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Assessment of Knowledge of Cancer and Radiation Protection among Medical students, Health Sciences workers, and General Public in Southern Libya

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Abstract

Introduction: Cancer is a leading cause of morbidity and mortality worldwide, with ionizing radiation being a significant risk factor. In Libya, the increasing exposure to radiation from medical, industrial, and environmental sources necessitates a better understanding of the associated health risks and protective measures. However, knowledge gaps persist among medical students, health sciences workers, and the general public regarding radiation risks and cancer prevention.

Aim: This study aims to assess the knowledge of cancer risks and radiation protection among medical students, health sciences professionals, and the general public in Southern Libya, identifying key gaps and areas for improvement.

Method: A cross-sectional survey was conducted among 107 participants from universities and the general public in Southern Libya. A structured questionnaire assessed demographics, knowledge of cancer risks and screening, awareness of radiation protection, and attitudes toward radiation exposure. Data were analyzed using SPSS to determine knowledge levels and statistical correlations.

Results: The findings revealed that 42.1% of participants had low knowledge of cancer risks, and 49.5% had low knowledge of radiation protection. Only 10.3% underwent regular cancer screenings, and misconceptions about radiation sources were prevalent, with none identifying sunlight as a radiation source. Knowledge of radiation safety principles, such as ALARA, was limited, with only 49.5% recognizing its meaning. While 82.2% acknowledged the need for radiation protection in medical procedures, gaps in formal education and training persisted.

Conclusion: Significant knowledge gaps exist regarding cancer risks and radiation protection in Southern Libya, even among health sciences professionals. The study highlights the urgent need for targeted educational programs, public awareness campaigns, and training workshops to enhance

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knowledge and safety practices, ultimately reducing radiation-related health risks.

Keywords: Cancer awareness, Radiation protection, Ionizing radiation, public health, Medical education, Libya

تقييم المعرفة بالسرطان والحماية من الإشعاع بين طلاب الطب، والعاملين في علوم الصحة، والجمهور العام في جنوب ليبيا

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الملخص

المقدمة:

يُعد السرطان من أبرز أسباب المرض والوفاة على مستوى العالم، وتُعتبر الأشعة المؤينة أحد عوامل الخطر المهمة. في ليبيا، أدى تزايد التعرض للإشعاع من مصادر طبية وصناعية وبيئية إلى الحاجة لفهم أفضل للمخاطر الصحية المرتبطة به ووسائل الحماية. ومع ذلك، لا تزال هناك فجوات معرفية بين طلاب الطب والعاملين في مجال العلوم الصحية والجمهور العام فيما يخص مخاطر الإشعاع والوقاية من السرطان.

الهدف:

تهدف هذه الدراسة إلى تقييم مستوى المعرفة بمخاطر السرطان ووسائل الحماية من الإشعاع لدى طلاب الطب، والعاملين في مجال العلوم الصحية، والجمهور العام في جنوب ليبيا، مع تحديد الثغرات الرئيسية ومجالات التحسين.

الطريقة:

تم إجراء مسح مقطعي شمل 107 مشاركاً من الجامعات والجمهور العام في جنوب ليبيا. استخدم استبيان منظم لتقييم البيانات الديموغرافية، والمعرفة بمخاطر السرطان والفحص المبكر، والوعي بالحماية من الإشعاع، والمواقف تجاه التعرض الإشعاعي. تم تحليل البيانات باستخدام برنامج SPSS لتحديد مستويات المعرفة والارتباطات الإحصائية.

النتائج:

أظهرت النتائج أن 42.1٪ من المشاركين لديهم معرفة منخفضة بمخاطر السرطان، و49.5٪ لديهم معرفة ضعيفة بالحماية من الإشعاع. فقط 10.3٪ أجروا فحوصات دورية للكشف عن السرطان، وكانت هناك مفاهيم خاطئة شائعة حول مصادر الإشعاع، حيث لم يُشِر أي منهم إلى ضوء الشمس كمصدر إشعاعي. كما أن المعرفة بمبادئ السلامة الإشعاعية مثل مبدأ "ALARA" كانت محدودة، حيث عرّفها فقط 49.5٪ من المشاركين. وعلى الرغم من أن 82.2٪ أقرّوا بضرورة الحماية من الإشعاع في الإجراءات الطبية، إلا أن هناك قصوراً في التعليم والتدريب الرسمي.

الاستنتاج:

توجد فجوات معرفية كبيرة فيما يخص مخاطر السرطان والحماية من الإشعاع في جنوب ليبيا، حتى بين العاملين في المجال الصحي. تسلط الدراسة الضوء على الحاجة المُلِحّة إلى برامج تعليمية موجهة، وحملات توعية عامة، وورش تدريبية لتعزيز المعرفة والممارسات الوقائية، بهدف تقليل المخاطر الصحية الناتجة عن الإشعاع.

الكلمات المفتاحية:الوعي بالسرطان ، الحماية من الإشعاع ، الإشعاع المؤين ، الصحة العامة ، التعليم الطبي، ليبيا/Libya

Introduction

Cancer is a leading cause of morbidity and mortality worldwide, and exposure to ionizing radiation is a well-established risk factor for the development of cancer (Sung et al., 2021; Abalo et al., 2021). With the increasing use of radiation in medical diagnostics, industrial applications, and even everyday technologies, the general population in Libya is increasingly exposed to low levels of ionizing radiation (Council et al., 2006). Understanding the risks associated with radiation exposure and the importance of radiation protection is crucial for public health (Choi et al., 2015). This study aims to assess the knowledge and awareness of cancer risks and radiation protection among the general population in Libya and to explore how this knowledge influences health and safety practices.

Radiation exposure can come from various sources, including medical imaging, natural background radiation, and occupational exposure. While medical imaging has revolutionized healthcare, it also contributes significantly to the cumulative radiation dose received by individuals (Rühm et al., 2022). The risk of cancer from low-dose radiation exposure is a topic of ongoing debate. Some studies suggest that even low doses of ionizing radiation can increase the risk of cancer, particularly when exposure occurs over a long period (Tao et al., 2024). Therefore, it is essential for the general population to be aware of the potential risks and take appropriate measures to minimize exposure.

Public awareness of radiation risks and protection measures is often limited. Many people are unaware of the radiation doses associated with common medical procedures or the long-term health risks of repeated exposure; for example, the risks of ultraviolet radiation from sun exposure (Afiouni et al., 2024). In addition to medical exposure, occupational exposure to radiation is a concern for certain groups, such as nuclear workers, radiographers, and airline crew members (Wakeford, 2009). These individuals may be exposed to higher levels of radiation than the general population, increasing their risk of cancer (Rühm et al., 2022). Despite this, studies have shown that even among these high-risk groups, knowledge of radiation protection is often inadequate For example, Elmorabit et al. (2024) found that while most Moroccan dentists were aware of radiation protection, only a small percentage followed best practices, such as using film holders and adhering to the ALARA (As Low As Reasonably Achievable) principle.

The lack of awareness about radiation risks is concerning (Yousef et al., 2025). Radiation exposure can have serious health consequences, including an increased risk of cancer, cardiovascular diseases, and genetic damage (Kavak Yürük, 2024). The risk is particularly high for children and young adults, who are more sensitive to the effects of radiation and have a longer life expectancy during which cancer can develop (Elamri et al., 2025). Therefore, it is crucial that the general population, especially vulnerable groups, is educated about the risks of radiation and the importance of protective measures.

This study aims to assess the knowledge of cancer risks and radiation protection across the general population in Libya. It also seeks to evaluate the awareness and understanding of cancer and radiation protection and to explore how this knowledge influences health and safety practices among medical students, health sciences workers, and the general public. The findings of this study will contribute to the development of targeted educational policies to protect the population from the harmful effects of ionizing radiation.

Methodology

Study Design and Population

This study was a cross-sectional survey conducted in Western Libya to assess the knowledge of cancer and radiation protection among university staff, students, and the general public. Participants were recruited from three academic institutions: the Faculty of Medical Technology at Tripoli University, the Faculty of Medical Technology at Zawia University, and the Faculty of Medicine at Geryan University, along with members of the general public in the same region.

Survey Instrument

Data collection was conducted using a structured, self-administered questionnaire that was validated by experts in the field. The questionnaire consisted of five sections: demographics (gender, age, region, occupation, education level, and field of study/profession), knowledge of cancer (risk factors and screening practices), knowledge of radiation protection (sources, safety measures, and best practices), attitudes and perceptions (concerns about radiation exposure and public awareness), and suggestions and feedback (opinions on improving public knowledge).

Ethical Considerations

The objectives of the study were explained to the participants, and informed consent was obtained. Participation in the study was voluntary.

Scoring System

The knowledge assessment utilized a scoring system in which each correct response was awarded one point. The total possible score for knowledge of cancer was 10, with cutoff levels defined as follows: ≤3 (low knowledge), ≤7 (moderate knowledge), and 10 (good knowledge). The total possible score for knowledge of radiation protection was 11, with cutoff levels of ≤3 (low knowledge), ≤7 (moderate knowledge), and 11 (good knowledge).

Data Analysis

Data analysis was performed using SPSS version 26 and Microsoft Excel 365. Descriptive statistics, including frequencies (N) and percentages (%), were used to summarize demographic characteristics and knowledge levels. Mean scores were calculated for ratio-scale data. Independent t-tests and one-way ANOVA were used to

compare knowledge scores across different groups based on gender and occupation, with statistical significance set at $p < 0.05$.

Results

Study Results

The study assessed the knowledge of cancer and radiation protection among medical students, health sciences workers, and the general public in Southern Libya. The results are presented in the following sections, organized by demographic characteristics, knowledge of cancer, knowledge of radiation protection, and attitudes and perceptions.

Demographic Characteristics

The study included 107 participants, with a slight majority being male (62, 57.9%) compared to female (45, 42.1%). The age distribution was as follows: 22 participants (20.6%) were aged 20 to 29, 29 (27.1%) were aged 30 to 39, 33 (30.8%) were aged 40 to 49, and 23 (21.5%) were over 50 years old. All participants were from the Southern region of Libya.

In terms of occupation, 74 participants (69.2%) were university staff or employees, 20 (18.7%) were students, and 13 (12.1%) were from the general public. The education levels of participants varied, with 6 (5.6%) having a high school diploma, 12 (11.2%) holding a diploma, 32 (29.9%) having a bachelor's degree, 36 (33.6%) holding a master's degree, and 21 (19.6%) possessing a PhD. Most participants (49, 45.8%) were from the medical/health sciences field, followed by applied sciences (27, 25.2%), engineering (14, 13.1%), and literature (5, 4.7%) (see Table 1).

Table 1 Demographics characteristics of the participants

		N	%
Gender	Female	45	42.1%
	Male	62	57.9%
Age Group	20 to 29	22	20.6%
	30 to 39	29	27.1%
	40 to 49	33	30.8%
	Over 50	23	21.5%
Occupation	General Public	13	12.1%
	Student	20	18.7%
	University Staff / Employee	74	69.2%
Education Level	High School	6	5.6%
	Diploma	12	11.2%
	Bachelor’s Degree	32	29.9%
	Master’s Degree	36	33.6%
	PhD	21	19.6%
Field of Study/Profession (if applicable)	Literature	5	4.7%
	Medical/Health Sciences	49	45.8%
	Engineering	14	13.1%
	Applied Sciences	27	25.2%
	Sciences	12	11.2%

Knowledge of Cancer

When asked about common causes of cancer, 46 participants (43.0%) identified radiation exposure as a cause, while 61 (57.0%) did not. Genetic factors were recognized by 26 participants (24.3%), with 81 (75.7%) not considering them a cause. Lifestyle choices were

identified as a cause by 68 participants (63.6%), and environmental pollution was recognized by 45 (42.1%). A small percentage, 5 participants (4.7%), admitted to not knowing the causes of cancer.

Regarding the association between radiation exposure and cancer, 93 participants (86.9%) believed that radiation exposure could cause cancer, while 5 (4.7%) disagreed, and 9 (8.4%) were unsure. When asked about specific types of cancer associated with radiation exposure, 68 participants (63.6%) identified skin cancer, 21 (19.6%) identified thyroid cancer, and 16 (15.0%) identified lung cancer. However, 17 participants (15.9%) admitted to not knowing which types of cancer are associated with radiation exposure (**see Figure 1**).

In terms of cancer screening practices, only 11 participants (10.3%) reported undergoing regular medical check-ups for cancer screening, while 13 (12.1%) did so occasionally, 24 (22.4%) rarely, and 59 (55.1%) never underwent cancer screening.

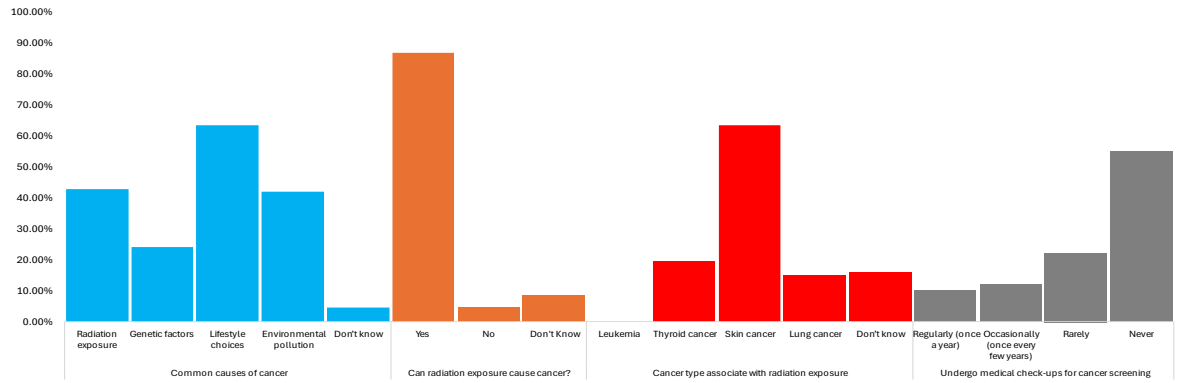

Figure 1 Knowledge of cancer among the participants

Knowledge of Radiation Protection

Participants were asked about common sources of radiation in daily life. X-rays were identified by 58 participants (54.2%), mobile phones by 67 (62.6%), and nuclear plants by 37 (34.6%). However, none of the participants identified sunlight as a source of radiation, and 6 (5.6%) admitted to not knowing the sources of radiation (see Figure 2).

Regarding formal education or training on radiation protection, only 37 participants (34.6%) reported having received any, while 70 (65.4%) had not. When asked about the meaning of ALARA (As Low As Reasonably Achievable) in radiation protection, 53 participants (49.5%) correctly identified it, while 2 (1.9%) provided an incorrect answer, and 52 (48.6%) admitted not knowing.

In terms of protective measures against harmful radiation exposure, 65 participants (60.7%) identified lead aprons, 58 (54.2%) recognized the importance of increasing distance from the radiation source, and 78 (72.9%) acknowledged time management to reduce exposure. However, none of the participants identified dosimeters as a protective measure, and 12 (11.2%) admitted to not knowing any protective measures.

Most participants (88, 82.2%) believed that radiation protection measures are necessary during medical procedures like X-rays or CT scans, while 7 (6.5%) disagreed, and 12 (11.2%) were unsure (see Figure 2).

Participant Level of Knowledge of Cancer and Radiation Protection

The level of knowledge about cancer and radiation protection was categorized as low, average, or good. For knowledge of cancer, 45 participants (42.1%) had low knowledge, 56 (52.3%) had average knowledge, and 6 (5.6%) had good knowledge. For knowledge of radiation protection,

53 participants (49.5%) had low knowledge, 54 (50.5%) had average knowledge, and none had good knowledge.

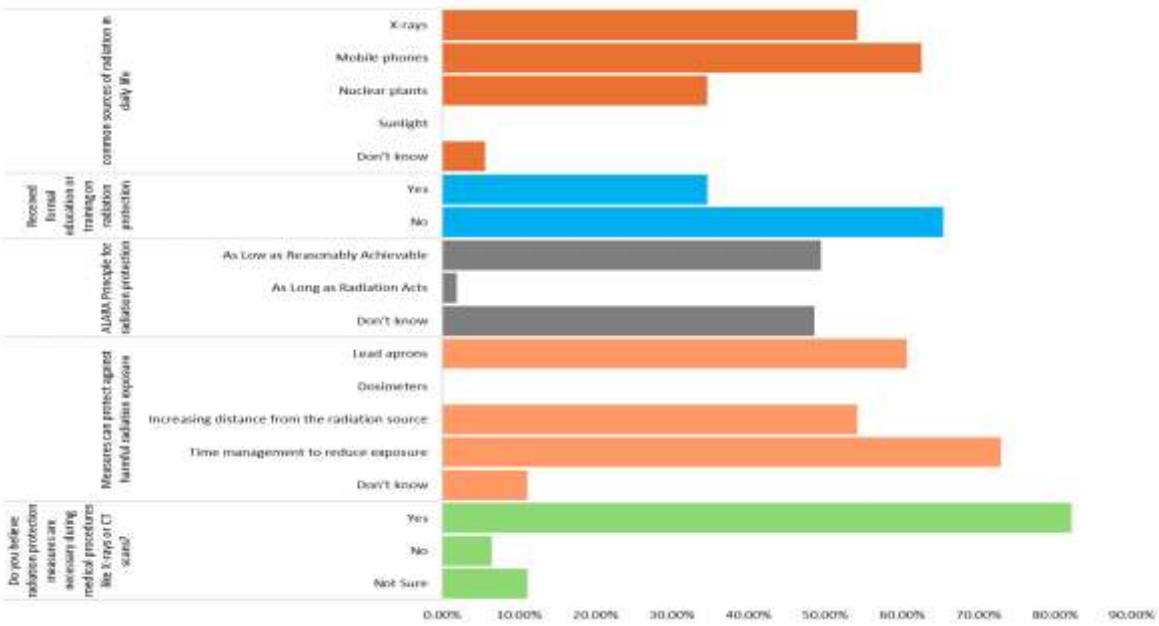

Figure 2 Knowledge of Radiation Protection among the participant

When analyzed by gender, female participants had slightly higher average knowledge scores for both cancer (3.93 ± 1.814) and radiation protection (3.80 ± 1.575) compared to male participants, who scored 4.18 ± 1.645 for cancer and 3.55 ± 1.467 for radiation protection. However, the differences were not statistically significant.

By occupation, university staff and employees had the highest average knowledge scores for both cancer (4.18 ± 1.968) and radiation protection (3.34 ± 1.427). This group was followed by students, who had scores of 3.85 ± 0.875 for cancer and 5.10 ± 0.852 for radiation protection, and members of the general public, who scored 3.85 ± 0.987 for cancer and 3.23 ± 1.536 for radiation protection (**see** Table 2).

Table 2 Participant level of Knowledge of Cancer and Radiation Protection

		Knowledge of Cancer						Knowledge of Radiation Protection					
		Low		Average		Good		Low		Average		Good	
Gender	Female	18	16.8 %	24	22.4 %	3	2.8 %	21	19.6 %	24	22.4 %	0	0.0 %
	Male	28	26.2 %	32	29.9 %	2	1.9 %	32	29.9 %	30	28.0 %	0	0.0 %
Occupation	General Public	4	3.7 %	9	8.4 %	0	0.0 %	7	6.5 %	6	5.6 %	0	0.0 %
	Student	8	7.5 %	12	11.2 %	0	0.0 %	1	0.9 %	19	17.8 %	0	0.0 %
	University Staff / Employee	34	31.8 %	35	32.7 %	5	4.7 %	45	42.1 %	29	27.1 %	0	0.0 %

Attitudes and Perceptions

When asked about their level of concern regarding radiation exposure in daily life, 24 participants (22.4%) reported being very concerned, 57 (53.3%) were somewhat concerned, and 26 (24.3%) were not concerned. The majority of participants, 82 (76.6%), believed that the public in Libya is not well-informed about cancer and radiation protection, while 21 (19.6%) were unsure, and only 4 (3.7%) believed the public is well-informed.

Participants reported obtaining information about radiation and cancer primarily from the media (76, 71.0%), followed by schools, universities, and workplaces (54, 50.5%), health professionals (20, 18.7%), and friends and family (14, 13.1%) (see Table 3 and Figure 3).

Table 3 Participant scores' means and SD of Knowledge of Cancer and Radiation Protection

		N	Knowledge of Cancer		Sig	Knowledge of Radiation Protection		Sig
			Mean	SD		Mean	SD	
Gender	Female	45	3.93	1.814	.470	3.80	1.575	.398
	Male	62	4.18	1.645		3.55	1.467	
Occupation	General Public	13	3.85	.987	.664	3.23	1.536	.000*
	Student	20	3.85	.875		5.10	.852	
	University Staff / Employee	74	4.18	1.968		3.34	1.427	

Feedback on Improving Public Knowledge

Participants suggested several ways to enhance public knowledge about cancer and radiation protection. The majority, 77 participants (72.0%), recommended more education programs in schools and universities. Additionally, 87 participants (81.3%) supported public awareness campaigns, 52 (48.6%) suggested training workshops, and 55 (51.4%) advocated for increased media coverage (**see** Table 4).

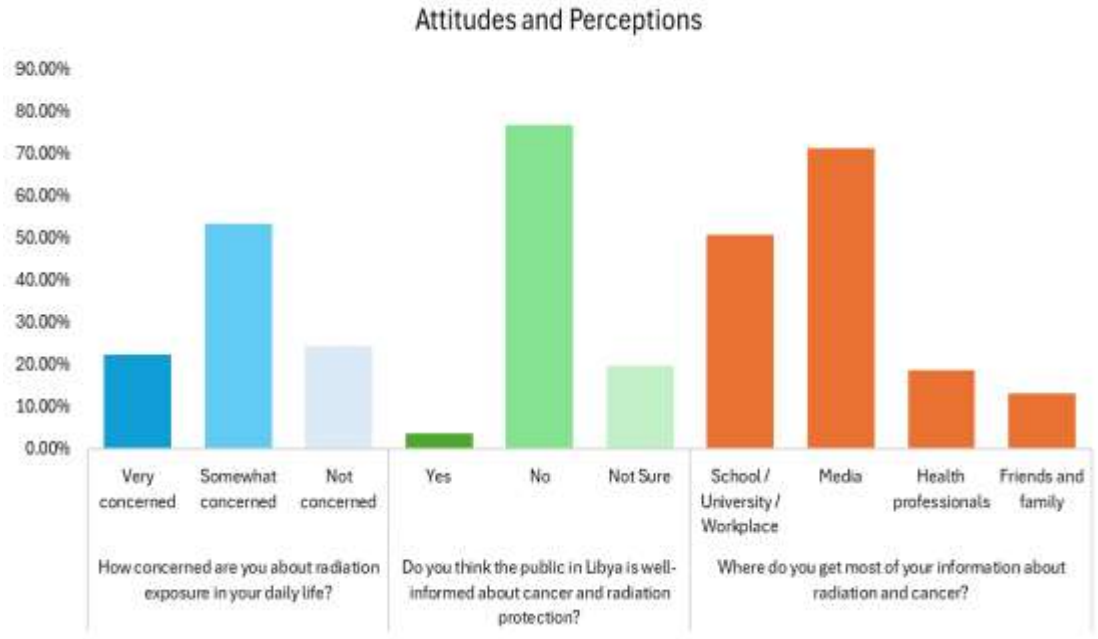

Figure 3 Participants Attitudes and Perceptions

Table 4 Feedback on Improving Public Knowledge

		N	%
More education programs in schools and universities	Yes	77	72.0%
	No	30	28.0%
Public awareness campaigns	Yes	87	81.3%
	No	20	18.7%
Training workshops	Yes	52	48.6%
	No	55	51.4%
Increased media coverage	Yes	55	51.4%
	No	52	48.6%

Discussion

The study revealed significant gaps in knowledge regarding cancer risks and radiation protection among participants in Southern Libya. Many participants were unaware of key sources of radiation, and few engaged in regular screening. Only 43% identified radiation as a cause of cancer, and notably, the public did not recognize sunlight as a radiation source. These findings indicate that even health staff and students possess only moderate knowledge, aligning with existing literature that highlights limited awareness of radiation safety principles among health professionals (Elmorabit et al., 2024).

Similarly, the low recognition of ALARA (49.5%) reflects gaps observed among healthcare students in Turkey, where formal training was also lacking (Kavak Yürük, 2024). This underscores the necessity for specialized training in radiation safety to minimize unnecessary exposure (Maharjan et al., 2020).

The study highlights the urgent need for more educational programs and public awareness campaigns, essential steps to improve protective practices. Literature suggests that enhanced training can lower radiation risks and improve protection in medical settings (Rühm et al., 2022; Tao et al., 2024).

Gender and occupational disparities in knowledge scores resonate with global patterns. Female participants exhibited marginally higher awareness, consistent with findings from Canadian breast cancer studies where gender influenced protective behaviors (Cao et al., 2025). University staff scored higher, likely due to greater academic exposure, confirming the role of continuous training in improving radiation safety among professionals (Elzaki et al., 2025).

Despite high concerns about radiation exposure (75.6%), this awareness did not translate into preventive actions, as only 10.3% underwent regular cancer screenings. This disconnects between awareness and practice mirrors challenges in pediatric radiography, where risk recognition rarely led to dose reduction protocols (Elamri et al., 2025). The emphasis on workshops (48.6%) and school programs (72%) aligns with Delphi consensus recommendations for integrating radiation safety into curricula (Rühm et al., 2022).

The preference for media (71%) as an information source underscores the potential of awareness campaigns. This finding aligns with studies in Lebanon, where media effectively raised knowledge of UV risks (Afiouni et al., 2024). However, reliance on

media without structured education may perpetuate misinformation, as demonstrated by French press coverage that neglected radiation risks in cancer screening (Britel et al., 2020).

Conclusion

This study underscores critical gaps in cancer and radiation knowledge in Southern Libya, particularly regarding protective measures and ALARA principles. The findings align with regional studies, highlighting the universal need for structured education and accessible training. Media campaigns and institutional programs could effectively bridge the awareness-practice gaps identified by participants.

Future efforts should adopt multidisciplinary strategies, integrating insights from global consensus guidelines (Wadsley et al., 2023) and leveraging technology for effective risk communication (Barki et al., 2024). Addressing these gaps is vital for mitigating long-term radiation-related health risks in vulnerable populations.

Ethical Considerations

Participation in the study was entirely voluntary, and participants were informed that they could withdraw at any time without facing any consequences. All responses were anonymized, and no personally identifiable information was collected. Ethical approval for the study was obtained from the relevant institutional review boards.

Limitations

The study was limited to participants from Southern Libya, which may affect the generalizability of the findings to other regions. Additionally, reliance on self-reported data may introduce bias, as participants might overestimate or underestimate their knowledge and practices.

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