RADON RISK AWARENESS AMONG UNIVERSITY EMPLOYEES OF OBAFEMI AWOLOWO UNIVERISTY, ILE-IFE,

Olusegun T Afolabi[1], *Deborah Falode[1], Bosun Banjoko[2], Adedeji A Onayade[1] [3]Tobih J.E.
1. Department of Community Health, Obafemi Awolowo University, Ile-Ife
2. Department of Chemical Pathology, Obafemi Awolowo University, Ile-Ife
3. Department of ORL/Head and Neck Surgery, Ladoke Akintola University Teaching Hospital, Osogbo
E-mail: falodedeborah@gmail.com

Abstract

Radon is considered a significant contaminant that affects indoor air quality. However radon is only known to few people, and there is limited documented research on its health hazards in Nigeria. We therefore assessed the awareness of radon and its health risk among employees of Obafemi Awolowo University Ile-Ife, Nigeria. Academic and non-academic staff members from all the 13 faculties were recruited for the study. Based on the requisite sample size, a semi-structured questionnaire was administered to the staff of these faculties. Only 42% of respondents are aware of radon, among which 43.8% knew about radon health risk. There was a statistically significant association between level of knowledge and academic background ($p=0.02$) with 41% of staff with core science background having good knowledge compared to 19% and 12% of respondents from health science and social science background respectively. Poor awareness of radon and its health risk exists among University employee of OAU.

Introduction

Globally, radon is the second most important cause of lung cancer after smoking (WHO, 2009). The proportion of lung cancers attributable to radon is estimated to range from 3% to 14%. Although not always publicized as a tremendous public health concern, cancer caused by radon exposure ranks very high among other preventable causes of death. Radon is responsible for the majority of the public exposure to ionizing radiation. It is often the single largest contributor to an individual's background radiation dose, and is the most variable from location to location. In the U.S, the average person gets more radiation dose from exposure to indoor radon than from any other source of natural or man-made radiation (Raymond, 1997).

Radon is a naturally occurring radioactive gas that emanates from rocks and soils and tends to concentrate in enclosed spaces like underground mines or houses (WHO,2009). It is formed as part of the normal radioactive decay chain of uranium-238 which is present in small amounts in most rocks and soil. It slowly breaks down to other products such as radium, which breaks down to radon. Some of the radon moves to the soil surface and enters the air, while some remains below the soil surface and enters the groundwater. Uranium has been around since the earth was formed and has a very long half-life (4.5 billion years), which is the amount of time required for one-half of uranium to break down. Uranium, radium, and thus radon, will continue to exist indefinitely at about the same levels as they do now (Tawfiq et al 2012).

Radon has a half-life of 3.8days. Unlike radon, the decay products are metal and easily attach to dust and other particles in the air. Radon's primary hazard arises from inhalation of its highly radioactive heavy metallic decay products (polonium, lead and bismuth) which tend to collect on dust in the air. Two of these radioactive elements, polonium-218 and polonium-214, emit alpha particles, which are highly effective in damaging lung tissues (Darby, Hill and Doll; 2001). These alpha-emitting radon decay products have been implicated in a causal relationship with lung cancer in humans.

If inhaled, radon decay products (polonium-218 and polonium-214, solid form), unattached or attached to the surface of aerosols, dusts, and smoke particles, become deeply lodged or trapped in the lungs, where they can radiate and penetrate the cells of mucous membranes, bronchi, and other pulmonary tissues. The ionizing radiation energy affecting the bronchial epithelial cells is believed to initiate the process of carcinogenesis. Although radon-related lung cancers are mainly seen in the upper airways, radon increases the incidence of all histological types of lung cancer, including small cell carcinoma, adenocarcinoma, and squamous cell carcinoma (USEPA 1993).

Radon exposure in homes may arise from certain subsurface rock formations and also from certain building (e.g. granites); greatest risk of radon exposure is from tight, insufficiently ventilated buildings and buildings that have leaks that let in soil air from the ground into the basement and upper dwelling rooms. High indoor radon concentration poses a serious health problem that can be addressed by individual actions and unless people become aware of the dangers radon poses, they will not act (USEPA 2011). Radon poses a serious health problem to a substantial portion of the population. According to the office of the United States Surgeon General, "Indoor radon gas is a serious health problem in our nation that can be addressed by individual action. Millions of homes are estimated to have elevated radon levels. Like the hazards from smoking, the health risk of radon can be reduced (USEPA 2011). Understanding the population's knowledge about radon can provide insights for policy makers and public health practitioners in developing and testing promotion campaigns. This study therefore assessed awareness of Radon and its health risk among University employees of Obafemi Awolowo University, Ile-Ife, Nigeria.

Material and Methods

The study was conducted in various office buildings of the Obafemi Awolowo University, Ife, Osun State. Obafemi Awolowo University (O.A.U) is a comprehensive public institution established in 1962 as the University of Ife. The landscape is marked by many steeply inclining hills of granite rock formation- the inselbergs- whose slopes are covered with dense vegetation, forming a natural green back drop to the campus. Its topography is hilly and there are many steep slopes, ranging from a 6-12% incline. The University campus is divided into 3 major zones; academic, student residential area and staff quarters. The academic zone consisting of the main core and its extensions contains the 13 faculties and Departmental buildings, including lecture rooms, seminar rooms, libraries, laboratories, auditorium and offices. This area is located on a gently sloping area in the centre of the campus designed as foreground to the nearby hills and planned as the heart of the entire university complex. Most of these buildings were built and landscaped according to terrain which suggests a possibility of radon emanation through these ground into the living spaces/ offices in the environment.

This study employed a cross-sectional study design and the offices in the academic area and their occupants were the study population. A sample size of 87 was calculated using the Fisher's formula with level of confidence set at 95%; a precision of 0.05 and prevalence of attribute at 6% which represented the proportion of households with radon levels exceeding 4 pCi/l in the U.S (USEPA 1990).

The buildings were stratified based on the classification by Adepelumi et al, 2005 into granite gneiss; grey gneiss and mica schist with most of the buildings in the academic area falling within the grey gneiss zone. The buildings were sampled randomly in each unit with a total of 8 buildings selected and these were further stratified into floor levels (basement, first and second) with equal sampling from the floor levels. Therefore, in each building, an average of 11 offices was selected distributed equally by floor. In each office, if there was only an occupant, the occupant of the office was automatically selected but if there was more than one occupant, then the respondent was selected by simple balloting. A total of 76 respondents participated in the study yielding a non-response rate of 13%.

The respondents were given explanation about the study and their consent sought and obtained. Thereafter, a pre-tested semi-structured questionnaire was administered. The questionnaire was in three sections with section A containing the socio-demographic characteristics of respondents; section B contained questions to assess respondents' awareness of radon and its health risk and section C contained questions on ventilation preferences of the respondents. To assess the knowledge of staff about Radon, a scoring system was developed based on 7 questions which were then made into a composite score of 9; poor knowledge was graded 0-2, fair knowledge 3-5 and good knowledge 6-9.

Data was entered using Epidata and then exported to SPSS version 16 where analysis was done at univariate and bivariate levels. Data were presented as tables and charts with significant p value set at <0.05.

Ethical clearance was obtained from the ethical review board of the Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife.

Results

Table (1) below reveals the socio-demographic characteristics of occupants of sampled offices. The mean age of the sampled respondents was 43years, the mean number of years spent in the office was 6 years and the mean length/hours of stay per day was 7.3hours. Respondents were academics and non-academic staff with Lecturer I and below accounting for 51%, Senior lecturers16%, Reader 2%, Professor 4%, Technologists (12%) and Administrative staffs (14%).

Age (years)	Frequency (76)	Percent (%)
21-30	9	11.8
31-40	26	34.2
41-50	28	36.8
51-60	10	13.2
61-70	3	3.9
Mean age (S.D)	43.4(9.4)years	
Designation/Cadre		
Technologist	9	11.8
Administrative staff	10	13.2
Assistant Lecturer	25	32.9
Lecturer II	6	7.9
Lecturer I	9	11.8
Senior Lecturer	12	15.8
Reader	2	2.6
Professor	3	3.9
Number of years of occupancy of the office		
<1	11	14.5
Between 1-9	48	63.2
Between 10-20	14	18.4
>20	3	3.9
Mean year (S.D)	5.9(5.4)years	
Average length of stay in the office/day		
Mean (S.D)	7.3 (2.5)hours	
Minimum stay	2 hours	
Maximum stay	12 hours	

Table (1): Socio-demographic characteristics of occupants of sampled offices

Table (2) shows the various faculties from which respondents were recruited. About 18% of respondents were from faculty of Arts and Humanities, Sciences- 21%, 9% from Environmental design and management. Other faculties included Engineering and Technology (11%), Health Sciences (30%), and pharmacy accounted for 11%.

Faculty	Frequency (76)	Percent (%)
Arts and Humanities	14	18.4
Environmental design and Management	7	9.2
Engineering and Technology	8	10.5
Health Sciences	23	30.3
Sciences	16	21.1
Pharmacy	8	10.5

Table (2): Faculties of Respondents of sampled offices

Table (3) compares the awareness of respondents about radon and its health risk. Only 42% of the respondents had ever heard about radon. Of those who had heard about radon, 14(43.8%) were aware of its health risk

	Frequency (%)	
	Yes	No
Proportion of respondents who had heard about radon(N=76)	32(42.1)	44(57.9)
Aware of health risk of radon (N=32)	14(43.8)	18(56.3)

Table (3): Awareness of respondents on radon and its health risks

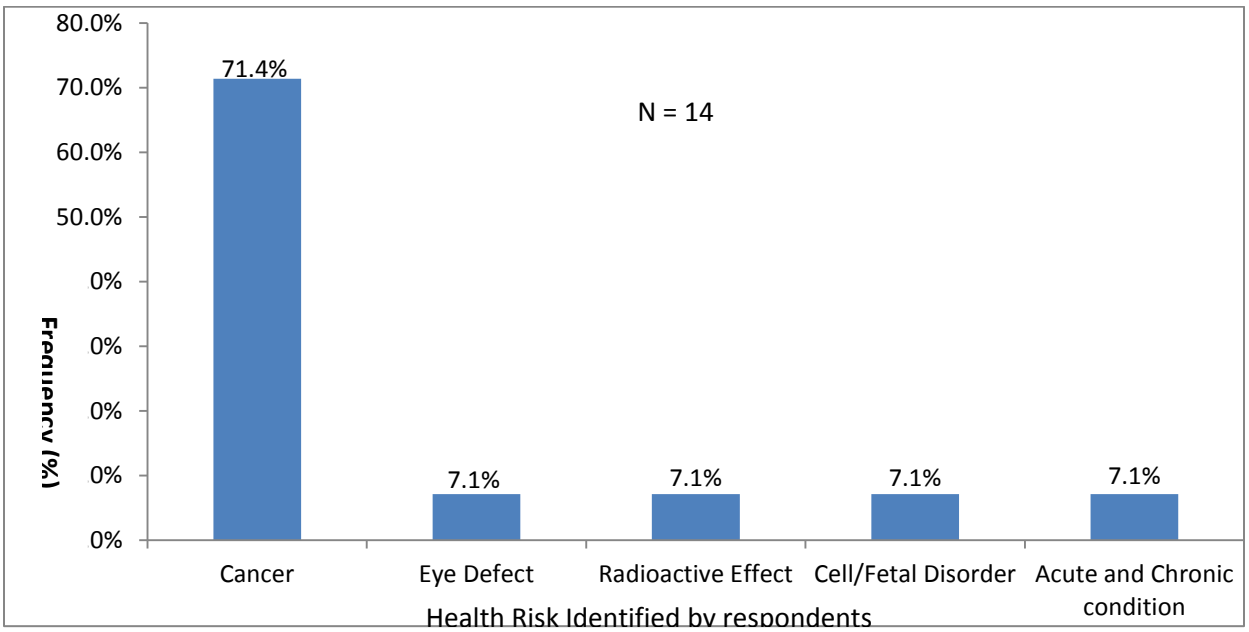

Figure (1): Health risks of radon as reported by respondents

In the study, 71% of the respondents who were aware of the health risk reported cancer as a health risk of radon. Other health risks reported includes eye defects (7%), radioactive effects (7%), fetal disorder (7%) and acute and chronic conditions (7%). See Figure (1) above.

Result of respondent's knowledge of radon is presented in Table (4) below. 91% of those who are aware of radon knew that radon is a gas; 71% identified open air as the source of radon and 84% of respondents knew radon can be detected.

Item	Frequency (N=32)	Percent (%)
Which best describes Radon?		
Radon is a gas	29	91
Radon is a solid	3	9
Can it be seen with naked eyes		
Yes	1	3
Where can Radon be found? {multiple answers allowed}		
Open air	22	71
Ground	16	21
Water	9	33
Don't know	1	3.8
Can Radon be detected?		
Yes	27	84
No	1	3.1
Not sure	4	12.5

Table (4): Respondent's knowledge of radon

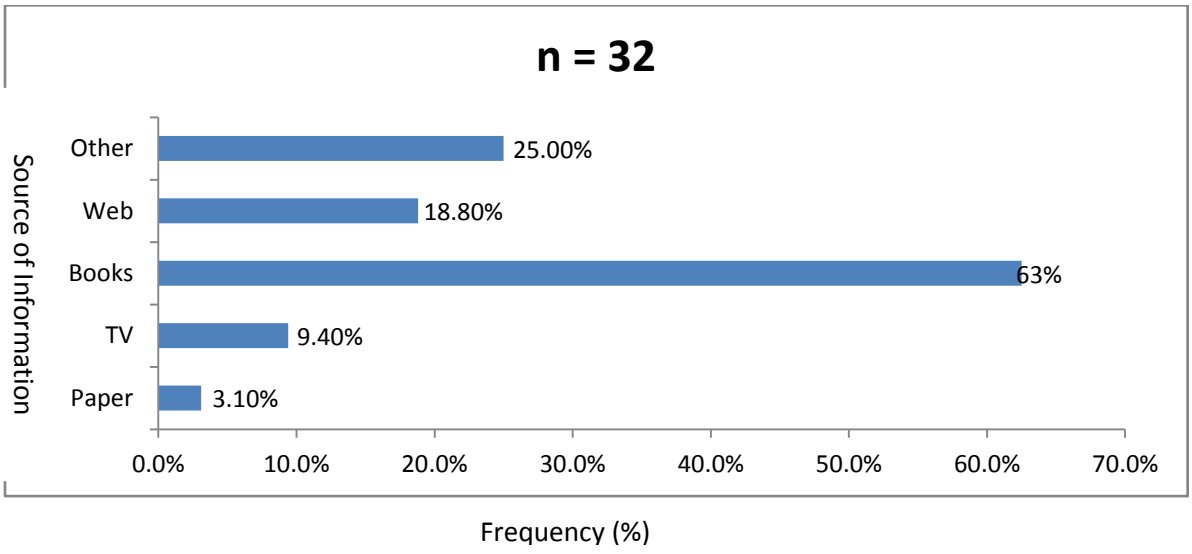

Figure (2): Respondents Source of Information about Radon

In this study, higher percentage of respondents read about radon from books (62.5%); internet accounted for 18.8%, newspapers (3.1%), television(9.4%) while 29.6% of the respondents stated other sources, which include training, lectures, classroom and journal articles.

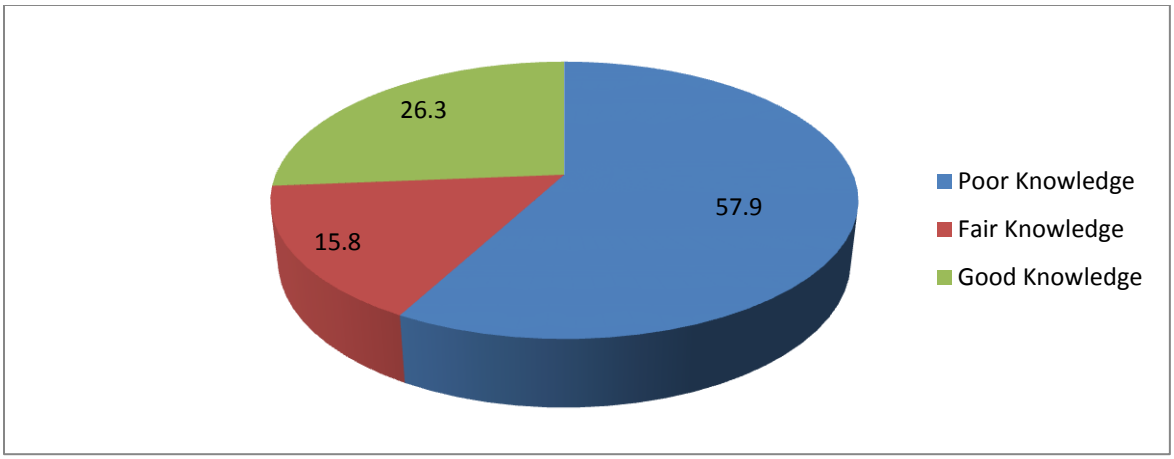

Figure (3): Knowledge level of OAU staff about radon.

More than half (57.9%) of respondents had a poor knowledge of radon, 15.8% had a fair knowledge while only about 26% of the respondent had a good knowledge of radon. See Figure (3) above.

Comparison of knowledge of respondents by academic background, Table (5), revealed that there was a statistically significant relationship (p=0.02) with 41% of respondents with core science background (e.g. Geology, Physics, Chemistry, etc.) having good knowledge about radon compared to 19.4% of respondents with health background (e.g. Doctors, Pharmacist, physiotherapists, etc.) and 12.5% of respondents with social science background (Dramatic arts, Music, African language and linguistics, etc.).

Background	Poor knowledge	Fair knowledge	Good knowledge	Total
Healthbackground	16(51.6%)	9(29.0%)	6(19.4%)	31(100%)
Social background	13(81.3%)	1(6.25%)	2(12.50%)	16(100%)
Core Science background	15(51.72%)	2(6.90%)	12(41.38%)	29(100%)
Total	44(57.89%)	12(15.79%)	20(26.32%)	76(100%)

Pearson Chi-square = 11.96, P= 0.02

Table 5: Determinant of knowledge of radon

Discussion

This study has shown a lack of knowledge on the part of the employees of Obafemi Awolowo University (OAU) about radon, with only 26% of respondents having good knowledge while a larger proportion (about 58%) of respondents had poor knowledge. Only 42% of the respondents had heard about radon among the sampled population and just about 44% of those who had heard knew about the health risk of radon. This reveals that awareness of radon and its health risk in this area is still very low. The result obtained in this study is lower than that of a study conducted

in Boston University, Boston, where 55% of respondents were aware of radon prior to the survey(Peterson and Howland 1996).This, in turn, is much higher than the study done by Home Owner Protection Agency among Canadian citizens which revealed a lack of awareness of radon with just 8% of the surveyed home owners being aware(Homeowner Protection Centre 2012).This could be attributed to the fact that our study was conducted in an academic environment compared to general public in the Canadian study. Also, in a study done by Pramod V. et al in India, it was reported that poor awareness and knowledge of Indoor Air Pollution (radon as an example) exists among its citizens.

This study showed the significant relationship between knowledge and educational background with 41% of staff with technical/science background having good knowledge. The reason for this is understandable when looked at in relation to the source of information, with respondents from core science background possibly coming across it as part of their course content. Also, early works, including the discovery of radioactivity were done by physicists and geologists.

High indoor radon concentration poses a serious health problem that can be addressed by individual actions and, unless people become aware of the danger radon poses, they will not act (USEPA 2011).Radon poses a serious health problem to a substantial portion of the population. The result from this study reveals a poor knowledge about radon among staff of OAU. This further emphasizes the urgent needs for increase in awareness raising activities and this could be achieved through mass media, campaigns, public lectures, and door to door campaigns for the general population. As part of National Action Month held on 15th of January, 2012, the U.S Environmental Protection Agency, Department of Housing and Urban Development and the American Lung Association jointly held a conference in order to publicize the health threat from radon and steps people can take to protect themselves and their families. This program can also be adopted in Nigeria.

Conclusion and recommendation

This study established that the knowledge of staff of Obafemi Awolowo University about radon is very poor. There is an urgent need by the management to increase awareness and sensitize the entire OAU community about the hazard of radon.

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