Journal of Multidisciplinary Healthcare

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ORIGINAL RESEARCH

Exploring Barriers in Self-Reporting of Errors and Near Misses: A Cross-Sectional Study on Radiation Oncology in Saudi Arabia

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Background: Radiation therapy utilizes complex technologies to target tumors. Radiation therapy is not immune to human errors. Reporting medical errors and near misses is crucial to improving patient outcomes and ensuring the safety of future patients.

Objective: This study aimed to measure the attitudes of radiotherapy staff members in Saudi Arabia regarding reporting errors and near misses in radiation therapy practice. It also examined the participants' reporting patterns and behaviors and explored the potential barriers to reporting errors and near misses as perceived by the participants.

Methods: A cross-sectional study utilizing an online questionnaire was implemented. A sample of 70 health professionals working in radiation oncology departments in Saudi Arabia, including radiation oncologists, medical physicists, and radiotherapists, were recruited to participate in this study from January to June 2023. The data was analyzed using chi-squared testing to compare different groups, and the Kruskal–Wallis was used to find any statistically significant differences between different groups.

Results: The study included 70 radiotherapy staff members. Professional roles did not significantly impact participants' decisions to report minor or major errors, with most consistently reporting errors to their supervisors regardless of role. The study revealed that fear of professional sanctions and the potential negative impact on a department's reputation are significant barriers to reporting errors or near misses. However, Only 17% of radiation oncologists did consider departmental sanctions as a barrier. Participants identified communication failure as the most significant source of errors in radiation oncology departments. The study also found a high level of agreement among the participants regarding the responsibility of reporting errors and near misses.

Conclusion: The study investigated reporting errors and near misses in radiotherapy and considered the factors influencing them. The findings highlight the importance of effective communication and the implementation of an electronic reporting system.

Keywords: radiotherapy, radiation oncology, medical errors, near misses

Introduction

The World Health Organization (WHO) estimates that medical errors affect about 1 in 10 patients and around 50% of those errors could be prevented.[1] To improve patient safety and prevent medical errors from occurring in the future, error and near misses reporting systems should be implemented.[2] The reporting systems should be used as a learning tool, not a way to seek punitive actions against healthcare providers involved in medical errors.[3] Many studies discussed the barriers that would hinder self-reporting of medical errors. Fear of consequences was the most common barrier to reporting medical errors.[4,5]

In Saudi Arabia, regarding the causes that would prevent reporting medical errors, Alsafi et al reported that 43% of their sample were discouraged from self-reporting of medical errors because of fear of punishment.[6] A similar study

Received: 13 August 2024
Accepted: 23 September 2024
Published: 9 October 2024

found that 73% of the sample agreed that fear of punishment would prevent them from reporting medical errors,[7] while another study showed physicians had a positive attitude toward reporting medical errors.[8] However, the researchers concluded that medical errors were still under-reported when it came to practice. Another study concluded that 48% of their sample admitted to committing a medical error, of which only 35% reported it.[9]

Radiation therapy involves using complex equipment to deliver complex treatment plans, making the process prone to errors.[10] International organizations recommend using systems to report errors and near misses in radiotherapy practices as part of their quality assurance programs.[11,12] Learning from errors and near misses benefits those involved in the occurrence of the error and other institutions.[13]

Many radiation oncology departments worldwide participate in either an internal or an external (national) type of reporting system. In the United States, the American Association of Physicists in Medicine (AAPM) and the American Society of Radiation Oncology (ASTRO) collaborated to establish the Radiation Oncology-Incident Reporting System (RO-IRS) in which many radiation oncology departments across the country voluntarily participate in the system to report errors and near-misses.[14] In the United Kingdom, the National Reporting and Learning System (NRLS) is used to report errors and near-misses in radiation oncology departments.[2]

In Saudi Arabia, the Saudi Patient Safety Center (SPSC) was established in 2017 as part of the National Transformation Vision 2030 and Health Sector Transformation Program.[15,16] The SPSC regularly assesses patient safety in hospitals and provides recommendations for implementing effective medical error reporting systems. Thus, many hospitals in the kingdom implement systems for reporting medical errors, including those related to radiation. In addition, radiation oncology departments are mandated to report errors to the Saudi Food & Drug Authority (SFDA).[17] Nevertheless, we were unable to locate any study that explored the reporting behavior and patterns of radiation oncology staff members in Saudi Arabia regarding self-reporting of errors and near-misses in radiotherapy practice.

This paper aimed to measure the attitudes of radiation oncology staff members toward voluntary reporting errors and near-misses at any stage of the radiotherapy process and explore the main barriers hindering error self-reporting and near-misses.

Materials and Methods

Study Design and Setting

This study followed a cross-sectional observational study design. It utilized a survey targeting health professionals working in radiation oncology departments in Saudi Arabia. An institutional review board approval (E-22-7088) was obtained from the authors' institution to conduct this study. A self-administered electronic questionnaire was utilized, and responses were collected from participants from January to June 2023.

Participants and Sampling

Convenience and snowball sampling were employed to recruit participants. The electronic version of the questionnaire was designed using Microsoft Forms and disseminated to the target population through the Saudi Medical Physics Society (SMPS) social media outlets. Radiation oncologists, medical physicists, and radiotherapists were invited to participate in the study. The inclusion criterion for this study was restricted to radiation oncology staff members practicing in Saudi Arabia. Individuals who were not actively practicing in Saudi Arabia at the time of the study were excluded.

Study Tool and Data Collection

A previously validated questionnaire was adopted for this study.[18] The study objectives were briefly explained at the beginning of the questionnaire, and informed consent was obtained from all the participants prior to their participation.

The definitions of errors and near misses in the context of radiation therapy, as outlined by ASTRO, were briefly introduced at the beginning of the questionnaire.[12,19] A distinction was made between major and minor events. An error is any event that leads to wrongful administration of a radiation dose, patient injury, or treatment delay. A near miss refers to any error that is prevented by attentive intervention. Both types of events are also classified as either major or minor according to their severity and whether they lead to patient injury or fatality.

After introducing these concepts, the participants were asked if they were familiar with the abovementioned definitions of errors and near misses before starting the survey. The only demographic information collected was the participants' role in the radiation therapy department and their years of experience. The participants were also asked if they were aware that their current department employed an internal reporting system and or participated in an external reporting system at a national level.

The questionnaire assessed four aspects regarding incident reporting in radiotherapy. The first aspect was concerned with the participants' past experience and behavior with reporting errors and near misses. The participants were asked if they had ever reported minor or major errors or near misses. The second aspect was concerned with the factors that were considered barriers to reporting errors or near misses. Potential reporting barriers were listed, and participants had to choose the factors most likely to hinder their willingness to report any event. Thirdly, the possible sources of errors and near misses, according to the participants, were explored. The participants had to choose from a list of the most probable sources of errors in a radiation therapy setting. Finally, the participants were asked to rate the level of their agreement on a Likert scale on statements that evaluate their attitudes toward reporting errors and near misses. Also, they were asked whether they would participate in a national reporting system if available in their department.

Statistical Analysis

SPSS was used for descriptive and inferential statistics. The chi-squared test was chosen to compare the responses among different groups: radiotherapists, medical physicists, and radiation oncologists. The significance level was chosen as 0.05, and the P values were reported.

The Kruskal–Wallis test was used to determine if there were statistically significant differences among the three groups in their responses to 12 statements on a Likert scale.

Results

Initially, 82 participants responded to the questionnaire, but only 70 were included in the analysis, as 12 were not working in Saudi Arabia at the time. The questionnaire was completed by 29 radiotherapists, 24 radiation oncologists, and 17 medical physicists. Table 1 shows the number of participants in each category and their years of experience.

Figure 1 illustrates the level of awareness among the participants regarding whether their department utilizes an internal or external reporting system for incident reports. Most participants confirmed that their department used an internal reporting system for errors and near misses (Figure 1A). On the other hand, around 50% of the participants in all categories were unaware if their department participated in a national or external reporting system (Figure 1B).

Figure 2 shows the participant's past experience and behaviors with reporting minor and major errors. There were no statistically significant differences among the three categories regarding their behavior in reporting minor errors (p=0.134). Most participants across all three categories (around 70%) indicated that they consistently reported minor errors to their supervisor. Only 7% indicated that they always fail to report minor errors, while 10% indicated that they sometimes fail to report minor errors (Figure 2A). Similarly, there are no statistically significant differences among the three categories regarding their behavior in reporting major errors (p=0.052). Most participants in the three categories

Table 1 Number of the Participants, Their Years of Experience, and Their Roles in Radiation Oncology

Years of experience	Radiation therapists	Medical Physicists	Radiation Oncologists
1 to 5 years	14	4	12
6 to 10 years	6	5	6
11 to 15 years	7	5	2
16 to 20 years	0	1	2
21 to 25 years	0	1	2
26 to 30 years	2	1	0
Total	29	17	24

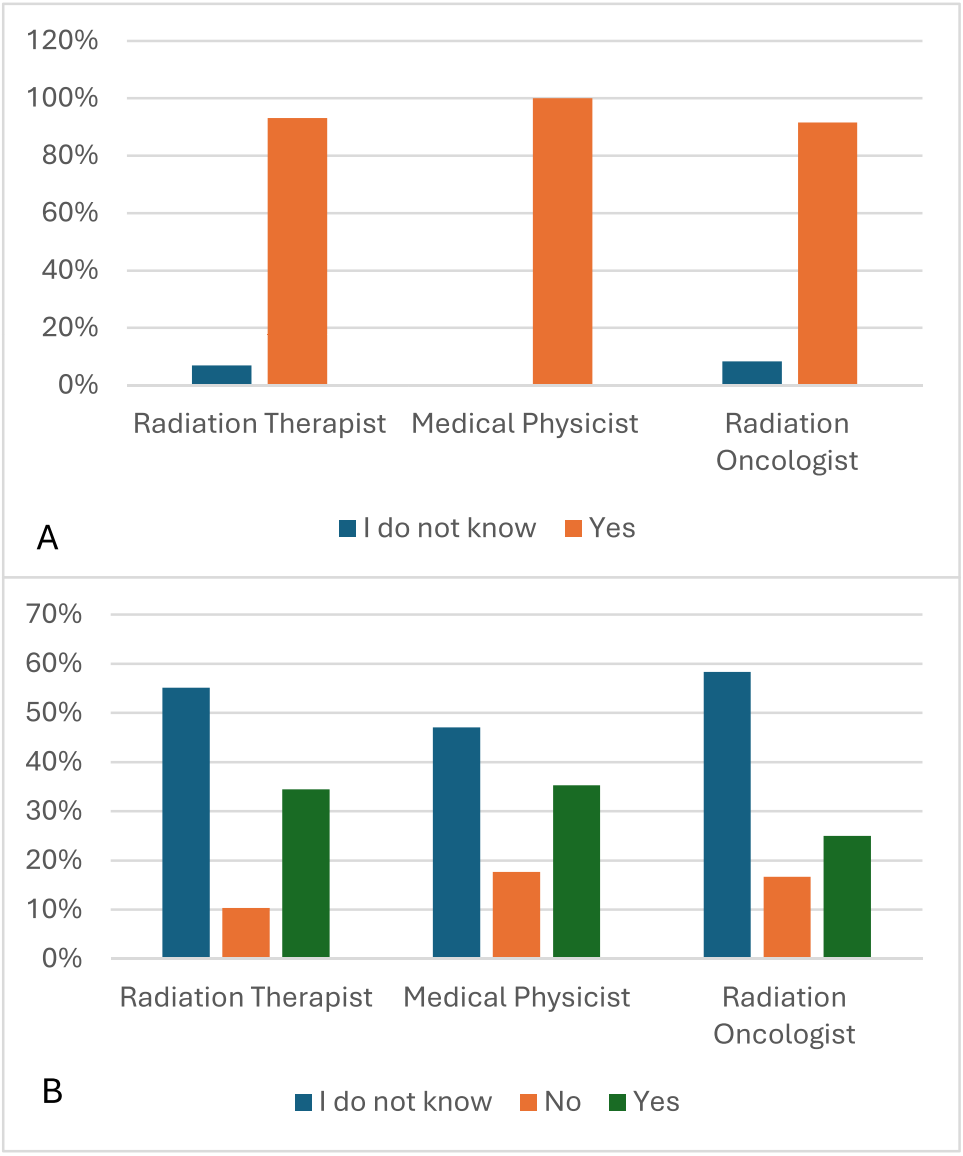

Figure 1 (**A**) Awareness of the participants regarding their department's participation in an internal reporting system for errors and near misses. (**B**) Awareness of the participants regarding their departments' participation in a national reporting system for reporting errors and near misses.

(70%) indicated that they consistently report major errors to their supervisors. Only 4% indicated that they always fail to report major errors, and 4% indicated that they sometimes fail to report major errors (Figure 2B).

Figure 3 shows the participant's past experience and behaviors with reporting minor and major near misses. There is no statistically significant difference among the three groups in reporting minor near misses (P=0.189). Across all groups, the participants (61%) indicated they consistently reported minor near misses to their supervisor. Around 9% reported that they always fail to report minor near misses, while 19% reported that sometimes they fail to report minor errors (Figure 3A). On the other hand, there is a significant difference among the three groups in reporting major near misses (0.048). About 13% of radiation oncologists indicated that sometimes they fail to report major near misses, and 8% of radiation oncologists indicated that they always fail to report major near misses. Around 88% of medical physicists and 69% of radiotherapists indicated that they consistently report any major near misses to their supervisor. In comparison, only 42% of radiologists indicated that they consistently report major near misses to their supervisor (Figure 3B).

Figure 4A shows the potential barriers to reporting errors and near misses as perceived by the participants. There is a statistically significant difference among the groups in their perception of departmental or professional sanctions as

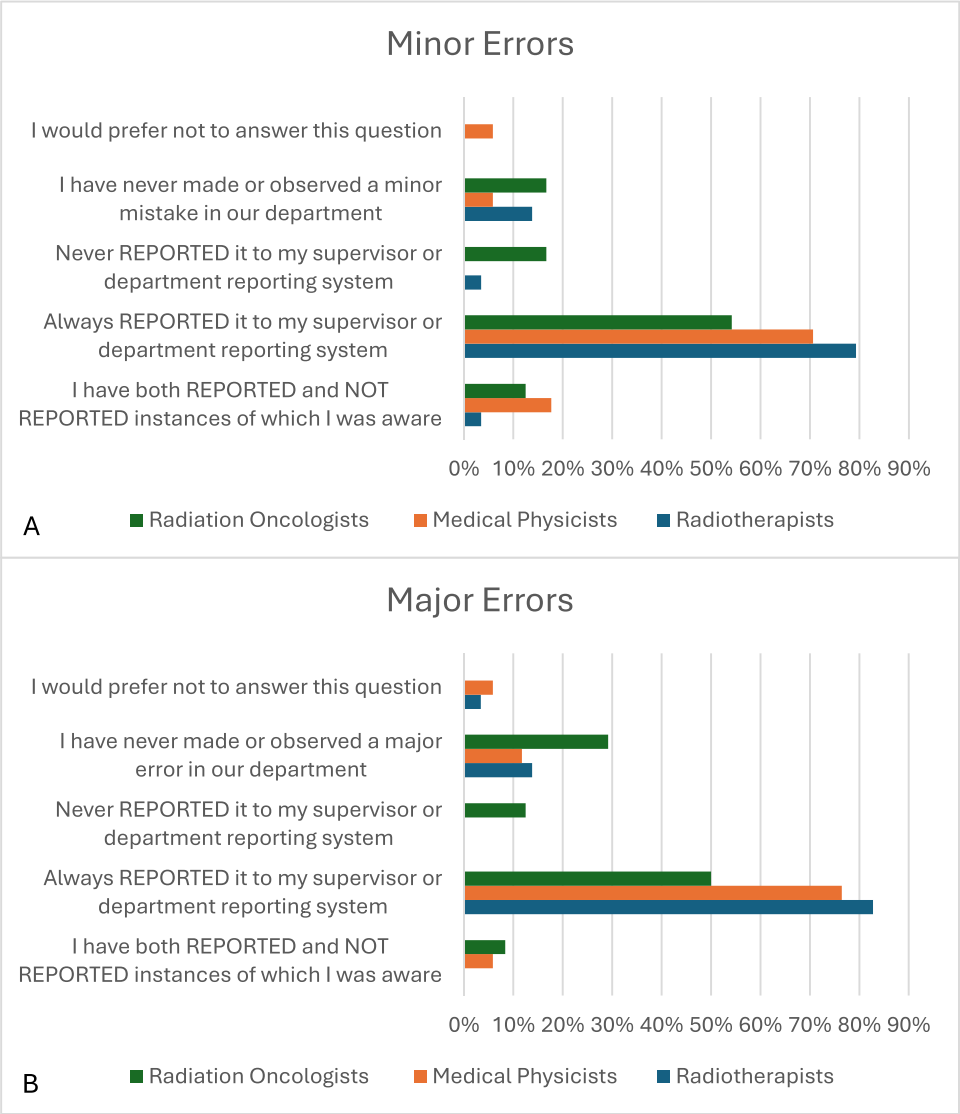

Figure 2 (**A**) The participants' experience and behavior regarding reporting minor errors. (**B**) The participants' experience and behavior regarding reporting major errors.

a barrier to reporting errors or near misses (p=0.0014). Fear of professional sanctions was cited by 53% of medical physicists and 66% of radiotherapists as a factor preventing them from reporting incidents. On the other hand, only 17% of radiation oncologists indicated that departmental or professional sanctions affect their decision in reporting errors or near misses. Another significant difference among the groups was found in their perception of whether they consider the potential negative impact that reporting errors may have on one's department's reputation as a barrier to reporting incidents (p=0.039). About 59% of radiotherapists, 35% of medical physicists, and 25% of radiation oncologists indicated they are concerned about their departments' reputation before reporting any error or a near miss.

Figure 4B shows the potential sources of errors in radiation oncology departments, according to the participants. Failure in communication was indicated by all three groups (p=0.56) as the most significant source of errors in the radiation therapy department (radiotherapists, 62%; Medical physicists, 76%; and radiation oncologists, 73%).

Table 2 shows the level of agreement of the participants on statements regarding reporting errors and near misses. There was a high level of agreement across all groups regarding the responsibility of incident reporting. Around 90% of the participants agreed that it is their responsibility to report errors and near misses (p=0.58). Similarly, most participants agreed they know how to report errors and near misses (P=0.32). Around 90% of radiotherapists, 82% of medical physicists, and 79% of radiation oncologists agreed they know how to report incidents. However, the statement "I know

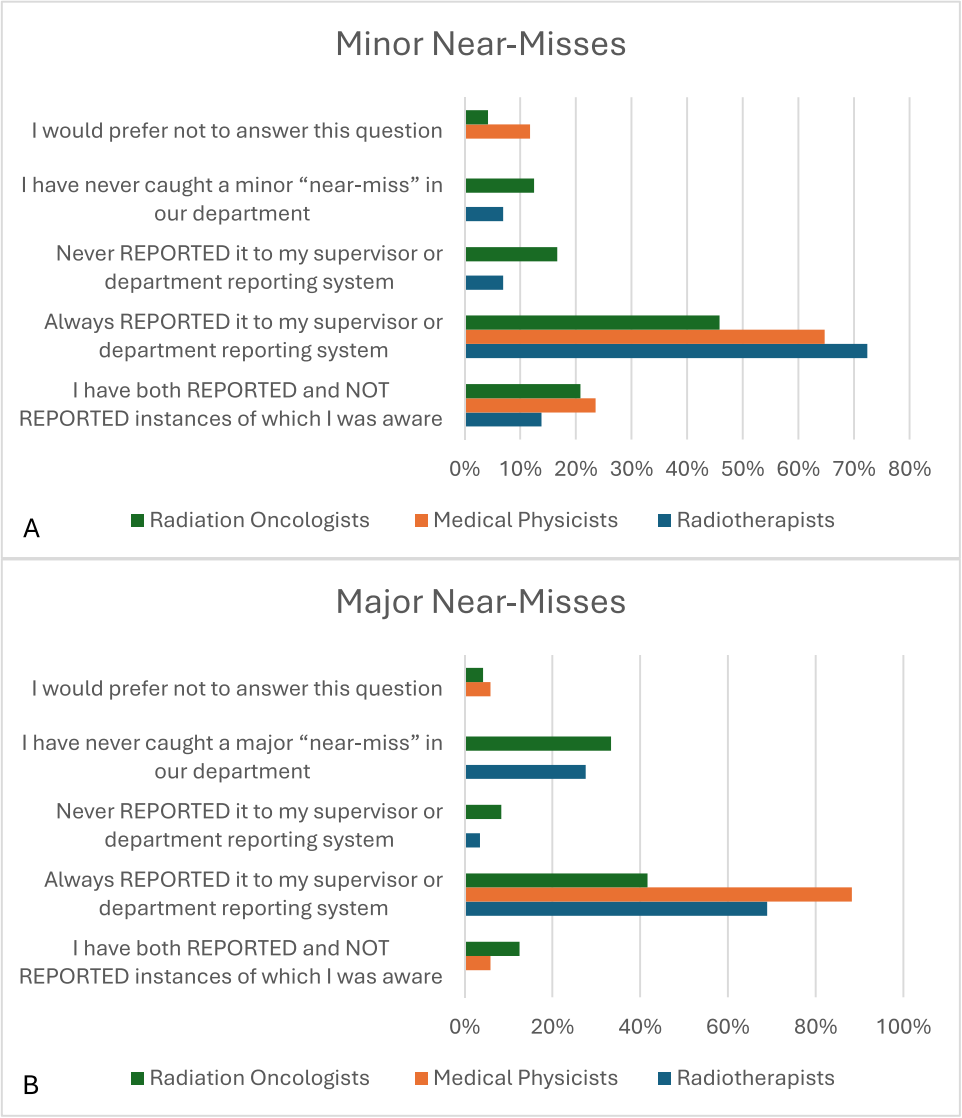

Figure 3 (**A**) The participants' experience and behavior regarding reporting minor near misses. (**B**) The participants' experience and behavior regarding reporting major near misses.

what kinds of errors/near-misses should be reported to my department" showed a statistically significant difference among the categories with a p-value of 0.025. About 90% of radiotherapists, 65% of medical physicists, and 83% of radiation oncologists confirmed they know what kinds of errors or near misses to report. In addition, there was a general agreement among the groups when they were asked about the willingness of their colleagues to report incidents.

Around 80% of the participants, as depicted in Figure 5, indicated that they would only report actual errors to a national reporting system if such a system existed. Fewer participants (18%) indicated they would include near misses in their reporting, and others (14%) indicated they would not participate in a national reporting system.

Discussion

This paper surveyed the attitudes of radiotherapy staff members in Saudi Arabia regarding reporting errors and near misses in radiation therapy practice. It also examined the reporting patterns and behavior of the participants. Furthermore, the paper explored the potential barriers to reporting and potential sources of errors as perceived by the participants.

At the time of conducting this research, there was no official data available that we could obtain on the total number of staff working in radiation oncology in Saudi Arabia that would help to determine a suitable sample size. Nevertheless,

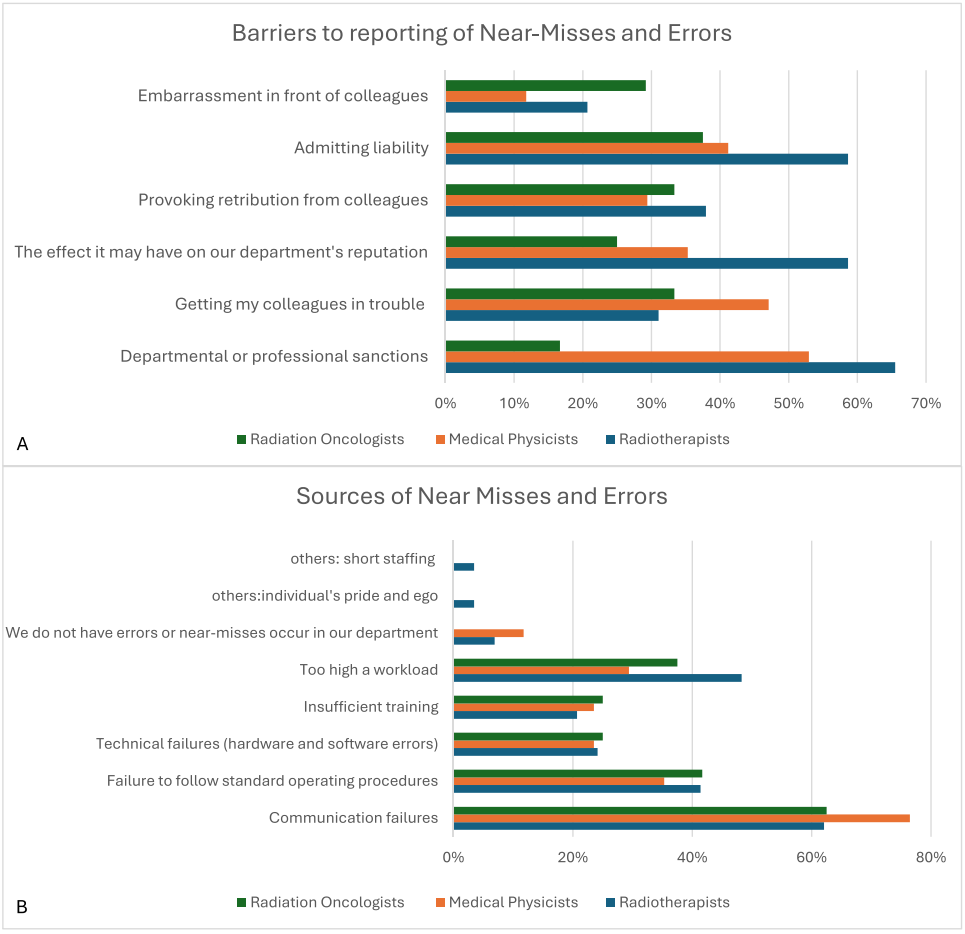

Figure 4 (**A**) Possible barriers to reporting errors or near misses according to the participants. (**B**) Possible sources of errors and near misses according to the participants.

it is documented that there are 18 radiation oncology centers of varying sizes in the country.[20] Therefore, a sample size of 70 participants seems reasonable for the current number of operating centers. The geographical location of the participants was not collected to add an extra level of anonymity and reduce social desirability bias.

The study suggests that the participants' professional role does not significantly impact their decision to report minor or major errors. Most participants indicated that they consistently report errors to their supervisor, regardless of their role

Table 2 Number of Participants in Each Group According to Their Level of Agreement with Statements Regarding Reporting of Errors and Near Misses

	Statement	Response*	Radiation Therapists		Medical Physicists		Radiation Oncologists		P-value
			n	%	n	%	n	%	
1	It is my responsibility to report errors/near-misses within my department	SA	20	69%	13	76%	14	58%	0.58
		A	6	21%	3	18%	9	38%	
		N	3	10%	0	0%	0	0%	
		D	0	0%	1	6%	1	4%	
		SD	0	0%	0	0%	0	0%	
2	I know how to report errors/near-misses within my department	SA	13	45%	8	47%	10	42%	0.32
		A	13	45%	6	35%	9	38%	
		N	1	3%	2	12%	1	4%	
		D	1	3%	1	6%	4	17%	
		SD	1	3%	0	0%	0	0%	

(*Continued*)

Table 2 (Continued).

	Statement	Response*	Radiation Therapists		Medical Physicists		Radiation Oncologists		P-value
			n	%	n	%	n	%	
3	I know what kinds of errors/near-misses should be reported to my department	SA	11	38%	8	47%	10	42%	0.025
		A	15	52%	3	18%	10	42%	
		N	3	10%	3	18%	1	4%	
		D	0	0%	3	18%	3	13%	
		SD	0	0%	0	0%	0	0%	
4	I would report errors/near-misses if I were not so busy	SA	4	14%	0	0%	3	13%	0.76
		A	7	24%	4	24%	5	21%	
		N	5	17%	4	24%	8	33%	
		D	8	28%	7	41%	5	21%	
		SD	5	17%	2	12%	3	13%	
5	I would be more likely to report errors/near-misses to my department if it were easier to do	SA	6	21%	5	29%	5	21%	0.27
		A	9	31%	4	24%	11	46%	
		N	3	10%	4	24%	3	13%	
		D	7	24%	2	12%	2	8%	
		SD	4	14%	2	12%	3	13%	
6	I would be more likely to report errors/near-misses to my department if it were anonymous	SA	8	28%	3	18%	13	54%	0.20
		A	7	24%	8	47%	4	17%	
		N	9	31%	5	29%	3	13%	
		D	3	10%	0	0%	3	13%	
		SD	2	7%	1	6%	1	4%	
7	I would be more likely to report errors/near-misses to my department if I received feedback afterward	SA	9	31%	2	12%	12	50%	0.63
		A	12	41%	8	47%	8	33%	
		N	6	21%	4	24%	3	13%	
		D	1	3%	3	18%	1	4%	
		SD	1	3%	0	0%	0	0%	
8	I have confidence that my error/near-miss reports get used to improve our system	SA	15	52%	12	71%	13	54%	0.48
		A	8	28%	1	6%	6	25%	
		N	4	14%	2	12%	3	13%	
		D	2	7%	1	6%	1	4%	
		SD	0	0%	1	6%	1	4%	
9	I know errors/near-misses happen, but my team is so careful we do not have events to report	SA	5	17%	1	6%	4	17%	0.89
		A	8	28%	5	29%	6	25%	
		N	6	21%	5	29%	5	21%	
		D	7	24%	3	18%	6	25%	
		SD	3	10%	3	18%	3	13%	
10	I believe that my colleagues value error and near-miss reporting	SA	7	24%	3	18%	4	17%	0.37
		A	12	41%	7	41%	14	58%	
		N	5	17%	6	35%	6	25%	
		D	4	14%	1	6%	0	0%	
		SD	1	3%	0	0%	0	0%	
11	I believe that my colleagues would report an error or a near-miss that I caused	SA	8	28%	3	18%	7	29%	0.62
		A	15	52%	9	53%	9	38%	
		N	3	10%	4	24%	6	25%	
		D	3	10%	1	6%	2	8%	
		SD	0	0%	0	0%	0	0%	
12	I believe that my colleagues would report an error or a near-miss that they caused	SA	7	24%	5	29%	4	17%	0.28
		A	11	38%	6	35%	7	29%	
		N	7	24%	6	35%	7	29%	
		D	2	7%	0	0%	5	21%	
		SD	2	7%	0	0%	1	4%	

Notes: *SA: strongly agree; A: agree; N: neutral; D: disagree; SD: strongly disagree. Adapted with permission from Smith KS, Harris KM, Potters L et al. Physician attitudes and practices related to voluntary error and near-miss reporting. *J Oncol Pract*. 2014;10(5):e350-e357. Copyright 2014, Wolters Kluwer Health, Inc.[18]

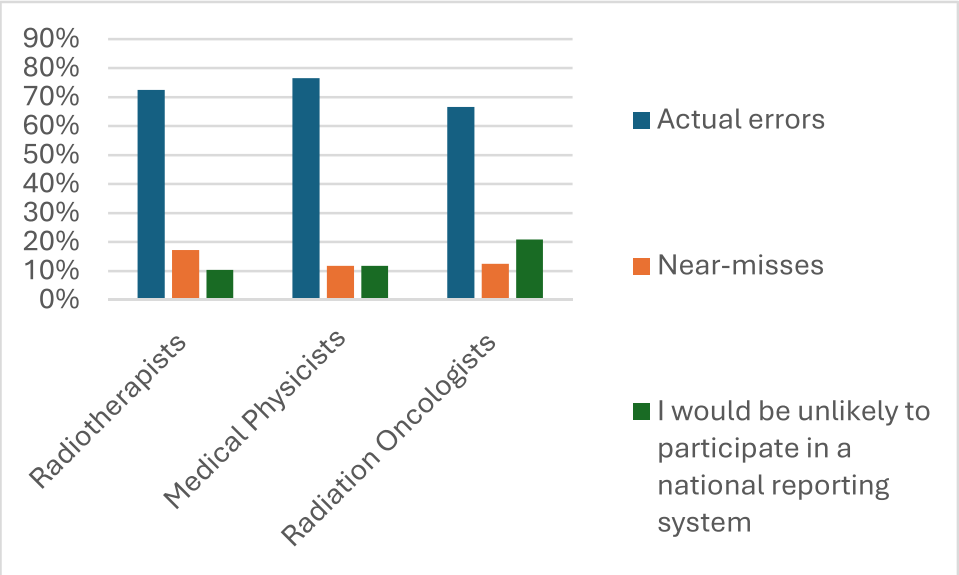

Figure 5 The participants' attitudes toward participating in a national reporting system to report errors and near misses.

in the organization. This is in contrast to the findings of Smith et al, who found that physicians were less likely to report minor errors.[18] Another study also concluded that around 50% of radiation oncologists in their sample felt that minor errors should not be disclosed.[21]

Our results also show a consensus among all groups regarding reporting minor near misses. The majority indicated that they reported minor near misses to their supervisor. However, it is worth noting that medical physicists and radiotherapists consistently reported major near misses, whereas fewer oncologists reported such incidents. This may indicate the need for more education on the importance of near misses as a learning tool.[11]

The study results suggest that departmental or professional sanctions are the most common barrier to reporting errors for medical physicists and radiotherapists. This result is consistent with the findings of Hamdan et al (2023), in which 60% of their participants cited the fear of repercussions as a significant deterrent to reporting incidents.[22] On the other hand, radiation oncologists indicated that reputation concerns in their department were a barrier to reporting errors. This agrees with the study of Church et al (2013), in which participants felt that personal reprimand reduced their comfort with reporting incidents.[23]

This study found that failure in communication was chosen by all three groups (radiotherapists, Medical physicists, and radiation oncologists) as the most significant source of errors in the radiation therapy department. This highlights the importance of effective communication in ensuring patient safety and minimizing errors in radiation therapy. This is in congruence with the church et al study that emphasized the importance of communication in radiation oncology.[23] It was also found that implementing an electronic reporting system helps in improved event communication.[11]

There is a high level of agreement among the participants regarding the responsibility of reporting errors. This reflects the level of safety culture adopted in the participants' departments. In addition, there was a statistically significant difference among the three categories regarding the participants' knowledge of what kinds of errors or near misses should be reported to their department. This finding highlights the importance of providing clear guidelines on what types of errors and near misses should be noted. A study has shown that implementing a categorized reporting system can improve incident reporting.[24]

The results of our study indicate that a majority (around 80%) of participants would only report actual errors to a national reporting system if such a system existed. Few participants (18%) indicated they would include near misses in their reporting, suggesting that healthcare professionals may not see near misses as report-worthy. This shows the need for more education on the role that reporting near misses could play in improving patient safety. Previous research

showed that underreporting near misses can hinder the identification of valuable learning opportunities in radiation oncology.[25]

This study's findings highlight the need for healthcare organizations and policymakers to address the concerns of radiation oncology professionals regarding the reporting system and create a culture of transparency and accountability that encourages reporting of errors and near misses.

Conclusion

The study addressed three main aspects regarding the reporting of errors and near misses during the radiotherapy process. These included participants' past experiences with reporting errors, barriers hindering reporting, and perceived sources of errors and near misses. Interestingly, the study found that the professional role of the staff members is independent of the decision to report errors or near misses. The study also highlighted the factors influencing the willingness of radiation oncology staff members to self-report errors and near misses, emphasizing the significance of effective communication and the implementation of electronic reporting systems.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of King Saud University (Ref No. E-22-7088; Date of approval 5 Dec 2022).

Data Sharing Statement

The data supporting this study's findings are available upon request from the corresponding author.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Acknowledgments

The authors extend their appreciation to the College of Applied Medical Sciences Research Center and the Deanship of Scientific Research at King Saud University for funding this work.

The authors express their appreciation to Koren S. Smith et al for granting permission to utilize their validated questionnaire in this study.[18]

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

The authors extend their appreciation to the College of Applied Medical Sciences Research Center and the Deanship of Scientific Research at King Saud University for funding this work.

Disclosure

The authors declare no conflicts of interest. A preprint for this manuscript is available at the SSRN server: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4823448.

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