A STUDY TO ASSESS THE PATIENT AWARENESS ON SAFETY IN RADIATION ONCOLOGY DEAPRTMENT IN A TRUST BASED HOSPITAL: A DESCRIPTIVE CROSS SECTIONAL QUESTIONNAIRE STUDY

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ABSTRACT

Introduction: The number of cancer patients is increasing day by day, so new advances in cancer treatment technology are on the way. Radiation Therapy treatment is one of the advance technologies to treat the cancer. The purpose of this study was to assess the level of radiation awareness among patients as well as the radiation safety situation. This descriptive, cross–sectional study was administered to patients, also making a review on the radiation-safety status in the hospitals.

Methodology: The data was collected among patients in Trust Based Hospital Vadodara through questionnaire to analyse the safety awareness about radiation-based treatment. 1 questionnaire including 15 questions were used in order to evaluate the level of radiation awareness among patients respectively. The questionnaires used included personal and general questions. The collected data was analysed with T test and One-way Anova test.

Result: The result of the study has shown that there is adequate knowledge and awareness of radiation and its health hazards among patients. However, awareness factor has an effect on patient's mindset and their health the study reveals that most of the patients have good knowledge of radiation treatment and have positive mindset as well.

Conclusion: Findings from this study have shown that there is adequate knowledge and

awarenessof radiation and its health hazards among patients. A large number of proportions ofcancer patient will received radiotherapy as a part of their care.Some patients don't have proper knowledge about the radiation therapy. They just wantto cure their cancer. Many of patienthave experienced some side effects, the extent ofthese depend on area treated and dose and fractionation. Impact on patient's overallwell-being. Some of the patient have fear about their personal life affecting because ofradiation therapy.

Overall the study finds out that radiation therapy is affecting on patients' but patientshave strong mind set to fight against the cancer.

Keywords: *Radiation oncology treatment, awareness about radiation treatment, cancer treatment*

Introduction

Patient Safety is a health care discipline that emerged with the evolving complexity in health care systems and the resulting rise of patient harm in health care facilities. It aims to prevent and reduce risks, errors and harm that occur to patients during provision of health care. A cornerstone of the discipline is continuous improvement based on learning from errors and adverse events. Radiotherapy, also known as radiation treatment, is the controlled use of high energy X-rays to treat many different types of cancer. Radiotherapy is a well-established, safe and effective form of treatment. Millions of patients are treated safely with radiotherapy every year to cure or control symptoms of cancers such as head and neck, brain, breast, cervical, prostate and skin cancer. Radiotherapy also is an effective treatment for some benign diseases. However, radiotherapy, like other cancer treatments, has the potential for side effects. Radiotherapy uses radiation such as x-rays, gamma rays, electron beams or protons to kill or damage cancer cells and stop them from growing and multiplying. It is a localized treatment, which means it generally only affects the part of the body where the radiation is directed. The radiotherapy treatment planning is used to obtain optimal balance between delivering a high dose to target volume and a low dose to intervening tissues. International guidelines such as Quantitative Analysis of Normal Tissue Effects in the Clinic (QUANTEC) allowing the clinician to limit the dose to normal tissue as much as possible and reasonably categorize toxicity raised based on dose/volume parameters. Although the radiation can also damage normal cells, they can usually repair themselves. It is well known that radiation saves countless lives, and serious accidents are rarely happened. While new technology grows, its complexity has created new avenues for error. That is why a very high level of accuracy is needed during radiotherapy treatment. Within acceptable ranges of good practice and equipment performance, the prescribed dose should be delivered to the tumour while minimizing the doses to other tissues and organs. All therapeutic exposures to ionizing radiation are subject to the principles of justification and

optimisation. The decision to perform a radiotherapy procedure rests upon a professional judgement of the benefit to the health of patient, while accounting for any biological effects that might be caused by the ionizing radiation. 22

For patient side, there are some practical things to consider. Before you give your consent for radiotherapy, you need to confirm that you are not pregnant and understand you should avoid becoming pregnant during treatment. This is because the radiation from the treatment could harm a developing foetus. For male patient, you are advice not to father a child during treatment and for a few months after the treatment finished. If you have a pacemaker, implantable cardiac devices or cochlear implant, please tell your oncologist. These devices can be affected by radiotherapy, so the treatment has to be planned to allow them. Stopping smoking during and after radiotherapy is very worthwhile. Research has shown that, smoking may make the treatment less effective, as well as increasing the side effects. As radiotherapy affects people in different ways, it's difficult to predict exactly how someone will react to the treatment. Most side effects disappear gradually once the course of the treatment is over; but for some people, they may continue for a few weeks. Being aware of side effects in advance can help patient to cope with any that may occur.

REVIEW OF LITERATURE

1. H sin, C-S wong, B Huang, K Yin, W Wong, YCT Chu(2012) Conducted a study to Assessing local patients' knowledge and awareness of radiation dose and risks associated with medical imaging. To assess the awareness of radiation dose and associated risks caused by radiological procedures among local patients. The method used for this research simple questionnaire. The questionnaire was in Chinese and consisted of 28 questions mostly in multiple choice/true-or-false format, divided into three sections examining demographic data, radiation knowledge/awareness and expectations. The final result come out was A total of 173 questionnaires were returned (83 females and 84 females; mean age of 53). Of these, 32.6% had attended college, 32.6% had completed matriculation and 24.4% secondary school. Most subjects underwent CT (75), MRI (70) and PET-CT (18). Education significantly affected the radiation knowledge ($P=0.013$). 60.7% and 32.7% were not aware of the radiation-free nature of MRI and USG, respectively. Respectively, 45.4% and 43.5% were of the misconception that Barium enema and Barium swallow studies do not involve radiation. Moreover, 77.6% and 87.9% were aware of the radiation-laden nature of CT and plain X-rays, respectively. Furthermore, 34% and 50%, respectively, think that they are not exposed to radiation at home and on a plane. Regarding the fatal cancer risk from CT, 17.8% chose the correct answer and 62% underestimated the risk. 32.2% correctly estimated the equivalent dose of CT in terms of number of conventional X-rays and 43.2% underestimated the dose. Most (98.2%) were told of the indication, and 42.7% were told the associated radiation

dose. They conclude that Patient radiation awareness is unsatisfactory. There is need to increase patient radiation awareness, and to provide them with the necessary information.

2. H William, H Michael(2011) Conducted a study about improving patient safety in Radiation Oncology and find that Beginning in the 1990s, and emphasized in 2000 with the release of an Institute of Medicine report, health care providers and institutions have dedicated time and resources to reducing errors that impact the safety and well-being of patients. However, in January 2010, the first of a series of articles appeared in The New York Times that described errors in radiation oncology that grievously impacted patients. In response, the American Association of Physicists in Medicine and the American Society for Radiation Oncology sponsored a working meeting entitled "Safety in Radiation Therapy: A Call to Action." The meeting attracted 400 attendees, including medical physicists, radiation oncologists, medical dosimetrists, radiation therapists, hospital administrators, regulators, and representatives of equipment manufacturers. The meeting was co-hosted by 14 organizations in the United States and Canada. The meeting yielded 20 recommendations that provided a pathway to reducing errors and improving patient safety in radiation therapy facilities everywhere.

3. Lukasz M, Lawrence M, Ron M, Waldemar K, Mosaly P, Gregg T, Robert A, Lesley H, Das S, CheraB(2018) perform a research about promoting safety in radiation therapy. They found there is a need to better prepare radiation therapy (RT) providers to safely operate within the health information technology (IT) socio technical system. Simulation-based training has been preemptively used to yield meaningful improvements during providers' interactions with health IT, including RT settings. Therefore, on the basis of the available literature and our experience, we propose principles for the effective design and use of simulated scenarios and describe a conceptual framework for a debriefing approach to foster successful training that is focused on safety mindfulness during RT professionals' interactions with health IT.

4. Ribeiro A, Husson O, Drey N, Murry I, May K, Thurston J, Oyen W Conducted a study to access a review of patient awareness Ionising radiation exposure from medical imaging. Medical imaging is the main source of artificial radiation exposure. Evidence, however, suggests that patients are poorly informed about radiation exposure when attending diagnostic scans. This review provides an overview of published literature with a focus on nuclear medicine patients on the level of awareness of radiation exposure from diagnostic imaging. A review of available literature on awareness, knowledge and perception of ionising radiation in medical imaging was conducted. Articles that met the inclusion criteria were subjected to critical appraisal using the Mixed Methods Appraisal Tool. After reviewing 140 articles identified and screened for eligibility, 24 critically assessed and 4 studies included in synthesis. All studies demonstrated that patients

were generally lacking awareness about radiation exposure and highlighted a lack of communication between healthcare professionals and patients with respect to radiation exposure. And they conclude Studies demonstrate a need to better inform patients about their radiation exposure, and further studies focusing on nuclear medicine patients are particularly warranted.

5. Marks L, Jackson M, Xie L, Chang S, at all(2011) conducted a study about the challenge of maximizing safety in radiation oncology. There is a growing interest in the evolving nature of safety challenges in radiation oncology. Understandably, there has been a great deal of focus on the mechanical and computer aspects of new high-technology treatments (eg, intensity-modulated radiation therapy). However, safety concerns are not limited to dose calculations and data transfer associated with advanced technologies. They also stem from fundamental changes in our workflow (eg, multiple hand-offs), the relative loss of some traditional "end of the line" quality assurance tools (port films and light fields), condensed fractionation schedules, and an under-appreciation for the physical limitations of new techniques. Furthermore, changes in our workspace and tools (eg, electronic records, planning systems), and workloads (eg, billing, insurance, regulations) may have unforeseen effects on safety. Safety initiatives need to acknowledge the multiple factors affecting risk. Our current challenges will not be adequately addressed simply by defining new policies and procedures. Rather, we need to understand the frequency and causes of errors better, particularly those that are most likely to cause harm. Then we can incorporate principles into our workspace that minimize these risks (eg, automation, standardization, checklists, redundancy, and consideration of "human factors" in the design of products and workspaces). Opportunities to enhance safety involve providing support through diligent examinations of staffing, schedules, communications, teamwork, and work environments. We need to develop a culture of safety in which all team members are alerted to the possibility of harm, and they all work together to maximize safety. The goal is not to eliminate every error. Rather, we should focus our attention on conditions (eg, rushing) that can cause real patient harm, and/or those conditions that reflect systemic problems that might lead to errors more likely to cause harm. Ongoing changes in clinical practice mandate continued vigilance to minimize the risks of error, combined with new, nontraditional approaches to create a safer patient environment.

6. Yorke E, Gelbulm D, Ford E(2011) perform a study on Patient Safety in External Beam Radiation Therapy. External beam radiation therapy is a highly effective treatment for many types of cancer and other diseases, but incorrect delivery of the high doses necessary for tumor control can cause serious normal tissue complications, and geographic misses of the tumor can cause tumor recurrence. External beam radiation

therapy (EBRT) provides cure or long-term disease-free survival with good quality of life or effective palliation for many cancers. Its goal is to deliver a tumoricidal radiation dose to a known tumor while sparing normal tissue as much as possible, subject to the laws of radiation physics and radiobiology. A complete or partial miss of the tumor has severe consequences, for which treatment options are limited by the proximity of previously irradiated normal tissue. There are always normal tissues, often some with critically important functions, in close proximity to the tumor. Though low (< 1 Gy) doses can have the undesirable long-term consequence of secondary carcinogenesis, the serious deterministic normal-tissue complications are the dose-limiting concern in EBRT. Severe and even lethal normal-tissue complications are part of historical and, unfortunately, modern EBRT [1, 2]. Enormous amounts of skill and technology are devoted to delivering effective radiation treatments to achieve the two competing goals—high tumor control and few complications. They conclude Benefits and risks of the explosive technologic growth of the last three decades will be described, as will efforts to reduce treatment errors and ensure safe effective treatment.

7. Clark B, Brown R, Ploquin J, DunscombeP (2013) conducted a study on patient safety improvements in radiation treatment through 5 years of incident learning. The purpose of the research was to quantify the impact of a comprehensive incident learning system in terms of safety improvements. An incident learning system tailored for radiation treatment and based on published principles has been used consistently in our large academic cancer center for more than 5 years. In the adopted system, every incident, whether or not there is a resulting direct impact on a patient treatment, is recorded and investigated to determine basic causes. The scope of the program thus includes potential, or near miss, events which have no impact on patients but which provide valuable insights into program weaknesses and hence facilitate proactive measures to minimize risk. Analysis of 2506 incident reports generated over a 5-year period demonstrate a substantial decline in actual, nonminor incidents;ie, those with a dose variation from that prescribed of greater than 5%. Only 49 incidents (1.95%) had an impact on patients. The actual incident rate at the point of treatment delivery, the most vulnerable point in our process, has also decreased. The system has provided rapid feedback to monitor several initiatives including implementation of new technology and several new treatment techniques. Using the evidence provided by these incident reports, strategies were developed by a multidisciplinary team to address system weaknesses. Interventions introduced include several human error reduction strategies including forcing functions and constraints to improve system resilience. And the final conclusion was results demonstrate that effective use of an incident learning system will strongly encourage the reporting of incidents, whether or not they directly impact a patient, and serve as a proactive means of enhancing safety and quality. As a side benefit, addressing and

overcoming the cultural barriers between the 3 professional groups involved in radiation treatment has in an improvement in the safety culture in our center.

8. Rivera J, Karsh B (2008) conducted a study on Human Factors and Systems Engineering Approach to Patient Safety for Radiotherapy. The traditional approach to solving patient safety problems in healthcare is to blame the last person to touch the patient. But since the publication of To Err is Human, the call has been instead to use human factors and systems engineering methods and principles to solve patient safety problems. However, an understanding of the human factors and systems engineering is lacking, and confusion remains about what it means to apply their principles. This paper provides a primer on them and their applications to patient safety. The quality of patient care and the efficiency of the healthcare system must be improved. Healthcare's past remedy to the lack of patient safety, blaming individuals, has not solved the problem. Thus, alternative approaches are needed. One approach that has worked in other industries is to use the principles and methods of systems and human factors engineering. The three systems approaches explained in this paper can aid in designing safer and more efficient systems.

9. IshikuraS(2008) perform a research on Quality Assurance of Radiotherapy in Cancer Treatment: Toward Improvement of Patient Safety and Quality of Care The process of radiotherapy (RT) is complex and involves understanding of the principles of medical physics, radiobiology, radiation safety, dosimetry, radiation treatment planning, simulation and interaction of radiation with other treatment modalities. Each step in the integrated process of RT needs quality control and quality assurance (QA) to prevent errors and to give high confidence that patients will receive the prescribed treatment correctly. Recent advances in RT, including intensity-modulated and image-guided RT, focus on the need for a systematic RTQA program that balances patient safety and quality with available resources. It is necessary to develop more formal error mitigation and process analysis methods, such as failure mode and effect analysis, to focus available QA resources optimally on process components. External audit programs are also effective. The International Atomic Energy Agency has operated both an on-site and off-site postal dosimetry audit to improve practice and to assure the dose from RT equipment. Several countries have adopted a similar approach for national clinical auditing. In addition, clinical trial QA has a significant role in enhancing the quality of care. The Advanced Technology Consortium has pioneered the development of an infrastructure and QA method for advanced technology clinical trials, including credentialing and individual case review. These activities have an impact not only on the treatment received by patients enrolled in clinical trials, but also on the quality of treatment administered to all patients treated in each institution, and have been adopted globally; by the USA, Europe and Japan also. Recent advances in RT focus on the need for a systematic

RTQA program that balances patient safety and quality with available resources. It is necessary to develop more formal error mitigation and process analysis methods such as FMEA to focus available QA resources more optimally on process components to avoid catastrophic delivery errors. External audit programs for RTQA are also effective. Both postal dosimetry audit and clinical trial RTQA, especially for advanced technologies, in collaboration with global networks, will serve to enhance patient safety and quality of care.

10. Yan G, Mittauer K, Huang Y, Lu B, Liu C, Li J(2013) conducted a study on Prevention of gross setup errors in radiotherapy with an efficient automatic patient safety system. Treatment of the wrong body part due to incorrect setup is among the leading types of errors in radiotherapy. The purpose of this paper is to report an efficient automatic patient safety system (PSS) to prevent gross setup errors. The system consists of a pair of charge-coupled device (CCD) cameras mounted in treatment room, a single infrared reflective marker (IRRM) affixed on patient or immobilization device, and a set of in-house developed software. Patients are CT scanned with a CT BB placed over their surface close to intended treatment site. Coordinates of the CT BB relative to treatment isocenter are used as reference for tracking. The CT BB is replaced with an IRRM before treatment starts. PSS evaluates setup accuracy by comparing real-time IRRM position with reference position. To automate system workflow, PSS synchronizes with the record-and-verify (R&V) system in real time and automatically loads in reference data for patient under treatment. Special IRRMs, which can permanently stick to patient face mask or body mold throughout the course of treatment, were designed to minimize therapist's workload. Accuracy of the system was examined on an anthropomorphic phantom with a designed end-to-end test. Its performance was also evaluated on head and neck as well as abdominalpelvic patients using cone-beam CT (CBCT) as standard. The PSS system achieved a seamless clinic workflow by synchronizing with the R&V system. By permanently mounting specially designed IRRMs on patient immobilization devices, therapist intervention is eliminated or minimized. Overall results showed that the PSS system has sufficient accuracy to catch gross setup errors greater than 1 cm in real time. An efficient automatic PSS with sufficient accuracy has been developed to prevent gross setup errors in radiotherapy. The system can be applied to all treatment sites for independent positioning verification. It can be an ideal complement to complex image-guidance systems due to its advantages of continuous tracking ability, no radiation dose, and fully automated clinic workflow.

The Statement of them problem

This study focus on the perceptions of the patient’s towards the radiation treatment. And also spread the awareness amongst the patient’s towards radiation treatment. There were

numbers of studies focus on the radiation based treatment. But this types of studies were not done in Gujarat as well as Trust Based Hospital also.

The present study

The study focuses on the patient's awareness towards radiation safety and spread awareness towards radiation treatment and overcome the fear about the radiation based treatment.

Objective

1. To study the patient's perception towards radiation treatment.

2. To spread awareness towards radiation treatment and overcome the fear about the radiation-based treatment.

3. To suggest safety recommendation of patient given by Hospital

Hypothesis

H01: There is no significant difference amongst the patients regarding Radiation safety with respect to gender.

HA1: There is significant difference amongst the patients regarding Radiation safety with respect to gender.

H02: There is no significant difference amongst the patients regarding Radiation safety with respect to Age.

HA2: There is significant difference amongst the patients regarding Radiation safety with respect to Age.

RESEARCH METHODOLOGY

The data will be collected from the patients who come for their daily Radiation-based treatment in a Trust based hospital, Vadodara. A cross sectional study with targeted patients. A self-administered questionnaire was distributed to radiation oncology patients, and the collected data was analyzed by statistician.

Research Design:

Time Period: 1 Month

Place of study: Trust Hospital, Vadodara.

A Multi-Specialty trusted based hospital in Vadodara with all new advance technology.

Study Design: Questionnaire

Sampling:

The Sample of this research is the patients who will take Radiation-based treatment in the

Oncology department in a trust hospital, Vadodara.

The population of the study is 50 to 60 patients who will come for their treatment. within a month. All the patients would be included in my study who come within the month.

Method and Tool of Data Collection

This is a cross sectional study to check the perception amongst the patients regarding the radiation treatment. The data was collected through the closed ended questionnaire by using scale of Yes or No. The collected data was recorded in the excel and coded with "Yes" with "1" and "No" with "2". The final data analysis was done through the SPSS Version 20. The data was analyzed with the use of independent T test.

Limitations

The limitation of the study was that the hospital was in rural area so the patient's were coming here were highly illiterate so it was a major task to collect the data. As well as the time duration was also the limitation for the study.

RESULT &DISCUSSION

Write brief intro

Here the collected data was analyzed through the SPSS with the use of independent t Test. Through the statistical software the frequency of the Gender and age was calculated with the percentage also. Here the data was analyzed with the use of Independent t Test with respect to gender and Oneway ANOVA with respect to age.

Table 1 : Demographic Factor of the respondents

	Demographic Factor	Frequency	Percent
Gender	Male	27	65.9
	Female	14	34.1
Age	21-30 Years	1	2.4
	31-40 Years	6	14.6
	41-50 Years	19	46.3
	51-60 Years	11	26.8
	61-70 Years	4	9.8

Above Table 1 shows the frequency distribution of demographic factors. Out of total patient's male are greater than female that is 65.9%. There were 19 (46.3%) patients whose age between 41-50 Years.

Table 2 : The difference in the knowledge amongst the respondents with respect to Gender

Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference	T Value	P value
Male	27	7.56	.892	.172	.841	2.180	.035
Female	14	6.71	1.590	.425			

The above table 18 shows the mean score and standard deviation of male and female which is 7.56 (SD±0.892) and 6.71 (SD±1.590) respectively. Mean difference values is 0.841 and p value is 0.035 which is less than 0.05. So the result shows that there is a significant difference in the knowledge between the Gender Hence the null hypothesis isfails to reject.

OnewayAnova

Table 19 : The Difference in the knowledge among the respondents with respect to Age

Age	Sum of Squares	Mean	Std. Deviation	df	Mean square	F	P Value
Between Groups	2.131	7.27	1.595	4	.533	.331	.855

The above Table 19 shows the knowledge amongst the respondents with respect to age using ANOVA. The p Value of F test is 0.855 which is greater than 0.05. Here there is a significant difference between the knowledge of different age category. Hence the null hypothesis is rejected.

Conclusion

Findings from this study have shown that there is adequate knowledge and awareness of radiation and its health hazards among patients. A large number of proportions of cancer patient will receive radiotherapy as a part of their care.

Some patients don't have proper knowledge about the radiation therapy. They just want to cure their cancer. Many of patient have experienced some side effects, the extent of these depend on area treated and dose and fractionation. Impact on patient's overall well-being. Some of the patienthave fear about their personal life affecting because of radiation therapy.

Overall the study finds out that radiation therapy is affecting on patients' but patients have strong mind set to fight against the cancer.

Discussion

The research study is conducted in hospital which is located in rural area. So the higher number of patient is not aware about the radiation therapy and its impact on body. Medical treatment is improving day by day with new technology and it is very important to have proper knowledge about that. This study finds that people have to be aware about what they are taking for curing their disease. As per the study conducted by H sin, C-S wong, B Huang, K Yin, W Wong, YCT Chu (2012) on the Assessing local patients knowledge

and awareness of radiation dose and risks associated with medical imaging. To assess the awareness of radiation dose and associated risks caused by radiological procedures among local patients They conclude that Patient radiation awareness is unsatisfactory. There is need to increase patient radiation awareness, and to provide them with the necessary information. And as per this study here is also found that patient need more awareness about the radiation safety and their impacts. There are similar results comes out from different researches. A Stusy conducted by Ribeiro A, Husson O, Drey N, Murry I, May K, Thurston J, Oyen W to access a review of patient awareness Ionising radiation exposure from medical imaging. Medical imaging is the main source of artificial radiation exposure. They also Concluded All studies demonstrated that patients were generally lacking awareness about radiation exposure and highlighted a lack of communication between healthcare professionals and patients with respect to radiation exposure. And they conclude Studies demonstrate a need to better inform patients about their radiation exposure, and further studies focusing on nuclear medicine patients are particularly warranted. That shows patient awareness is very important which is similar to this study recommendation.

Findings & Suggessions

The study reveals that there is a mix awareness level among the patient who comes for their radiation treatment in trust-based hospital. However, investigator observed and recommended for rectifications.

Every single patient needs to know the basic knowledge of radiation oncology treatment. And the hospital staff should train for giving the knowledge and basic introduction of treatment to their staff. They also train for how to handle patients' questions and reactions.

There should be awareness and safety illustrator poster near the waiting area. The patient and their family members should be aware about the side effects which may affect after taking the treatment.

The staff should be train to cooperate with patient and respect their emotions. Rumors in patients mind will make then sacred about the radiation treatment. The staff should make sure that their all patient doesn't have any rumors.

The positive mindset will give positive result.

References

1. Sin, H. K., Wong, C. S., Huang, B., Yiu, K. L., Wong, W. L., & Chu, Y. C. T. (2013). Assessing local patients' knowledge and awareness of radiation dose and risks associated with medical imaging: a questionnaire study. Journal of medical imaging and radiation oncology, 57(1), 38-44.

2. Hendee, W. R., & Herman, M. G. (2011). Improving patient safety in radiation oncology. Medical physics, 38(1), 78-82.

3. Mazur, L. M., Marks, L. B., McLeod, R., Karwowski, W., Mosaly, P., Tracton, G., ... &Chera, B. (2018). Promoting safety mindfulness: Recommendations for the design and use of simulation-based training in radiation therapy. Advances in Radiation Oncology, 3(2), 197-204.

4. Ribeiro, A., Husson, O., Drey, N., Murray, I., May, K., Thurston, J., & Oyen, W. (2020). Ionising radiation exposure from medical imaging–A review of Patient's (un) awareness. Radiography, 26(2), e25-e30.

5. Marks, L. B., Jackson, M., Xie, L., Chang, S. X., Burkhardt, K. D., Mazur, L., ... & Adams, R. D. (2011). The challenge of maximizing safety in radiation oncology. Practical radiation oncology, 1(1), 2-14.

6. Yorke, E., Gelblum, D., & Ford, E. (2011). Patient safety in external beam radiation therapy. American Journal of Roentgenology, 196(4), 768-772.

7. Clark, B. G., Brown, R. J., Ploquin, J., &Dunscombe, P. (2013). Patient safety improvements in radiation treatment through 5 years of incident learning. Practical radiation oncology, 3(3), 157-163.

8. Rivera, A. J., & Karsh, B. T. (2008). Human factors and systems engineering approach to patient safety for radiotherapy. International Journal of Radiation Oncology* Biology* Physics, 71(1), S174-S177.

9. Ishikura, S. (2008). Quality assurance of radiotherapy in cancer treatment: toward improvement of patient safety and quality of care. Japanese journal of clinical oncology, 38(11), 723-729.

10. Yan, G., Mittauer, K., Huang, Y., Lu, B., Liu, C., & Li, J. G. (2013). Prevention of gross setup errors in radiotherapy with an efficient automatic patient safety system. Journal of Applied Clinical Medical Physics, 14(6), 322-337.