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NOISE EFFECT ON HUMAN AVERAGE AGE

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ABSTRACT

Due to modern civilization consequences, the number of vehicles, trains, etc. have been rapidly increasing, in return, the noise ratio has been increased in modern cities and communities around the world. This increase has several effects on humans, where the human age is one of the main effects of noise increasing. This work tries to study the effect of noise caused by high sound levels on the average human age. Two areas in Jordan have been selected to conduct the study; one in the middle of the city and the other in a remote village. The center of Amman city and the center of Salt city have been selected as a case study. The measure and collected data represent the sound level, the most common diseases, the growth rate of population. The results show that there is a strong relationship between these data and the level of noise. Further, the results show that the average age of human has been negatively impacted by the level of noise that caused by high sound levels.

1. Introduction

The recent studies show that the growth of population number within Jordan has been largely increased, where the rate of growth has been reached to 2.49%. By this rate, the number of population reached to 5,906,760 residents (CIA, 2006). This increase joints with the widespread and fast introduction of mechanical approaches for transportation and for equipment and goods production. The new conditions of life added a novel factor to soil, water and air pollution which known by noise.

Recently, the concern about the noise that obtained from unwanted sounds and how it can impact on the people has been considered (Burns, 1973). Masten and Davis (2004) defined the noise by any sound disturbs or annoys the people and causes adverse physiological and psychological impact on the people.

Further, the traffic is considered as one of the key noise sources (Skanberg and Ohsrom, 2002). However, the noise obtained from roads traffic is not constant and it is continually changing, thus this noise cannot be easily quantified or forecasted (Stoilov and Stoilova, 1998). According to Piccolo et al (2004), about 25% of the people within Italy are impacted by the traffic noise obtained from Messina road. In addition, the investigation performed by Calixto et al (2003) indicated that about 73% of participants indicated that the traffic within roads is considered as the main source of noise.

The noise impact on individual can be categorized into two main classes: indirect impacts and direct impacts. The direct impacts involve problems in hearing signals of sound, perception interference and loudness sensation. The indirect impacts involve activity disturbance, annoyance, potential impacts on health and sleep disturbance (Burns, 1973).

2. Related Works

Al-Shobaki and Jamrah (2008) conducted a study to measure the impact of noise on human health. The survey was conducted in 2007 from June to December. Irbid and Zarqa cities were selected to perform the survey. Various areas within each city were selected to be surveyed, where the data were collected at various times throughout the day. Further, random way was utilized to select participants with various employment state, education, age and gender. In addition, questionnaires were prepared to determine the annoyance indication that caused by the sound, understand the individual psychological evaluation toward their environment and measure the subjective reactions toward the noise. Also, the survey aimed to determine if people considered the noise as a health risk and environmental pollution and to determine how this noise impacted on their lives. The tables below illustrate the data related to the participants of the survey.

Table 1: Zarqa city participants' information, (Al-Shobaki and Jamrah, 2008).

Zarqa city			
Gender	**Age (years)**	**Employment state**	**Education**
Female: 118 (47.20%)	15-27: 148	Housewife: 12	Illiterate: 22
Male: 132 (52.80%)	28-40: 60	Unemployed: 3	Literate: 228
	41-53: 32	Employee: 111	
	Above 53: 10	Student: 114	
		Other: 10	

Table 2: Irbid city participants' information, (Al-Shobaki and Jamrah, 2008).

Irbid city			
Gender	**Age (years)**	**Employment state**	**Education**
Female: 216 (61.71%)	14-29: 268	Housewife: 15	Illiterate: 27
Male: 134 (38.29%)	30-45: 56	Unemployed: 8	Literate: 323
	46-61: 24	Employee: 73	
	Above 61: 2	Student: 223	
		Other: 31	

Also, 35 various locations in Irbid city and other 35 locations in Zarqa city were selected to take the measurements, which involved five key roads of Irbid and Zarqa city with high and quite volume of traffic.The selected locations were observed during the night and the day, where the time hours of the night were selected from 5:00 pm to 10:00 pm, while the time hours of the day were selected from 7:00 am to 4:00 pm . The measurements were still for five days within each city. In addition, the sound-level meter "Reten Electronic RS-232 Data Logging"was utilized to measure the levels of noise. The levels of noise were measured for various sources involving; noise of building and construction works, noise of celebration halls, noise of commercial area,schools noise, traffic noise, mosque noise and noise of industrial area.

The results show that the levels of noise that measured from various sources in both cities were higher than the levels set by the noise standards of Jordan. Further, the survey show that the highest levels of noise impacted on people in various terms of working ability, hearing, concentration loss and annoyance. Further, the collected data showed that the levels of noise in Zarqa differed from the levels of noise in Irbid and this variation referred to the variations within the traffic nature in both cities.

On the other hand, Shepherd et al (2013) conducted a survey to determine the benefits of living within quiet areas as compared with the noisy areas. The survey was conducted on four various areas: noisy rural, quiet rural, quiet city and noisy city. A questionnaire to measure the "Health-Related Quality of Life (HRQOL)" was designed, where about 823 respondents were collected to be analyzed. The data were gathered from three cross-sectional surveys to determine the relationship among HRQOL and noise annoyance in adults. The data within the first study were gathered in July 2009 to examine the noise caused by aircraft. The data were gathered from residences that located near to the Auckland International Airport. The data of the second study were gathered in July 2010 to measure the noise caused by the wind farm. This study was conducted on two rural areas within the North Island of New Zealand. The data of the third study were gathered in July 2010 from Auckland, which represents the largest city within New Zealand. The data related to the participants within the survey are shown in the table below:

Table 3: participants information in city and rural areas, (Shepherd et al, 2013).

Variable	City (Quiet)	City (Noise)	Rural (Quiet)	Rural (Noise)
Gender				
Female	140	236	23	91
Male	105	117	16	63
Age				
18-20	4	10	1	2
21-30	14	35	1	1
31-40	67	64	5	22
41-50	55	68	10	53
51-60	40	73	11	44
61-70	42	48	7	27
Above 71	21	50	3	9
Education				
University	84	88	17	54
Polytechnic	73	95	11	48
High School	83	171	11	55
Employment State				
Retired	38	71	10	40
Unemployed	12	26	6	27
Unpaid work	24	43	1	3
Part time	45	47	0	3
Full time	126	170	21	83
Noise sensitivity				
Severe	25	41	5	20
Moderate	122	211	21	76
None	94	98	13	60
Current illness				
Yes	74	97	10	50
No	170	155	27	104

The gathered data were analyzed by version 19 of the "Statistical Package for Social Sciences (SPSS)". Multivariate Analysis of Variance (ANOVA) was utilized to assess the variations of HRQOL within the four areas. The results indicated that the relationship between the measures of HRQOL and noise annoyance was an inverse relationship. Also, the mean domain scores of HRQOL were higher in quiet areas than the noisy areas. The study aimed to protect the quiet areas and to reduce the noise within noisy areas.

Harding et al (2013) conducted a study to estimate the impact of day-time noise on the UK population health. The study focused on measuring the noise impact on the blood pressure of people and the related health complications involving; dementia, stroke and heart disease. About 1160 locations were observed to evaluate the noise pollution levels and this observation was conducted during the period extended from 2000 to 2001. UK residents with various sex and age participated within the survey. The obtained results indicated that the exposure to high levels of noise caused 542 heart attack cases, 788 stroke cases and 1169 dementia cases.

Furthermore, Schmidt et al (2013) conducted a study to estimate the effect of night-time aircraft noise on about 75 healthy participants. The participants were selected with different ages that extend between 20 and 60 years. The participants were suffering from various aircraft noise patterns within their homes. The heart rate and blood pressure of the participants were monitored during the night. The results indicated the health of participants was impacted by the noise obtained from aircraft. Also, the quality of sleep became lower with the noise existence. The results also indicated that the long-time exposure to aircraft noise will negatively impact on the heart rate and blood pressure.

3. Methodology

3.1 Data Collection Methodology

iSTI application has been utilized to measure the sound level in this study. The application of iSTI is utilized to measure the "Speech Transmission Index (STI)", which represents the intelligibility of speech. This method produced a value between 0 and 1 and it represents the value of STI. The higher value of this index represents the better intelligibility of speech. The sound level and the sample rate ratio should be calibrated to obtain more correct data. Further, the iPhone microphone is utilized as input source of the signal. In addition to this application, many statistics have been collected to discuss and determine the impact of noise on the health and average age of human.

3.2 Information about collecting data

The study was conducted during two days from 27 April to 28 April 2016. The study conducted in the center city of Amman and the center city of Salt. The level of noise for various sounds at various times during the day were measured. The data were collected in two various periods, in the morning and in the evening. The collected data represent the noise levels and the signal transmission index. Further, statistics about the number of vehicles in Amman and Salt for the last four years, the number of the population in both sites for the last four years and the main diseases caused by noise and infected people within the both sites have been collected.

4. Case study and Results

The center of Amman city and The center of Salt city have been selected to conduct the study. The data were collected from the both sites in different locations and periods. The sound level in Amman city center has been measured in various locations. The table below illustrates the measured sound levels and the STI values.

Table 4: sound levels in Amman city.

STI	Sound level (dBA)
0.83	64.5
0.26	76.8
0.28	80.5
0.52	76.2
0.12	82.8
0.43	79
0.43	74.6
0.22	83.3

The sound levels have also been measured in various locations within the center of Salt. The data were collected during the period from morning to evening. The table below illustrates the measured sound levels.

Table 5: sound levels in Salt City.

STI	Sound level (dBA)
0.76	47
0.53	52
0.78	45
0.54	51.6
0.51	54.5
0.47	59
0.52	54
0.53	52.3
0.75	48.7
0.76	47.1
0.74	49.2
0.51	53
0.52	54.2
0.74	49.1
0.55	50.2

Based on data collected, the statistics show that there is an increasing in the number of vehicles in Amman and Salt. However, the number of vehicles in Amman is higher than that in Salt. The table below illustrates the number of operating vehicles during the period from 2010 to 2013.

Table 6: number of vehicles in Amman and Salt.

Year	Number of vehicles in Amman	Number of vehicles in Salt
2010	616.281	28.545
2011	661.065	29.368
2012	670.753	29.982
2013	681.953	30.755

For the number of population in Amman, the statistics show that the population number during the period from 2004 to 2015 has been increased and it reached to 4 million Inhabitants. The figure below illustrates the growing number of population in Amman during the period from 1979 to 2013.

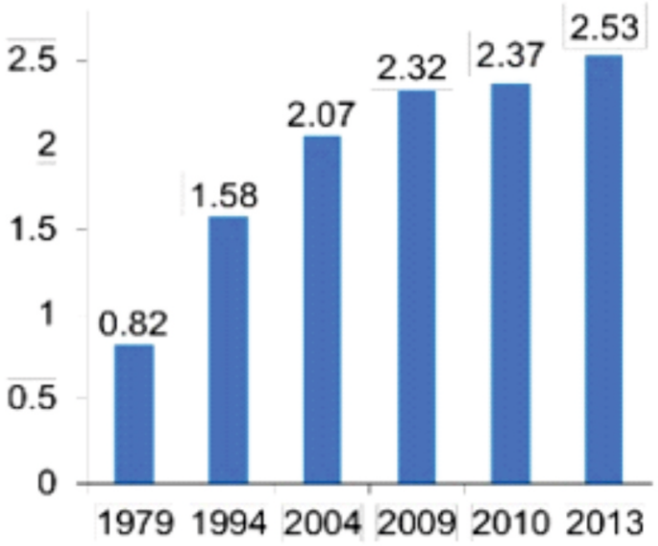

Figure 1: number of population in Amman during the period from 1979 to 2013.

Moreover, statistics about the average ages of Jordanian population have been collected and summarized as shown in the table below:

Table 7: information about Jordainian population.

Rate of population growth (%)	2010-2015	3.5
Rate of population growth in Urban areas(%)	2010-2015	3.8
Rate of population growth in Rural areas(%)	2010-2015	2.1
Life expectancy at birth (years)	2010-2015	75.5 (female) 72.2 (males)
Infant mortality rate (per 1000 live births) (%)	2010-2015	17.1

In addition, statistics about the most common diseases in Jordan in 2014 have been collected and summarized. The table below illustrates these statistics.

Table 8: Disease types caused by noise in Jordan.

Disease type	Number of deaths	Percentage of deaths (%)
Stroke	2,751	11.95
Hypertension	1,117	4.85
Coronary heart disease	4,329	18.80
Endocrine Disorders	301	1.31

Other statistics about these diseases in rural and urban areas within Jordan have been summarized as below.

Table 9: Disease types casued by noise in urban and rural areas in Jordan.

Disease type	Urban areas (%)	Rural areas (%)
Stroke	0.2	0.1
Hypertension	5.2	3.6
Heart attack	0.4	0.3

5. Data Analysis

Various data were collected to show the impact of noise caused by high sound level on the health and age of people in Jordan. The aim of the study is to show this impact within urban and rural areas in Jordan. As shown in Table 1, the number of vehicles has been measured in Amman and Salt during the period from 2010 to 2013. The statistics show that this number has been increased with the years, where the number of vehicles in Amman is larger than that in Salt. These values indicated that the noise caused by high sound levels that caused by road traffic in Amman is higher than that in Salt. This means that more annoyance and health problems will exposure residents in Amman and this will negatively impact on the average age of those residents.

Further, the statistics show that the growth rate of population within urban areas is higher than the rural areas. This means that the number of population in urban areas like Amman is larger than the number of population in rural areas like Salt. The large number of population increases the levels of noise and this will negatively impact on their health and average age.

Also, various types of diseases are largely distributed during the last years. The statistics show that there is a strong relationship between these diseases and the noise caused by high sound levels. The annoyance and the low quality of sleep are the main causes of these diseases. The number of deaths caused by these diseases have been largely increased during the few last years. However, the percentage of these diseases and the number of deaths caused by these diseases are higher in urban areas as compared with rural areas. This refers to that the rural areas have low levels of noise that caused by high sound levels and this because the low number of population and the small traffics caused by vehicles.

In addition, the measures of sound levels and STI show that the volume of noise within Amman is larger than that in Salt. The large number of people and the large number of vehicles in Amman obtained high sound levels, which increased the volume of noise within the area. Further, the number of diseases in Amman is larger than that in Salt due to the higher volume of noise. Based on this, the average death of human in Amman became lower than that in Salt.

6. Conclusion

Due to the increase in noise level during the last years, this study conducted to measure and determine the impact of this noise on the health and average age of humans. The center of Amman city has been selected to represent the urban areas, while the center of Salt city has been selected to represent the rural areas. The levels of sound have been measured in various locations within the two cities. Further, many statistics like the number of vehicles, the growth rate of population and the most common diseases have been collected to perform the evaluation. The results show that the noise volume increased with the increasing of sound level. Also, the increasing in vehicles number and population number increased the noise volume and this increasing has negatively impacted on the health and average age of people. Also, the results show that the noise is the main cause of the stroke, heart and Hypertension diseases, which have been largely increased in the recent years and negatively impacted on the average age of humans.

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