Scientific Research Publishing

Journal of Geoscience and Environment Protection, 2018, 6, 146-157
http://www.scirp.org/journal/gep
ISSN Online: 2327-4344
ISSN Print: 2327-4336

Knowledge of, Attitudes toward, and Practices regarding Indoor Pollution at Kuwait University

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How to cite this paper: Al-Khamees, N. A. (2018). Knowledge of, Attitudes toward, and Practices regarding Indoor Pollution at Kuwait University. *Journal of Geoscience and Environment Protection, 6,* 146-157.
https://doi.org/10.4236/gep.2018.612011

Received: November 21, 2018
Accepted: December 24, 2018
Published: December 27, 2018

Abstract

Despite the increasing recognition of the importance of indoor air pollution, there have been few attempts to delineate the knowledge of and attitudes towards indoor air pollution, as well as the use of said knowledge and the effect of the attitudes on practice. This study sought to measure these attributes in a representative sample of students and teachers at Kuwait University using a self-administered questionnaire. Overall, the mean values for knowledge and attitudes were 7.88/19 and 3.89/5 respectively, indicating low knowledge and sub-optimal attitudes. The mean value for polluting practices was rather high at 1.05/2. Disappointingly, these results are very similar to those obtained in the previous surveys. Newspapers and magazines (65.8%) were the main source of information, followed by radio and television (62.4%). Teachers were significantly ($p < 0.001$) more knowledgeable and less likely to engage in polluting practices as compared to the students. Females scored significantly higher ($p < 0.001$) than males in attitude but were also significantly ($p < 0.001$) more likely to engage in polluting practices. Participants in colleges of Education and Sharia scored significantly ($p < 0.05$) higher in knowledge compared to those in Medicine and Allied Health, as well as Science and Engineering disciplines. However, the latter were also significantly more likely ($p < 0.001$) to engage in polluting practices than Medicine and Allied Health, and Law and Arts students. Participants in Medicine and Allied Health scored significantly lower ($p < 0.001$) on the attitude scale than those in Law and Arts, Education and Sharia, Social Science and Business Administration, and Science and Engineering. A significant Pearson correlation (0.314, $p < 0.001$) was found between knowledge and attitude. Similarly, a significant negative correlation (−0.067, $p < 0.05$) was observed between attitudes and engaging in polluting practices. Further research into the dynamics that influences the decision on whether to engage in polluting practices is needed. Also another

survey is needed which includes people who are outside the high level education field and make the comparison.

Keywords

Indoor Air Pollution, University, Kuwait, Perception, Attitude, Practice

1. Background

According to the Hester et al. (2016: p. 363), 4.3 million people die annually from exposure to household air pollution. Most of these deaths occur in the developing countries and are largely attributable to cooking and home heating with open fires using traditional kerosene stoves or solid fuels (firewood or charcoal).. Household cooking using solid fuels poses the greatest risk after alcohol, tobacco, and high blood pressure. Hester et al. (2016) further observed that more people die from smoke from household fires than from HIV/AIDS, malaria, and tuberculosis combined. Even though deaths from such practices are relatively uncommon in the developed countries, indoor air pollution may still have significant health effects that many people might not be aware of (McGranahan & Murray, 2012: p. 142). In these countries, the most important indoor air pollutants appear to be environmental tobacco smoke; products of combustion from stoves, heaters, furnaces, and fireplaces; volatile organic compounds, including formaldehyde, pesticides, solvents, cleaning agents, scents, hair sprays, paints and other finishes, glues, dry-cleaning fluids, aerosols, and many others.

Other pollutants include fragrances contained in personal products, deodorizers, and cleaning agents; as well as biological materials that include animal dander, insects, and molds. In some areas, outdoor pollutants that enter indoor spaces by natural ventilation through windows or crevices may be important (Jacobson, 2012: p. 207). A study conducted by Kondo et al. (2014: p. 37) found the levels of volatile organic chemicals to be up to ten times higher than in outdoor air in the residences in areas that border on petrochemical plants. This is particularly important given that persons in industrialized nations often spend 90 percent or more of their time indoors (Driver et al., 2013: p. 12; National Academy of Engineering, 2017: p. 1). Usually, the most effective way to improve indoor air quality is to control the source of pollution, and the other methods are proper ventilation and the use of air cleaners (Syed, 2012: p. 14).

A study by Al Khamees and Alamari (2009: p. 1306) and Al-Hubail and Al-Temeemi (2015: p. 570) found that the overall knowledge of indoor air pollution among Kuwaiti students and teachers in schools and colleges was poor and that the average attitude towards the same is mediocre. Another study by Al Khamees (2014) found medium rate of polluting practices.

Kuwait faces a major environmental challenges as it ranked 10th out of 91 countries in air pollution according to the world health organization report

2011, Kuwait ranked 32nd and the last in terms of environmental vitality and ranked 126th in the world and 13 out of 15 Arab countries according to the Environmental performance index 2012.

But Kuwait has moved up more than 100 places since the first posted about Environmental Performance Index 2017, and Kuwait is now ranked 42out of 178 countries listed. This makes Kuwait the 3rd best performing Arab country behind only UAE and Saudi Arabia.

Therefore, the current study was designed to examine the knowledge, attitudes, and practices of students and teachers at Kuwait University with respect indoor air pollution after such improvement of Kuwait in Environmental Performance.

2. The Importance of the Research

People in both industrialized and developing countries spend a great deal of their time indoors. Nevertheless, with increasing pollution, the quality of air in the indoor spaces is not always favorable to human health. Human exhalations such as body odors, and exhaled carbon dioxide; and activities such as heating, cooking, renovating, and smoking tobacco are responsible for producing indoor air pollutants. Different kinds of gaseous substances given off by consumer products, furnishings, and building materials also cause the deterioration of the indoor air quality. Over the last ten years, national-level organizations have recognized the importance of indoor spaces as the source of exposure to pollutants. For example, the European Union's Sixth Framework Programme for Research and Technological Development recognized indoor air pollution as an overlooked but important research area. The significance of indoor air quality was again mentioned and underscored during the WHO Ministerial Conference on Environment and Health that took place in Budapest in 2004. In fact, American scientists rank indoor air pollution as being among the environmental problems that are of great significance based solely on cancer risk. The knowledge of and attitude towards something determines the level of awareness. In turn, the level of awareness about indoor air pollution determines the prevalence of health-related problems. The practices determine the behaviors which may increase the health problems. A health education program related to indoor pollution for university students and teachers can be developed based on the results of this study.

3. Research Problem

Urban air pollution is considered a key health risk to millions of people residing in urban areas all over the world. Worldwide, indoor air pollution attributed to cooking fires is estimated to cause 2 million fatalities annually (Ghiaus & Allard, 2016: p. 11). The problem continues to intensify in numerous towns and cities throughout the developing world where increasing urban populations, coupled with increasing activities have caused significant increase in polluting emissions.

This is further worsened by industrial growth that occurs in a climate of non-existent or weak environmental regulation laws. This results in air pollution levels that greatly surpass the emission standards recommended by the World Health Organization. Even though the significance of indoor air pollution is recognized, only a small number of surveys has been conducted to assess the knowledge of, attitudes towards, and practices that contribute to indoor air pollution.

A search of bibliographic databases of biomedical and life sciences information with the terms "indoor air pollution," "attitudes," and "knowledge" returned no more than seven related entries. Two of the studies were related to dust mites and the risk of asthma among children (Patelarou et al., 2015; Golden & Holm, 2017), three were on tobacco smoke particles and the quality of indoor air (Lin et al., 2007; Mueller et al., 2011; Gerber et al., 2015), and further two on radon (Hoskins, 2016; Al-Zoughool & Krewski, 2009). None of these studies examined the knowledge of, attitudes toward and practices regarding indoor air pollution within an educational setting. Due to Kuwait's hot and arid climate, most people tend to spend a great deal of their time in indoors, which means that they are constantly exposed to indoor air pollutants. This exposure is further exacerbated by most of the buildings being covered with lagging on the inside to make air conditioning more effective; a practice that serves to concentrate the indoor air pollutants. Even so, despite the recognized detrimental effects of indoor air pollutants, very few studies on the knowledge of, attitudes toward and practices regarding indoor air pollution have been conducted in Kuwait. The current study aims to examine the knowledge, attitudes and practices towards indoor pollution in Kuwait University. The results of this study can provide useful input in designing better education about indoor pollution. The questions that this research attempts to answer include:

1) To what degree are Kuwait university students, professors, and faculty staff knowledgeable about indoor air pollution?

2) What are their sources of information or knowledge?

3) What are the attitudes of the university professors, students, and faculty staff towards pollutants and indoor air pollution?

4) What are the practices of the university professors, student, and faculty members regarding indoor air pollution?

5) Does their knowledge and attitudes affect their practices?

4. Method

A faculty-based cluster sample design was used to produce a representative sample of students and teachers of Kuwait University, 3% out of 37000 total students and 15% of 1596 teachers through 17 colleges in Kuwait university. The first stage was to determine the number of classes to be sampled within each of the 17 faculties to represent the proportion of students enrolled in each faculty. Classes within each faculty were selected through systematic equal probability sampling

from all the classes in each college. All the students and teachers in selected classes were eligible to participate. Teachers of the selected classes were contacted in person. The concept of the study was explained to them, and they were invited to participate and to invite their students to participate, as well. All students who understood the instructions and were willing to participate in the study were included. Participation was anonymous and voluntary though the participants were asked to identify their gender, college, and their sources of information about indoor air pollution. The questionnaire was self-administered by the participants.

The questionnaire was designed by the investigator based on an extensive search of previous literature and personal communication with experts in the field, to cover all the required information regarding knowledge, attitudes and practices related to indoor pollution in line with the needs of the current study. A pool of 55 statements related to knowledge (20 items), attitudes (15 items) and practices (20 items) was prepared and was validity checked by five Kuwait University Professors and modified according to their suggestions to be in its final form (47 items).

The questionnaire, which sought to determine the knowledge of, attitudes towards, and practices of the participants regarding indoor air pollution, was then administered. Reliability was calculated using SPSS. Cronbach's alpha values were 0.735 in the knowledge test, 0.431 on the attitude scale, and 0.731 for the practices section. For the knowledge section, correct answers were scored as 1 and incorrect answers as 0. The attitude section was scored on a 5-level Likert scale, with 1 representing a "strongly disagree" position and 5 representing "strongly agree." For practices, no or rare use of a polluting practice was scored as 0, sometimes use as 1, and regular use as 2. Data were recorded as a number, percentage, mean and standard deviation. Student's t-test was used to analyze the inter-gender differences and student-teacher differences while differences between colleges were analyzed using a 1-way ANOVA and Scheffe procedure. Pearson correlation coefficient was used to calculate the correlations among knowledge, attitude, and practices.

5. Results

1288 questionnaires were returned, 1062 (82.5%) from students and 228 (17.5%) from teachers. There were 760 females (59%) and 528 (41%) males. For the purpose of analysis, colleges were grouped into Law and Arts (n = 235; 18.2%), Medicine and Allied Health Sciences (n = 131; 10.2%), Education, Sharia and Women's Studies (n = 291; 22.6%), Social Science and Business Administration (n = 243; 18.9%), and Sciences and Engineering (n = 388, 30.1%). The main source of information on indoor pollution was Newspapers and magazines (808), followed by radio and television (766), classes (609), books (481), family (469), friends (306), and other sources (134). Although most participants were aware of the hazards associated with smoking, raising pets or birds inside the

home, and the use of certain types of glue, and the fact that indoor plants and air exhaust in kitchens and bathrooms decrease pollution, the average knowledge of indoor air pollution was low at 7.88 ± 3.00/19. The results for other factors were also disturbing. The fact that 30.6% thought the practices of using naphthalene to prevent mold and using a clothes dryer inside the house decreased air pollution was particularly a cause of concern (Table A1 in Appendix).

The most common beliefs were that there must be laws to protect the consumer from toxic chemicals in household products, that it is necessary for products to bear labeling listing their contents in Arabic and English, and that the presence of an air exhaust in the kitchen and toilets is an important way of expelling indoor pollutants. The items that met with the least agreement were that it is better not to use a gas stove for cooking at home, that there is a connection between incense and indoor air pollution, and that it is not difficult to reduce the rate of indoor air pollution (Table A2 in Appendix).

The most likely polluting practices were using a gas stove, perfumes, or candles while the failure to use air exhaust fans in the bathroom or kitchen and not opening windows were regarded as practices that were least likely to cause pollution (Table A3 in Appendix).

The t-test analysis of gender showed that despite there being no significant difference in level of knowledge between the males and the females, and significantly better attitudes of females; females on average engaged in significantly more polluting activities than males (see Table 1).

Not surprisingly, teachers displayed significantly higher knowledge than students and engaged in significantly fewer polluting activities than students (see Table 2).

The average overall values for knowledge, attitude, and practices by the college are shown in One-way ANOVA analysis of the data showed that participants in the Education and Sharia group were significantly more knowledgeable than those in Medicine and Allied Health Sciences or Science and Engineering (Table 3). It further showed that those in Medicine and Allied Health Sciences had significantly worse attitudes towards indoor air pollution than those in any of the other college groupings; and that participants in Education and Sharia were significantly more likely to engage in polluting activities than those in Law

Table 1. The t-test results for indoor air pollution knowledge, attitude, and practice by gender.

Measure	Gender	N	Mean	S.D.	t	df	Sig. (2-tailed)
knowledge	Male	528	7.94	2.98	0.535	1286	0.593
	Female	760	7.84	3.02			
Attitude	Male	528	3.86	0.30	−3.23	1286	0.001**
	Female	760	3.92	0.31			
Practice	Male	528	1.02	0.19	−4.498	1286	<0.001**
	Female	760	1.07	0.19			

**Significant difference at the 0.01 level.

Table 2. The t-test results for indoor air pollution knowledge, attitude, and practice comparing students and teachers.

Measure	Sample	N	Mean	S.D.	t	df	Sig. (2-tailed)
knowledge	Students	1062	7.74	2.99	−3.673	1286	<0.001**
	Teachers	226	8.54	2.98			
Attitude	Students	1062	3.89	0.32	−1.658	1286	0.098
	Teachers	226	3.93	0.27			
Practice	Students	1062	1.07	0.18	9.752	1286	<0.001**
	Teachers	226	0.94	0.19			

**Significant difference at the 0.01 level.

Table 3. Descriptive analysis of knowledge, attitude, and practice by college.

Measure	College	N	Mean	Std. Deviation
Attitude	Law & Art	235	3.903	0.307
	Medicine & Allied Health	131	3.783	0.271
	Education & Sharia	291	3.896	0.302
	Social Science & Business Administration	243	3.898	0.308
	Sciences & Engineering	388	3.934	0.320
knowledge	Law & Art	235	7.885	3.006
	Medicine & Allied Health	131	7.435	2.807
	Education & Sharia	291	8.399	2.988
	Social Science & Business Administration	243	7.782	2.966
	Sciences & Engineering	388	7.706	3.053
Practice	Law & Art	235	1.029	0.201
	Medicine & Allied Health	131	1.020	0.193
	Education & Sharia	291	1.091	0.201
	Social Science & Business Administration	243	1.059	0.183
	Sciences & Engineering	388	1.041	0.176

and Arts or Medicine and Allied Health Sciences or Science and Engineering. Using Pearson's correlation and t-test, a significant correlation was found between the average overall knowledge and the average overall attitude: r (1286) = 0.314, $p < 0.001$; 9.86% of the variance in the attitude variable that was accounted for by a variance in knowledge. Again, a significant negative correlation was found between the average overall attitude and average the overall participation in polluting activities: r (1286) = −0.067, $p = 0.017$ ($p < 0.05$).

6. Discussion

The findings from the current study agree with those of Al Khamees and Alamari (2009), that the knowledge of indoor pollution was poor. Also, the two studies agree that the survey indicated little advancement in the education on this topic

within the examined population. Again, as expected, teachers showed significantly greater knowledge compared to students, and this greater knowledge translated into their indulging in fewer polluting practices. Scores on the attitude questionnaire were nearly identical with those in the study by Al Khamees and Alamari (2009). While still suboptimal, they are much nearer the desired mark than in the case of knowledge. This may be indicative of an unmet desire to learn, which shows the need for more effort to meet the desire. Unlike in the previous study which showed books to be the major source of information, participants in this survey indicated newspapers and magazines as their major source of information. Perhaps well-placed articles in newspapers and magazines would be a good way of conveying the message about the hazard posed by indoor pollution.

The fact that females were more likely to engage in polluting activities despite exhibiting significantly better attitudes may be attributable to the fact that females do most of the housework in most households. The significant correlation between knowledge and attitudes could also be the result of a mutually reinforcing effect. However, neither increased knowledge nor a better attitude seems to guarantee better practice. Students of Medicine and Allied Health Sciences had the lowest scores among all the college groups for both knowledge and attitude, although their score for practice was the highest. Similarly, while those in Education and Sharia had the highest average score for perception, they recorded the worst score for polluting practices. This presents a dilemma in the sense that it becomes difficult to achieve the goal of reducing the pollution if neither increasing knowledge nor bettering of the attitudes can reliably promote a reduction in polluting practices.

Amegah and Jaakkola (2016: p. 215) and Pilishvili et al. (2016: p. 14) observe that for homes, enforcement of building standards and improved home ventilation through education are the most important—and in many instances the only feasible—ways of achieving improved indoor air quality. However, it must be noted that for the population examined in the current study, education does not seem to have made much difference. Research into the dynamics that influence the decision to engage or desist from engaging in polluting practices is needed.

7. Recommendations

As already noted, the current study found the knowledge about indoor pollution to be poor. Social and behavioral sciences have put forward several theories to explicate and manipulate human actions. The social cognitive theory is among the most notable because it provides a possible explanation on the link between knowledge, attitude, and behavior or practices. The theory places on knowledge a special importance because of its mediating function. Together with other theories, the social cognitive theory is the basis of the traditional KAP (knowledge, attitude, practice) models, also known as KAB (knowledge, attitude, behavior) models, on modifying actions. Several studies on pollution and other

health-related issues have demonstrated the crucial mediating role played by knowledge within the context of health-related behavior, attitude, and action (practice).

It is, therefore, recommended that improving the knowledge of harmful indoor air pollutants among Kuwaiti university students, professors, and faculty staff is a critical step towards modifying attitudes and behavior and thereby reducing exposure to indoor pollutants. The absence of knowledge about the relationship between exposure to the said pollutants and unfavorable health outcomes serves as a barrier to the adoption of practices that reduce contact with pollutants. Future research should also be carried out on the knowledge of, attitudes towards, and practices related to indoor air pollution in other populations across Kuwait other than in university setting, and how do people with highly educated background can influence the perspective of general people regards to indoor pollution.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix

Table A1. Frequency distribution of responses to all the items in the knowledge test.

Item	Increases (N, %)	Decreases (N, %)	No Relation (N, %)	Do not know (N, %)
Incense and candles	485 (37.7%)	65 (5.0%)	504 (39.1%)	234 (18.2%)
Air fresheners	454 (35.2%)	191 (14.8%)	412 (32.0%)	231 (17.9%)
Gas stove for cooking	545 (42.3%)	139 (10.8%)	293 (22.7%)	311 (24.1%)
Fixed carpets	555 (43.1%)	117 (9.1%)	389 (30.2%)	227 (17.6%)
Paint for walls and furniture	619 (48.1%)	83 (6.4%)	348 (27.0%)	238 (18.5%)
Glue for fixing furniture, carpets, etc.	687 (53.3%)	34 (2.6%)	302 (23.4%)	265 (20.6%)
Plywood	178 (13.8%)	103 (8.0%)	593 (46.0%)	414 (32.1%)
Electrical appliances	283 (22.0%)	49 (3.8%)	772 (59.9%)	184 (14.3%)
Dry cleaning	245 (19.0%)	277 (21.5%)	373 (29.0%)	393 (30.5%)
Reducing humidity	202(15.7%)	467 (36.3%)	257 (20.0%)	362 (28.1%)
Using naphthalene to get rid of molds	358 (27.8%)	394 (30.6%)	140 (10.9%)	396 (30.6%)
Wallpaper	271 (21.0%)	148 (11.5%)	519 (40.3%)	350 (27.2%)
Disinfectants used in swimming pools	363 (28.2%)	501 (38.9%)	186 (14.4%)	238 (18.5%)
Smoking	1227 (95.3%)	28 (2.2%)	20 (1.6%)	13 (1.0%)
Raising pets, birds inside home	984 (76.4%)	47 (3.6%)	171 (13.3%)	86 (6.7%)
Plastic floor tiles	230 (17.9%)	253 (19.6%)	448 (34.8%)	357 (27.7%)
Indoor plants	127 (9.9%)	929 (72.1%)	146 (11.3%)	86 (6.7%)
Air exhaust in kitchens and bathrooms	56 (4.3%)	1150 (89.3%)	65 (5.0%)	17 (1.3%)
Cloth dryer inside the house	105 (8.2%)	542 (42.1%)	432 (33.5%)	209 (16.2%)

Table A2. Mean and standard deviation in descending order of means for all the items in the attitude survey.

Item	N	Mean	Standard Deviation
There must be laws protecting the consumer from toxic chemicals in household products	1288	4.85	0.421
It is necessary to have labeling that shows the contents of the product in both English and Arabic	1288	4.81	0.552
The presence of air exhaust in the kitchen and toilets is important to expel the air outside the house	1288	4.80	0.522
Daily cleaning and the use of heavy-duty vacuum cleaners help reduce indoor pollution.	1288	4.54	0.739
Indoor pollution may be related to some health problems that a person may be suffering from	1288	4.31	0.835
The presence of indoor plants is necessary	1288	4.12	0.931
Using household cleaning products may cause some health problems	1288	3.95	0.889
Indoor pollution can be twice as high as the outdoor pollution	1288	3.73	1.055
It is not difficult to reduce the level of indoor pollution	1288	3.03	1.145
There is a connection between burning incense indoor and indoor pollution	1288	2.56	1.209
It is better not to use a gas stove for cooking at home	1288	2.16	.989

Table A3. Mean and standard deviation in descending order of means for all the items in the practices survey.

Item	Mean value out of 2	Standard Deviation
Using gas stove	1.87	0.41
Using perfumes	1.83	0.43
Using candles	1.66	0.55
Using room deodorizer	1.59	0.59
Using metal polishes	1.26	0.69
Bringing dry-cleaned articles in the house	1.24	0.79
Using insecticide	1.16	0.58
Not using air purifier	1.13	0.83
Using paint	1.11	0.63
Using pesticide	1.06	0.62
Using adhesives	0.96	0.62
Using oil or kerosene heater	0.89	0.72
Not keeping houseplants	0.84	0.78
A home craft is carried out	0.78	0.76
Not opening windows of the rooms of the house	0.26	0.50
Not operating the air exhaust fans in the kitchen	0.13	0.42
Not operating the air exhaust fans in the bathroom	0.12	0.39