdowsi Square                               | 10                       |
|               | Beheshti Blvd                                 | 10                       |
| Military      | Army barracks                                 | 10                       |
|               | Hafeziyeh barracks                            | 10                       |

Figure 1) Location of Kermanshah (study area), Iran
In this study, a researcher-made questionnaire consisting of four sections was used that included general questions along with 47 questions in terms of KAP. In order to score the items in the awareness and performance sections, 1 and 0 were given to the Yes and No responses, respectively. Regarding the attitude scoring, "completely agree", "agree", "no idea", "disagree", and "completely disagree" were scored 4, 3, 2, 1, and 0, respectively. The first section of the questionnaire sought such general information and personal details as gender, education level, marital status, occupational status, land use, and building type. Furthermore, section two included 15 items on awareness of noise pollution, its effects, and how to deal with the noise. Similarly, section three sought information about the attitudes and ways to control and manage them (n=16), and the performance of the respondents regarding ways to prevent the noise input and reduce its effects was evaluated in section four (n=16). The questionnaires were distributed at the stations and completed by the respondents. The data were recorded in tables and analyzed in SPSS software (version 16.0).

### Results

This study was conducted on 340 citizens in Kermanshah, Iran. At first, the questionnaires were divided by gender (Figure 2) using percentages. The majority of the respondents in this study were male (57%) of which 134 (39.4%) cases were married and the rest were single. Table 2 summarizes other information

![Figure 2) Gender frequency of the respondents](image)

| Table 2) Frequency distribution of demographic characteristics | Abundance | Percent |
|---------------------------------------------------------------|-----------|---------|
| **Variables**                                                 |           |         |
| **Gender**                                                    |           |         |
| Female                                                        | 145       | 42.6    |
| Male                                                          | 195       | 57.4    |
| High School (no degree)                                       | 14        | 4.1     |
| Diploma                                                       | 183       | 53.8    |
| Bachelor                                                      | 128       | 2.36    |
| Master and PhD                                                | 20        | 9.5     |
| **Education level**                                           |           |         |
| Single                                                        | 206       | 6.60    |
| Married                                                       | 134       | 4.39    |
| Employee                                                      | 68        | 20      |
| Self-employed                                                 | 165       | 5.48    |
| Housewife                                                     | 46        | 5.13    |
| Others                                                        | 61        | 9.17    |
| **Occupational status**                                       |           |         |
| Residential                                                   | 89        | 2.26    |
| Commercial                                                    | 70        | 6.20    |
| Residential-commercial                                        | 51        | 15      |
| Public                                                        | 100       | 4.29    |
| Industrial                                                    | 10        | 9.2     |
| Military                                                      | 20        | 9.5     |
| **Land use**                                                  |           |         |
| Apartment                                                     | 95        | 9.27    |
| Villa                                                         | 245       | 1.27    |
about the frequency distribution of the respondents' demographic characteristics.

**Level of knowledge**

Table 3 tabulates the responses about the health effects of noise pollution and its possible impacts on the people in Kermanshah, Iran. At first, the percentage and standard deviation of the items evaluating knowledge were calculated in this study. For questions 2, 4, 7, 8, 10, and

| Number | Questions                                                                 | Knowledge | Lack of knowledge | Knowledge% | SD  | P-value |
|--------|---------------------------------------------------------------------------|-----------|-------------------|------------|-----|---------|
| 1      | Do you know the effects of noise pollution on human health?              | 305       | 35                | 89.7       | 0.304| 0.001   |
| 2      | Is muscle cramping an unwanted complication from noise?                  | 131       | 209               | 38.5       | 0.487| 0.001   |
| 3      | Is the safe sound level in residential areas (public streets or streets) less than sound levels in industrial areas? | 172       | 168               | 50.6       | 0.500| 0.829   |
| 4      | Is the reflection levels of high-rise buildings a factor in raising the level of noise pollution? | 109       | 231               | 32.1       | 0.467| 0.001   |
| 5      | Can trees reduce noise pollution?                                        | 326       | 14                | 95.9       | 0.198| 0.001   |
| 6      | Are deciduous trees with much leaves more effective in reducing the noise pollution than evergreen trees (e.g., pine)? | 198       | 142               | 58.2       | 0.493| 0.002   |
| 7      | Is the sound level in your neighborhood in the standard state?           | 119       | 221               | 35         | 0.477| 0.001   |
| 8      | Can the first floor of the buildings be used as a noise reduction factor for other blocks in a building complex? | 73        | 267               | 21.5       | 0.411| 0.001   |
| 9      | Is vegetation density effective in reducing noise?                       | 277       | 63                | 81.5       | 0.389| 0.001   |
| 10     | Is creating walls more effective in reducing noise pollution than using dirt hills next to highways? | 91        | 249               | 26.8       | 0.443| 0.001   |
| 11     | Are you familiar with the suitable plant species for reducing sound?     | 47        | 293               | 86.2       | 0.345| 0.001   |
| 12     | Are you familiar with the suitable materials of the highway walls to reduce noise? | 32        | 308               | 90.6       | 0.292| 0.001   |
| 13     | Is the wind and the its direction causing changes in the amount of noise pollution? | 134       | 206               | 39.4       | 0.489| 0.001   |
| 14     | Does the distance between residential houses and the street (at least 51 meters) reduce the amount of noise pollution? | 177       | 163               | 52.1       | 0.500| 0.440   |
| 15     | Do car speeds have a significant effect on reducing traffic noise pollution? | 250       | 90                | 73.5       | 0.441| 0.001   |
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13, this corresponding value was less than 50%, and for the rest of the questions, it was more than 50%. Items 8 (effectiveness of the first floor of the buildings as a factor in reducing the noise for other blocks in a building complex, 21.5%) and 5 (noise reduction by trees, 95.5%) obtained the lowest and highest scores by the respondents, respectively. In the next step of the test, the assumption of a fixed SD of 0.5 was used for comparison, and questions with an SD of less than 0.5 were rejected. It was observed that this assumption was rejected for all questions, except for questions 3 and 14; therefore, it was concluded that respondents had no sufficient knowledge of the issues raised in all of the questions. In this study, the mean±SD awareness level of the citizens about the health effects of noise pollution was estimated at 22.82±2.56 (range:2-15).

**Level of attitude**

As can be seen in Table 4, the mean±SD

| Number | Questions                                                                 | Positive attitude | No comments | Negative attitude | Mean   | SD    | P-value |
|--------|---------------------------------------------------------------------------|-------------------|-------------|-------------------|--------|-------|---------|
| 1      | The noise of your surroundings (your workplace) is annoying.              | 298               | 18          | 24                | 3.80   | 0.546 | 0.001   |
| 2      | There is a disturbing noise in your home.                                 | 301               | 14          | 25                | 3.81   | 0.548 | 0.001   |
| 3      | Noise can cause decentralization and interruptions in conversation.      | 231               | 85          | 24                | 3.60   | 0.616 | 0.001   |
| 4      | When you watch the TV, the traffic noise will disturb you.               | 145               | 85          | 110               | 3.10   | 0.861 | 0.028   |
| 5      | The traffic noise causes insomnia.                                       | 172               | 96          | 41                | 3.29   | 0.795 | 0.001   |
| 6      | Noise can cause fatigue and anger.                                       | 214               | 85          | 41                | 3.50   | 0.701 | 0.001   |
| 7      | Mass media notification can be effective in controlling noise pollution. | 195               | 102         | 43                | 3.44   | 0.708 | 0.001   |
| 8      | Are penalties and taxes effective in reducing noise pollution?          | 104               | 146         | 90                | 3.04   | 0.755 | 0.316   |
| 9      | The municipality has taken appropriate measures to control the noise in the neighborhood. | 30               | 130         | 180               | 2.55   | 0.651 | 0.001   |
| 10     | The traffic police carry out appropriate control and training for the reduction of noise pollution | 40               | 135         | 165               | 2.63   | 0.684 | 0.001   |
| 11     | In your neighborhood, noise control engineering has been done.           | 38                | 146         | 156               | 2.65   | 0.671 | 0.001   |
| 12     | The people of the city are familiar with the importance and the way not to create noise pollution; moreover, they have received the necessary education. | 22               | 56          | 262               | 2.29   | 0.581 | 0.001   |
| 13     | Implementation of educational programs for people is effective in reducing noise pollution. | 194              | 115         | 31                | 3.47   | 0.658 | 0.001   |
| 14     | Traffic noise accounts for the highest percentage of environmental noise that you are exposed to it. | 277              | 43          | 20                | 3.75   | 0.550 | 0.001   |
| 15     | Horns are the most important source of traffic noise (the most disturbing noise caused by traffic). | 288              | 36          | 16                | 3.80   | 0.504 | 0.001   |
| 16     | The best way to reduce traffic noise pollution is to build a retaining wall or separator. | 91               | 178         | 71                | 3.05   | 0.688 | 0.116   |
score of citizens' attitudes toward the health effects of noise pollution and its possible effect on people in Kermanshah, Iran, was determined at 52.66±5.90 (range:34-73). After comparing the obtained mean with the hypothesized mean value, the expected value for all questions is determined at 40 if the answer is equal to 40. It is observed that the attitude of citizens about the health effects of noise pollution and its possible effects on people in Kermanshah, Iran, is slightly higher than the expected average (assumed average). In addition, the results of a single-sample t-test showed this difference, except for questions 8 and 16 (P=0.001); accordingly, it can be concluded that the overall attitude of the participants was positive regarding the discussed issues.

**Level of practice**

The mean±SD score of citizens' practice regarding the health effects of noise pollution and its possible effects on people in Kermanshah, Iran, was estimated at 5.42±2.10. After comparing this value with the hypothetical mean (the expected value in the case of chance response to all questions is equal to 8), it is observed that the citizens' practice in this regard is lower than the expected average (hypothesis average) (P=0.001). In addition, only 2.05% of the people complained to competent authorities to control noise pollution, which indicates a low level of performance (Table 5). The t-test results related to the level of citizens' KAP regarding the health effects of noise pollution and its potential impacts on people in Kermanshah, Iran, are summarized in Table 6.

### Table 5) Citizens' practice on the health effects of noise pollution and its possible impact on people in Kermanshah, Iran

| Number | Questions                                                                 | Yes | No | P-value |
|--------|---------------------------------------------------------------------------|-----|----|---------|
| 1      | You use double glazed windows at home.                                    | 158 | 30 | 0.193   |
| 2      | You drive at authorized speeds.                                           | 310 | 30 | 0.001   |
| 3      | In the neighborhood, you have taken action or participated in the creation of green space. | 52  | 288| 0.001   |
| 4      | You close the door of your workplace due to the noise of the environment  | 59  | 315| 0.001   |
| 5      | Due to the high noise of the neighborhood, you have moved to another neighborhood. | 25  | 315| 0.001   |
| 6      | Due to the high noise, you moved your workplace to another location.      | 13  | 327| 0.001   |
| 7      | You have complained to the competent authorities (the environment, the municipality, or the judiciary) to control the sound. | 7   | 333| 0.001   |
| 8      | You have been referred to a doctor due to complications resulted from noise. | 23  | 317| 0.001   |
| 9      | You suffer from hearing impairment caused by noise and use personal protective equipment. | 9   | 331| 0.001   |
| 10     | You have used sound control methods in the shop or at the workplace.      | 93  | 247| 0.001   |
| 11     | You always set the sound of the TV in a suitable range.                   | 312 | 28 | 0.001   |
| 12     | Are you willing to collaborate in noise reduction programs?               | 261 | 79 | 0.001   |
| 13     | Until now, you jumped from sleep due to a lot of noise                    | 111 | 229| 0.001   |
| 14     | Until now, you have been headed due to noise from neighbors or traffic.   | 152 | 188| 0.051   |
| 15     | High environmental noise makes you angry over the day.                    | 201 | 139| 0.001   |
| 16     | The high noise causes you to lose your focus on driving, and the resulting accident has occurred. | 58  | 282| 0.001   |

### Table 6) T-test results related to the level of knowledge, attitude, and performance of citizens

| Variable | Number of questions | Hypothetical Mean | Potential Score | Calculated range | Mean±SD | t  | P-value |
|----------|---------------------|-------------------|-----------------|------------------|--------|----|---------|
| Knowledge | 15                  | 7.5               | 0-15            | 2-15             | 17.56±7.2 | -2.307 | 0.022   |
| Attitude  | 16                  | 40                | 16-80           | 34-73            | 66.90±5.52 | 39.55  | 0.001   |
| Practice  | 16                  | 8                 | 0-16            | 2-15             | 42.10±5.2 | -22.517 | 0.001   |
This study investigated the KAP of people in Kermanshah, Iran, regarding the effects of noise pollution caused by traffic on health. A total awareness score of 7.5 or higher is used as a diagnostic criterion for a good level of knowledge. Accordingly, it was observed that the knowledge level of the subjects in the field of health effects due to noise pollution and its possible impacts on the people in Kermanshah, Iran, was slightly less than the diagnostic criteria. For various reasons, including the increase in the city population and traffic load, the amount of noise is increasing, which needs to be controlled. One of the effective factors in controlling noise pollution is the enhancement of public awareness as well as community participation. In fact, raising public awareness about the effects of noise pollution is a preventive solution to deal with this issue (19). According to a study conducted by Mirzaei et al. (2012), 48% of the participants believed that raising public awareness was the best way to reduce noise pollution in cities. Different media (e.g., radio and television programs), social networks, other media, schools, and universities can improve the level of public awareness (20).

Koushki et al. (2004) conducted a study on 500 workers who were randomly selected from 26 construction projects to investigate their awareness of noise pollution in Kuwait. Although the noise in these areas was often significantly higher than the standard level, none of the workers were equipped with a hearing protection device; moreover, the majority of the workers neither considered noise a problem nor had sufficient awareness about the effects of noise pollution (21). According to the results, the people in Kermanshah had a positive attitude towards the effects of noise pollution on health. Positive attitudes of people towards this issue increase their willingness to participate in programs to control noise pollution (22). The study found that a great deal of noise pollution was caused by traffic noise or vehicle traffic, which is consistent with the results of a study carried out by Alesheikh and Omidvari 2010 (23). In another study performed by Bialiatsas, 67% of the participants considered noise the cause of distraction and impaired speech (13). Similarly, 62% of the respondents in a study conducted by Mirzaei et al. (2012) in Zahedan believed that the street noise was very annoying, and the anger was the main side effect of noise pollution (20). Furthermore, the majority of the respondents considered horns the most important and annoying source of traffic noise pollution.

In a study carried out by Mohd Rus, employees had a low level of attitude about aspects of prevention (24). The present study showed poor performance of people, which could be the result of their low awareness about the negative effects of noise pollution on health. Therefore, it is required to implement educational programs to educate people and raise their awareness along with practice regarding the effects of noise pollution in order to overcome and control this issue.

According to the results of this study, in general, the citizens do not have a sufficient level of knowledge about all the items. Furthermore, 38.5% of the respondents regarded cramping of muscles as unwanted side effects. In addition, 62.9% of the citizens believe that noise causes fatigue and anger, and 57.3% of them report that communicating information can be effective in controlling noise pollution. Since 76.7% of the respondents are willing to participate in programs to reduce their noise pollution, it is essential that educational and participatory programs, in addition to raising citizens' awareness, implement ways to prevent
and reduce noise pollution. In order to reach this goal, authorities of the municipalities, Traffic Police of NAJA, Islamic Republic of Iran Broadcasting, universities, and other environmental departments should pay much more attention to this issue.

**Footnotes**

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**Conflict of Interest**

The authors declare that they have no conflict of interest.

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