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Guards of Vehicles need to Guard their Health

Vara Saritha[1☼], Manoj Kumar Karnena[2]

1. Department of Environmental Studies, GITAM Institute of Science, GITAM University, Visakhapatnam – 530 045, Andhra Pradesh, India
2. Department of Environmental Studies, GITAM Institute of Science, GITAM University, Visakhapatnam – 530 045, Andhra Pradesh, India

☼**Corresponding author:** Assistant Professor, Department of Environmental Studies, GITAM Institute of Science, GITAM University, Visakhapatnam – 530 045, Andhra Pradesh, India, e-mail: vsjr08@gmail.com

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ABSTRACT

It has become inevitable for the consumers to look beyond the traditional retail stores towards organized outlets with changing retail scenario, which led to packed consumers with overcrowded parking in the cellars of many malls. The overwhelming flow of

vehicles release great concentrations of pollutants like oxides of carbon monoxide, nitrogen, respirable particles, sulfur dioxide, hydrocarbons and lead and into the areas whose dispersion is lesser resulting in health effects. Occupational hazards on health with reference to environmental pollution have been receiving great attention in public health management and occupational medicine; hence the prime objective of this paper is to study health effects of cellar parking security guards in a rapidly developing urban environment. The study is essentially a cross-sectional survey, where in data from nearly 250 people was collected and analyzed. It is observed that there are notable occupational health effects which can be stated as: Respiratory problems (57.08%), cough (47.17%), musculoskeletal disorders (73.58%), hypertension, unbearable noise and soiling of clothes (100%). We conclude that the health of respondents has been affected in many ways with reference to their duration of stay inside.

Key Words: Automobile pollution, cellar parking, security guards, occupational health effects

1. INTRODUCTION

Indian economy has witnessed slow progression from state led towards becoming market friendly economy during 1990's. Rapid expansion of organized retail formats was seen over the past decade. Concept of shopping has altered in terms of organization and consumer procurement behavior, accompanying in a revolution in shopping in India as the contemporary retail sector has reflected in extensive shopping centers, multiplex- malls and huge complexes offering shopping, entertainment and food all under one roof (Quazi et al., 2014), leading to inadequate space for the packed consumers and their vehicles.

In a built-up metropolis there is great demand for but short supply of land and building space. This is manifested in hike of prices and charges for industrial, commercial and residential property. Commercial and industrial buildings are almost invariably high-rise and densely populated. Therefore, cellar, multi-storey parking has become a solution in order to optimize the usage of the land for both the government and developers.

One of the important issues in many urban cities around the world is the growth of automobile population. It not only creates a horde of problems like indoor air quality and noise pollution, but also affects demand of parking spaces in any city, as land is scarce and expensive resource that has to be utilized to its fullest value. Diverged parking spaces are designed to meet the demand such as surface (ground level), underground (basement) and above ground (elevated and usually multi-storey complex).

Increased affluence and wider education are making the people more aware of environmental issues, not least air quality. Enactments of new legislation governing air quality and vehicle emissions and strengthened environmental policies have required responses from commerce and industry (Burnett and Chan, et al., 1997). An underground parking is defined as below a street or an open space and / or is a basement to a building which includes any floors constructed under ground level (Burnett and Chan 1997; Raha Sulaiman et al., 2015).

Significant source of ultra-particle in (Jafary et al., 2007 and Zhu et al., 2002)an urban environment is caused by vehicular emissions. Vehicular pollution produce volatile organic compounds, oxides of nitrogen, oxides of Sulphur, suspended particulate matter and carbon monoxide which results in adverse health effects on the(Ingle et al., 2005) exposed populations. Vehicular air pollution is an occupational health(Nielsen et al., 1995) hazard to individuals who work close to vehicles (Pramila and Girija, 2012).

When inhaled, these pollutants cause damage to the airways and the lungs. The prevalence of the functional impairment of the lung like obstructive, restrictive and mixed type has been found to have direct relationship with (Ingle et al., 2005, Chattrjee et al., 1989, Chattopadhyaya et al., 1994) the dust concentration and duration of exposure. Prolonged exposure to dust can result in chronic (Taggart, 1996; Rusas 1998; Cassino et al., 1999; English et al., 1999) bronchial problems. Studies on the respiratory health effects from vehicular pollution are essential in order to predict the (Stone, 2000; Grahm, 1990; Tiittnen et al., 1999) risk factors that may cause an asthmatic response.

Many studies conducted previously have reported problems associated with cellar parking like acute traffic congestion; buildup of traffic / vehicular fumes and their effects on people (Malcolm, 1988).Higher concentrations of pollutants crossing the threshold limits and guidelines given by WHO which might lead to human health effects (Wahyu et al., 2015; Choudhury et al., 2013) and Chaisansuk et al., 2007 have proposed guidelines for improving ventilation naturally in the cellar parking using Computational Fluid Dynamics (CFD).Scarcity in literature is observed with reference to studies on perception of health by the personnel working in cellar, to our knowledge this is one of its kind study taken up on how personnel, working in these zones acknowledge their wellbeing.

Hence the objective of the present study is to evaluate the occupational health effects of security guards working in cellar/underground parking.

2. MATERIALS AND METHODS

2.1 Study Area

Present study is conducted in the city of Visakhapatnam which is a major port and second largest city in the state of Andhra Pradesh and the third largest city located on the east coast of India (Figures 1 & 2), with a population of approximately 1.3 million. Nestled among the hills of the Eastern Ghats the city faces Bay of Bengal to the east.

Around 7 lakh vehicles in the city come under the commissioner ate of city police. RTA officials pointed out that nearly 450-500 new motor vehicles are hitting the city's roads each day. While cars constitute 12% of the total vehicle population in the city, 73% are two-wheelers and only 8% is contributed by auto-rickshaws and taxis (The Times of India, 2015).Three major shopping complexes have been selected in the city of Visakhapatnam for the present study, which are selected based on land use patterns like Coast line, commercial junction and heavy traffic zone.

S.No	Site Number	Land Use pattern
1	Site – 1	Coast line
2	Site – 2	Commercial Junction
3	Site – 3	Heavy Traffic Zone

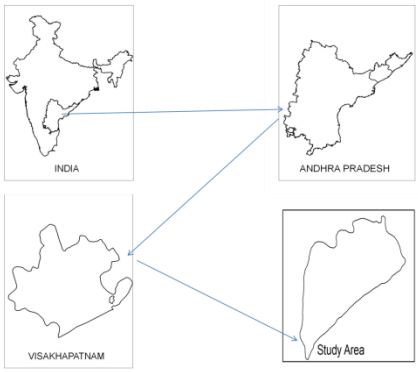

Figure 1 Study Area

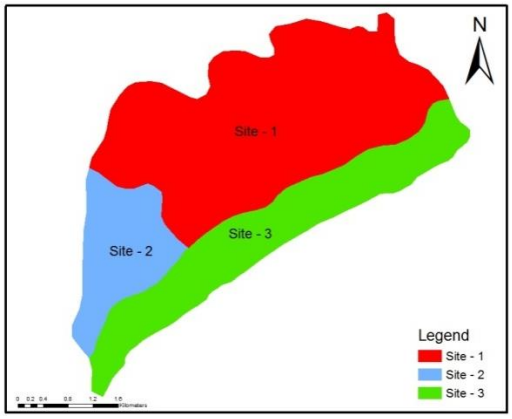

Figure 2 Sampling Sites

2.2 Respondents

Prior to participating in the study, all the respondents had to sign an informed consent form. Permission was taken from all the respondents of the study for collection of data. A total of 250 respondents with at least one year of experience with no major previous health problems have been selected for the study.

2.3 Study design

The study aimed to obtain information regarding the perceived occupational health effects of the respondents and to identify physical factors and ergonomic factors that may have contributed to these problems. Each respondent participated in a face-to-face

interview. The questionnaire was intended to obtain information about the demographic data, awareness regarding their work place, physical workand exposure duration of the respondents.It also includedconsideration on the prevalence and nature of health effectswith their "work-relatedness".

During the face-to-face interview, the questions consisted of five parts:

i. Demographic data: information included name, age, height and weight.
ii. Vehicular Data: data regarding the frequency and number of vehicles temporally in a day, week and year.
iii. Awareness on Vehicular Pollution: respondents level of awareness regarding vehicular pollution.
iv. Health Effects: to assess the effect of working environment on the health.

The face-to-face interview was thought to be more reliable in obtaining accurate information from the respondents as they were from a wide range of backgrounds with different educational levels. This will also help to confirm that all questions were answered precisely and also that the answers were recorded in a consistent manner. Annexure – 1 (Saritha et al., 2016)

3. RESULTS

Table – 1 reveals the cumulative demographic data of the respondents showing that the maximum 35.38% of respondents were in the age group of 20 – 30 followed by 31.13% belonging to age group 30 – 40, while the minimum 4.25% from 50 – 60 age group. This is also reflected with the data from individual malls.

Table – 2 represents the vehicular flow in these malls at any given point of time during a year, month, day etc. It is noted that the weekends are the most heavy vehicle flow days of the year reaching up to 1, 25, 000 (Two Wheelers) and 95, 000 (Four Wheelers) cumulatively. This is also shown with the individual malls vehicles reaching high numbers during these days. Results have shown a clear demarcation between the vehicle flow from weekdays and weekends, weekdays being less flow and weekends being more flow including holidays and festivals.

Table 1 Demographic data of the Respondents

Variable		%
Age	<20	15.09
	20-30	35.38
	30-40	31.13
	40-50	14.15
	50-60	4.25
Education	Primary	14.15
	Secondary	22.17
	Intermediate	35.85
	Degree	27.83

Table 2 Vehicular Flow during given days

Variable	Two Wheeler	Four Wheeler
Year	16500	9500
Month	12500	6000
Weekends Friday, Saturday,	5000	5000

Sunday	6200	4900
Working days MTWT	5000	3500
Holidays	6100	4800
Festivals	6600	5500

Table – 3 depicts the general awareness levels of the respondents, awareness on vehicular pollution was highest in all the respondents (94.34%) which is identical with all the three malls. However the awareness on types of pollutants released from vehicular exhausts is not known to most of the respondents (69.81%). All the respondents have perceived health effects from the pollutants. 83.02% respondents have reported change in health after taking up the job, which is obvious with 86.32% respondents not satisfied with their jobs.

Health problems articulated by the respondents are presented in Table – 4. Respiratory problems were found to be high in majority of respondents 57.08%, 68.87% of respondents reported medium levels of sneezing which is evident with 37.26% respondents having recurrent cold whereas 47.17% has constant cough. Difficulty in ingestion was observed to be high in 70.75% of the respondents, which correlates with high levels of irritation in throat by 42.45% of the respondents.54.72% of the respondents have stated moderate levels of effects on eyes. 51.89% of respondents testified intermittent headaches while difficulty in sleep was informed by 32.08% of respondents. Persistent skin infections were observed in 10.38% while recurrent infection was noticed in 23.58% of the respondents. Musculoskeletal disorders and high body temperature were reported by 73.58% and 95.28% respondents respectively. 100% of respondents have unanimously testified stress in job, hypertension, soiling of clothes and unbearable noise.

Table 3 Level of Awareness of the Respondents

Variable	**Yes (%)**	**No (%)**
Awareness on vehicular pollution	94.34	5.66
Types of pollution	30.19	69.81
Awareness on health effects due to pollution	100.00	0.00
Change in health	83.02	16.98
Job satisfaction	13.68	86.32

Table 4 Health Effects of the Respondents

Variable	**High (%)**	**Medium (%)**	**Low (%)**
Respiratory problems	57.08	25.00	17.92
Constant sneezing	2.83	28.30	68.87
Cough	22.64	47.17	24.53
Cold	0.00	37.26	62.74
Difficulty in ingestion	70.75	19.81	9.43
Irritation in throat	42.45	38.68	18.87
Effects on eye	27.36	54.72	17.92
Headache	22.17	51.89	8.96
Difficulty in sleep	28.30	32.08	22.64
Skin infections	10.38	23.58	49.06

Other health problems	22.64	7.55	0.00
Musculo skeletal disorders	73.58	9.43	0.00
Body temperature	95.28	4.72	0.00
Stress in job	100.00	0.00	0.00
Hypertension	100.00	0.00	0.00
Soiling of clothes	100.00	0.00	0.00
Unbearable noise	100.00	0.00	0.00

Comparative account of health effects from the three sites can be summarized as follows:
Respiratory problems were high in site – 2, constant sneezing was less and only recorded at site – 3, and cough was reported but was less in all the three sites. Difficulty in ingestion was high in site – 2, along with irritation in throat. Effects on eyes, headache, difficulty in sleep and skin infections are associated with site – 3. Whereas musculoskeletal disorders, body temperature, stress in job, hypertension, soiling of clothes and unbearable noise were recorded more or less to 100% in all the sites (Fig – 3).

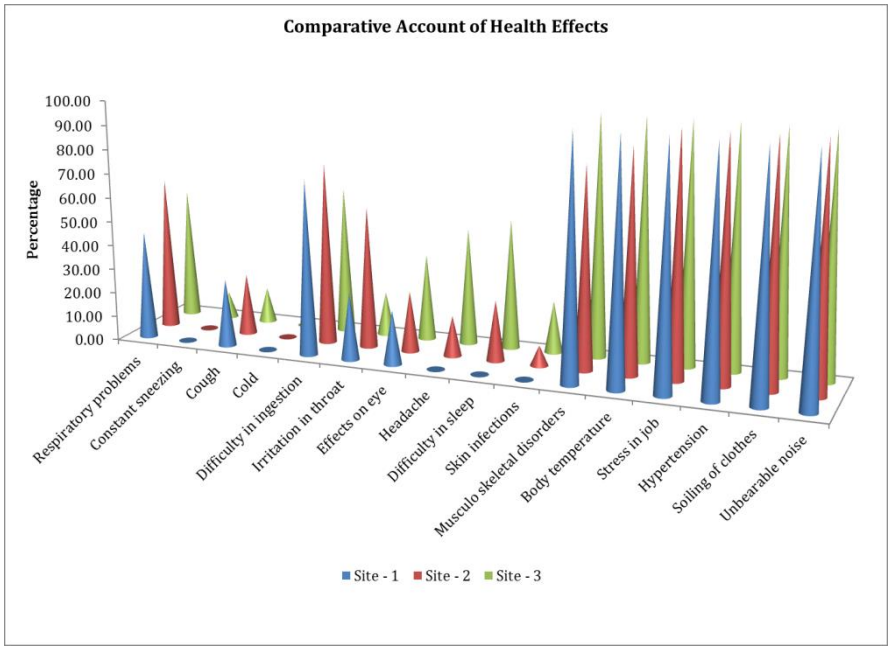

Figure 3 Comparison of Health Effects among the three Sampling sites

4. DISCUSSION

In order to provide solution for a problem, one must be aware of the reason, which is why people's awareness, knowledge and attitude to different environmental issues become necessary. One of the ways to improve the quality of life is by paying attention to environmental issues. Man has duty to be aware of our environment for defense and sustainability (Yaghoobi, 2003).The effects of air pollution include breathing and respiratory problems, intensification of current cardiovascular and respiratory disease, alterations in the body defense system against foreign materials, carcinogenesis, lung tissue damage and premature death (Cotes, 1978; NIH, 1995).

4.1 Age group vs Education and Awareness

The present study has enabled us to gain richer experience with reference to the time spent with the respondents in understanding their environmental awareness. From the results we could relate more awareness in older age groups and respondents with good educational background when compared to others. Younger age groups due to less experience and less study levels may receive less information than older ages. The older group has presented higher levels of knowledge than others. Based on an interpretation of Strong, 1998 older ages has more probabilities of learning owing to their life time (Zarrintaj et al., 2011). This might be due to the reason that the older age respondents may have received information from the media or other sources (Arduni, 2000; Strong, 1998; Yun, 2002; Chung and Poon, 2003; Sehat, 2000).

Maximum respondents were from the age group of 20 – 30, who were having educational qualification only up to intermediate. Most of the respondents even though acknowledged about environmental pollution could not define it precisely. Age factor is very important in assessing occupational health effects as with increasing age there will be decrease in immunity which might also lead to elevated effects. Same was previously reported by USNRC 1981 who focused on age induced asthma in the population (Williams, 1986; WHO 1997). Cotes, 1978 reported decline in the perfusion of lung by increasing age. Sengupta et al., 1974 has reported age induced asthma is in the Indian population.

4.2 No.of Automobiles

Tremendous increase in motor vehicles in India is associated with rapid urbanization. Since the last one decade these vehicle fleets have even doubled in some cities, increasing mobility which came with a high price. Congestion is increasing as the number of vehicles is continuously growing; vehicles are now becoming chief cause of air pollution in urban India. Auto mobiles have become indispensable tribulations, although living had been made easy and convenient by them, they also have resulted in making human lives more complicated and vulnerable to both toxic emissions and also increased risk of accidents. Urban people are the most affected and among the worst sufferers are personnel who are particularly close to the automobiles exhaust, studies conducted in India indicate high rate of occurrence of respiratory, eye irritation and skin problems among the vehicular guards and a significant number of them become victims of lung disorders.

Occupational health effects are directly proportional to magnitude of exposure. Study with reference to no.of vehicles coming into the cellar parking will give a direct measure of the health effects. From the study it is seen that flow of vehicles is very high during weekends and holidays. We observed traffic median volumes of 1500/day on weekends and 600/day on weekdays. This will eventually lead to 2-fold increase in traffic volume from weekday to weekend. This not only creates congestion but also exerts pressure on the personnel working over there. This will result in short term exposure to high concentration of pollutants.

Sung et al., 2007 have found out that the increase in traffic volume have increased pollution, which corresponded with an increase in median air pollution that varied from a minimum 2- (CO) to a maximum 7 (pPAH)-fold. Upon inhalation these pollutants are capable of causing negative health impacts which lead to numerous problems related to cardiac and pulmonary, which under extreme conditions lead to mortality. This scenario is continuously present in enclosed/cellar parking areas creating indoor air pollution to the extent of severity. Owing to the lack of appropriate ventilation system in enclosed parking areas, these buildup combustion pollutants. Studies have shown that the pollutant concentrations were very high compared to ambient atmosphere; e.g., minimum and maximum levels of CO found were 12 ppm and 164 ppm, which exceed the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and WHO guidelines; likewise $PM_{2.5}$ concentration averaged more than 100 $\mu g \cdot m^{-3}$ with a maximum concentration of 234 $\mu g \cdot m^{-3}$ and NO_2concentration were 25 to 56 $\mu g \cdot m^{-3}$, thereby leading to indoor air pollution and main sufferers are the guards and employees of working over there (Choudhury et al., 2013).

4.3 Conditions within cellar parking

Concern about the environment within enclosed parking embraces fire safety, thermal comfort and air quality. Employees and subcontractors providing security, maintenance and other services may regularly work in parking for up to 12h periods. Their work nature needs them to move around a large area or stay at a location. Hence, their health risk is generally due to long-term exposure to various pollutants, enabling them to be applicable to occupational health criteria. The feeling of comfort associated with cellar parking personnel depends on a number of factors. With inside temperatures 1–8°C higher than those outside (Consumer Council, 1993) the summer temperatures of 30°C or more coupled with high humidity means the thermal comfort within enclosed parking

can be most unsatisfactory. This discomfort can contribute to negative reactions too ours and pollutants. Extremities of discomfort due to heat along with high levels of pollution might be overwhelming to sensitive people.

Petrol and diesel-engined vehicles are distinctly different, so are the concentrations of pollutants that are discharged which depend very much on the particular vehicle and the mode of operation. Air pollution due to motor vehicles has been summarized by Williams, 1989, he also presented the differentiation between primary pollutants affecting people in the form they are released, and secondary pollutants that undergo or are formed by reactions in the atmosphere.

Oxides of carbon and hydrogen are produced from petrol and diesel as a consequence of incomplete combustion. Of the most concern are the primary pollutants which include particulate matter, carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), lead along with a range of organic compounds generally known as volatile organic compounds (VOCs). Major contribution of VOC emissions arise from evaporative and futile losses rather than from combustion. Of these pollutants, CO, NOx, SO_2 and lead compounds are toxic. Though NO_2 is the most toxic substance it only accounts to 5% of the total NOx emitted (Rogers, 1984). Total hydrocarbons (THC) include aromatic hydrocarbons (PAH), polynuclear (or polycyclic)which are group of numerous organic compounds, which benzo[a]pyrene (BAP), is suspected to be best known human carcinogen.

4.4 Health effects perceived by the Respondents

4.4.1 Assessment of exposure risk

Risk assessment is complicated because individuals and organizations perceive risk differently, depending on the one responsible for perception and one that pays for the solution or in other terms clean-up. Risk assessments associated with air quality take into account concentration of dose (pollutant) and its consequent health effects. Assessment of exposure includes determination or estimation of the magnitude, frequency, duration and route of exposure. Characterization of health effects depend on the risk associated with the individual lifetime, relative risk between exposed and unexposed persons and debilitating temporary effects (De Koning, 1987).

4.4.2 Health effects

Health effects from vehicular emissions have been well documented previously. In the present study following health effects were articulated by the respondents: Respiratory problems, Constant sneezing, Cough, Difficulty in ingestion, Irritation in throat, effects on eye, Musculo skeletal disorders, Body temperature, Headache, Difficulty in sleep, Skin infections, Other health problems, Stress in job, Hypertension, Soiling of clothes.

Study carried out by Rizwanet.al., 2013 found that vehicular pollution effects in Delhi had 1.7-times higher prevalence of respiratory symptoms (in the past 3 months) when compared to rural controls ($P < 0.001$); the odds ratio in Delhi was 1.59 (95% CI 1.32-1.91) with reference to upper respiratory symptoms and for lower respiratory symptoms it was 1.67 (95% CI 1.32-1.93)which included symptoms like dry cough, wheeze, breathlessness, chest discomfort. Asthma prevalence during the study (in the last 12 months) and physician-diagnosed asthma among the participants of Delhi was expressively higher than in controls. The prevalence of hypertension was 36% in Delhi than in the controls 9.5%, that was positively correlated with particulate matter (PM_{10}) and respirable suspended level in ambient air. Significantly higher levels of chronic skin irritation, eye irritation and headache were reported in Delhi.

Community based studies from several workers have found that air pollution is associated with respiratory morbidity (Chhabra et al., 2001; Agarwalet al., 2006; Jayaraman, 2008). Numerous studies have reported an association between indoor air pollution and respiratory morbidity (Firdaus and Ahmad, 2011; Kumar et al., 2008; Kulshreshtha et al., 2008; Saksena et al., 2003; Sharma et al., 1998; Kumar et al., 2007).Some of these studies also focused on children's respiratory morbidity (Kumar et al., 2008; Saksena et al., 2003; Sharma et al., 1998; Kumar et al., 2007). Other studies on children reported similar associations between particulate matter in ambient air and attention-deficit hyperactivity disorder (Siddique et al., 2011) and also between vehicular air pollution and increased blood levels of lead (a potential risk factor for abnormal mental development in children) (Kalra et al., 2003) and between decreased serum concentration of vitamin D metabolites and lesser mean haze score (a proxy measure for ultraviolet-B radiation reaching the ground) (Agarwal et al., 2002).

Many studies related to examining compounding effect of meteorological conditions on air pollution found that winter has worsened the quality of air in both outdoor and indoor. In addition positive correlation between the winter weather and rise of patients with chronic obstructive airway disease in hospitals was also noted (Agarwal et al., 2006; Kulshreshtha et al., 2008).

A direct relationship between prevalence of restrictive, obstructive and mixed type of functional impairment of the lungs was found to have with the dust concentration and duration of exposure (Taggart, 1996; Rusas, 1998; Casino et.al., 1999; English et.al., 1999; Cotes and Malhothra 1964). Investigations of the respiratory health effects from the vehicular pollution exposure are essential for predicting the risk factors that may cause an asthmatic response (Stone V 2000; Grahm, 1990; Tittnen et.al., 1999). Several research works has confirmed the effects of air pollutants on respiratory function of the human being. The continuous vehicular exhaust inhalation can lead in the symptoms of lower respiratory tract such as shortness of breath, cough and pain with inspiration (Dockery and Pope 1994; Pope III et.al., 1997).

5. CONCLUSION

Health, as known and understood is an encompassing issue, which not only lies within the fields of the health department but with all those involved in development of humans. Several great scholars from Charaka to Hippocrates have stressed the significance of environment in relation to health of an individual. Therefore, all those who play a role in modifying the environment in some way, for whatsoever motive, need to contribute to protection of people's health by controlling all those factors which affect it.

We can conclude that the health of respondents has been affected in countless ways with reference to their duration of stay inside the underground parking. Many of the respondent claimed that they encountered discomforts feelings if they stayed in the underground parking for quite long time. This is because the longer they stayed, the higher chances for them to expose to the environment in the underground parking and the more chances they experienced discomfort feelings. This study is a significant contribution to public health by providing a unique assessment of health effects perceived the respondents due to air pollution and source contribution from their working environment.

DISCLOSURE STATEMENT

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