Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

East African Journal of Health and Science
eajhs.eanso.org
Volume 7 Issue 2, 2024
Print ISSN: 2707-3912 | Online ISSN: 2707-3920
Title DOI: https://doi.org/10.37284/2707-3920

EANSO
EAST AFRICAN NATURE & SCIENCE ORGANIZATION

Original Article

Preliminary Assessment of the Awareness Level of Radon and its Health Risks among High School Science Teachers and Health Workers in Nagongera, Tororo Uganda

Nahori Baniyo[1] *& Saphina Biira*[1*]

[1] Busitema University, P. O. Box 236 Tororo, Uganda.
*Author for Correspondence ORCID ID: https://orcid.org/0000-0002-8439-1293; Email: bsaphina@yahoo.co.uk

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

Date Published:
20 December 2024

Keywords:
Radon Awareness, Radon Health Risks, High School Science Teachers, Health Workers, Tororo District.

ABSTRACT

This study aims to evaluate the awareness levels regarding radon, its associated health risks, and potential mitigation strategies among high school science teachers and health workers in Nagongera Sub County, Tororo District, Uganda. Tororo District, known for its rich natural mineral resources, particularly around the Osukuru Hills, has attracted numerous industries. The combination of mineral-rich geography and substandard building structures may elevate health risks for residents due to radon exposure. An instrumental case study approach was adopted, utilizing a questionnaire designed to assess the awareness of radon-related health risks alongside demographic information such as occupation. The study surveyed 30 health workers and 30 high school science teachers, totalling 60 respondents. Findings revealed that fewer than half of the health workers (30%) and high school science teachers (40%) were aware of radon as a radioactive substance and its health implications. These results highlight the need for targeted efforts by relevant authorities to improve radon awareness among the general population in the district.

APA CITATION
Baniyo, N. & Biira, S. (2024). Preliminary Assessment of the Awareness Level of Radon and its Health Risks among High School Science Teachers and Health Workers in Nagongera, Tororo Uganda. *East African Journal of Health and Science*, *7*(2), 198-207. https://doi.org/10.37284/eajhs.7.2.2536.

CHICAGO CITATION
Baniyo, Nahori and Saphina Biira. 2024. "Preliminary Assessment of the Awareness Level of Radon and its Health Risks among High School Science Teachers and Health Workers in Nagongera, Tororo Uganda". *East African Journal of Health and Science* 7 (2), 198-207. https://doi.org/10.37284/eajhs.7.2.2536

HARVARD CITATION
Baniyo, N. & Biira, S. (2024). "Preliminary Assessment of the Awareness Level of Radon and its Health Risks among High School Science Teachers and Health Workers in Nagongera, Tororo Uganda", *East African Journal of Health and Science*, 7(2), pp. 198-207. doi: 10.37284/eajhs.7.2.2536.

IEEE CITATION
N., Baniyo & S., Biira "Preliminary Assessment of the Awareness Level of Radon and its Health Risks among High School Science Teachers and Health Workers in Nagongera, Tororo Uganda", *EAJHS*, vol. 7, no. 2, pp. 198-207, Dec. 2024.

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

MLA CITATION

Baniyo, Nahori & Saphina Biira. "Preliminary Assessment of the Awareness Level of Radon and its Health Risks among High School Science Teachers and Health Workers in Nagongera, Tororo Uganda". *East African Journal of Health and Science*, Vol. 7, no. 2, Dec. 2024, pp. 198-207, doi:10.37284/eajhs.7.2.2536.

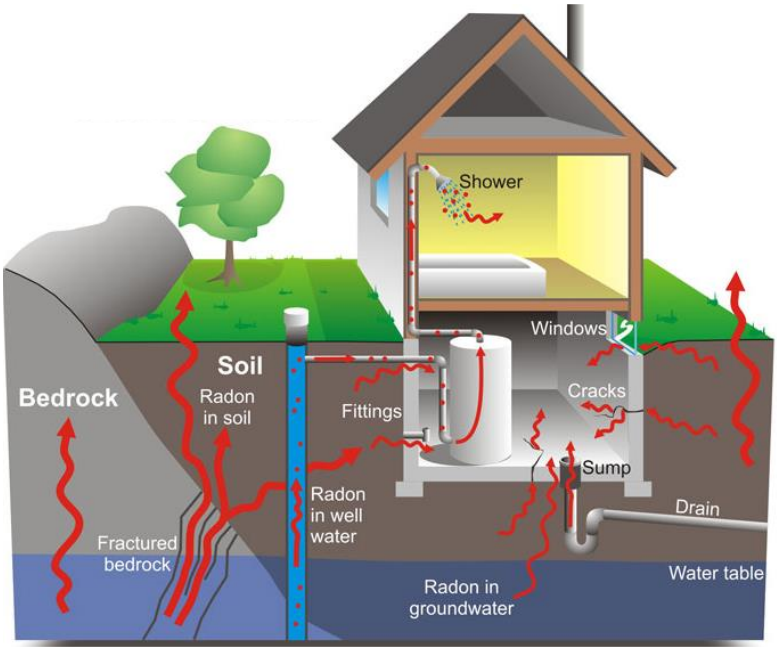
INTRODUCTION

Radon is a colourless, odourless radioactive gas that results from the natural decay of uranium present in many common minerals globally (Frumkin Howard & Jonathan Samet M., 2008); (Biira, Kisolo, & D'ujanga, 2014). Specifically, radon (222Rn) originates from the decay of 226Ra, a part of the 238U-decay series, and is found in various geological formations including rocks, soils, plants, and groundwater. As a significant source of natural background radiation, radon exposure can occur indoors through soil, building materials, or water, either through inhalation of 222Rn gas or ingestion. Such exposure presents serious health risks (Kwok, Yeung, & Xu, 2017).

In residential and occupational environments, radon infiltrates buildings through cracks in walls and floors, construction joints, and spaces around pipes, wires, or pumps. This is illustrated in Figure 1. Basically, radon entry into buildings is governed mainly by four factors, these are: the amount of radon generated in the soil; transport of radon through the soil; transport through the building shell (e.g. through cracks in the slab); and driving forces such as indoor-outdoor pressure differences. With the many factors in play, radon entry is a relatively complex problem (Andersen, 2001).

Studies have established a clear link between chronic radon exposure and lung cancer, prompting agencies like the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC) to classify radon as a human carcinogen (Frumkin Howard & Jonathan Samet M., 2008). Prolonged radon exposure is considered the second leading cause of lung cancer in the United States, after tobacco use. It is estimated that 50% to 55% of the average annual dose from natural background radiation is due to 222Rn (Lantz, Mendez, & Philbert, 2013).

Figure 1. Common Radon entry routes into buildings (Cavity walls, floor slab, basement walls, sanitation pipes, sanitation pipes, etc.)



(Mwitondi, Al Sadig, Hassona, Taylor, & Yousef, 2018).

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

Radon research has been extensive, covering its presence in air, soil, building materials, and water. Its production rates are influenced by the geological characteristics of the soil and underlying strata (Alaamer, 2012). In certain regions, such as the Midwest and Rocky Mountain areas of the United States, high household radon levels pose significant health risks, especially for children who are more susceptible to long-term exposure (Hardback, 1995). Raising public awareness about radon is crucial for monitoring its levels in homes and minimizing health risks. Public awareness also supports researchers conducting field surveys and studies (Kwok et al., 2017).

In Uganda, radioactive elements have been studied since the 1940s, with airborne geophysical surveys covering over 80% of the country, gathering data on radioactive elements like uranium, thorium, and phosphate. Identified uranium-bearing minerals in Uganda include euxenite, microlite, betafite, and pyrochlore, with the latter being especially prominent around the carbonatite complexes of Osukuru Hills in Tororo District (Saphina Biira, 2019). Due to the presence of these minerals and the industries that process them, the areas around Osukuru Hills may have elevated radon levels, increasing the risk of exposure for the local population.

Given Tororo District's mineral-rich environment, enhancing public awareness of radon and its associated risks is essential. The objective of this study is to assess the awareness level of radon and its associated health risks among high school science teachers and health workers in Nagongera, Tororo District, Uganda, with an aim to identify knowledge gaps and guide policymakers in implementing awareness programs and mitigation strategies. This can be done through conducting household radon tests and educating the public on effective mitigation strategies. High school science teachers and health workers, being key sources of knowledge for the community, were selected for this assessment. The findings are expected to inform government efforts to address radon-related health risks in Tororo District.

MATERIALS AND METHODS

Study Area and Target Population

The study was conducted in selected private and public high schools and public health facilities in Nagongera Town Council, Tororo District, Uganda. This area was chosen due to its proximity to Osukuru Hills, a mining complex, and its significance as the location of Busitema University's Faculty of Science and Education, which motivated the researchers to contribute to the local community. The GPS coordinates of the high schools and health centres visited were recorded using Google Maps on a smartphone and are provided in Table 1.

The study targeted high school science teachers and health workers in Nagongera Town Council. A stratified sampling method was used to select participants. Public health centres were chosen based on their employment of qualified staff, as opposed to some private facilities where qualifications may vary. For schools, both public institutions and well-regarded private schools were included, based on their academic performance and the qualifications of their teachers. A total of 30 health workers and 30 high school science teachers participated in the survey, leading to 60 respondents overall.

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

Table 1: Number of Respondents from each High Schools and Health Centres Surveyed in Nagongera Sub-county

Name of High School	Number of Respondents	GPS Coordinates
Kirewa Secondary School	4	0.783928N, 33.956359E
Paya Senior Secondary School	5	0.831502N, 34.015778E
Tororo High School	5	0.786428N, 34.039100E
Peta Community Secondary School	5	0.769341N, 34.088856E
Mahanga Secondary School	5	0.765428N, 34.037744E
Peace Christian School	6	0.765504N, 34.040051E
Name of Health Centre		
Namwaya Health Centre II	5	0.743553N, 34.057341E
Maundo Health Centre II	5	0.787482N, 34.054804E
Pokongo Health Centre II	4	0.755176N, 34.077647E
Were Health Centre II	5	0.751365N, 34.005969E
Nagongera Health Centre IV	11	0.769853N, 34.026031E

Study Design

The study utilized a questionnaire-based approach to evaluate awareness levels of radon, its health risks, and potential mitigation strategies. The questionnaire included sections that covered demographic characteristics, fundamental knowledge of radon, health risks, and mitigation strategies. The questions were designed based on key concepts about radon and its associated health risks. The study employed questionnaires as the primary data collection tool due to the limited availability of respondents for face-to-face interviews, as many health workers and teachers were occupied with their duties. The questionnaire consisted of four sections, each with a combination of open-ended and closed-ended questions tailored to meet the study's objectives.

Data Collection Procedure

Approval for the study was obtained from the administration of Busitema University, which provided an introductory letter for data collection in the Nagongera Community. This letter was presented to the administration of the selected high schools and health centres to gain permission for interaction with their staff. Consent was obtained from health workers who agreed to participate in the survey, and questionnaires were distributed for completion. At Nagongera Health Centre IV, the questionnaires were completed and collected on the same day due to the availability of multiple health workers. In other health centres, participants were given time to fill out the questionnaires, which were collected later.

For High schools, the Science teachers present during the visits were given questionnaires, and in cases where only one or two teachers were available, they were asked to distribute the questionnaires to their colleagues. Data collection from high schools was challenging due to the limited availability of staff and a general shortage of science teachers. In Paya Community Secondary School, a larger group of teachers participated because the visit coincided with a staff meeting. After the completion of data collection, participants were provided with information on radon, including its sources, health risks, and methods for mitigation.

Demographic Data of Participants

Table 2 presents the demographic characteristics of the health workers and high school science teachers who participated in the study. Among the health workers, the majority were male (53%), with most participants aged between 46-60 years (43%), followed by 36-45 years (30%), and 25-35 years (27%). A significant portion of health workers were married (83%), with a few single participants (17%). In terms of education, 43% held certificates, 40% held diplomas, and 17% held bachelor's degrees. Most of the health workers (81%) were

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

nurses and midwives, while the remainder included two medical doctors, two laboratory technicians, and one dentist.

Table 2. Socio-demographic Characteristics of Health Workers and High School Science Teachers

Participants	Health Workers		High School Teachers	
Characteristics	**Number**	**Percentage**	**Number**	**Percentage**
Gender				
Male	16	53%	24	80%
Female	14	47%	06	20%
Age group				
25-35	8	27%	5	17%
36-45	9	30%	20	67%
46-60	13	43%	5	17%
Level of Education				
Certificate	13	43%	0	0%
Diploma	12	40%	17	57%
Degree	5	17%	13	43%
Masters	0	0%	0	0%
Marital status				
Single	05	17%	06	20%
Married	25	83%	24	80%
Divorced	0	0%	0	0%

For high school science teachers, 80% were male, with 17% aged 25-35 years, 67% aged 36-45 years, and 17% aged 46-60 years. The majority (80%) were married, while 20% were single. Most teachers held diplomas (57%), while 43% held bachelor's degrees, with no certificate holders among them. The study considered science teachers specializing in Physics, Chemistry, Biology, Mathematics, and Geography. Overall, the demographic data highlighted a predominantly male cohort of science teachers and a majority of male health workers, providing insight into the composition of the respondents in Nagongera Town Council.

RESULTS AND DISCUSSIONS

Awareness of Participants about Radon

Table 4 illustrates the levels of awareness about radon among high school science teachers and health workers. Most science teachers (73%) were familiar with radioactivity, and 80% had heard about the health hazards of radiation. However, only 40% of the science teachers were aware of radon, with 35% of those being chemistry and physics teachers. Among the science teachers who were aware of radon, 57% recognized that radon poses a health hazard, while 10% did not, and 33% did not provide an answer. Similarly, a large majority (93%) of health workers reported familiarity with radioactivity, while 97% were aware of the health hazards associated with radiation. However, 70% of health workers had not heard specifically about radon, leaving only 30% who reported awareness. Despite this, 80% of the health workers acknowledged that radon is a health hazard, while 17% did not, and 3% did not provide an answer. These findings align with a study on radon awareness among Vermont residents, where 91% believed radon to be a health risk (Riesenfeld et al., 2007). However, the actual knowledge about radon and its specific characteristics was much lower.

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

Figure 4: Awareness of High School Science Teachers and Health Workers about Radon

Respondents	Are you familiar with radioactivity?	Have you heard of the health hazards of radiation?	Are you aware of radon?	Is radon a health hazard?
Science Teachers	73% Yes, 27% No	80% Yes, 20% No	40% Yes, 60% No	57% Yes, 10% No, 33% No Answer
Health Workers	93% Yes, 7% No	97% Yes, 3% No	30% Yes, 70% No	80% Yes, 17% No, 3% No Answer

Knowledge of Participants about Radon

Table 5 provides further insight into the participants' knowledge of radon. Half (50%) of the high school science teachers correctly identified radon as a radioactive colourless gas, while 43% indicated that they did not know the answer, and 7% mistakenly identified it as a visible gas. Only 20% of the teachers understood that radon can seep through cracks in walls, with 60% indicating that they did not know this, and 20% incorrectly mentioning smoke as the medium through which radon can penetrate. Additionally, 30% of science teachers correctly reported that radon originates from underground, while 50% were uncertain about its source, and 20% believed that radon comes from the air.

For health workers, 43% correctly identified radon as a radioactive colourless gas, 54% did not know what radon is, and 3% incorrectly identified it as a visible gas. A small proportion (30%) of health workers correctly noted that radon can penetrate through cracks in walls, while 37% did not know this, and 23% mistakenly mentioned smoke.

Table 5. Establishing whether the Science Teachers (ST) and Health Workers (HW) truly heard of Radon

What is Radon?			Radon can penetrate through the walls.			Where does Radon come from?		
Respondents (%age)	**ST**	**HW**	Respondents (%age)	**ST**	**HW**	Respondents (%age)	**ST**	**HW**
Visible gas	7%	3%	Smoke	20%	23%	Underground	30%	50%
Aromatic gas	0%	0%	Cracks on walls	20%	30%	Water	0%	3%
Radioactive colorless gas	50%	43%	Ceiling	0%	10%	Air	20%	10%
I don't know	43%	54%	I don't know	60%	37%	I don't know	50%	37%

Exactly half (50%) of the health workers understood that radon comes from underground, while 37% were unaware of this information, with 10% thinking it originates from the air, and 3% from water. A participant is considered to have true knowledge about radon if they can identify radon as a radioactive colourless gas, understand that it can penetrate through cracks in walls, and recognize that it originates from underground. Otherwise, they are classified as lacking true knowledge of radon.

Awareness of Health Risks Associated with Radon

Participants' awareness of the health risks related to radon varied widely, reflecting differences in their knowledge levels about radon gas, its origins, and its potential health effects. Some participants had a

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

high level of awareness, while others had never heard of radon before the study. As shown in Table 6, 33% of science teachers strongly agreed that radon is harmful to humans, with many being physics or chemistry teachers holding bachelor's degrees. An additional 50% of the teachers agreed with this statement. Among health workers, 57% strongly agreed that radon is harmful, while 30% agreed.

Conversely, 20% of science teachers strongly disagreed that radon is useful to humans, and 20% disagreed with most of these being physics teachers with bachelor's degrees. Regarding the health risk of radon exposure, 40% of teachers strongly agreed that radon can cause lung cancer if exposure is frequent, while 33% agreed and 23% had a neutral stance. Among health workers, 17% strongly agreed and 53% agreed that radon can cause lung cancer, while 30% remained neutral. When considering the belief that radon cannot easily penetrate the interior of houses through cracks in the walls, 40% of science teachers disagreed, while 30% were neutral, and only 7% strongly agreed. In contrast, 63% of health workers took a neutral stance on this matter, with 13% agreeing and 3% strongly agreeing. Regarding the perception that people who stay in well-constructed houses have a higher risk of being exposed to radon, 50% of science teachers were neutral, 40% disagreed, and only 3% strongly disagreed. Among health workers, 37% were neutral, 20% disagreed, and 30% strongly disagreed with this statement.

These findings suggest that the overall level of awareness about radon among health workers and science teachers in Nagongera Town Council is generally low. The analysis indicates that fewer participants were aware of the link between radon exposure and lung cancer compared to a similar study in Vermont (Riesenfeld et al., 2007), where 85% recognized the connection. The findings are consistent with a study conducted in southwestern Nigeria, which revealed that only 19% of respondents had a high perceived risk of radon (Esan et al., 2020).

Table 6. Awareness of Science Teachers (ST) and Health Workers (HW) of health risks associated with Radon.

Responses	*ST/HW*	*Radon is **harmful** to humans*	*Radon is **useful** to humans*	*Radon **can** cause lung cancer if one is exposed to radon frequently*	*Radon **cannot** easily penetrate into the interior of the house through cracks in the walls*	*People who stay in well-constructed houses have a **high risk** of being exposed to Radon*
Strongly	ST	33%	6%	40%	7%	-
Agree	HW	57%	-	17%	3%	-
Agree	ST	50%	27%	33%	20%	7%
	HW	30%	3%	53%	10%	13%
Neutral	ST	17%	27%	23%	30%	50%
	HW	13%	40%	30%	63%	37%
Disagree	ST	-	20%	-	40%	40%
	HW	-	40%	4%	13%	20%
Strongly	ST	-	20%	-	3%	3%
Disagree	HW	-	17%	-	10%	30%

Mitigation Strategies

In the survey, participants were asked to suggest effective media for communicating radon risks to residents and recommend actions to raise awareness. The majority (77%) suggested radio as the most effective medium, followed by television, newspapers, and social media. Regarding awareness campaigns, 70% emphasized the need for

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

community sensitization, suggesting activities such as:

- Radon Awareness Radio Talk Shows
- Radon Awareness Community Meetings
- Radon Awareness Social Media Campaigns
- Radon Awareness Television Programs

In general, the findings indicate that most health workers (93%) and science teachers (77%) in the Nagongera Sub-county are familiar with radioactivity. However, awareness specifically about radon is significantly lower, with only 30% of health workers and 40% of science teachers aware of it. Nonetheless, a majority of both groups; 73% of health workers and 53% of science teachers recognize radon as a health hazard. Notably, many participants first learned about radon through this study. Knowledge about radon appears to correlate with education level and subject specialization. For instance, medical doctors generally have more advanced knowledge about radon compared to nurses, and physics teachers with bachelor's degrees tend to have more knowledge than those with diplomas. These observations are consistent with findings from studies in Riyadh, Saudi Arabia (Alaamer, 2012), where radon awareness increased with education level and a science background. Therefore, there is a low level of radon awareness among both health workers and science teachers in Nagongera Sub-county. This suggests that the broader community may also lack critical information about radon, highlighting the need for government intervention to provide essential knowledge about this silent health threat.

The findings of this study reflect broader trends observed in low- and middle-income countries, where radon awareness and mitigation strategies are underdeveloped. In contrast, countries such as Canada and the United States have implemented extensive public awareness campaigns, leading to higher levels of knowledge and proactive mitigation efforts (Vogeltanz-Holm & Schwartz, 2018). For example, the Environmental Protection Agency (EPA) in the United States has successfully promoted radon testing and mitigation strategies through national campaigns, resulting in greater public engagement and understanding (Cronin, Trush, Bellamy, Russell, & Locke, 2020).

Drawing on these comparisons, it is evident that targeted awareness campaigns, as suggested by the participants, could significantly improve radon knowledge in Nagongera and beyond. The preference for radio and community sensitization programs aligns with the findings of (Esan et al., 2020) who highlighted the importance of using accessible media to communicate complex scientific information in resource-limited settings.

Implications of the Findings

The lack of radon awareness has significant health implications for the community. Radon exposure is one of the leading causes of lung cancer globally, particularly in non-smoking populations, as highlighted by the World Health Organization (WHO, 2009). The limited awareness among science teachers and health workers, who are key influencers and educators in society, implies that the broader community in Nagongera Town Council may also be uninformed about radon and its associated risks. This gap in knowledge poses a silent but significant health threat, as individuals may be unknowingly exposed to radon in their homes, schools, and workplaces, particularly in areas with high geological radon emissions.

Additionally, the study highlights misconceptions about radon pathways. For example, 60% of science teachers and 37% of health workers were unaware that radon penetrates homes through cracks in walls. This misconception suggests that individuals may underestimate their exposure risks, particularly in poorly ventilated or sealed homes. Research by (Darby et al., 2005) in Europe underscores that long-term radon exposure, even at moderate levels, significantly increases the risk of lung cancer.

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

Therefore, the misconceptions identified in this study could lead to inadequate mitigation measures, further compounding the public health risks.

CONCLUSION

This study explored the level of awareness regarding radon as a health risk among high school science teachers and health workers in the Nagongera sub-county, as well as the mitigation strategies known to them. Additionally, it gathered insights from participants on the most effective methods for raising public awareness about radon-related health risks and encouraging preventative actions.

The findings revealed that most respondents lacked crucial information about radon, including its nature as a harmful radioactive gas and the potential exposure pathways, particularly in indoor environments. The majority of residents in the Nagongera sub-county were unaware of the health risks associated with prolonged radon exposure, such as the increased risk of lung cancer. Participants identified radio as the most effective medium for raising awareness among Nagongera's residents, alongside other media like newspapers, television, and social media. The study also emphasized the need for government-led mass testing of residential homes in Tororo District to determine the levels of radon exposure and address potential health risks.

Recommendations

The findings underscore the urgent need for government intervention and policy development to address the knowledge gaps regarding radon. Implementing mandatory radon testing in schools, health facilities, and residential areas could be a critical step toward mitigating the health risks associated with radon exposure.

To improve radon awareness among the public, this study recommends that relevant authorities take deliberate measures to educate the population. Electronic media, particularly radio and television, should be leveraged to broadcast short awareness and prevention messages about radon. The dissemination of radon-related information through print media, such as newspaper articles and advertisements, can further enhance public knowledge. Additionally, radon education should be incorporated into school curricula at various educational levels. Regular seminars and workshops could also be organized to inform communities about radon risks and mitigation strategies. The study suggests integrating radon awareness into primary healthcare education to ensure that the general public receives basic information about radon and its health implications. This would foster a better understanding of the risks and encourage preventive actions. Furthermore, builders and homeowners should prioritize construction practices that minimize radon infiltration by ensuring that walls and floors are free of cracks or openings that could allow radon to enter indoor spaces. This study also advocates for further research in other areas of Tororo District to assess the general public's awareness of radon and measure radon concentrations in homes and public buildings to provide empirical evidence of exposure risks. Longitudinal studies assessing the health impacts of radon exposure in the region would further inform policy and public health initiatives. Such studies would also aid in developing targeted risk communication strategies that encourage residents to take action to mitigate radon exposure in their homes.

Acknowledgement

The authors would like to acknowledge the financial support extended to them by Busitema University during the course of this study.

REFERENCES

Alaamer, A. S. (2012). Radon Awareness among Saudi People in Riyadh, Saudi Arabia. *World Journal of Nuclear Science and Technology, 2*, 165–168.

Article DOI: https://doi.org/10.37284/eajhs.7.2.2536

Andersen, C. E. (2001). Numerical modelling of radon-222 entry into houses: an outline of techniques and results. *Science of the Total Environment*, *272*(1–3), 33–42.

Biira, S., Kisolo, A. W., & D'ujanga, F. M. (2014). Concentration levels of radon in mines, industries and dwellings in selected areas of Tororo and Busia districts, Eastern Uganda. *Advances in Applied Science Research*, *5*(6), 31–44.

Cronin, C., Trush, M., Bellamy, W., Russell, J., & Locke, P. (2020). An examination of radon awareness, risk communication, and radon risk reduction in a Hispanic community. *International Journal of Radiation Biology*, *96*(6), 803–813.

Darby, S., Hill, D., Auvinen, A., Barros-Dios, J. M., Baysson, H., Bochicchio, F., … others. (2005). Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies. *Bmj*, *330*(7485), 223.

Esan, D. T., Obed, R. I., Afolabi, O. T., Sridhar, M. K., Olubodun, B. B., & Ramos, C. (2020). Radon risk perception and barriers for residential radon testing in Southwestern Nigeria. *Public Health in Practice*, *1*, 100036.

Frumkin Howard, & Jonathan Samet M. (2008). indoor air has raised concern that it may also be a cause of lung cancer for the entire. *A Cancer Journal for Clinicians*, *51*(6), 1–14.

Hardback, B. (1995). 14 Radon Toxicity. *The National Academies of Sciences, Engineering, and Medicine*, (1995), 1–34.

Kwok, T. F., Yeung, C. H., & Xu, Y. (2017). Swaying public opinion on nuclear energy : A field experiment in Hong. *Utilities Policy*, 1–10. https://doi.org/10.1016/j.jup.2017.04.001

Lantz, P. M., Mendez, D., & Philbert, M. A. (2013). Radon, smoking, and lung cancer: the need to refocus radon control policy. *American Journal of Public Health*, *103*(3), 443–447.

Mwitondi, K., Al Sadig, I., Hassona, R., Taylor, C., & Yousef, A. (2018). Statistical estimate of radon concentration from passive and active detectors in Doha. *Data*, *3*(3), 22.

Riesenfeld, E. P., Marcy, T. W., Reinier, K., Mongeon, J. A., Trumbo, C. W., Wemple, B. E., & Kaminsky, D. A. (2007). Radon awareness and mitigation in Vermont: a public health survey. *Health Physics*, *92*(5), 425–431.

Saphina Biira. (2019). Overview of nuclear energy reactor safety and the key issues for Uganda. *Journal of Engineers Registration Board*, (4), 92–95.

Vogeltanz-Holm, N., & Schwartz, G. G. (2018). Radon and lung cancer: What does the public really know? *Journal of Environmental Radioactivity*, *192*(January), 26–31. https://doi.org/10.1016/j.jenvrad.2018.05.017

WHO. (2009). *WHO handbook on indoor radon: a public health perspective*. World Health Organization.

