WRD 2022 ISRRT SPECIAL EDITION

RADIOGRAPHERS

AT THE FOREFRONT OF PATIENT SAFETY
Cover artist - Leslie Robinson

Leslie has again created a special commission for the cover of this special edition to celebrate World Radiography Day 2022 on November 8.

Leslie trained to be a radiographer in the UK in the early 1980s and then worked as a radiographer in the UK and Saudi Arabia, eventually specialising in CT and MRI. She went on to become a radiography lecturer and researcher at the University of Salford in the UK.

She has presented all over the world, has published widely and achieved a Doctorate in Education. She was recognised for her work by the UK Society of Radiographers, receiving the Radiographer of the Year prize (regional and national) twice. This year she was awarded the prestigious Fellowship of the College of Radiographers.

Leslie always enjoyed the visual element of radiography and, on retirement in 2018, she dusted off her paint brushes and started to paint again. Her love of painting the human form has been enhanced by many years of looking at and understanding radiographic anatomy. She has integrated this knowledge into her paintings to show both the abstract and objective sides of the human form.
CONTENTS

Message from the ISRRT President 5
Message from the ISRRT Regional Director Europe 6

Thematic approach – practicing radiographer’s view:
Anne Dorte Blankholm, Denmark 11
Beth Weber, USA 15
William D. Bryan, USA 16
Denise Chong, Singapore 18
Debbie Gilley, USA 20
Gill Harrison, United Kingdom 22
Manuel José Cruz Duarte Lobo, Portugal 25
Brandon Hirsch, USA 28
Kitiwat Khamwan, Thailand 30
Mark Chukwudi Okeji, Nigeria 34
Anastasia Sarchosoglou, Greece 36
Ellian Schlattmann, Germany 38
Boniface Yao, Côte d’Ivoire 42
Edward Wong, Hong Kong 50

ISRRT Societies – member views and initiatives on patient safety:
Australia 54
India 57
Indonesia 58
Greece 62
Portugal 64
Taiwan 66
Zimbabwe 69

Contributing stakeholders views:
Michael Fuchsjaeger, ESR 72
Jesse Clarijs-de Jong, Ricardo Khine, EFRS 74

In this Special Edition, articles and reports by authors/societies
do not necessarily reflect or represent the opinion
and thesis of the ISRRT.
Message from the ISRRT President

By Donna Newman, ISRRT President

Dear ISRRT Members and Radiography Professional Stakeholders,

World Radiography Day will be celebrated around the world by radiographers/radiological technologists on November 8, 2022. This day has not only become an important time to celebrate our profession, but also to increase public awareness of the vital role that diagnostic imaging and radiation therapy plays in healthcare. This year’s theme was chosen to raise awareness, help educate and celebrate radiographers/radiological technologists in their daily practices highlighting how they are key to patient safety not only relating to radiation safety but other aspects of patients’ safety. I’m excited to share this special addition of World Radiography Day with the theme, “Radiographers at the Forefront of Patient Safety”, highlighting the role that radiographers/radiological technologists play in promoting and maintaining radiation safety and general patient safety in all aspects of the patient journey.

Part of the key success of the ISRRT is its member experts from around the world and we are delighted to share some of the daily best practices. As a global organization we hope that our members and health professionals around the world will read this book and incorporate what they learn from our authors and help drive the ISRRT key messages of creating, influencing and impacting change within their countries and daily practices.

The World Health Authority [WHO] is leading a global initiative on radiation safety in strengthening medical Imaging in an effort to have Universal Health Care Coverage in all countries around the world. In this process, the Radiation and Health Unit of the WHO works to improve the quality and safety of the use of radiation for medical imaging which is essential for the diagnosis and management of non-communicable diseases [cancer, heart disease, stroke, chronic disease the obstructive pulmonary disease]. Additionally, the Global Action Plan on Patient Safety 2020-2030, towards eliminating avoidable harm in Health Care has been developed as part of this strategy and adopted by the WHO Assembly in May of 2021. The WHO also decided to have Director-General report back on progress in the implementation of the global patient safety action plan 2021–2030 to the Seventy-sixth World Health Assembly in 2023. This important global document focuses on the WHO’s Global action plan on patient safety and provides a Framework of suggested actions for governments, non-State actors, international organizations and intergovernmental organizations. These actions have been grouped under the following seven strategic objectives (SOs).

SO1: Make zero avoidable harm to patients a state of mind and a rule of engagement in the planning and delivery of health care everywhere.

SO2: Build high reliability health systems and health organizations that protect patients daily from harm.

SO3: Assure the safety of every clinical process.

SO4: Engage and empower patients and families to help and support the journey to safer health care.

SO5: Inspire, educate, skill and protect every health worker to contribute to the design and delivery of safe care systems.

SO6: Ensure a constant flow of information and knowledge to drive mitigation of risk, a reduction in levels of avoidable harm and improvements in the safety of care.

SO7: Develop and sustain multisectoral and multinational synergy, solidarity and partnerships to improve patient safety and quality of care.

The ISRRT has contributed to this WHO strategic agenda representing your global voice around the world in the development of this plan. As a global organization we are also committed to disseminating and contributing to the success of this plan. We continue to do this by developing educational materials which includes radiation safety and safety for our patients through our ISRRT Facebook live session, the ISRRT E-learning platform and our ISRRT Position statements. Continuing with the ISRRT strategy for elevating safety, the World Radiography Day Special Edition is a perfect forum to showcase some best practices from our member experts around the world.

The ISRRT collaborated with ISRRT Member Experts, ISRRT Member Societies and Regional Stakeholders to create this special addition highlighting the Radiographers/Radiological Technologist’s crucial role in their protocols and procedures ensuring safe practice not only in radiation but also other areas of our engagement with patients. You will see these strategies demonstrated throughout this issue as radiographers/radiological technologist share their best practices toward radiation safety and general safety in their daily roles and practices.

This educational publication will demonstrate the high educational and professional standards radiographers/radiological technologists live by each day and will help strengthen radiation safety and the general safety of patient care worldwide.

Enjoy this issue and the ISRRT hopes that its ISRRT members and Radiography Stakeholders will find relevant resources, educational tips and ideas that will help radiographers/radiological technologists influence, impact and create change in their daily workplaces in countries across the world. Just think if each of us incorporates one idea from these articles within our daily practice, we will have contributed to elevating patient safety globally.

ISRRT SPECIAL EDITION ON WORLD RADIOGRAPHY DAY 2022 5
Patient safety beyond radiation protection in CT

By E. Agadakos, ISRRT Regional Director Europe

Introduction
PATIENT safety according to the WHO is the absence of preventable harm to a patient during the process of health care and reduction of risk of unnecessary harm associated with health care to an acceptable minimum. Whereas patient harm is defined as, “an injury that was caused by medical management (rather than the underlying disease) and that prolonged the hospitalization, produced a disability at the time of discharge, or both.” [Harvard Medical Practice Study]

Purpose
The article aims to highlight the significance of our professional role in patient safety beyond radiation protection and in upholding the functionality of healthcare systems during this pandemic.

Background
WHO data:
- The occurrence of adverse events due to unsafe care is likely one of the 10 leading causes of death and disability in the world1.
- Each year, 134 million adverse events occur in hospitals in low- and middle-income countries (LMICs), due to unsafe care, resulting in 2.6 million deaths2.
- In high-income countries, it is estimated that one in every 10 patients is harmed while receiving hospital care3. The harm can be caused by a range of adverse events, with nearly 50% of them being preventable4.

In computed tomography (CT), patient safety is traditionally linked to radiation protection and contrast medium (CM) issues. Although CT examinations are performed based on the three principles of radiation protection (i.e. justification, optimization and dose restrictions - ALARA), the method remains a high radiation dose modality. While authoritative bodies, healthcare professionals, equipment vendors are troubled with the direct risks and continue to promote and develop dose reduction strategies, CT radiographers are often faced with a wide range of patient safety concerns.

According to the Joint Commission International, there are 6 International Patient Safety Goals (IPSGs), and CT radiographers need to be aware of the actions to attain them5.

1. Identify patients correctly
Patient identification is a cause of error for several adverse events. Radiographers must use at least two steps to identify patients prior to a CT examination. Ask patients to tell you their name. Repeat the question if necessary and ask for their D.O.B. Never state the patient’s name. Allow time for the patient to tell you their name. Simply ask: “What is your name?” Always cross check patient name against their ID bracelet. The ward and bed number is an inappropriate method to identify patients6.

2. Improve effective communication
Obtaining patient history and conveying instructions prior and after the CT examination is always important for patient cooperation and patient consent as well as for guidance following IV of CM.

Verbal errors, and ineffective communication, are a common cause of medical errors, risking patient safety. Moreover, they can minimize patient cooperation affecting the CT

Figure 1: Facts on Patient Safety (Annual data from WHO& JCI).
scanning procedure causing motion artifacts due to breathing and patient movement. In addition they may result in adverse IV CM events. Always ensure that the patient has understood your questions and instructions. The 5Cs are an excellent tool leading to effective communication.

**Poor communication risk factors include:**
1. Disruptive behavior including rude language or verbal abuse.
2. Environmental noise issues such as cell phones, pagers, and phones.
3. Cultural differences among patients and providers.
5. Providers acting as autonomous agents.
6. Personality differences.
7. Language barriers.
8. Lack of working as a team.
9. Multiple conversations are occurring simultaneously.
10. Socioeconomic variables, such as education and literacy.

**The 5 Cs to effective communication**

- **Clear**: Words used should be simple and the easy to understand.
- **Concise**: Message should be kept as concise as possible.
- **Complete**: The information provided should be complete. Therefore, it should answer the basic Why? When? Where? How? questions related to the subject matter.
- **Courteous**: Delivered in a calm tone and positive manner and respectful to needs and preferences of the receiver. Body language and non-verbal cues should portray respect and empathy.
- **Consistent**: The message and information given should be the same, irrespective of who is providing or receiving that information.

**3. Improve safety of high alert medication**

Adverse drug reaction is the most common safety incident in CT, with medication and IV safety is the second most common safety incident in CT. According to a study of multi-year experience in incident reporting in CT.

For instance a medication error may occur following the administration of high dose epinephrine to manage a severe allergic reaction to IV CM or the use of CM in patients with contraindications causing nephrotoxicity and eventually renal failure. Such adverse incidents are avoided with comprehensive patient history, electronic patient files and adherence to ESUR guidelines on IV CM administration based on GFR levels. It is significant that patients are differentiated correctly depending on their previous history related to CM allergies in order to undergo the indicated procedure with or without IV CM. Furthermore radiographers need to be alert and recognize an allergic reaction to CM early using the Ring and Messmer classification of anaphylaxis severity.

In general the CM administered is decided prior to the examination while the iodine concentration and flow rate depend on patient body weight and diagnostic requirements. The procedure is performed with automatic injectors and IV pumps which need to function correctly and as intended to minimize the risk of:

- i) Extravasation
- ii) air embolism
- iii) nephrotoxicity
- iv) lactic acidosis
- v) iodine related reactions- CM allergy

In addition it is expected that air is removed from patient tubing prior to the injection, vein integrity is maintained and CM is heated.

4. **Ensure correct site, correct procedure, correct side**

Radiographers must confirm that the correct patient undergoes the correct procedure including the correct region and when applicable the correct side. Ask the patient using simple language. For eg "What exam are you having today?".

- Always cross check corresponding referral or scheduled exam on PACS-RIS
- Avoid the use of mirroring and or other post processing correction tools
- Apply correct side markers when applicable and patient position directly on your scan data and topogram by assigning correct patient position and table direction eg. supine head first
- Always ensure equipment is maintained and functions according to vendors specification

5. **Reduce the risk of healthcare infections**

Generally, radiographers are aware of the basic infection control principles and CT departments seem well prepared to cope with highly communicable infectious diseases. Unfortunately these expectations...
were quickly dismissed with the first wave of the COVID-19 pandemic in early 2020. The healthcare systems were too weak and staff were not prepared to detain the impact of the pandemic. Social distancing was inevitable, clinical radiographers in hospitals and institutions complained of limited access to PPE, inadequate staff training, shortage of PPE, reduced understanding of PPE use and confused PPE guidance.12

The past two years radiographers had to overcome an airborne disease with an amazingly high transmission rate. Their anxiety in managing patients at the front line while protecting themselves and other staff from infection was affecting their practice and their well being. Many were infected leading to staff shortage in CT departments. The appeal for working guidelines became apparent. However, the initial working guidelines assumed that healthcare would be delivered at a safe social distance of 1.5 m and when inevitable, healthcare professionals were instructed to wear Personal Protection Equipment, PPE (WHO, ECDC, CDC National Infection Control Committees). Admittedly, CT imaging cannot be performed at 1.5m distance from the patient and PPE was not readily available for radiographers. Either, due to the lack of supplies or due to a minority of government officials who failed to recognize radiographers as front line professionals. This unjust perception was resolved by the quick response of professional societies.

Moreover, aimed guidelines were necessary to strengthen their professional capacity and self confidence to handle patients in need of CT examinations, particularly when CT was initially considered the examination of choice for COVID-19 detection and follow up. The Panhellenic Society of Radiological Technologists in Greece response was to develop and to disseminate focused guidelines for radiographers in all modalities via free webinars by the end of March 2020.13

These instructions reshaped the general guidelines published by WHO, ECDC, CDC and the National Infection Control Committee to support our professionals who had no previous knowledge and sufficient experience in similar situations. The
feedback from participants was encouraging and an e - conference on clinical practice during the pandemic followed including academics and radiography students. This significant work was later incorporated in the ISRRT e-learning platform and courses, the ISRRT COVID-19 practical guidelines, ISRRT rapid guide, ISRRT Position Statement and WHO publication titled "Use of chest imaging in COVID-19. A rapid advice"14,15

Once radiographers visit the aforementioned web pages they will become familiar and are expected to implement the following five fundamental principles to minimize contagion:
1. Separate red (contaminated) and blue (clean) zones,
2. Exercise donning and doffing procedures of PPE correctly.
3. Apply the WHO five moments hand hygiene effectively
4. Ensure appropriate & frequent room and equipment decontamination/disinfection and ventilation according to local regulations and vendor specifications
5. Practice with transparency i.e. record suspected and confirmed cases and report relevant incidents
6. Reduce the risk of patient harm from fall

Hundreds of thousands of patients fall every year and of those 30-35% sustain an injury. According to JCI it is ranked among the top 10 incidents that caused or created potential for serious patient injury or death 16. In a survey of 415 radiology-related lawsuits in U.S., radiologic technologists appeared to be called to court most often in cases of patient falls.17 Falls have been identified as an event that is preventable and should never occur. Frequently, radiographers support porters during lifting and moving patients to and from the CT table, consequently they should:

- practice safe patient handling techniques,
- communicate with patient and porters,
- be aware of policies
- use appropriate restraints and transfer equipment.

Preventing adverse events in a medical imaging department can be challenging due to the number of patients seen, the amount of equipment in use, and the rapid pace of care delivery in this setting. Keep in mind that most medical errors occur before and after the procedure. Therefore it is essential that radiographers practice in a CT department which focuses on three actions: measure, intervene, and prevent.

The healthcare system must first, identify and describe (measure) a safety issue, act to help the patient [intervene], and then avoid similar events in the future [prevent].

Today most healthcare institutions exercise a proactive patient safety methodology shifting from a blame culture to Safety culture. They implement a sociotechnical approach to measure the wellness of a health system combining culture, processes and technology.

**Conclusion**
Despite all measures and safety precautions radiographers/radiological technologists remain at the point of service and thus maintaining a physical distance of 1.5 mm from their patient is inevitable. Although we are customarily committed to patient radiation protection our role extends further. Patient safety requires that radiographers practice encompassing the six IPSGs, aiming for enhanced patient safety and to safeguard the National Healthcare System during and after the coronavirus pandemic. We can only guarantee this by adhering to the working guidelines developed by our national society and the ISRRT Position Statement of the Radiographer/Radiological Technologist’s Role in Patient Care and Patient Safety August 2021

**References**
1. Jha AK. Presentation at the “Patient Safety – A Grand Challenge for Healthcare Professionals and Policymakers Alike” a Roundtable at the Grand Challenges Meeting of the Bill &
Take home message

Answer these questions:

1. Is my CT department safe enough for patients?
2. Do I know enough about patient safety?
3. Have I done enough to improve patient safety?
4. Should my patient advocacy extend beyond...
Magnetic Resonance safety from a Danish perspective

By Anne Dorte Blankholm, Denmark

Introduction
BEING a radiographer and working with Magnetic Resonance (MR) for more than 30 years, MR safety and patient safety has always been on my agenda.

When I started in MR in 1989, MR safety and patient safety was important. MR was a new imaging modality and MR education was scarce. Therefore, I was involved in starting MR education in Denmark in the early 90s. Very few implants had been tested back then and it was not uncommon that we had to decline to scan patients with implants.

Things have developed over time, but we still have considerable work on the safety agenda. This article provides a brief summary of the history of MR safety, information about directives, MR safety guidelines and consensus papers. Education, teamwork and responsibility will be discussed and finally, I will mention some of the organizational and political work I am involved in.

History
In Denmark, we have strict government regulations for the use of x-rays. This is not the case for MR, which I believe is quite a riddle. Exposure to radiation in x-ray imaging may kill people over time due to the carcinogenic effect and potential development of cancer, which is increasing with increasing x-ray dose. In MR, we may kill people in seconds if they are hit by heavy metallic objects attracted by the strong magnetic field. The first deadly accident related to MR was reported in 2001, when the six-year-old Michael Colombini tragically died after being hit by an oxygen tank at a hospital in New York1. After more than 20 years (>30 years for MR), one should expect that we had learned to avoid such accidents, but unfortunately, they seem to continue to happen. In 2018, there was a deadly accident in India, in 2019 two serious accidents in Sweden and in October 2021 another deadly accident in India2-5. All of these accidents could have been prevented.

It is a concern in the MR community that MR-related accidents and incidents (adverse events) are underreported but documentation is beginning to be published in the literature6-8. Different databases have been established for the reporting of adverse events in the healthcare sector and in some countries, also in Denmark, it is mandatory to report adverse events to a national database. Most of the databases are not constructed specifically for MR-related adverse events, which can make it difficult when searching for MR-related adverse events. A list of international databases and related guidance for reporting can be found at: www.ismrm.org/mr-safety-links/incident-reporting-guidance/. It is extremely important that adverse events are reported because it is the only way we can learn from other people’s mistakes and thereby prevent future incidents and accidents.

The status of MR safety is not static. The MR discipline develops continuously with added higher and lower field strengths, stronger and faster gradients, and new sequences etc. – not to forget all the new types of implants, also including non-medical implants. With an aging population and the increasing number of available implants, the need for a user-friendly database including all implants and the associated MR labelling is becoming more and more urgent, both to ensure patient safety but also to save money and time resources. We need to update MR safety education regularly as recommended in several guidelines and consensus papers9-12. MR safety is very different now compared to the early years of MR.

Directives, guidelines, and consensus papers
There are no common European guidelines on MR safety. There is a Directive from the
Updates are recommended in several European Parliament, Directive 2013/35/EU of the European Parliament and the Council, on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields). As the title indicates, this directive concerns the safety of workers and not patients. However, some points in this directive also impact on patient safety, such as the demand for risk assessment as in Chapter II, Obligations Of Employers, Article 4, Assessment of risks and determination of exposure, 7, stating the following: "The employer shall be in possession of an assessment of the risks in accordance with Article 9(1)(a) of Directive 89/391/EEC and shall identify which measures must be taken in accordance with Article 5 of this Directive. The risk assessment may include the reasons why the employer considers that the nature and extent of the risks related to electromagnetic fields make a further detailed risk assessment unnecessary. The risk assessment shall be updated on a regular basis, particularly if there have been significant changes which could render it out of date, or if the results of the health surveillance referred to in Article 8 show this to be necessary."14

Consensus papers are available regarding recommended responsibilities for management of MR safety and for recommended minimum requirements for performing MRI in humans in a research setting.15

The most well known and recently updated MR safety guidelines are from the United Kingdom, Australia and the USA. Some countries in Europe have their own MR safety guidelines but this, however, is not the case in Denmark or the other Scandinavian countries.

Useful guidelines are available, but the question is if we follow them. In my experience, some departments in Denmark do not follow a guideline to the point because we do not have a guideline in Danish. Hence, sometimes the department leaders have never read a guideline and just rely on local regulations and home-made guidelines, which, in principle, may be outdated or insufficient. However, the MR community has always had a high degree of self-regulation, and we are highly dependent on local policies and procedures. This means that some MR departments, facilities and clinics have a high degree of MR safety, but we have to bear in mind that MR safety is never better than the extent to which staff and leaders are educated.

Education
Some of the guidelines define educational levels: 2. a person with supervision rights and educated to handle patients, perform the MR examination, be responsible for patient and staff safety. 1. a person at a lower level responsible only for own safety only in the MR environment and without supervision rights. A minimum of two levels is absolutely necessary because guests in the MR environment such as anesthetists staff, hospital porters and cleaning staff need a certain level of education in MR safety to contribute to a safe MR environment for patients and staff. It has been shown that guests in the MR environment constitute a safety risk.

Updates on MR safety education is needed on a regular basis both because techniques develop and because we need refresher courses just as in other areas such as in cardiopulmonary resuscitation (CPR). Updates are recommended in several guidelines and consensus papers.13

Consensus papers and MR safety guidelines recommend a teamwork approach where a Magnetic Resonance Safety Medical Director (MRMD) / Magnetic Resonance Safety Research Director (MRRD), a Magnetic Resonance Safety Officer (MRSO) and a Magnetic Resonance Safety Expert (MRSE) are defined. The MRMD/MRDR is the person who is operationally responsible for the MR facility. This title is in clinical departments held by a medical doctor, whereas in research departments the MRRD can be held by a person with another professional background. The MRSO is typically held by a radiographer or a MR technologist responsible for MR safety in daily practice. The MRSE can be held by a MR physicist or another professional with higher level of technical expertise in MR (could be found locally for larger clinical sites or externally for smaller ones). In practice, we have been working with a model like this for many years at Danish university hospitals. With the consensus papers and guidelines recommending this model, which has been widely endorsed by several professional bodies in Europe, USA, and Australia, we are obliged to work with a model like this.13 This may sound easy, and departments/ facility leaders appoint people for these positions, but we must bear in mind that titles are not enough - education must be an integrated part. A radiologist is not necessarily well educated in MR safety, a physicist or an engineer is not necessarily a specialist in MR safety and a radiographer or MR technologist is not by default educated in MR safety at a level of expertise to fulfill a role of an MRSE.

Therefore, it must be ensured that the level and extent of education for these safety roles is defined, and that education at this level is available and preferably certified to match the education system in the country in question.

Educational content
In 2021, the European Federation of Radiographer Societies (EFRS) published an MRSO Role Descriptor: A European Qualifications Framework (EQF) benchmarking document. The purpose of this document was to propose a robust framework of knowledge, skills and competences required by the MRSOs and to help inform and standardize the requirements for MR safety training of MR radiographers in Europe.15

This document describes the roles of the MRSO in different countries, the key subjects the MRSO should know about, as well as the knowledge, skills and...
competences required for a European MR SO suggesting that the knowledge should be at EQF level 7, which is equal to master’s level[1].

Certification
Currently, courses are offered in several places and countries. The only certification I know of is made by The American Board of Magnetic Resonance Safety (ABMRS). They conduct examinations for both MRMD/ MRRD, MRSO and MRSE. The content of the exam (I have only taken the MRSO) is perfectly sufficient, well organized and executed. I suggest that we create our own national or European certification suited for our educational system. It should not be necessary for radiographers to travel to other countries to undertake MRSO courses or examinations or have representatives from the AMBRS to travel and organize the examinations, this should be available nationally. There are many people who need these educational courses, and traveling is expensive and not sustainable.

Therefore, I currently collaborate with a Danish university to explore the possibility of setting up MRSO courses.

Locally, I have taken the initiative to launch e-learning courses. Support was given by the Aarhus University Hospital management team. In collaboration with the regional center for e-learning and an MR physicist, I created basic and advanced e-learning courses recently launched in Central Denmark Region. The intention is that this course can supplement in-person training and be used as annual refresher courses hoping that we reach more people than with the in-person courses. It takes many resources to gather entire departments for in-person teaching, hence in a busy working environment, e-learning may be more flexible because it can be undertaken at any time where it suits the individual. At Aarhus University Hospital and in collaboration with The Danish Council of Radiographers, I arrange biannual Nordic MR safety meetings. These meetings have become very popular, and it is our plan to continue arranging these.

Organizational, political, and strategic work
As mentioned in the background, MR safety has always been high on my agenda. Therefore, I find it strange that we do not have the same strict regulations for MR as for x-rays. For several years I have been collaborating with the Danish council of radiographers [Radiograf Rådet, RR]. In 2019, we arranged a conference on MR safety at the Danish parliament. We aimed to attract political attention to the importance of MR safety for the patients and advocated for the ministry of health to take the initiative to establish a Danish guideline for MR safety. The conference was well attended, and the politicians showed great interest. Then we had a referendum in Denmark and a new government, followed by the COVID-19 pandemic, which stole the political focus. Therefore, I contacted the RR and together with the president of the RR, Charlotta Graunsgaard, I took the initiative to form a Danish MR safety guideline. We started by contacting the Danish Society of Radiologists (Dansk Radiologisk Selskab, (DRSI)), The Danish Society of Medical Physicists (Dansk Selskab for Medicinsk Fysik (DSMF)) and the Danish society for medical magnetic resonance (Dansk Selskab for Medicinsk Magnetisk Resonans (DSMMRI)). In collaboration, we founded a steering committee and a working group which are currently creating a Danish national guideline on MR safety. When the guideline work is finalized, there will be a hearing including the political system, professional societies, public and private hospital leaders etc. It is our hope that the guideline will be well received, by leaders in the healthcare sector and the politicians, who we hope will endorse it.

Norway and Sweden are also in the process of creating their own national guidelines for MR safety but for the time being no formal collaboration is going on to form a Scandinavian or Nordic guideline for MR safety. I acknowledge that we need MR safety guidelines in our own languages but a collaboration between the Nordic countries would be useful.

The number of MR examinations and the number of patients with implants, both medical and non-medical, are increasing. Still, we are occasionally challenged to find out exactly what kind of implants the patients have. We need exactly the type, name, and number of the implant to find the MR labelling. Therefore, this information should always be listed in the patient’s medical record, and a comprehensive user-friendly implant databases is still on our wish list as radiographers and MR technologists.

Research
Research is performed in MR safety and the increasing academization of the radiographer profession has resulted in radiographers publishing in this area. However, more research is needed to focus attention on best practice in MR safety, the importance of reporting MR-related adverse events, educational needs, interdisciplinary teamwork and sufficient staffing to ensure patient safety in relation to MR.

Summary
Over the years, MR safety has developed and changed. In Denmark we still lack a national guideline, but work is currently in progress. We need to attract the attention of leaders and authorities to the importance of teamwork, education, minimum staffing, regular MR safety education updates and general MR safety risk assessment of the MR facilities. Furthermore, it must be ensured that the necessary information regarding implants is available in the patient’s medical record and a user-friendly implant database is established including easy access to the MR labelling of the implants and devices.

References
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A common reason that radiology technologists enter the profession is “to help others.” Patient safety is an essential component of the radiographers’ responsibilities in helping others. The American Society of Radiologic Technologists / ASRT Radiography curriculum includes patient safety in the didactic courses of Patient Care and Assessment, Infection Control, Radiation Protection, Professional Liability, and students further review patient safety during clinical instructions.

During patient care and assessment the radiographer verifies the order is entered appropriately for the correct patient. Patients are transported and assisted safely on and off imaging tables. The exam is performed with age-specific protocol, proper patient identification, as well as marked with applicable side indicator marker.

Radiographers pay close attention to infection control measures routinely applying universal precautions for the safety of the patient and themselves. When necessary the suitable isolation requirements are applied. During the recent pandemic, the technologist performed chest exams through the clear glass window of the patient’s room with the assistance of the nurse caring for the patient, thus reducing the number of staff donning and doffing personal protective equipment.

The ALARA “as low as reasonably achievable” (ICRP103) principle is synonymous with the radiographers’ role in patient safety. It is the radiographers’ responsibility to protect the public, patient and themselves from unnecessary radiation exposure.

In the 2019 World Health Organization report finds; “the occurrence of adverse events due to unsafe care is likely one of the 10 leading causes of death and disability in the world.” Unfortunately, sometimes safe patient care is not adequate to prevent errors from occurring, “Human Error” is sometimes not the liability of the radiographers. System failures need to be considered and reviewed.

Radiographers are educationally prepared and clinical competent to perform examinations ensuring patient safety. The radiographers’ emphasis on patient safety is knowing they too will be a patient and need someone “to help them.”

References
1. ASRT American Society of Radiologic Technologists; Radiography Curriculum; www.asrt.org
2. International Commission on Radiological Protection. ICRP www.icrp.org

2022 Radiographers at the forefront of patient safety

By Beth Weber, USA

Beth Weber
Beth Weber, MPH, RT(R), RDMS, CRA, FASRT, has been the Director of Imaging Services and Privacy Officer for the Avera Heart Hospital in Sioux Falls, South Dakota since 2000.

Beth is involved in the Avera Health Systems Radiology Service Line, serving as chair of the Quality and Safety Committee.

Beth received a Master’s in Public Health with a certificate in Healthcare Executive studies from the University of Minnesota in 2007.

Beth’s progressive professional experience includes being a staff Diagnostic Radiologic Technologist, Sonographer, Chief Technologist, and Director of Imaging Services.

Beth served four years on the Board of Directors of the American Society of Radiologic Technologists / ASRT as Vice Speaker and Speaker of the House of Delegates. Beth currently serves on the American Registry of Radiologic Technologists / ARRT Board of Trustees. Beth is part of the ARRT legislative committee.
A personal account of radiation safety in interventional radiology

By William D. Bryan, USA

INTERVENTIONAL radiology is an exciting field where interventional radiographers assist physicians in using a fluoroscopic machine, commuted tomography machine, or ultrasound scanner to guide operators for image guided minimally invasive procedures. Examples of procedures include removing thrombus from a clotted vessel, treating cancer with image guided therapies, stopping bleeds, and placing long term venous access and countless additional procedures. While the interventional radiographer may not be positioning a broken limb on a cassette/image receptor and choosing exposure factors to obtain an image, we are still the stewards of proper radiation techniques needed for a procedure. We must rely on our training and education as radiographers to apply principles learned from radiography school to interventional practices. Potentially, interventional procedures can be lengthy and require a high radiation dose which could potentially lead to harmful effects of radiation exposure to patients and staff involved. Knowledge of imaging characteristics, patient safety, and operator safety ensure that we continue to assist the physicians we work next to while providing optimal patient care and follow best practices in reference to radiation safety.

Most modern interventional units are digital imaging systems that use a x-ray tube and an imaging intensifier system with automatic exposure controls and specialized dosing protocols (usually vendor specific) to create an image. While the interventional radiographer is not setting the kv, ma, and time of exposure needed applying knowledge of basic imaging factors can help reduce patient and operator dose. The first exposure factor I like to remember is to collimate. Collimating an image uses filters within the x-ray tube to decrease the size of tissue exposed. Proper collimation ensures proper exposure to the area of anatomy while reducing scatter radiation. The second exposure factor I like to remember is magnification factors. Interventional radiologists may need to focus on fine detail of tiny anatomic structures to complete cases. One easy way to view these is to increase magnification of the x-ray tube however, this increases the amount of radiation used to create the image. Instead of magnifying the image, adjusting the imaging intensifier can sometimes yield the same result without changing exposure factors. Remember, the farther the image intensifier is away from the anatomy exposed, the more magnified the image will appear. The final imaging factor I like to remember is to always use pulsed fluoroscopy at the lowest frame rate required for the procedure. Using pulsed fluoroscopy at low frame rates reduces dose while maintaining diagnostic quality imaging. While interventional radiographers may not use the same imaging characters to create our images as our colleagues in other modalities, it is still important to remember and apply basics of exposures to our examinations.

Patient safety is one of the pillars that radiographers strive to uphold. In diagnostic imaging and in interventional imaging, we are there to help ensure that every exam completed is done in a safe environment. Just as in diagnostic imaging, patient positioning is critical to ensure a safe exam. It is imperative that interventional technologists position patient on procedural tables in the proper way for the procedure to be completed. Proper patient positioning usually leads to a more efficient exam which usually lowers radiation dose. Patient shielding is rarely used in interventional imaging however, on the rare occasions that shields are used it is important to remember where the source of radiation is and that we want to position shields between the source and the image. If shields are used incorrectly, dose will actually increase. Finally, being mindful of the amount of time fluoroscopy is use for a procedure will help decrease dose. Obviously, radiation must
be used to watch wires and catheters in the body however, it is not always necessary to use radiation while panning the table, prepping devices, or monitoring patient vital signs. Decreasing the amount of time radiation is used decreases dose. All of the above are examples of how providing a safe environment for the patient can lead to a more efficient procedure with the lowest amount of radiation needed.

As interventional radiographers we spend the vast majority of every day assisting with procedures that require the use of ionizing radiation. This leads to higher levels of occupational exposure than some of our colleagues that work in other modalities of radiography. Lowering radiation exposure to ourselves is important to prevent potential side effects of occupational dose. The first way I lower occupational exposure to myself to wear a lead apron and leaded glassed while involved with a procedure. Wearing lead works to lower occupational exposure by scatter radiation interacting with and being absorbed by lead worn by the operator instead of scatter radiation interacting with tissues of the operator. This is important to remember in regards to operator exposure to radiosensitive tissues such as the thyroid and eyes. The next way I lower my occupational exposure is by always remembering the inverse square law and applying that to my daily practice. We all know that exposure reduces by the square of the distance, therefore the further away I am able to position myself from the source of radiation, the lower exposure I will receive. Newer machines on the market are even provide robot arms to manipulate wires and catheters thus allowing human operators to be further away from the source. Another creative way to lower operator exposure is to use surgical drapes and surgical wear that is imbedded with lead. Multiple manufactures sell drapes, surgical caps, surgical gowns, and disposable lead “chucks” that can be positioned on a sterile environment to absorbed scatter radiation and decrease exposure to others involved with the procedure. Lowering occupational dose theoretically could lead to a longer and more safe career practicing as an interventional radiographer.

Interventional radiology is an exciting modality that relies heavily on the use of ionizing radiation to guide procedure to help patients we see on a daily basis. We all know the practice of ALARA (as low as reasonably achievable) and above are just a few examples of how I engage with that practice on my daily work as a radiographer. As the radiographer in the room working aside physicians, we are the stewards of radiation use and can help protect the patient and ourselves to wisely use x-rays to help our patients.
Radiographers at the forefront of patient safety

By Denise Chong, Singapore

As medical imaging professionals, patient safety is a key tenet of our practice no matter what modality we specialize in. Whenever patients arrive at our departments and are under our care, it is our responsibility to ensure that their physical and psychological safety is protected. With a focus on ultrasound, this piece will briefly touch on aspects of safety in ultrasound – from the biological effects of ultrasound waves, environmental safety and infection control specific to our ultrasound practice, to less tangible, psychological impact that undergoing an ultrasound procedure can have on patients. Furthermore, ultrasound is an operator dependent modality with radiographers requiring to perform some level of reporting and as such competency becomes crucial in ensuring patient safety in ultrasound practice.

Among the range of modalities in medical diagnostic imaging ultrasound often seen as the safest mode of imaging due to its lack of use of radiation. This key advantage of ultrasound, in addition to being cost effective and readily available, is the reason it is considered the modality of choice to image the more ‘vulnerable’ patient population that possesses particularly delicate structures such as paediatric and obstetrics patients. Since the early application of ultrasound as a diagnostic tool (Kane et al. 2004), there have been little to no reports of the detrimental acute effects of ultrasound on the human body, leading to the widespread belief that diagnostic ultrasound is harmless. It is important to remember however that the absence of evidence of harmful effects does not exclude the potential harm that ultrasound can have on the human body.

The application of ultrasound waves on the body results in the deposition of energy within biological tissues which can lead to heating or thermal effects, mechanical interactions with molecules or cause tiny bubbles to form in fluids that can lead to cavitation. (Moderiano et al, 2018; Hedrick, 2013) The heating properties of ultrasound are evident as it forms the basis for therapeutic ultrasound on musculoskeletal tissues. When used safely by trained professionals, this therapy can increase circulation to promote healing in muscles, tendons and nerves. In obstetric diagnostic ultrasound examinations however, small but sustained rises in temperature can cause cell damage within foetal tissues and even cause foetal abnormalities if a 2°C temperature rise is sustained over an extended 2-hour period. The bubbles that form as a bioeffect of ultrasound can react to the soundwaves, undergo large changes in size, expanding and contracting rapidly before collapsing. This violent bursting of bubbles can fragment and damage delicate membranes. In modern day instrumentation, two indices were developed as indicators of the acoustic output power of the machines and the likelihood of inducing the aforementioned bioeffects. The thermal index (TI) and mechanical index (MI) are displayed on the ultrasound display at all times so radiographers can easily see what the potential risk is to the patient with regard to generating these bioeffects. (Ter Haar, 2011) To ensure the safety of patients and minimize these effects, radiographers are trained to pay attention to these indices and apply the ALARA principle in ultrasound by ensuring that scan times are not prolonged unnecessarily, especially over a fixed scan area.

In terms of environmental safety, long dangling ultrasound transducer cables may trip patients and personnel who may not notice them. This is particularly important in the ultrasound setting where a large number of patients may be fasting and hypoglycemic, or may experience postural hypotension when arising from laying down after the duration of the scan. This may lead to dizzy spells and an unsteady gait, thereby increasing the chance of patient falls, especially if these cables are not tidied. Radiographers routinely keep transducer cables tidy, away from the floor and pay attention to these patients during and especially after the scan is complete.
Good infection control and hand hygiene practices are imperative in our daily work for our patient’s safety. These include regular hand washing and using alcohol hand rub frequently at the 5 moments of hand hygiene for each patient interaction, as well as paying attention to the use of appropriate personal protective equipment depending on the type of precaution. Cleaning and disinfection of common fomites is essential. In ultrasound, a potential source of infection comes from the acoustic gel that is used for every ultrasound procedure. Ideally single use bottles are recommended. Commonly however, for economies of scale and to reduce our environmental impact with plastic waste, acoustic gel may be purchased in large format containers ranging from 1 to 5 litre bottles, and smaller gel bottles may be refilled and reused. Extra care must be taken by radiographers in this instance as it is associated with higher rates of contamination. While scanning, radiographers should ensure there is no contact between the dispensing tip of the small gel bottle and the transducer scanning surface. During the examination, gel that has been in contact with the patient’s skin remains on the transducer surface, and without careful application of additional gel, bacteria may be introduced into the bottle and can increase the risk of infection when the same gel is used on other patients. (Nyhsen et al, 2017)

For immunocompromised patients, post operative patients and ultrasound guided interventional procedures, sterile gel is used. The cleaning of transducers should be performed after every procedure with appropriate cleaning agents. Through careful attention to these routine actions, radiographers are able to keep patients safe by limiting these possible routes of infection.

Radiographers also play an important role in protecting each patient’s psychological safety by maintaining high standards of professional competency in ultrasound and actively practicing effective communication with clinicians and patients. As a highly operator dependent modality that relies heavily on the skill of the radiographer, it is critical that they are trained and competent to perform a thorough sonographic assessment of the patient, acquire and interpret appropriate information. (Liu et al, 2017) For example, since ultrasound images are commonly not acquired in a manner that can provide a dataset for post procedure analysis, identification and recognition of abnormalities is required at the time of image acquisition. Otherwise, pathologies may be missed by the radiographer and hence the reporting radiologist. This may lead to possible misdiagnosis, reduced confidence and possible psychological stress of the patient.

Currently radiographers performing all types of ultrasound undergo specialised training through post graduate qualifications or rigorous on job training and regular image quality and reporting audits to maintain high standards of sonographic assessment and high quality imaging to practice competently and safely. Through this training and experience, they are also able to recognise the limitations of ultrasound and escalate these cases to radiologists and refer for further imaging as required. In addition to honing clinical skills through practice and continuous professional development, radiographers also undergo training on how to effectively communicate with patients when the need to hold critical conversations arises. This is particularly important in obstetric scanning and possibly in rural settings where the radiographer practices independently. The mindful disclosure or non-disclosure of sensitive results, depending on each practitioner’s clinical setting, is extremely important in providing patients with not only appropriate medical care but also reassurance and psychological safety.

While there are more ways in which radiographers can ensure patient safety during their ultrasound practice, the key approaches are summarized as awareness of technical machine settings and potential bioeffects of ultrasound on patients, attentiveness to the patient’s physical environment, compliance with strict infection control practices, as well as being competent clinically and communicating effectively. As we radiographers support our healthcare systems at the frontlines, we need to constantly strive to provide appropriate, competent and safe care for our patients. Patient safety cannot be undermined, no matter how busy we are or which modality we specialise in.

References
Be the Change
By Debbie Gilley, USA

In 2021, the International Atomic Energy Agency launched a new training initiative to improve radiation safety culture in medicine. This training material is available at: www.iaea.org/resources/rpop/resources/radiation-safety-culture-in-medicine. This training material is designed for facilitated discussion based on case studies in medical applications using ionizing radiation. There are questions about the case and questions about safety culture to be discussed in an open transparent way utilizing a trained facilitator. Safety culture is defined as the assembly of characteristics and attitudes in the organization, its managers and workers, which assure that, as an overriding priority, safety issues receive the attention warranted by their significance. This is further defined by identifying traits within an organization that can be measured and observed. A trait is a personal and organization presence such as a pattern of thinking, feeling and behaving that prioritizes safety. The training is composed of 10 case studies, one for each of the 10 traits of a strong safety culture. The traits are described behaviors within an organization that promotes a strong culture of safety.

These traits describe the characteristics one would see in an organization that promotes a strong safety culture.

They are:
1. Personal accountability
2. Questioning attitude
3. Effective safety communications
4. Leadership safety values and actions
5. Decision-making
6. Respectful work environment
7. Continuous learning
8. Problem identification and resolution
9. Environment for raising concerns
10. Work process

The incorporation of radiation safety culture into healthcare setting can help prevent injuries and deaths and help reduce unnecessary or unintended radiation dose to patients and staff.

Change in culture is hard! Each radiographer brings to the work place their own culture, based on their societal expectation, family environment, religion, education and other influencers. Radiographers are also asked to incorporate into an existing organizational culture where they work. Their choice of profession also has influence on their activities in the work environment. Many professional organizations have ethical standards that influence behavior in the workplace. Professional organizations are positioned to support radiographers through training to implement the traits to strengthen radiation safety culture.

A change in culture takes time requiring positive energy from all individuals to effectively change the way people think and how they act. Looking at each of the traits we see how they work together to improve safety by changing behavior. Radiographers are key to making the change; they first must accept responsibilities for the culture of safety within their own organization. In fact the first trait of the 10 traits is personal accountability.

Personal Accountability
Personal accountability reflects the belief that both leaders and employees are individually responsible for their performance and the roles they play in radiation protection and patient safety.

Individuals with strong safety culture take personal accountability to support radiation protection values and this is reflected in the activities they perform in the clinical environment. Its coning in to the area of interest when taking an x-ray of the chest, its setting parameters that reduce unnecessary exposure to the patient, its taking the time to make sure the correct patient is getting the correct examination.

These individuals create an organizational culture to assure the safe operation of the facility, patient safety, and care for their colleagues and members of the public. Leaders have an important role to demonstrate person accountability by their
behavior. They provide employees with the resources they need to safely perform their duties. This includes training and professional development, time to perform the task and any resources needed to perform the task, such as assuring there is an adequate number of lead aprons for all staff, assuring that ionizing equipment is properly maintained and when not, provide for service. Leaders establish “through doing” the commitment to a strong safety culture, these actions also reinforce the expected behavior of the employees.

Everyone must take personal ownership for their own actions and be accountable for these actions. Leaders have an additional responsibility to encourage positive reinforcement of behavior that promotes a strong culture of safety.

**Be the change**

Even if you are not in a “formal leadership” role, you can be a leader in supporting a strong culture of safety. Its how you conduct yourself and this is reflected in your circle of influence. Others see your behavior, approve and mimic you. It may take a few more seconds to assure that you have the correct patient for the correct exam, it may take a few more seconds to collimate that image before making the exposure and it may take a few more seconds to set a “technique” that would optimize the exposure, but it is always a reflection of you as a professional. Others will notice, others may observe and then others may adopt. There are always naysayers in any organization, but we don’t let those individuals have us change our beliefs. Radiographers who take personal responsibility for radiation safety culture can and are the catalyst for change.

Leaders too, can be the change. Walking around management is very effective for managers as well as employees. When employees feel that management “cares” they will adapt to the standards set forth by management in the organization. Those lead aprons will be returned to the rack instead of bunched on the table or floor, the collimated images will be acknowledged as good practices and equipment will be less likely to be damaged in the day-to-day operations. Managers need to make sure the environment where employee’s work is safe and those who do not ascribe to the culture may not be a good fit for the organization and management will need to work with these employees or suggest another environments that might be better for them. In these situations, management is the catalyst of change.

So how do we become the “change?”

There are four activities that can be performed by any radiographer to improve the radiation safety culture of the workplace. They are:

- Lead by example;
- Improve communication with peers and patients;
- Prioritize a few critical activities; and
- Involve other radiographers in becoming active in strengthening radiation safety culture.

Radiographers who choose to “own” the responsibility can and will be the change to improve radiation safety culture. They will be accountable for safety culture and for the overall improvement in culture of the organization. As professionals, radiographers should embrace this responsibility and be the change to improve the culture of radiation protection and patient safety.

**Reference**

Radiographers at the forefront of patient safety: Ultrasound

By Gill Harrison, United Kingdom

WHEN I started ultrasound training in the United Kingdom the early 1990s, to complete the national Diploma in Medical Ultrasound I was in a lucky position to be working with a tight knit team of sonographers and radiologists who had all learnt ultrasound together. This meant that we were scanning most of the cases that came through the department. We provided independent reports and over time began to communicate findings to patients in areas other than obstetrics. At the time many sonographers were focusing their practice predominantly in obstetrics. General ultrasound was the domain of the radiologist and national level discussion was ongoing about whether radiographers/sonographers were able to safely provide ultrasound reports, without impacting on patient outcomes.

Developments in ultrasound practice by radiographers continued, as the debates about patient safety progressed. With appropriate education, supported training and experience in ultrasound, sonographers and radiologists began to demonstrate comparable results for independent report writing. As audits were undertaken and findings published to evidence this, a gradual change took place, partly driven by the shortage of radiologists in the NHS, but also due to an increasing evidence base suggesting high standards of patient care and outcomes. The career development of radiographers in ultrasound continued globally, although their role as independent reporting sonographers was limited in many countries, and this continues to be the case in some areas. Radiographers/sonographers have gradually expanded their areas of clinical practice into all aspects of ultrasound. Meanwhile technological enhancements continue at a rapid pace and are providing on-going opportunities for radiographers/sonographers to develop service provision, improve diagnosis and accuracy of reporting to enhance the quality and safety of the service to patients.

Education and registration:
Many ultrasound practitioners in the UK are radiographers registered with a statutory regulatory body, the Health and Care Professions Council (HCPC). There are an increasing number of sonographers who are unable to register with the HCPC or other statutory regulatory body. To try and mitigate this and ensure an element of safety for patients, the College of Radiographers administered a voluntary register of sonographers. This closed in 2021 and transferred to the Register of Clinical Technologists (RCT) on the advice of the Professional Standards Authority (PSA) in their report into sonography regulation. The RCT register has robust processes to protect the public. It is however still a voluntary register; sonographers do not need to apply to join this register and can practise without any registration. On-going lobbying for sonographer regulation continues in the UK and other countries such as Australia. To provide patients with safe, effective ultrasound examinations high quality education, training, assessment and on-going audit is required. In the UK the national Diploma in Medical Ultrasound was replaced by Higher Education Institution awards at master’s level (post graduate certificate, diploma or master’s e.g. MSc) in the early 1990s. To oversee the quality standards of education provision the Consortium for the Accreditation of Sonographic Education (CASE) was formed in 1993 and has always advocated that the person performing the ultrasound examination should be responsible for issuing the final report. CASE continues to provide a high level of scrutiny for ultrasound programmes in the UK and Ireland, however CASE accreditation is not mandatory, so there are programmes operating outside the accredited route.
Due to the national shortage of sonographers in the UK work is progressing on the development of a career framework, preceptorship and capability development framework, to increasing the number of sonographers qualifying and entering the workforce from other routes e.g. direct entry for non-health care professionals. In the UK the ‘gold standard’ is for an ultrasound course to be accredited by CASE. Until 2019 CASE only accredited postgraduate ultrasound education or focused courses with a narrow and clearly defined scope of practice. In response to the need to grow the workforce, CASE developed standards for sonographic education to enable both undergraduate and postgraduate entry to ultrasound practice. It is essential that anyone completing a CASE accredited programme of study can perform, interpret, analyse and report the ultrasound examination. This requires intense clinical and academic training. Many education providers across the world are looking at how best to ensure standards of ultrasound training meet the needs of patients, not only in the ability to perform the scans, but also to manipulate the equipment to reduce the chance of harm, communicate with patients to explain the procedure fully and provide patient choice, discuss findings if appropriate and explain the next steps in their care pathway.

Simulation has developed rapidly in ultrasound. Many education providers have integrated simulation into the early stages of ultrasound training, to take some pressure off busy clinical departments, standardise the learning experience and allow students to learn in a more relaxed setting. Colleagues in New Zealand tested out an intensive pre-course education package using simulation, phantoms and volunteer patients to increase the clinical skills of students prior to starting placements, thus ensuring a level of competence before they saw real patients. The impact on patient care was not evaluated as part of that initial study but having learners with a good understanding of the basic skills is likely to improve patient confidence and reduce the time they need to be in the hospital or clinic environment.

Simulation can also be used to provide communication skills training with peer and supervisor feedback. This was introduced into the course at City, University of London many years ago as part of the flipped classroom approach to teaching, giving learners the opportunity to share multi-professional feedback. By using simulation for communication skills training, students are able to try out methods of communicating unexpected or complex findings. Doing this in the clinical setting when a patient is anxious or upset can be more challenging for students and patients alike.

In England, Health Education England has funded several imaging academies to assist in the training of radiologists, reporting radiographers and sonographers. As part of that funding, Clinical Ultrasound Training Academies (CLUSTAs) are being developed, with a view to increasing the clinical placement capacity in England for sonographer training. As these develop further, the vision is to assist existing sonographers to develop their clinical skills into other areas of ultrasound practice, but also develop wider non-clinical skills to enhance the patient experience and safety though service development, analysis of clinical techniques and care pathways via research and teaching the next generation of health care professionals. Similar initiatives are being considered in the devolved nations of the UK and in other countries around the world.

Professional body input
In the UK the professional body for radiographers is the Society and College of Radiographers (SCoR). Imaging and radiography professional bodies around the world provide advice and guidance for ultrasound and other areas of imaging. The Society of Radiographers (SoR) have recently updated documents such as the SoR and BMUS ‘Guidelines for Professional Ultrasound Practice’, input into national guidance on the safe use of ultrasound gel, transducer decontamination and various clinical guidelines. Their input also includes working with governmental bodies to lobby for appropriate professional recognition, workforce planning, funding for education and career development, equipment and processes to provide safe access to ultrasound services for patients.

Developments
More sonographers are now engaging in the wider aspects of advanced and consultant clinical practice, including education, leadership and management, service development and research. The value of developing non-clinical skills and expertise on patient safety has already been discussed, but it can also impact on sonographer job satisfaction and motivation to continue to improve the care they provide. Using the latest evidence-based research and guidance to inform practice developments, backed up by clinical audit to assess local implementation and outcomes, leads to an on-going cycle of quality enhancements in care.

Sonographers are also extending their clinical role to include, for example elastography, interventional procedures such as fine needle aspiration, biopsy and contrast enhanced ultrasound. Others are specialising in a clinical area such as breast, musculoskeletal or head and neck imaging, whereby they are involved in the whole patient care pathway and imaging, not only performing the ultrasound examination. Sonographers’ roles in obstetrics and gynecology might include early pregnancy assessment,
management and discharge or fetal medicine assessment of complex or high-risk pregnancy follow-up using high levels of expertise, communication and counselling skills.

Artificial intelligence (AI) is being developed, with research studies investigating AI clinical applications of ultrasound. As machine learning and deep learning systems come to the market, radiographers/sonographers will be well placed to further enhance patient care and communication. Working with researchers, manufacturers and patient groups ultrasound practitioners will need to validate algorithms, monitor safety, determine ways to implement the technology into patient care pathways whilst ensuring the patient experience remains the same or ideally is improved.

Conclusion
Ultrasound practice is undergoing major developments across the globe in terms of technological innovations and radiographer/sonographer practice. Radiographers are developing knowledge, skills, and competency to progress in ultrasound practice, enhance patient care pathways utilising the latest technological developments whilst providing high levels of patient communication. All of this is underpinned by appropriate education, training, on-going lifelong learning, audit, mentoring and reviewing patient outcomes and feedback, to provide excellence in clinical care and safety.

References
Conventional radiography on the forefront of patient safety

By Manuel José Cruz Duarte Lobo, Portugal

THE classical Conventional Radiology (CR) has come a long way since Wilhelm Conrad Roentgen presented the results of his investigations at the memorable session of the Society of Physics and Medicine in Würzburg on December 29, 1895. The discovery of X-rays provided, for the first time, the possibility of visualization of the interior of the human body without the need to open it (Abrantes, 2017).

In many ways, radiography has changed little from the early days of its use. We still capture a shadow image of the sample with a detector opposite the x-ray source. Film is sometimes still used with procedures and processes technologists were using in the late 1800’s.

Film processing has evolved to an automated state, producing more consistent film quality by removing manual processing variables. Electronics and computers allowed the evolution towards the use of “filmless radiography” that provides a means of capturing an image, digitally enhancing, sending the image anywhere in the world, and archiving an image that won’t be deteriorated with time (Iowa State University, 2022).

Although in recent times the CR may be seen as a “less important exam” in the imaging panorama, it is still a very important technique that shouldn’t be ignored or substituted by other more expensive and/or more radiation techniques. It is important that all the stakeholders have this in mind so that all the potential of this imaging technique could be fully achieved, rationalizing the use of other less accessible and more expensive techniques. For instance, The International Society of Radiographers and Radiological Technologists (ISRRT) had a very interesting webinar talking about Adaptative Radiology, providing some hints and tricks about CR. This kind of events are very important so that radiographers could improve and enhance their technical skills and deliver more quality exams.

Hence, new tools for conventional Radiology are becoming available such as Direct Digital Imaging and Artificial Intelligence (AI), the latter, with a rapid impulse because of the COVID-19 pandemic.

The AI is a hot theme regarding the future of Medical Imaging in general, always raising the question of whether these professions would be threatened by these advances. Alongside this matter, there is also the question of whether AI could help manage the huge number of medical images produced daily and help to mitigate the shortage of specialists responsible for performing and reporting these exams. They also discuss whether they could help to humanize health care more, as they leave more free time for professionals for patient care (Murphy & Liszevsky, 2019).

A study by Leeuwen, Rooij, Schalekamp, Ginneken, & Rutten (2021) highlighted six essential advantages of AI systems applied to medical imaging sciences:

1. Improved workflow;
2. Shorter exam reading time;
3. Dose and intravenous contrast reduction;
4. Early detection of disease;
5. Improved diagnostic accuracy;

Preliminary results from the application of AI to medical sciences have been very promising, proving to be a useful tool to support and complement areas such as, Detection of pulmonary nodules (Nam et al, 2019), Covid-19 patterns (Goel, Murugan, Mirjalili & Chakrabartty, 2021), Fracture detection (Rayan et al, 2019; Thian et al, 2019; Kuo et al, 2022) and Intracranial hemorrhages (Arbabshirani et al, 2018). In the study by Nam et al (2019), AI tools surpassed the performance of Radiologists,
at the same time that they contributed to all of them improving their detection skills, which proves their usefulness and complementarity. In other study by Kuo et al. (2022), in a systematic review and meta-analysis of 42 studies (37 studies with radiography and five studies with CT), the pooled diagnostic performance from the use of artificial intelligence (AI) to detect fractures had a sensitivity of 92% and 91% and specificity of 91% and 91%, on internal and external validation, respectively.

It should be noted that despite all this fantastic evolution in the field of artificial intelligence to detect imaging patterns, it is worthless if the image is not obtained under optimal technical conditions, a factor very much in favor of the continued importance of the radiographers.

**Direct Digital Solutions to reduce dose and repetition**

Digital radiography (DR) is an advanced form of x-ray inspection which produces a digital radiographic image instantly on a computer. This technique uses x-ray sensitive plates to capture data during object examination, which is immediately transferred to a computer without the use of an intermediate cassette. The incident x-ray radiation is converted into an equivalent electric charge and then to a digital image through a detector sensor that can be made in a direct or indirect way, as described in the image.

**Main advantages of Direct Digital radiology:**
1. Shorter exposure times;
2. Use of analysis tool and defect recognition software;
3. Digital image enhancement and data storage;
4. Higher productivity, immediate feedback;
5. Enhanced SNR and linearity.

While both computed radiography (CR) and digital radiography (DR) have a wider dose range and can be post processed to eliminate noise, DR has many advantages over CR. DR improves workflow by producing higher image quality instantaneously while providing up to three times more dose efficiency than CR. With ongoing technological advancements and reduction in price, DR is fast becoming the preferred choice for non-destructive testing operators (TWI, 2022).

It is also important to have an appropriate use of DAP chambers incorporated in the equipment, as well as removable anti scatter grids so that we can control better the dose that is delivered to patients and try to reduce and optimize it.

**Justification, quality criteria and referrals**

Although technological issues are important to reduce dose, technologist work processes and criteria are also very important. Justification and optimization are the two fundamental principles of radiation protection in medical exposures, as follows:

Medical exposures shall be justified by weighing the expected diagnostic or therapeutic benefits against the potential radiation detriment, with account taken of the benefits and the risks of available alternative techniques that do not involve exposure to radiation. The principle of justification applies at three levels in medicine (ICRP, 2013).

1. Do more good than harm to society and patient;
2. A procedure is justified for patients showing relevant symptoms;
3. If the clinical condition could be detected by those techniques.

Justification of an exam must rely on professional evaluation of comprehensive patient information including: relevant clinical history, prior imaging, laboratory and treatment information.

When indicated and available, imaging media that do not use ionizing radiation, e.g. ultrasonography (sound waves) or MRI (radiofrequency and electromagnetic

<table>
<thead>
<tr>
<th>What the referrer should consider</th>
<th>Preventable exposures to radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has it been done already?</td>
<td>Same previous exams recently made</td>
</tr>
<tr>
<td>Do I need it?</td>
<td>Undertaking investigations when the results are unlikely to change patient management</td>
</tr>
<tr>
<td>Do I need it now?</td>
<td>Investigation too early (before possible treatment)</td>
</tr>
<tr>
<td>Is the best examination available?</td>
<td>Doing the best suitable investigation to the clinical condition</td>
</tr>
<tr>
<td>Have I explained well the problem?</td>
<td>Failing to provide appropriate clinical information and questions that imaging are expected to answer</td>
</tr>
</tbody>
</table>

Source: Adapted from who communication radiation risks in pediatric patients (WHO, 2016).
waves) are preferred, especially in children and in pregnant women (particularly when direct fetal exposure may occur during abdominal/pelvic imaging). The final decision may also be influenced by cost, expertise, availability of resources and/or patient values. In the context of the system of radiation protection, optimization signifies keeping doses “as low as reasonably achievable” (ALARA). (ICRP, 2013).

The Image Gently Alliance provide us a flowchart to give some orientation in our workflow as we can see on the following page (Image Gently Alliance, 2022).

Other important issue is the duplication of imaging already performed at other healthcare facilities which constitutes a significant fraction of unnecessary examinations. To prevent this repetition, previous investigations (including images and reports) should be recorded in PACS or Patient Clinical Process, in sufficient detail and be available to other healthcare providers (private and public). This would help record an individual patient’s imaging history.

**Imaging referral guidelines**

Faced with a clinical presentation, the referrer makes a decision based upon best medical practice. However, complexities and rapid advances in medical imaging make it difficult for referrers to follow changes in evidence-based standards of care. Guidance for justification of imaging is usually provided by professional societies in conjunction with national ministries of health. Referral guidelines for appropriate use of imaging provide information on which particular imaging exam is most apt to yield the most informative results for a clinical condition, and whether another lower-dose modality is equally or potentially more effective, hence more appropriate. Imaging referral guidelines should be advisory rather than compulsory, and this questions below should be always on the professionals mind. (WHO, 2016).

Without any control mechanisms, this type of phenomenon will overflow the work of radiographers, increasing his burden of work and decreasing his morale in general, because they think that their jobs hasn’t been used properly. We will work harder, with no suitable clinical criteria and delivering avoidable radiation into patients. Hence it is important that Radiographers could build comprehensive bridges between multidisciplinary teams because they are still feeling very under-evaluated in their working context. They must have the ability to work with the teams, regarding their profession limits and with their own autonomy.
Elevating patient care with Artificial Intelligence: An educator’s point of view

By Brandon Hirsch, USA

I OFTEN at times find myself during lectures giving examples of how informatics, technology and radiologic equipment function and how those functions affect image quality. For example, when speaking about pixel and matrix sizes I may ask students if they remember how computer screens looked before flatscreens came out with the 16:9 aspect ratio and how poor the resolution was. Or when discussing the dead man switch on the x-ray portable I may explain it as how telephones used to have a coiled cord connecting the receiver to the transmitter just like the deadman switch will when they get to their clinical rotations. Each year less and less of the class have recollections of such antiquated mechanisms and technologies and it amuses me when I witness the increasingly absent memories of film processing and light bulbs with filaments.

Change is inherent in diagnostic imaging and radiotherapy, as we are all radiologic technologists by profession. Technological change should be fun and keep us invigorated as we learn new things and see our healthcare profession change with technological improvements. Perhaps the most impactful technological change in recent years has been and will continue to be machine learning and artificial intelligence. Moore’s law was an observation of computational power doubling about every two years made in the 1960’s and this technological trend continues. While not a literal law, it is more of an observation of the trend of computational improvement over time. Around 2012-13, I recall interning for a medical physicist who performed remote work for a radiation oncology clinic. Our tasks were mostly related to treatment planning which entailed operating a treatment planning system remotely. Long story short, there was a fair amount of lag on our screen which was displaying their computer hundreds of miles away. Fast forward to today, I perform an identical task remotely and rarely experience any lag between my computer and the host site.

A more recent example of technological improvements could be video conference software performance pre-pandemic to now. Data transmission and processing capabilities seem to have conquered the requisite for more common tasks such as remote logins and teleconferencing enabling health professionals to log in to remote clinics far away. Smaller rural and isolated areas are now connected to a larger network of resources and professionals. Now that our processing power has largely met all our workplace demands, with multiple screens and applications simultaneously running, where will the next horizon be? It seems this will occur with new developments involving artificial intelligence or machine learning applications. While our processors are more capable of multitasking and large-scale computations and our networks can transmit big data, the coding and algorithm development will be next in line to get major improvements.

Artificial intelligence is a popular buzzword in radiology and its subfields, and a few basic definitions can help to explain the role AI may play in our daily work lives. Machine learning is commonly used as a synonym for artificial intelligence, which describes algorithm-driven computer learning that improves with an increase in repetitions. Two types of machine learning may be described as supervised versus unsupervised learning. Supervised learning is that which utilizes more human input such that a training dataset is labeled by a human which could be annotating pathology or defining a region of interest on an image such that a training dataset is labeled by a human. Unsupervised learning on the other hand does not depend upon human input or labeling in order to find a relationship amongst the data. A blend of both methods, semi supervised learning may utilize a small amount of labeled data but a larger amount of unlabeled data. In short, AI offers the potential to analyze data and make a prediction or an analysis outcome.

Brandon Hirsch

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He has been employed clinically for over 10 years including roles within radiography, computed tomography and medical dosimetry. He has been an instructor/professor at SIU since 2014. He enjoys teaching students at various levels in their academic careers and feels lucky to be able to help educate the next generation of medical imaging professionals.
In diagnostic imaging there is potential for AI applications to analyze image datasets to detect pathology. This of course has not been without debate, as critics worry about false positives or false negatives from AI decision making. The enormous potential of AI however seems to have helped wane the trepidation of potential pitfalls and compromise may be found by establishing AI as an augmentation to human decision making. Concerning pathology detection, AI applications can help with triage and emergency situations by analyzing an image set before a radiologist is available, thereby flagging statim cases. Pathology detection applications can also give human dictation a second set of eyes.

The big data era provides the nutrients needed for AI applications to thrive and seems too promising to go unanalyzed. Data scientists and health informatics have become a permanent fixture within healthcare organizations, and they are eager to show their value within the healthcare industry. The electronic medical record (EMR) includes a patient’s comprehensive medical history and information and may be used to help predict outcomes and identify unique patient characteristics. This of course extends beyond imaging and radiotherapy, and one need not look far to explore AI applications outside of your field. In radiation oncology, automated processes have been implemented such as auto segmentation whereby normal organs are contoured to identify their location on a dataset. Automated planning seeks to utilize big data from previous radiation treatments to automatically design new treatment plans. Somewhat ironically, when we ask how these automated processes are considered with respect to quality assurance, we see human verification being suggested as being necessary to affirm machine determinations in the workflow. Some suggest an independent algorithm to corroborate the findings of another.

While discussing the specific details of how AI may be utilized, we need not forget that healthcare is all about caring for people. So how does all of this help our patients and improve their outcomes? Hopefully their services are improved by shorter wait times, faster results, individualized care plans and lower costs. Clinical decision support (CDS) can be augmented with big data whereby physicians can consult with patients on potential risks and benefits of treatment options. Perhaps wishful thinking would extrapolate those automated processes may result in lowered costs for patients.

Patient safety concerning optimized outcomes can hopefully be improved with machine intelligence augmenting clinical decisions. Telemedicine and improved data sharing can offer remote and rural areas access to physicians and specialists not otherwise available. Adding AI to this data sharing only strengthens this position. Time and resources saved from reduced travel should also be considered.

Research centered around AI in medical imaging has been growing rapidly each year and readers can engage the firehose of information with a quick google scholar search. AI has many facets and has already inserted itself into many aspects of the workflow in diagnostic imaging and radiotherapy. Radiologic science is by nature a technological field which is becoming increasingly integrated with information science. As healthcare professionals we should seek to understand the risks and benefits for our patients.
PATIENT safety is a crucial element of high-quality healthcare. It has been defined as the reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum. However, errors are very common in healthcare centers. Radiological technologists have an important role influenced on improving patient safety and involving the frontline caregivers for a mechanism to raise concerns regarding patient safety culture in place. For more than six decades, nuclear medicine studies have been used to evaluate practically all systems within the body as well as to image many types of cancer. The use of low levels of radiation in these procedures has some possible risk but it is also recognized that if an appropriate procedure is not performed when necessary, due to fear of radiation, it can be detrimental to the patient. In accordance with the “Position statement on dose optimization for nuclear medicine and molecular Imaging Procedures” stated by the Society of Nuclear Medicine and Molecular Imaging (SNMMI), when nuclear medicine and PET imaging procedures are performed correctly on appropriate patients, the benefits of the procedure very far outweigh the potential risks. The procedure that provides the most useful clinical information is the one that should be performed.

In nuclear medicine, small amounts of radioactive agents are administered to the patient to allow physicians to examine molecular processes within the body. These procedures are highly effective, safe and painless diagnostic tools that present a detailed view of what’s going on inside a patient’s body at the molecular level. Furthermore, radiation dose for all Nuclear Medicine and PET imaging procedures is optimized so that the patient receives the smallest possible amount of radiopharmaceutical that will provide the appropriate diagnostic information. As such, dealing with patient with radiopharmaceuticals, nuclear medicine technologists should be appropriately trained and certified, and should have comprehensive quality control measures in place to ensure that the patients receive the best, safest and most appropriate care.

Radiopharmaceuticals are used to diagnose and treat a variety of diseases ranging from cancer to noncancerous disorders. Radiation exposure to patients is usually minimal for most diagnostic scans and slightly higher when being used as therapies. This is because diagnostic imaging uses a low-energy radiation to see the target organ on the scan, while the therapy requires a higher energy radiation to target and kill the abnormal cells. Radiopharmaceuticals can save lives and improve a patient’s quality of life by providing diagnostic information crucial for appropriate medical care or delivering a much-needed therapy. Nuclear medicine technologists should usually work following the ALARA principle (As Low As Reasonably Achievable) to carefully select the amount of radiopharmaceutical that will provide an accurate test with the least
amount of radiation exposure to the patient. The actual dosage is determined by the patient’s body weight, the reason for the study and the body part being imaged. The targeted nature of radiopharmaceuticals allows them to be delivered mostly to the organ of interest while maintaining a low whole-body radiation exposure. Administration of radioactivity to patients for diagnosis or treatment of diseases raises concern for radiation exposure to family, caregivers, and the public. Therefore, radiation safety restriction instruction should be established and followed to minimize such exposure.

In diagnostic imaging procedures, there are several possibilities of the occurrence of an error such as inadequate technique, failure of understanding, wrong diagnostic judgment, combination of several factors, wrongs in report and communication. In the hospital environment, possible nuclear emergencies may occur whenever the use of radioisotopes for diagnostic purposes and for therapeutic purposes. When prescribing the exam, various moments are identified such as, identification of the patient, evaluation of the opportunity to perform the service (justification), identification of appropriateness, the coexistence of any contraindications, the correct preparation of the patient. In the preparation phase of the diagnostic or therapeutic procedure it is possible to identify the moment of drafting and printing the daily program, the process of identifying the patient and the type of service, the drafting of the anamnesis and the consequent forecast of adverse reactions, the compilation of labels, the preparation of the radiopharmaceutical and its identification in relation to the patient and the service to be performed, the time of administration of the radiopharmaceutical. When the diagnostic or therapeutic procedure is performed, the possible error could be occurred and should be careful when identifying the patient, when checking the time and type of service, during the distance to and from the diagnostic section, when positioning the patient, the technical management of the service, the data processing phase, and the identification of labels - the right test with the right dose given to the right patient at the right time. The impact of wrong patient, wrong site and wrong procedure events in nuclear medicine can be profound. Unnecessary radiation exposure, delayed or incorrect treatment and patient distress make this an important safety issue.

**Patient safety for diagnostic nuclear medicine**

Patients in nuclear medicine undergo diagnostic tests with administration of short-lived radionuclides to detect diseases in different parts of the body. Since the amount of radioactivity administered is extremely small, the radiation exposure to nuclear medicine personnel and the public is minimal. So, all diagnostic patients are discharged after the procedures without any specific instruction as to radiation exposure to the family members or the public. The following is a brief outline of the essential steps in the patient safety management of patients administered with radioactivity while in the nuclear medicine section, or in hospital.

- During the procedure (scanning), the technologist should not be too close to the patient and maintain an optimal distance from the patient to minimize the exposure.
- For compromised or incontinent patients, care should be taken to avoid contamination of the patient’s bed or stretcher. If contaminated, decontamination should be performed. Otherwise, these items should be removed and let decay.
- If the floor of the scanning room or injection room is contaminated, they must be decontaminated using general rules.

**Patient safety in therapies nuclear medicine**

Management of therapeutic patients are quite different from diagnostic patients because of the higher level of exposure involved. Unsealed radionuclides in the form of liquid are administered orally...
or intravenously to treat cancers in patients. Patients are treated for cancer by intravenous administration of 153Sm, and 223Ra on outpatient basis. Because of the particulate radiations, radiation exposure from the patient to the caregiver or the family is insignificant. Also, in the case of treatment of hyperthyroid patients with ≤30 mCi (1 GBq) 131I, radiation exposure from the patients are not deemed hazardous with some limitations. Therefore, these patients are allowed to leave the facility following treatment, and only general radiation safety precautions are advised. On the other hand, thyroid cancer patients are treated after thyroidectomy with oral administration of hundreds of mCi (GBq)s of 131I. Radiation exposure from these patients increases by many orders of magnitude necessitating an effective measure of radiation protection.

For treatment, the patient in this category is assigned a designated private room away from common traffic in the hospital because of the high radiation exposure. Release consideration of patients treated with 131I

The primary concern for the release of patients administered with radioactivity is the exposure to the public and the family members. Arrangements should be in place to manage the release of patients and consideration should be given to the respective flow of patients and visitors in the facility. The instructions must be given to the released patient if the dose to others is likely to exceed 1 mSv, which is the dose limit for the public. The recommendation for release consideration from hospital of I-131 therapy are as followings: for patient dose rate measurement at 1 m < 30 μSv/hr, moderate restrictions on family contact after release should be advised; for patient dose rate measurement at 1 m < 70 μSv/hr, high restrictions on family contact after release should be advised. To achieve this goal, the patient is recommended to adopt ALARA principles at home and around, so that the dose to others from exposure does not exceed 1 mSv. This is accomplished if the patient follows a set of instructions given to patient, which vary with the circumstances of the patient at home. Additional instructions are required to be given to breast-feeding patients who are administered with radiopharmaceuticals and released, if the dose to the breast-fed infant or child likely exceed 1 mSv on the assumption of continuous breast-feeding. The instructions include discontinuation of breast-feeding for a period of time depending on the radionuclide administered.

Patient safety in theranostics

Theranostics, a pairing of diagnostic biomarkers with therapeutic agents, was first introduced into nuclear medicine in 1940’s to identify the relevant molecular targets in cancer for the treatment and imaging on thyroid cancer patients with radioactive iodide-131 or RAI. Among several radionuclides used for theranostics, Lutetium-177 (177Lu) has been recognized as a radioisotope that widely used for therapeutic agent in targeted radionuclide therapy. It is critical to perform dosimetry analysis as part of patient treatment to calculate absorbed dose from radionuclide administration by tumors and critical organs to evaluate the potential of treatment success. As patients undergo many treatment fractions, radiation doses received should be of concern and the appropriate administered activity for each fraction should be calculated in order to avoid toxicity to critical organs. Radiation emission after 177Lu therapy is quite low, allowing the treatment to be done in the outpatient setting. Except for the first few days after therapy, there are no specific restrictions for contact with other persons. Radiation activity persists at low levels for several weeks after therapy because of ongoing decay of the administered radionuclides. This radiation activity is not harmful to others but can be detected by sensitive radiation detectors. The therapy is most commonly given as four cycles with two months between treatments. Travelling while undergoing 177Lu treatment should be discussed with the patient by the clinical...
care team and nuclear medicine team before treatment. Patients can arrange their schedules accordingly if they are well informed about this process ahead of time.

**Patient safety concern in children and pregnant women**

Nuclear medicine studies have been performed on babies and children of all ages for more than 40 years without any known adverse effects. The functional information about the body obtained from these exams and the low doses of radiation used make it a safe and effective diagnostic tool in children. Nuclear medicine procedures expose children to a very small amount of radiation that is within the lower range of what is received from routine diagnostic imaging procedures using x-rays. The specific amount of radiation exposure varies depending on the type of study. Preparation for a nuclear medicine examination depends on the type of scan is having, and child’s individual needs. Some scans require fasting for the actual imaging sequences, and others require fasting for sedation. Distraction techniques are utilized for all scans for all age patients in nuclear medicine. Some nuclear medicine scans need to be performed while a child is asleep under a general anesthetic. This is quite rare, but may be required if sedation will not be effective for the children and their scan. Most children can watch a movie while having their scans, bringing in a smartphone, tablet, or child’s favourite movie or TV show to keep a child occupied and distracted during the scan. This could be reduced the sedation rate and risk for pediatric patients. However, sedation of the pediatric patient for nuclear medicine imaging procedures requires careful planning, patient preparation, and monitoring to ensure patient safety. Furthermore, according to the guideline of SNNNMI regarding guideline for pediatric sedation in nuclear medicine, a written pediatric sedation policy is strongly recommended, and written medication protocol for sedation are also strongly recommended.

In case women who are or who might be pregnant and who are breastfeeding a child, a patient should inform physician or nuclear medicine technologist prior to having a nuclear medicine procedure so that medical care can be planned for both the mother and her baby. Some of the pharmaceuticals used in nuclear medicine procedures may pass into a breastfeeding mother’s milk and subsequently to the child. To avoid this possibility, it is important to inform physician and nuclear medicine technologist before the examination begins. Nuclear medicine studies in pregnant women should be considered when appropriate, and extra caution should be taken when developing protocol for pregnant females. For best practice, nuclear medicine staff should have questionnaire and pregnancy test screening protocol.

**Summary**

Nuclear medicine technologists play an important role influenced on improving patient safety and involving the frontline caregivers for a mechanism to raise concerns regarding patient safety culture in nuclear medicine procedure in a place. When nuclear medicine procedures are performed correctly on appropriate patients, the benefits of the procedure very far outweigh the potential risks. Therefore, dealing with patient with radiopharmaceuticals, nuclear medicine technologists should be appropriately trained and certified, and should have comprehensive quality control measures in place to ensure that the patients receive the best, safest and most appropriate care to avoid unnecessary radiation exposure, delayed, incorrect diagnostic or treatment. Administration of radioactivity to patients for diagnosis or treatment of diseases raises concern for radiation exposure to family, caregivers, and the public. Therefore, radiation safety restriction should be established and followed to minimize such exposure.
Championing patient safety in radiography practice: The role of academic radiographers

By Mark Chukwudi Okeji, Nigeria

Introduction

The discovery of X-rays in 1895 by Wilhelm Conrad Roentgen and its subsequent application in medical imaging marked the birth of radiography profession. X-rays was later to be applied in the field of oncology for treatment of various diseases. The addition of other non-ionizing imaging modalities such as ultrasound and MRI enlarged the clinical base of radiography profession. The application of radiation in diagnosis, treatment and in image-guided interventional procedures brought profound benefits to the patients. However, these benefits are not without risks to the patients. Patient safety is fundamental in the application of radiation for diagnosis, treatment and interventional procedures. This is to ensure that the benefits derivable from the procedure by the patients outweigh the risks therefrom. Radiographers are expected to complete formal education in tertiary institutions in order to be properly equipped with the requisite skills and experience to perform their duties, and thereafter be registered to practice.

Academic radiographers have the primary roles of teaching, research and supervision. They are expected to adhere to the curriculum of study and improve on it from time to time, in order to impact the requisite skills and knowledge to student radiographers. Curriculum is a standards-based sequence of planned experiences where students practice and achieve proficiency in content and applied learning skills. Curriculum is the central guide for all educators as to what is essential for teaching and learning, so that every student has access to rigorous academic experiences. The adherence to the standards in the curricula ensures safety of patients while rendering quality care. Patients’ safety outside technique are addressed under the following headings:

Radiation protection and radiobiology

The success of radiation protection program depends on the development of procedures for the safe use of radiation and radioactive material and on the education about radiation safety principles, the risks associated with radiation exposure and contamination, and the procedures for safe use. The three fundamental principles of radiation protection for patients; justification, optimization and dose reference level (DRL) should be expanded in the curriculum and adequately taught. For the benefits of our patients and the public, the radiographers should be taught that every radiological examination must be justified to ensure that the benefits outweigh the risks. The three levels of justification should be taught, namely, general level, specified procedure and application of a specific procedure to an individual. The optimization principle which is the conscious effort to reduce the radiation dose to the patient should be underscored. The two levels of optimization namely, the room design, appropriate equipment selection and installations, and everyday technique and measures to bring the radiation dose “As low as reasonably achievable” (ALARA) should be emphasized. It should be emphasized to the students and practitioners that the DRLs are regulatory limits used to improve regional, national, or local distribution of observed results for a general medical imaging task, by reducing the frequency of unjustified high or low values. The DRL is meant to promote attainment of a narrower and optimal range of values that represent good practice for specific imaging protocols. The above three principles, in addition to distance time and shielding, must be emphasized and imbied by the would-be practitioners. The content of the curriculum should be periodically revised and comparison made with others from various regions of the world.

Safety from physical harm and nosocomial infection

Safe patient handling techniques and basic infection control measure should...
be addressed in the curriculum. Safe patient handling is defined as any activity requiring force to push, pull, lift, lower, transfer or in some way move or support a person or body part. The students should be taught and exposed to their roles and responsibilities in handling patients, prevention of physical harm and prevention of transmission of infection from patient to patient or to staff. Specific attention should be given to teaching and learning how to handle children and other vulnerable persons such as the elderly and persons with disabilities. The post COVID-19 pandemic era brought some modifications in the basic infection control protocols which should be captured in the curriculum. The general principle for infection control is still relevant and should be taught. These are good hand washing technique, the use of alcohol-based solution for disinfection, application of personal protective equipment, proper disposal of medical wastes. For radiographers, the policy on changing gowns should be one per use or the application of disposable changing gowns, which is not obtainable in developing countries. The International Society of Radiographers and Radiologic Technologists (ISRRT) should work towards producing a guideline on patients’ safety in radiology departments, as has been done by some societies. The guideline will form the benchmark for curriculum development in developing countries.

Prevention of reaction to contrast agents
Contrast agents for conventional X-ray, CT, MRI and ultrasonography present different safety challenges. The curriculum should encompass the duties of a radiographer before the administration of contrast, during a reaction and after a reaction. The use of water soluble and low-osmolar contrast agents should be taught. The students should be made to appreciate the importance of documenting history of previous allergy due to contrast agents, determining the renal function prior to injection of the contrast and the hydration of high-risk patients. The lecturers should emphasize relevant training and update courses in other to administer contrast and other emergency drugs by radiographers. In order to minimize adverse drug reactions to our patients, the dose of the contrast for a particular investigation should be considered against the weight of the patient and health status. The course contents for pharmacology for radiographers should be revised and updated.

Consent and communication
The ethical principle of Autonomy provides that the consent of patients undergoing radio-diagnostic examination or radiotherapy should be obtained and the benefits and the risks explained to them. This ethical principle should be emphasized. It starts with adequate communication and obtaining patient’s consent. For patients who are incapable of decision making, such as infants, children and mentally retarded/incapacitated, the parents or guardian should take responsibility. The code of ethics for practitioners should clearly define the duties of practitioners to patients presented in a document for students and practitioners. In this way the students imbibe the culture of providing concise information about the examination or treatment, thereby allowing the patients to be part of the decision-making process during the course of their investigation or treatment. The information should be in the language understandable by the patients.

Conclusion
This paper presents an insight into the apparent role of academic radiographers in patient safety. It underscores the importance of teaching, research and supervision based on robust curriculum rich in content and scope on patient safety issues. The curriculum captures the outline for the training of undergraduate radiographers in patient safety and the academics are the drivers. The academic radiographers have critical roles in driving the culture of patient safety and the responsibilities of practitioners towards their patients. Several authors have advocated for the inclusion and expansion of patient safety in the undergraduate curricula. It is the duty of academic radiographers to regularly update the curriculum and ensure its applicability in order to raise future radiographers with sound knowledge of patient safety in our work places. This task should be highlighted in ISRRT publications and the benchmark established as a guide for societies and regulatory bodies across the globe. The EFRS has a benchmark document for undergraduate training which highlights the topic on patient safety and the learning outcomes. Other regions, such as Africa, Australasia and the Americas can adapt or improve on the European document.

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Managing patient safety in radiotherapy

By Anastasia Sarchosoglou, Greece

RADIOThERAPY is one of the main treatment options for cancer management. About 50% of cancer patients will receive radiotherapy at least once during their treatment journey. 40% of cancer cures are attributed to radiotherapy alone or when combined with other modalities. Radiotherapy is also one of the safest disciplines in medicine, due to regulations and robust quality assurance programs governing the use of ionizing radiation in medicine. “… yet, for some [patients], this essential treatment can bring harm, personal tragedy and even death.”

“It was not out of the ordinary for something to stop the machine…It would often give a low dose rate in which you would turn the machine back on… I can’t remember all the reasons it would stop, but there were a lot of them.” Derived from the testimony of an operator involved in the Therac-25 accidents. These accidents were associated with massive overdoses to six patients between 1985 and 1987. Four patients died while two lived with serious injuries. The operator also testified that she had been informed during instructions that there were «so many safety systems» that it was impossible to overdose a patient. The primary cause of the accidents was associated with software programming errors while contributing factors including managerial, organizational and technical issues influenced the magnitude of the consequences. These accidents were considered the worst accidents in the history of medical accelerators.

Following this and other serious events, professional bodies and regulatory authorities required enhanced radiation protection measures such as the implementation of quality management programs and error reporting systems in radiotherapy facilities. Clinical audits and quality improvement methods including plan-do-study-act cycles were also strongly recommended for quality and safety improvements. Although accidents rarely happen in radiotherapy, it is recognized that errors are much more common and occur at any stage of the process sometimes capable of compromising clinical outcomes. The International Commission on Radiological Protection (ICRP) rings the alarm bell particularly about new technologies as they may pose new risks influenced by human factors. Therefore, one might wonder whether there are instances that beliefs and attitudes during Therac-25 accidents are still relevant today!

The Global Patient Safety Action Plan 2021-2030 (WHO)4 aims to eliminate avoidable patient harm placing the maxim of the Greek physician, Hippocrates (460–375 BC), "first do no harm" on the foundations of healthcare systems and organizations. The action plan provides guidelines for concrete actions to be taken globally by governments, stakeholders, healthcare facilities and the WHO. One of the objectives is to build high-reliability health systems and organizations that prevent patient harm in daily practice. High-reliability organizations maintain an almost error-free performance in challenging and complex conditions. These organizations implement mechanisms to control the risks creating safer systems in which an error cannot disable the system’s safety.

The Joint Position Statement by the International Atomic Energy Agency (IAEA) and WHO – Bonn Call for Action (2012), highlighted ten main actions to be taken by stakeholders to strengthen radiation protection including the implementation of risk management and the establishment of a strong safety culture to radiation facilities. Risk management (proactive and reactive) and safety culture are key elements of high-reliability organizations and now are included in the IAEA International Safety Standards and the European Council Directive 2013/59. Proactive risk management utilizes methods that assist organizations in proactively managing weaknesses in
their systems. The implementation of proactive risk management is supported by the fact that generally there is underreporting of errors while it would be unethical to wait for an error to occur to implement interventions for patient safety improvements. There are several proactive risk assessment methods while the American Association of Physics in Medicine (AAPM) TG-100 designed a radiotherapy specific proactive risk management tool. There is extensive literature about the implementation of proactive risk management in radiotherapy centers with clear benefits in risk reduction.

Reactive risk management, which is commonly applied to incident learning systems (ILS), analyses incidents, errors, or near misses aiming at preventing error recurrence. An effective ILS implements corrective actions to improve the system and provides feedback to the staff. On the other hand, barriers to error reporting include lack of communication in terms of learning from errors and a blame culture. SAFRON (SAFety in Radiation Oncology) and ROSEIS (Radiation Oncology Safety Education and Information System) are voluntary international ILS introduced by the IAEA and ESTRO, respectively. They can be used both by individuals or departments for error reporting and additionally provide valuable information toward safety improvements.

An essential feature of risk management good practice is patient and family engagement. The WHO states that reporting systems should include and encourage patient-generated reports and patients’ voice is the best way to increase organizations’ efforts to improve patient safety. The European Federation of Radiographer Societies in the statement on Patient Engagement and Inclusion in Radiotherapy highlights the importance of patients being active partners with regard to their treatment and safety.

The statement provides examples of good practices in patient identification, communication, collaboration during treatment, schedule management, and patient involvement in proactive and reactive risk management.

Any patient safety initiative and intervention to be effective requires a strong safety culture (SC) to be established and maintained in healthcare organizations. SC is associated with the attitudes, beliefs, and values, of all the individuals at any level of an organization and their perception of safety as a priority. After analysis of many radiotherapy incidents, major organizations concluded that the lack of SC was the main contributing factor in the majority of the events. The IAEA developed the "Radiation Safety: Trait Talks handbook", a training material for building a strong SC in radiation medicine. It includes both organizational and individual aspects that shape a positive safety culture characterized by effective communication, psychological safety and confidence in the efficacy of safety interventions. Recently, the International Society of Radiographers & Radiological Technologists published the "ISRT Safety Culture and General Safety Management Guide for Diagnostic Imaging and Radiation Therapy Departments". It is a useful tool for those wishing to establish and maintain a positive safety culture and improve the safety of patients in their facilities and especially for all radiographers who undoubtedly play a key role in patient safety.

Radiotherapy radiographers (RTRs) or else radiation therapists’ (RTTs) role is critical throughout the radiotherapy pathway. They are well positioned to safeguard patient safety as they are involved in many stages of the radiotherapy process, but most importantly, they are the last line of defense in treatment delivery, where error detection is more likely to occur. Additionally, RTRs/RTTs’ daily interaction with patients results in a unique relationship between them, which enables them to encourage and optimize patient engagement in their treatment safety. SAFRON database and the vast majority of studies on error reporting indicate that RTRs/RTTs are committed to patient safety interventions. They discover and report the majority of errors at all stages of the radiotherapy process while the reporting rates of the other disciples are low. Nevertheless, there is also a sizable proportion of RTRs/RTTs who had been reprimanded and harassed when an error was occurred. Even if this is a minority, it should not be overlooked. In fact, it is the safety culture of all team members that shapes patient safety.

However, a culture change begins with education and professionalism. All countries should develop educational curriculums that follow formal recommendations and RTRs/RTTs’ research should be supported. RTRs/RTTs must continually perform best practices within the profession’s standards and code of ethics and always seek for continuing professional development opportunities. At organizational level, managers and healthcare staff should recognize the RTRs/RTTs’ input, in order for cohesive radiotherapy teams to be built that support strong safety cultures. RTRs/RTTs’ engagement in the organization’s patient safety policies and programs is important to ensure that front-line perspectives are taken into account. Similarly, RTRs/RTTs’ involvement in national and international patient safety strategies in radiotherapy would provide the unique insights they gain from their daily interaction with patients. Now, it is the time for a “collaborative ecosystem” (WHO) whereby all parties involved including policy-makers and front-line staff contribute, share and learn so that “no one is harmed in health care, and every patient receives safe and respectful care, every time, everywhere.”

continued on page 53
MRI is often considered a safe examination method, which is basically correct - at least, as everyone knows, we do not use any ionizing radiation. That’s why many people like to say “just give it a try”.

But it’s not quite that simple, danger is often underestimated. There are some risks that professionals should be aware of, assess and manage to keep patients safe. To this end, it is essential to raise awareness of the staff, to train them and to develop established work processes.

Progress in Radiology is extremely rapid, a great gift for patients to get better diagnosis and therefore treatments. It is expected that the amount of MRI exams gets higher and higher, and the sequences should be faster and faster.

However, this also means that the demands on radiographers are constantly increasing. How does the radiographer adapt to these fast changes in technology to ensure the safety of patients? Precisely because the MRI has its hidden dangers.

The radiographer must be well trained to minimize the hazards that arise from misuse.

So what are the aspects we have to be aware of?

Since the physical basics would go beyond the scope of this article, I will assume that they are known in general terms. Lets have a look in detail: first on the MRI itself and hazards arising from it, then on external factors that require special awareness to avoid hazards resulting from improper use.

The first thing that we think of if we hear the topic safety of patients in MRI is our inner voice: “don’t bring any ferromagnetic objects in the examination room!”

But is it really as simple as that?

Permanent magnet as a source of risk

The MRI must be located in the safety area and must not be freely accessible to all.

In the access control area itself, the stray field exceeds 0.5 mT (5 Gauss). It must therefore be marked with appropriate safety- and warning symbols. Outside the 0.5 mT line, physical interactions with implants (e.g., pacemakers) and magnetic attraction to objects are negligible.

Consequently, ferromagnetic objects must not be brought into the examination room. The attraction and rotational force on ferromagnetic objects mean projectile hazards to the patient and staff.

The radiographer is also the last instance to check whether all objects have actually been removed and at some point knows the last frequently forgotten objects such as the obligatory lucky coin or similar.

Not to be forgotten is the observation of the MRI compatibility of surveillance monitors, sedation equipment and similar.

It is possible that special distances to the MRI are to be observed. Unfortunately, as so often the case, no generally applicable standard rule can be given to you for this, but be aware to check it before using these items. It is important to remember, as it is often forgotten, especially by patients or external staff: the magnet is always on, even when the MRI is currently not used. Often difficult for laymen to understand and yet one of the most elementary factors!

If an emergency situation does occur, it is important to remain calm and be aware of the procedures:

Only the activation of the emergency stop switch leads within a few seconds to the loss of the magnetic force, by interruption of the helium cooling and thus loss of the superconductivity for the maintenance of the magnetic field.

Quenching is therefore the emergency
solution in the event of, for example, objects becoming projectiles and patients and/or staff becoming trapped.

Additionally, not to be forgotten, are possible physiological effects due to the static magnetic field. There are possible side effects triggered by the strong static magnetic field:

- Nausea, dizziness, metallic taste, magnetophosphenes (light flashes). If one is aware of this, a fall e.g. can be avoided by simple means, such as moving more slowly in proximity of the tunnel.

**High frequency pulses as a source of risk**

As is known, high-frequency pulses are necessary for the measurement in the MRI. These interact with the patient. The specific absorption rate (SAR) refers to the radiofrequency power absorbed by the patient per unit mass [W/kg]. This absorption leads to heating of the patient. It is up to the radiographer to ensure that a certain level is not exceeded. They can directly influence the specific absorption rate and thus the change the effect on body core temperature by adjusting the sequence parameters or by selecting a different operating mode. Normally, we work in normal mode, which means a whole-body SAR of less than 2 W/kg.

In the first control mode, level 1, we get up to a value of 4W/kg. A warming of the body temperature of 0.5°C (level0) or 1.0°C (level 1) will not be exceeded. This is important to keep in mind. We as the user actively allow this the first level mode by confirming it. We should therefore be aware that, for example, patients with disorders of body temperature regulation require special attention, but also in the case of known febrile infections, since we must not, of course, increase the core body temperature even further.

Patients or even newborns under anesthesia should be monitored appropriately, for example with MRI-compatible temperature detectors, since this group of patients is obviously unable to report any unusual warming phenomena. Special attention must also be paid to the SAR value for implants. Significant restrictions may be necessary here to minimize the risks to the patient. If the use of higher levels than level 0 is necessary, we should ensure sufficient air circulation. This is because excessive perspiration can of course also lead to unwanted formation of conductor loops and as a result to burns (more in the section on improper patient positioning as a source of risk).

**Switched gradients strength as a source of risk**

Switched gradients are getting better, faster and stronger. This can be a blessing for more accurate imaging but also a curse for the patient. The fast and strong switching of the gradients can lead to peripheral nerve stimulation. Similar to the SAR values, we as users also approve the higher control levels here, we should pay special attention to the patient. A notification of a felt twitch or similar must therefore be taken seriously as an indicator of nerve stimulation.

Let us now turn to the dangers and challenges in our daily work that affect the patient themselves. The patient arrives and is welcomed. A detailed anamnesis takes place. Several challenges may come to light:

**Implants as a source of risk**

Our patient comes in and has implants. We hear our inner voice “no metallic things into the examination room” again. So do we have to send them away? At first no, as there is still hope that this implant is MRI compatible.

The first instance is to take a medical history and can “warn” us if implants are present. Of course, it is essential in the screening process really to become aware that the patient has metallic implants. At best, the exam requester has passed this information on to us, so that we can already prepare measurement conditions and the examination can take place without extra waiting time for the patient. The next instance is ourselves as the radiology department. In the clarifying discussion, we can uncover further dangers by specific questions.

Accordingly, we should never rush and take for granted the patient interview, no matter how stressful it may be. Implants are becoming more and more diverse and reach from pacemakers to spinal instrumentation to bladder pacemakers. Even with emergency patients, attention must be paid to previous images and scars that might be caused by any past operations as an indicator for implants. We, the radiographers are again the last instance who can notice previously overseen things.

It is always important to be aware that no two implants are alike and that certain combinations may no longer be MRI compatible. Even if this may be the case with individual implants. One must always remember that implants are in almost never MRI safe, but “only” MRI conditional and these conditions must be researched and fulfilled. Statements such as “we have always done it this way” or “we examined it the same way the other day” should always set alarm bells ringing. In our clinic we have the advantage of having a competent physicist team for approvals regarding MRI implants. This has already developed a standard of care for some implants, others must always be released on patient-specific. In our department, we book a physics department slot and share known data into this file physicists then examined all the documents and send a recommendation or an interdiction for the MRI exam.
How does such a recommendation look like?
We describe which examination is planned. We are then given, for example, restrictions on coils, placements, slew rate, SAR limits, pauses after a certain active measurement time, whether the patient must be monitored separately and whether an examination under anesthesia is excluded, since the patient must be able to respond. This recommendation is “valid” for six months if the implant remains unchanged. After that, a new check takes place.

Both directly at the beginning of the MRI registration, but also especially now after the recommendation, a renewed indication check of the radiologist is essential - is the MRI really necessary or is another type of examination sufficient? If the radiologist determines after the recommendation of the physicist team that the MRI is necessary despite an increased risk, a separate consultation with the patient takes place in order to explain risks and behavioral instructions and to be assured of his or her consent. For example, the patient should of course report any unusual heat sensation, etc.

The scan itself and thus the compliance with the parameters is done by us, the radiographer. We should clarify in advance how many sequences are necessary, and never scan unnecessarily much just because you can. “as much as necessary, as little as possible” is also applicable here. The radiographer must therefore be aware of the entire procedure with the implant, as he must ultimately comply with the recommendations from the physicist team. We need to focus attention on physical approval because in addition to sequence parameters, there may be information about usable coils or positional variations for that patient. Are certain areas in the MRI tunnel not allowed to be touched, or is only prone or supine positioning allowed, but no lateral positioning? The danger of induction loop

In the best case, we have already learned during the patient information session whether the patient has already received MRI contrast media and has tolerated them well - which is not a free pass, however, since the patient can still react allergically. Regardless of this, a contrast agent benefit-risk evaluation should always take place. Even if the cyclic contrast medium has a lower risk of being released due to the complete encapsulation of the Gd³⁺, it is still potentially releasable and toxic in vivo. If no contrast medium is required to answer the medical question, it should of course be not used.

The risk of nephrogenic systemic fibrosis (NSF) is reduced due to high stability and rapid excretion of the MR contrast agent. Good to know: NSF is exclusive in patients with renal insufficiency. In 90% of cases, GFR was < 15 ml/min/1.73m². Thus, we radiographers are again the last safety instance to check the blood values before we inject the contrast medium.

Time pressure as a source of risk
Especially at a time when everything is becoming more stressful, the MRI is becoming an indispensable imaging tool for patients and therefore lack of time rules the routine work, mistakes can easily happen, something can be overseen. Therefore, all risks must really be filtered out during the examination of the patient and carefully implemented during the examination. The common thread is again: the radiographer is the final instance to maintain the safety for the patient through the magnetic field, to remove the last ferromagnetic objects, but also to have all the necessary behaviors in mind for the examination itself.

“Do I have to change certain parameters? Are special monitoring measures necessary? Do I have to give premedication? …” Not to forget extern staff: they might be a source of risk, too. Often we have to cope with changing rotating staff, anesthesia, doctors, etc. All personnel entering the room must be aware of the hazards and have received work instructions. Standardized training and documentation for these personnel should be established. No matter how stressful it is and how many other patients are waiting for imaging, currently it counts to keep full concentration on the current patient-device constellation to avoid unnecessary mistakes and risks.

Surroundings as a source of risk
To avoid bringing the wrong materials into the examination room, it is advisable to adapt the environment to the conditions of the MRI. It is the small details that make it easier to handle the device and the patient safely. If there are no metallic ECG electrodes in the as already mentioned separated MRI - area, no wrong electrodes can be attached. If the MRI trolleys are already marked as MRI safe or conditional, then everyone does not have to think about which one is allowed into the examination room for puncture for example.

Also a small thing, but one should be aware of: Close the door to the MRI examination room when the scanner is free. After all, how quickly does a patient leave the preparation room in search of a restroom or have a question and make his way to the MRI with his wheelchair? If the door is closed, the temptation is not so strong. So the small things can be a great relief.

Improper Patient positioning as a source of risk
As mentioned, we have approvals and recommendations from the physicist team for implants. We need to focus attention on physical approval because in addition to sequence parameters, there may be information about usable coils or positional variations for that patient. Are certain areas in the MRI tunnel not allowed to be touched, or is only prone or supine positioning allowed, but no lateral positioning? The danger of induction loop
formation and the resulting burns must never be ignored.

Avoid skin-to-skin contact, as sweating makes the skin conductive and can cause burns at the points of contact. Particularly vulnerable areas are thighs, calves, folded hands and grease aprons. Therefore, always interrupt skin contact with a towel, for example. The same applies to corpulent patients whose bare skin in the arm and shoulder area lies at the edge of the tunnel. In addition, the cables of the surface coils must not be placed on the bare skin.

This is our responsibility. Therefore, we should take patients’ comments serious if they experience a feeling of warmth or heat and check the areas mentioned by the patient. So-called hotspots can always occur, since the exact distribution of the high-frequency field cannot be predicted for different patients and coils.

If the patient lies correctly they must be equipped with an emergency bell, in order to be able to contact ourselves. The procedure and things they should report as unusual have of course already been explained at this stage. Now the noise protection is put on. As it is known, the MRI is very loud, the patient must be appropriately secured from hearing damage.

Patient themselves as a source of risk

In addition to the indicators already mentioned, psychological effects also have an influence on patient safety that should not be underestimated. The way we as radiographers respond to the patient can significantly change the patient’s path forward in terms of scans. Especially in the case of children who are entering the machine for the first time, which may be understandably frightening for them, we can significantly ease the way for further upcoming examinations. If we respond well to the child, take our time, perhaps take a flight to the moon together with the coil as an astronaut’s helmet in the case of cranial examinations, and let the child tell us about their experiences afterwards, they may be much more likely to come to us the next time than if we had led them through the examination joking and having fun.

A successful first examination sets the stage for follow-up examinations and makes it all the easier for the following radiographer.

If we take enough time to explain things thoroughly and to respond sufficiently to the patient in the examination room, anesthesiological support can be dispensed with for further examinations. After all, this is also an intervention for the body. This should be a matter of routine, but it can sometimes be lost unknowingly due to a lack of time.

If we look back at all the points mentioned above, we can see that: We have better and better equipment and examination methods at our disposal. The motto remains “higher, faster, further...”, always stay in progress to make better diagnoses.

Nevertheless, we must keep in mind that not all measurements and methods are practicable for every patient. It is important to have trained personnel. Dangers must first be recognized, especially in MRI, (danger, burns, etc. are often only seen afterwards) and then dealt with sensibly. Unfortunately, there is no patent recipe that can be used for all patients, a “that will be fine, we have always done it that way” should make the radiographer sit up and take notice, as already mentioned.

No matter how long we have been working in the profession: remain attentive. If attention and attentiveness are lost, mistakes can quickly occur. Nothing should be taken too much for granted.

Having both regulated standard and emergency procedures in place simplifies the workflow at the unit immensely and prevents accidents.

And keep in mind: we, the radiographer, are within most points, the last instance who can notice overseen things, manage them and keep the patients safety.
Patients safety policies in Africa

By Boniface Yao, Côte d’Ivoire

Introduction
It is well established that imaging procedures have notably increased in the past decade. Besides, the use of radiation in medicine is now pervasive and routine. From their crude beginnings 100 years ago, diagnostic radiology, nuclear medicine and radiation therapy have all evolved into advanced techniques, and are regarded as essential tools across all branches and specialties of medicine.

This has resulted in tremendous benefit to humankind in diagnosis and treatment of disease. Remarkable technological advances have enabled precise imaging of many complex physiologies and often ensure more accurate diagnoses. Though medical imaging provides many benefits to patients, it can also cause potential harm. Ionizing radiation is potentially hazardous unless used with strict adherence to safety rules and procedures. Unlike most other such hazards, the risks of unguarded exposure to ionizing radiation includes the possibility of damage to future generations. Thus, the safety rules which govern all uses of ionizing radiation are concerned with preventing genetic damage as well as protecting the health of the exposed individual. When followed faithfully, these rules limit the exposure of persons who work with radioactive materials to levels far below those that are believed to cause any adverse effects. The rules and procedures set forth have one single straightforward purpose: to protect employees and the public against unnecessary and potentially harmful exposure to ionizing radiation.¹

The use within medical practice thus involves an informed judgment regarding the risk/benefit ratio. This judgment requires not only medical knowledge, but also an understanding of radiation itself and implementation of regulations, rules and a policy.

The challenge of medical imaging is to offer services of sufficiently high quality to allow effective treatment without compromising the vital prognosis of the patient by any overexposure to radiation or any other risk inherent in the practice. This presupposes the establishment of a quality management system that emphasizes patient safety. How to build a relevant strategy to ensure patient safety? What is the contribution of international organizations in the implementation of security policies? What is the situation of African countries?

The objective of this paper is to provide an overview of patients safety policies implemented in African countries as regards to the practice of medical imaging.

I. SAFETY POLICY AND PROCEDURE
In its organizational Structure a safety policy should create two main organs described as follows.²

1. The Radiation Safety Committee (RSC)
The Radiation Safety Committee (RSC) is responsible for evaluation of proposed uses and users of radiation and for the overall management of radiation safety under the broad scope license. It aims, among all at:

- developing procedures and criteria for training and testing each category of worker,
- establishing methods for maintaining records of the Committee’s proceedings and radiation safety evaluations of proposed users and uses of radioactive materials.
- developing radiation safety manuals as necessary to ensure proper program implementation and good health physics practices.
- Monitoring the institutional program to maintain occupational doses as low as reasonably achievable (ALARA),
- reviewing on the basis of safety with regard to the training and experience

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¹ The Radiation Safety Committee (RSC) ¹
² Establishing methods for maintaining records of the Committee’s proceedings and radiation safety evaluations of proposed users and uses of radioactive materials.
standards for individuals as required by the regulations of the States

- Review all incidents involving radioactive material with respect to cause and subsequent actions taken.

2. The Radiation Safety Officer (RSO)
The Radiation Safety Officer (RSO) will act as the executive agent for the RSC, and will utilize members of the Radiation Safety Staff to carry out specific responsibilities. The RSO will have the responsibility to:

- Maintain surveillance of all activities involving radioactive material, including, monitoring and surveys of all areas in which radioactive material is used

- Determine compliance with rules and regulations, license conditions, and the conditions of project approvals authorized by the Safety Committee.

- Attend periodic training to stay current with regulations and radiation safety practices.

- Conduct training programs and otherwise instruct personnel in the proper procedures for the use of radioactive material prior to use, at periodic intervals (refresher training);

- Supervise and coordinate the radioactive waste disposal program, including effluent monitoring and record keeping on waste storage and disposal records.

- Hold periodic meetings with and provide reports to the Radiation Safety Committee.

3. The Radiation Safety Staff
Under the supervision of the RSO, the Radiation Safety Staff will perform required measurements (surveys, etc.), maintain and calibrate survey and monitoring instruments, train technical staff, and perform other duties as required on a day-to-day basis in accordance with policy and procedure as adopted by the Safety Committee.

Other tasks include monitoring radiation core facility for safety compliance; attendance at Radiation Safety Committee meetings; meeting with Radiation Safety Officer, monitoring and ordering of supplies for the radiation core facility; and meeting and consulting with radiation core facility users.

II. CONTRIBUTION OF INTERNATIONAL ORGANIZATIONS
To contribute in the process of implementation of safety policies in medical imaging, international organizations join their hands to provide required resources.3

1. UNSCEAR
The objective of the United Nations Scientific Committee on the Effects of Atomic Radiation is to define precisely the present exposure of the population of the world to ionizing radiation. UNSCEAR assesses the levels and effects of exposure to ionizing radiation and its scientific findings underpin radiation risk evaluation and international protection standards.

2. ICRP
ICRP is an independent, international and non-governmental organization with the mission to provide protection, recommendations and guidance to radiation protection. ICRP aims to contribute to an appropriate level of protection for people and environment against the detrimental effects of radiation effects without unduly limiting the desirable human action that may be associated with such exposure.

Upon the scientific findings on levels and effects of radiation exposure, ICRP elaborates recommendations on protection standards for regional and local bodies to transcript in national regulations.

3. IAEA
Widely known as the world’s “Atoms for Peace and Development” organization within the United Nations family, the IAEA is the international centre for cooperation in the nuclear field. The Agency works with its Member States and multiple partners worldwide to promote the safe, secure and peaceful use of nuclear technologies. In that way, IAEA assists member countries to implement patients safety policies.
III. BONN CALL-FOR-ACTION
At the international plan, the IAEA with WHO identified and addressed issues arising in radiation protection in medicine during the International Conference on Radiation Protection in Medicine in 2012 in Bonn, Germany. The aim was to (i) indicate gaps in current approaches to radiation protection in medicine, (ii) identify tools for improving radiation protection, (iii) review advances, challenges and opportunities in the field of radiation protection in medicine and (iv) assess the impact of the International Action Plan for the Radiation Protection of Patients, in order to prepare new international recommendations, taking into account newer developments.4

The Bonn Call-for-Action highlights ten main actions, and related sub-actions, that were identified as being essential for the strengthening of radiation protection in medicine over the next decade including actions by all stakeholders. Five of the ten actions focused on protection and safety:

Action 2 is dedicated to enhance the implementation of the principle of optimization of protection and safety;

Action 3 focuses on strengthening of manufacturers’ role in contributing to the overall safety regime to ensure improved safety of medical devices;

Action 7 is to improve prevention of medical radiation incidents and accidents, Implement and support educational safety reporting systems to learn from the return of experience of safety related events in medical uses of radiation and implement prospective risk analysis methods to enhance safety in clinical practice;

Action 8 aims to strengthen radiation safety culture in health care so as to establish patient safety as a strategic priority in medical uses of ionizing radiation, and recognize leadership as a critical element of strengthening radiation safety culture

Action 10 is designed to strengthen the implementation of safety requirements globally by developing practical guidance to provide for the implementation of the International Basic Safety Standards in health care globally.

To sum up, numbers of actions carried out at international plan furthers the establishment of sufficient legislative and administrative framework for the protection of patients, workers and the public at national level. They include enforcing requirements for radiation protection education and training of health professionals, and performing on-site inspections to identify deficits in the application of the requirements of this framework.

IV. AN OVERVIEW OF PATIENTS SAFETY POLICIES IN AFRICA
Every patient has the right to be treated using the safest technology available in health facilities. This implies freedom from unnecessary or potential harm associated with health care. Therefore, all health-care professionals and institutions have obligations to provide safe and quality health care and to avoid unintentional harm to patients.

Medical errors could result in numerous preventable injuries and deaths. Adverse events have been estimated to occur in 4% to 16% of all hospitalized patients.

More than half of these occur in surgical care, and more than half are preventable. Unsafe injections, blood and medicines are other important sources of patient harm worldwide.5

In the African Region, most countries lack national policies on safe health-care practices. Inappropriate funding and unavailability of critical support systems, including strategies, guidelines, tools and patient safety standards, remain major concerns in the region.8

There is need for investment to enhance patient safety in health-care services.

The high level of illiteracy and lack of mechanisms for forging strong partnerships limit the involvement of patients and civil society in the improvement of patient safety. This is due to cultural or societal norms regarding medical care as well as the complexity of some safety issues.

In addition, other major health problems affect quality of care.9 Creation of “patient for patient safety” associations and involvement of civil society in improving patient safety are at initial stage.

Besides, inadequate human resources for health, weak health-care delivery systems with suboptimal infrastructure, poor management capacity and under-equipped health facilities have brought about a situation where the likelihood of adverse events is high. This reflects the situation at all levels of health-care systems in the Region. Health-care systems that are not fully functional will inevitably result in error and patient harm.

Moreover, availability of minimum supplies and basic treatment tools, lack of adequate working conditions in hospitals, overcrowding and limited microbiological information directly impact on the provision of safe patient care.

Nevertheless, some countries in Africa can justify the existence of well designed policies for patients safety.

Radiation safety policies, principles, directorates, and guidelines in South Africa

In South Africa, there are a long list of policies and guidelines to govern patient safety directly and indirectly. A summary of the policies, directorates, and guidelines is provided in Table 1 below. Overall, the aim is to provide quality healthcare in
both private and government hospitals. In addition, all healthcare workers, such as radiographers, must be registered with the Health Professions Council of South Africa (HPCSA). As such the HPCSA protects the rights of patients by making sure that all healthcare workers’ skills are current and can thus provide optimal patient centred care. Below, a few highlights are presented to summarise the content of some of the policies and guidelines.

The Hazardous Substances Act, 1973 (Act 15 of 1973) and Regulations (No R1332 of 3 August 1973) govern the safe use of medical x-ray equipment in South Africa. The Code of Practice for Users of Medical X-ray Equipment sets out requirements and recommendations for radiation safety associated with the use of medical diagnostic x-ray equipment. The Act does not allow any person to use radiation equipment unless they hold a licence under the Act for that purpose.

a) Basic radiation protection principles in South Africa are based on the IAEA principles:

- **The justification of the practice**
  No radiation examination shall be adopted unless the benefit outweighs the associated risk.

- **The optimisation of protection**
  Radiation doses from medical exposures and those received by the public and occupationally exposed persons must be kept as low as reasonably achievable (ALARA), economic and social factors taken into account.

- **Limitation of individual dose and risk**
  All medical applications of ionising radiation must be managed in such a way that radiation doses to occupationally exposed person and members of the public do not exceed the specified dose limits (see par 6.1).

b) The South African Health Products Regulatory Authority (SAHPRA)

SAHPRA is tasked with regulating

| Table 1. Radiation safety policies, directorates, and guidelines in South Africa |
|---------------------------------|------------------|
| **RSA GOVERNMENT**              |                  |
| Hazardous Substances Act        | Act No 15 of 1973|
| Regulations concerning the control of electronic products | Regulation R1332 |
| Policy on quality in healthcare for South Africa | 2007 |
| **DIRECTORATE RADIATION CONTROL (DRC)** |                  |
| Code of Practice for users of medical X-ray equipment | DRC 2015 |
| Requirements for licence holders with respect to quality control tests for diagnostic X-ray imaging systems | DRC 2012 |
| **GUIDELINES**                  |                  |
| Radiation monitoring requirements and Radiation occurrences (11/2011) | DRC Guideline |
| Personal monitoring when a lead rubber apron is worn – medical and veterinary use of X-ray equipment | DRC Guideline |
| Protective Clothing             | DRC Guideline    |
| Management of pregnant radiographers and other staff members | DRC Guideline |
| Medical examinations for radiation workers (10/2009) | DRC Guideline |
| Radiation protection of personnel in theatre | DRC Guideline |
| Monitoring of radiation workers in a theatre (11/2011) | DRC Guideline |
| Holding of patients during X-ray procedures (10/2009) | DRC Guideline |
| Request for medical X-ray examinations (10/2009) | DRC Guideline |
| Patient dose measurements in diagnostic radiology (10/2009) | DRC Guideline |
| Design of X-ray rooms           | DRC Guideline    |
| Display and format of radiation warning signs at entrances to rooms containing X-ray units | DRC Guideline |
| Tube leakage procedures and measurements (ICRP report 2004) | DRC document |
| Minimum requirements for fixed diagnostic X-ray installations | DRC Guideline |
| Radiographic grid ratio (10/2009) | DRC Guideline |
| Bone densitometer – shielding, monitoring and positioning of operators (10/2009) | DRC Guideline |
| Test procedures for film processing and intensifying screens (6/2010) | DRC Guideline |
| Sensitometric technique for evaluation of processing [step] | DRC document |
| Sealing / not sealing and unsealing of X-ray units / film processors | DRC document |
| Display considerations for hospital wide viewing of soft copy images (British Journal of Radiology 2007) | DRC document |
| Definitions: Supervision        | DRC Guideline    |
| Regulatory control of X-ray equipment used in the mining industry in South Africa to screen workers for security purposes (30/11/2011) | DRC Guideline |
| Requirement of conveyer belt/cabinet type luggage X-ray equipment (2/2/98) | DRC Guideline |
| Dental radiography              | DRC Guideline    |

which classifies electronic generators of ionising radiation as Group III hazardous substances, and radioactive sources as Group IV hazardous substances. Section 3 of the Act controls the sale, letting, use, operation, application, and installation of Group III substances. These are further regulated by Regulation R1332 of 1973.

Section 3A of the Act controls the production, acquisition, disposal, importation, exportation, possession, use and conveyance of Group IV substances.

These are further regulated by Regulations.
THEMATIC APPROACH – PRACTICING RADIOGRAPHER’S VIEW


Patient safety policy situational report in Tanzania

Radiation safety in Tanzania is managed by two different bodies, the Tanzania Atomic Energy Commission (TAEC) and the Medical Radiology and Imaging Professionals Council (MRIPC). TAEC was established by Parliament Act in 2003.

It was formerly known as the National Radiation Commission established which was established by Parliament Act of 1983 with responsibilities to control the safe use of radiation in the country, to promote the safe use of nuclear technology and to conduct research and provide advice and information on Nuclear Science and Technology. After her establishment, TAEC was given the following roles:

- To inspect all centres which uses radioactive sources in order to monitor the implementation of the Atomic Energy Act and its regulations?
- To issue permits for the importation, ownership, transportation and use of radioactive sources.
- To take sample and analyse radiation in all imported and exported foodstuff, fertilizers, animal foods and tobacco.
- To test environmental samples to identify radioactive contaminants in the environment.
- To measure the level of radiation on telephone towers and communications radars.
- To collect, transport and store radioactive material.
- To provide radiation monitoring service to employees working in radioactive areas.
- Conducting an air pollution testing station from the Radionuclides Monitoring Station.
- To coordinate various nuclear technology projects in the country.
- To provide public education on the benefits and effects of nuclear technology.
- To develop nuclear technology research for sustainable economic and social development.
- To provide maintenance and services to all nuclear technology equipment’s such as X-Ray, CT-scan, and MRI etc.

In 2007, on the other hand, MRIPC was established by the Parliament Act in 2007. MRIPC created a structure that oversees and regulates radiology an imaging professional who work in Tanzania through an overseeing. The council consists of members from the Tanzania Association of Radiographers (TARA) and the Tanzania Radiology Society (TARASO), as well as other radiology professionals working around the country such as oncologists, nuclear medicine physicians, radiopharmacists and medical physicists. The Council have the sole authority for registering, enrolling and enlisting of Medical Radiology and Imaging Professionals.

The aim of any radiology facility is to provide services of high quality at lowest dose possible to the patient, workers and public as well as low cost to the hospital and patient. This goal can be achieved when the main principles of radiation protection (justification, optimization and dose limits) are implemented. However, an organized approach is required to implement the radiation protection principles.

To achieve this goal, establishment and implementation of radiation protection plan (RPP) is crucial if a facility is to provide quality radiology services at lowest dose possible and cost. Almost all radiology facilities in Tanzania do not have documented program on how radiation protection and safety is implemented. As a result, most of radiology staff in Tanzania are not aware or do not have knowledge on basic issues regarding radiation protection and regulatory requirements. There is no organized approach to radiation protection and safety matters in the country despite that there are few hospitals with local radiation safety program established.

Some of short weakness in establishing radiation safe environment are;
- Lack of clear assignment of responsibilities regarding radiation safety;
- no platform to discuss, share, advise and learn expertise on radiation protection and safety issues and build competence within the facilities;
- Lack of criteria to evaluate the facilities with regard to radiation protection and safety;
- no clear policy on disposal of x-ray machines and other radiation sources, the sale, transfer, or discontinuance of use of any source of radiation;
- lack of diagnostic reference levels (DRLs);
- lack of knowledge in quality control measures

Although the radiography workforce is limited (especially higher cadre level), Tanzania has been developing programs to make radiology and care more accessible. With the support from IMF to combat the effects of COVID 19, Tanzania is currently establishing a huge instalment of radiology and imaging equipment where more about 5 MRI, 29 CT Scan and 100 digital radiography equipment are installed. With this big investment, proper thought of safety is crucial.

Radiographers need to be prepared in the area of managing modern equipment, radiation management and safety, quality assurance, pattern recognition, artificial intelligence in radiography and ethics and professionalism.

It is also important that radiographers are supported to help them upskill their knowledge by increasing access to academic and professional scholarships.
3. Patient safety policy in Nigeria

In Nigeria, the national safety policy is promoted by the registration board which defines the general duties and ethical responsibilities of actors as follow:

A Radiographer shall:

- be accountable for his/her work, and be able to practice safely and effectively within the scope of training, knowledge and competence.
- avail himself or herself of the opportunities provided by the continuous education programmes of the Board (RRBN), and those approved by the Board for Continuous Professional Development to improve knowledge, competence and skill.
- make known to the appropriate authority any conscientious objection he/she holds on any issue or matter relating to his/her professional practice.
- competently carry out alternative examinations or procedures or treatment where in his/her professional judgment, the original request was inappropriate to the patient's condition and the clinical history provided.
- be free to exercise his/her professional judgement to refuse to accept a request for examination where the request is not appropriate and/or Justifiable.
- be committed to keeping the radiation dose to the patient as low as reasonably practicable, consistent with the diagnostic and treatment needs of the patient.
- not solicit for gift, favour, hospitality and any gratification that might influence his/her professional judgement.
- not take alcohol or be under the influence of narcotic drugs when on duty or likely to be called to duty.
- for all purpose comply with the laws of the country, state or local council where he/she works and shall have due regard to and respect for the culture and customs of the area.
- provide written opinions on investigations and examinations carried out.
- provide reports on medical ultrasound examinations, provided he/she is a Sonographer certified by the RRBN.
- generally, have the right to administer intramuscular and intravenous injections, provided that he/she has been properly trained to provide that service.
- contribute to the education of Radiographers (students, interns and trainees).
- ensure that when rendering independent professional services, any advertising is honest, accurate, and lawful and does not misrepresent the Radiography profession.

In the terms of article 3 of the policy document relevant to radiographers' duties to the patient, the radiographer owes the patient a duty of care and confidentiality which include:
- to hold in confidence any information relating to the patient’s condition or state, obtained from or during a diagnostic or therapeutic procedure.
- to exercise due caution in passing information to the patient or his/her relations regarding the outcome of the procedure(s) carried out on the patient.
- to not disclose such information to any third parties except with the clear consent of the patient
- Or where there is a legal requirement to divulge such an information, it should only be given following a written permission from the Radiographer’s employer or any authority acting in that capacity.
- To adhere strictly to Institutional/ Departmental protocol, and established regulations/Helsinki Declaration, when conducting Teaching/Research, involving Patient or their data.
- provide reports on medical ultrasound examinations, provided he/she is a Sonographer certified by the RRBN.

4. Patient safety policy Ghana

In Ghana and most other countries in Africa, there’s no formal patients safety policy with respect to radiography practice. However, there are informal safety guidelines that radiographers employ in their day to day activities during radiological procedures. Examples of such include but not limited to the following:

The application of Alara principle, collimation, avoidance of repetition, the use of 10 day rule, and justification of request forms before any radiological examination is conducted.

V. ACTIONS PROPOSED

1. Develop and implement national policies for patient safety

Guidance on the concepts and safe procedures for patient safety is a key intervention to help countries develop and implement their policies. A national policy should define standardized procedures for patient safety components. WHO guidelines could serve as the basis for the development of a national policy for patient safety.
A multidisciplinary approach is necessary to address patient safety issues within the framework of strengthening the health-care system. The way forward is to mobilize additional resources as part of the investment in patient safety as a health priority. Bodies are dedicated to promote and monitor patient safety and quality of health care. The national policy for patient safety should also include norms, standards and codes of ethics on patient safety.

2. Improve knowledge and learning in patient safety
The next step for implementation of patients safety policy is to carry out intensive sensitization campaigns on the prevention of adverse events should be held on a regular basis for health-care workers.

In addition, special training programmes need to be developed to provide an understanding of the potential causes of errors. Patient safety should be included in the curricula of health-related training institutions.

3. Raise awareness.
Due to inadequate awareness of patients about their rights, countries should develop patient charters and provide them in local languages. The involvement of patients in raising awareness and campaigning for the development and implementation of safety improvement measures in health-care settings is crucial. In addition, creating awareness by sharing information among health-care workers and the general population will help improve patient safety.

4. Address the context in which health services and systems are developed
Reducing adverse events and the risk of error in health care requires a significant and sustained response across all levels of the health-care system. Health systems should be reoriented to make patient safety an integral part of quality care improvement activities, including improvement of health infrastructure and provision of essential equipment and supplies for infection control.

5. Minimize healthcare-associated infection
The implementation of simple measures such as improved hygiene conditions, radiation safety management will minimize healthcare-associated infections and biological effects. It should be promoted as the entry point for subsequently enforcing other essential preventive measures. WHO and partners have published numerous tools and guidelines on management of health-care workers, blood safety, injections, hand hygiene and patients radiations safety; these could be adapted to national contexts and subsequently implemented.

6. Ensure health-care waste management
Availability in health-care settings of safe disposal systems for the secure containment and elimination of contaminated waste will improve the management of waste in health-care settings. Tools and guidelines developed by WHO and partners should be adapted to the national context and implemented in order to improve health-care waste management. Health-care workers should be trained on how to sort out medical waste according to type and nature.

7. Ensure appropriate use, quality and safety of radiations
A national multidisciplinary coordinating body to enhance implementation of policies in radiation protection should play a critical role in promoting appropriate use of radiations. Interventions should rely on clinical guidelines, nationwide DRLs based on essential radiological procedures should be developed to educate care providers.

8. Promote partnerships
Increased partnerships between patients, family members, health professionals and policy-makers will effect meaningful change in patient safety. The establishment of national associations of patients for patient safety will contribute to create safer health-care settings. The involvement of patients and civil societies in the discussion of the establishment of procedures related to patient safety will enhance quality of care and increase utilization of health services.

9. Provide adequate funding
Allocation of funds for patient safety activities by national authorities will demonstrate government commitment to improve safety in health-care settings; such commitment will encourage and enhance partner intervention in this area of public health. Increasing funding for patient safety will improve conditions in the workplace environment which may improve attitudes of health-care workers.

10. Strengthen surveillance and capacity for research
Establishment or improvement of basic data collection and promotion of research projects will allow countries to know the real magnitude of the patient safety problem. Research priorities should include epidemiological surveys and provide regular reporting of all adverse events occurring in all health-care facilities of adverse events, optimal and standardized procedures and patient safety solutions.

Conclusion
The challenges for safer patient care are numerous and serious, calling for global action to ensure that all concerned players contribute to the best of their ability.

Improving patient safety requires well-designed health-care systems to minimize risks to patients. Change is needed not only at systems level but also among individual health-care workers, teams and organizations. Of vital importance
are competent, conscientious and safety-conscious health-care workers in front-line services that are supported to deliver safe health care.

This paper outlined the major features of the current situation on patients safety policies in some south, west and eastern African countries and the issues that it raises for policy making. It describes major production changes, the actions to carry out for new production methods.

Upon this information, it is up to professional associations, expert groups and regulatory authorities, as well as the government to take appropriate action to establish safety policies for the benefit of patients in the interest of the health system.

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The theme of WRD this year is “Radiographers at the Forefront of Patient Safety”. As Patient Safety is a board topic, I will nail down a bit to Radiation Safety and through this article provide you some incites of what role radiographers/RTs are playing in the Asia/Australasia Region. I performed a general survey (May, 2022) to collect information from some countries in the region and this article will reflect their feedback.

The range of countries in Asia/Australasia region in many aspects is very wide. We have huge differences in Gross Domestic Product (GDP) per capita, highest is Singapore which is around 50 times of Nepal. We have also a very broad educational background in the region. Although I haven’t got a very concrete figure but a recent survey from IAEA reported that the training period of radiographers range from one month to four years in Europe and Central Asia and training hours of radiation protection range from <10 to 100 hours or more. For the number of radiographers per million population, I show some figures from my survey for your references. It spans from 37.2 to 974.6 radiographers per million of population.

The diversity in the region constitutes the big gap in providing radiation safety and protection measures to patient which we will explore in the moment. The Bonn Call-for-Action seeks to foster coordinated work to address issues arising in radiation protection in medicine. ISRRT being one of stake holder bears the responsibilities for advocating and implementing solutions to strengthen radiation protection in medical use globally. Radiographers in A/A region work on proposals from Bonn Call-for-Action to enhance radiation safety.

I) Enhance the implementation of the principle of justification
This is easy to say but hard to do, just an example, you received a request for an AXR E&S but the clinical history does not indicate an erect projection. I have discussed this scenario on many occasions in A/A conferences and as a question on the survey I conducted. Some radiographers will just do as told. They either do not want to confront the clinician that make the request, or it is quicker to finish the job by following the request. Luckily this is not the majority, many of us, will try to verify the request or minimize the number of projections. Or they will take the supine AXR projection first to look for signs/appearances that support the erect exposure. Communication is important for implementing the Justification principle as it is interprofessional in basis. Australia will improve the situation through regular education, training, communication,

<table>
<thead>
<tr>
<th>Name of Region/Country</th>
<th>No. of Radiographers</th>
<th>full time Total population</th>
<th>Radiographers per million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sri Lanka</td>
<td>~800</td>
<td>21.5 million</td>
<td>37.2</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>~1500</td>
<td>7 million</td>
<td>214.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>~3000</td>
<td>70 million</td>
<td>42.8</td>
</tr>
<tr>
<td>Australia</td>
<td>~14500</td>
<td>26 million</td>
<td>557.7</td>
</tr>
<tr>
<td>South Korea</td>
<td>~50000</td>
<td>51.3 million</td>
<td>974.6</td>
</tr>
</tbody>
</table>

Data in 2022, radiographers to population ratio in five region/country of Asia/Australasia.
and collaboration among professionals. Some hospitals in Korea will form a dose management team composed of radiographers to continuously look for improvement in the justification issue.

III) Enhance the implementation of the principle of optimization of protection and safety
Optimization of imaging protocols related to patient safety and radiation safety is a continuous process and radiographers should play an important part in this aspect as we are familiar with the machines and setting of parameters. However, from the result of the survey and from experience, this is true only in half of the cases. Some institution seldomly optimize their protocols. In some hospitals, medical physicists will work closely with radiographers during the optimization while in others, different colleagues are involved when workplaces are special for performing the examination.

III) Strengthen manufacturer’s role in contributing to the overall safety regime
Medical equipment can play a vital part in radiation safety. Routine Quality Control (QC) will guarantee their performance while high end machines usually produce less dose for image acquisition. In the survey, it was asked if QC is done by radiographers and whether radiographers will contribute to the specification preparation during new equipment procurement. For the first question, from most of the replies, radiographers will perform regular QC if appropriate tools are available. Some will perform Quality Assurance test and calibration as well. In some countries, radiographers will work along or collaborate with medical physicists in this area. For the second question, radiographers will not participate in some countries because of regulations. For others, radiographers work closely with medical physicists or are consulted during the procurement process.

IV) Strengthen radiation protection education and training of health professionals
In the general survey1, I ask if radiographers need to participate radiation protection training program? The reply in A/A region is absolutely “YES”. In some countries like Australia, the CPD education sessions delivered by the workplace radiation safety officer need to be performed annually as to update on any changes in legislation or practice and policies. In countries like South Korea, if a radiographer is appointed as a Radiation Protection Officer, he or she must participate in special training program within one year of being appointed and once every two years after initial training. Therefore, in A/A region, training is well structured which is complemented by several CPD programs for on job radiographers.

V) Shape and promote a strategic research agenda for radiation protection in medicine
In the A/A region, particularly for the developing countries, the overall number of research done is relatively low. In case there is extra manpower, they will be allocated to production rather than research. We hope that the developed countries will take up the role in this aspect and invite others to join in some studies to elevate the level of strategic research agenda for radiation protection.

VI) Increase availability of improved global information on medical exposures and occupational exposures in medicine
Patient nowadays know their benefits and is very eager to know their radiation dose especially after some high dose examination like CT. In Hong Kong, although it is not required by law, some hospitals start to record the dose in the radiology report. This move can help the patient to monitor the dose of the institute and may become one of the selection criteria of their own towards the imaging services. In the survey, question was asked if patient radiation doses are recorded by radiographers? And whether Diagnostic Reference Level (DRL) is used as a tool to monitor the radiation dose level of examinations. Most of the countries do not record the dose individually but will archive the dose in DICOM standard along with the medical images. Then if required, this dose information can be retrieved for dose calculation. In some countries like Thailand, a dose monitoring program may be installed to keep all the examination dose record. In other countries like South Korea, government had prepared a “Exposure dose calculation” program to help institutes to manage, keep track and reduce patient radiation dose. DRL is introduce by ICRP7 and is universally used for evaluating the dose level of an institute. It is already widely utilized in some tertiary care and university hospitals as a practical tool for monitoring. In some countries, DRL is recommended by government and institute will make effort to lower their dose below the DRL.

VII) Improve prevention of medical radiation incidents and accidents
To reduce the incidents and accidents, we should target to record all incidents and investigate on accidents, as to find ways to improve and avoid same risk in the future. Yet in some countries within the region, they do not have such mechanism. On the other hand, for most of the hospitals in A/A region, their countries have rules regulate the reporting mechanism. There will be a well-structured hierarchy and protocol of reporting and escalation of incidence reporting will be based on the severity of the incidence. In Hong Kong, we have an “Adverse Incidence Reporting System” which are used by all hospitals in government healthcare system network. In some countries, it is the requirement of radiation license holder to report certain types of radiation incident to the government.

VIII) Strengthen radiation safety culture in health care
One way to strengthen the culture is to establish a role/duty that purposely work on radiation protection. All countries in the region unanimity to have a post named Radiation Protection Officer. This position is established according to radiation safety regulation in some countries. Nevertheless, this position can be a radiographer or a medical physicist.

Summary
This article aims to review and suggest the current situation of radiographers’ role in enhancing radiation safety. The information was based on personal experience and the reply from the general survey launched on
mid-May 2022. Although there is a broad spectrum of countries in the region, "Radiographers at the Forefront of Radiation Safety" had quite large consensus in managing the affairs related to Radiation Protection and Safety in A/A region.

Acknowledgement
Thanks to all society associations in A/A region that provide information and special thanks to those who give details answers or comments on the questions, including V.G.

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www.who.int/ionizing_radiation/pub_meet/radiation-risks-paediatric-imaging/en/


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1. [https://docs.google.com/forms/d/1xFl7nKK_P69FFS_bWcdVB7z6gjBCJMU6s5G_anySis/edit](https://docs.google.com/forms/d/1xFl7nKK_P69FFS_bWcdVB7z6gjBCJMU6s5G_anySis/edit)

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**References**

Improving and promoting patient safety

THE Australian Society of Medical Imaging and Radiation Therapy (ASMIRT) is the peak body representing medical radiation practitioners in Australia. Our aims are to promote, encourage, cultivate, and maintain the highest principles of practice and proficiency of medical radiation science, always mindful that the welfare of the patient should be at the centre of everything we do.

Medical Radiation Practitioners (MRPs) include radiographers, radiation therapists and nuclear medicine technologists. To practice in Australia, MRPs are required to be registered with the regulatory authority the Australian Health Practitioners Regulation Agency (AHPRA).

Currently in Australia as of March 31, 2022¹, there are approximately 18,487 registered Medical Radiation practitioners. 78.5 percent are Diagnostic Radiographers, 14.5% are Radiation Therapists and 7 percent are Nuclear Medicine Technologists. 68.5 percent are female practitioners and 31.5 percent are male practitioners.

As a registered professional, the role MRPs spans a diverse range of technical expertise, complex clinical expertise, clinical patient management, clinical informatics, coupled with radiation safety considerations. MRPs are both registered and licenced practitioners which requires them to hold the equivalent of a “User Licence” in the State and some Territories in which they practice. They are aware of and comply with legislative requirements and have a culture of implementing monitoring procedures and quality assurance processes as well as incident reporting and review to ensure that the public and patients are safe. MRPs are responsible for the safe and accurate delivery of diagnostic and radiation therapy doses of radiation to patients. MRPs are trained in principles of radiation physics, anatomy, pathology and physiology, as well as general patient care issues such as infection control and workplace health and safety. Radiation safety principles and practice are also an essential part of an MRPs education.

**ASMIRT’s Advocacy**

ASMIRT’s mission is to empower medical radiation professionals provide excellent patient care through leadership in advocacy, education, professional standards, research and innovation.²

According to the Cambridge dictionary³ advocacy has been defined as the public support for an idea, plan, or way of doing something. An advocate is someone who argues for, recommends supports and champions a cause or policy to influence change. As such, ASMIRT as the professional body is here to:

- Advocate for high quality and safe patient care.
- Engage with key government agencies, industry stakeholders and the wider community.
- Advocate for the best possible health outcomes, equity and access.
- Advocate for the recognition of the role, scope and professional status of the medical radiation professional in health care.
- Advocate for the wellbeing of the medical radiation professional.

Part of this advocacy lies in assisting consumers / patients with a variety of queries that they have. These can include and are not limited to:

- Treatments and options
- Lived experience
- Education – courses
- Assistance to find resources
- Overseas practitioners seeking educational opportunities
- General advice relating to medical imaging and radiation therapy
- Information on specific imaging techniques
- Research institutions, clinical trials
- A friendly ear to listen to their concerns

**ASMIRT Projects**

To provide many of these services to the consumer, ASMIRT have a wide range of specialist reference groups, working parties and committees who advise the Board of Directors on matters pertaining to areas of specialist expertise and make recommendations to the Board related to the particular discipline(s)/specialist area. ASMIRT currently have eighteen specialist reference groups, two working groups and four Committees.

**Infection control – PPE (COVID)**

During 2020 – 2021, as the health systems became impacted by COVID-19, it was vital that staff were equipped with the appropriate Personal Protective Equipment to provide continuous service to patients. It was crucial that these services whether affiliated with public hospitals or not, continued to receive the resources and support to ensure safe service provision. ASMIRT along with other stakeholders continued to advocate for provisions to maintain safe practice.

**Cultural Safety**

Recent regulatory changes to MRP Professional capabilities have highlighted the need for cultural safety to be a key capability and essential requirement for medical radiation practice. MRPs require a working knowledge of factors that contribute to and influence the health and wellbeing of Aboriginal and Torres Strait Islander Peoples. These factors include history, spirituality and relationship to land, and other determinants of health in Aboriginal and Torres Strait Islander communities. To support this, ASMIRT have
partnered with Indigenous Allied Health Australia (IAHA) to provide MRPs professional development via online training, required to comply with National APhra Registration.

Spectrum Umbrella and Advocacy Series – assisting practitioners to assist patients
Additional continuing professional development opportunities have been provided for all MRPs through ASMIRT’s magazine Spectrum. In 2022, an “Umbrella series” was developed containing information such as:

Diversity, Equity, and Inclusion - there are differences in health outcomes between those who identify as LGBTIQ+ and those who don’t. MRPs are encouraged to explore diversity, equity, and inclusion for our LGBTIQ+ community, to acknowledge and respect diversity and improve patient-centred care and health outcomes ensuring inclusive access for all.

Culturally and linguistically diverse patients – MRPs are key in developing effective communication skills to facilitate a safe environment for patients that are within their care. Providing the best and safe care for patients requires cultural competence, knowledge of cultural diversity in patients of varying backgrounds.

Culturally responsive communication for Aboriginal and Torres Strait Islander peoples – there are differing perspectives, approaches and priorities for health and well being in additional to communication differences between First Nations patients and care providers. MRPs can assist by learning culturally safe communication skills to improve engagement and reduce patient distress and anxiety when attending for imaging or treatment.

Effective communication with the deaf community - It is important that practitioners have patience and empathy when dealing with patients or staff that are hard of hearing. Utilising a combination of Auslan (Australian Sign Language) interpreters and family members/escorts can help. Speak directly to the patient/client, not the person interpreting for them. The use of written communication can be used, along with basic body language and facial expressions to give context such as pointing to body parts, or physically demonstrate the action. Speaking slow, steady in a normal voice.

This Umbrella series has also been supported by an advocacy series that provides information on the types and range of issues that are experienced by both consumers and MRPs.

Other online events have comprised of events such as supportive care for patients with disability, and our LGBTIQ+ communities which have been designed to support the current clinical environment and the diverse range of patients that are presenting within imaging and radiation therapy facilities.

Radiation Protection / Quality Assurance
In most imaging and radiation therapy facilities in Australia, MRPs will perform quality control of their radiation equipment on a regular / daily basis. While most of the quality control outcomes are usually within the required technical parameters, any that are outside those parameters are passed on to the manufacturers’ parent company to ensure they are rectified in either routine or corrective equipment maintenance which is performed by the manufacturers’ specialist engineers. This will be in conjunction with either a clinical application specialist of the manufacturers which supplies the equipment and / or with a medical radiation physicist. Radiation protection principles are key to ensuring the safety of patients and are extremely well established in work practices throughout both public and private radiation facilities throughout Australia. MRPs are a key part of the team involved in the optimization of radiation protocols related to patient safety and radiation safety. Other team members can include a medical radiation physicist and a Radiation Protection Officer (RPO) which is a well-established role within both public and private radiation facilities in Australia. It is the responsibility of the RPO to ensure that MRPs participate in yearly radiation protection training programs within their respective radiation facilities.

ASMIRT work closely with the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to regularly review both radiation incidents and Diagnostic Reference Levels (DRLs). In Australia there are DRLs for multi-detector computed tomography which are considered the “gold standard” in terms of benchmarking radiation doses to the Australian public who undergo multi-detector computed tomography examinations.

In the instance that there is a radiation accident or incident, a facility “incident form” is filled out with any remedial recommendations to be implemented by the designated RPO. These incidents are classified into a tiered system from near miss, all the way to an abnormal exposure other than a justified medical exposure, exceeding 1 mSv total effective dose.4,5

A serious incident will require the RPO of the facility formally contacting the respective State Department of Health’s Radiation Safety Division. Procedurally this incident will be logged within their information database and be reviewed by the Department’s radiation safety officers, with their results being released back to the facility for further discussion and implementation.

Contrast media
A recent coronial inquest into the death of a patient has highlighted the need for all healthcare workers to be aware of patient safety in the area of contrast media delivery and the requirements for good documentation and communication.

ASMIRT run an IV Cannulation and Radiographic Contrast Media course which is made up of several stages: including pre-requisite training, self-paced online learning and a practical component workshop via Zoom. This is designed to ensure that MRPs have the theoretical knowledge and practical skills to ensure safe provision of patient cannulation, and the ensuing post contrast examination care for the patient.

Ergonomics/ Staff wellbeing
The outbreak of the COVID-19 pandemic globally in 2020, highlights the types of occupational hazards experienced by healthcare workers daily in busy, stressful clinical environments. These hazards range from exposure to infection, fatigue, occupational burnout and physical and psychological exhaustion.4,7,8 ASMIRT are currently undertaking a project to identify the key
Occupational Work Health and Safety issues affecting medical radiation practitioners within the Australian workplace. This will enable the development of a comprehensive document identifying the key issues and recommendations for improvements to Occupational Work Health and Safety practice in the MRP workplace. The results of this research will assist in providing recommendations for improvements to Occupational Work Health and Safety practice and will underpin the ASMIRT ergonomic guidelines document. Recommendations in this report will be of benefit to key MRP stakeholders.

New technology
ASMIRT supports the establishment and development of new technology to improve patient care and outcomes. For any new technology introduced, ASMIRT supports an evidence based, collaborative, interprofessional approach to ensure safety and quality. ASMIRT acknowledges that preparation is necessary in terms of training and education requirements, provision of leadership, and guidance on quality and safety in the delivery of service. It is essential that ASMIRT ensures the profession is represented at all forums and participates in the planning for new modalities such as the introduction of particle therapy in Australia. ASMIRT supports the development of education and training programs for Australian radiation therapists, and credentialing programs and the active involvement of radiation therapists in the planning and implementation of any new technology.

Education and training for clinicians
ASMIRT currently offers a range of certifications to assist MRPs demonstrate their expanded knowledge and commitment to their specialities within the Medical Imaging profession. This certification is not a qualification like a Master’s degree which has no clinical requirement, but rather a program that ensures a level of knowledge that is measurable and common across Australia. Once the certification has been attained, ASMIRT encourages practitioners to maintain their certification to demonstrate their specialist professional practice standard.

These certifications include MRI, CT, Angiography, Mammographic Practice and Preliminary Image Evaluation.

ASMIRT Scholarships
Each year a range of scholarships are offered to ASMIRT members to support them as they undertake personal and professional development activities. These include travel and research scholarships for both our early career and qualified practitioners. Research scholarships have been specifically designed to encourage researchers to develop projects which will add to the body of knowledge and also increase best practice within the Medical Radiation Science profession.

ASMIRT continues to contribute to the advocacy on behalf of its members to ensure that practitioners are provided with the most current and up to date knowledge and resources required, in order to provide the best care in the safest manner possible to their patients.

References
Radiographers at the Forefront of Patient Safety

SERVICE to Man is Service God. Fortunately we have been entered into the service sector where we have been paid a salary as well as the thanks from the patients and their attendees. After a treating physician, only a radiological technologist among all the technical/paramedical staff will attend the patient directly. The behaviour, communication and service rendered by them reflect on the reputation of the department or hospital. Hence it is very important to handle the patient very delicately with a soft touch, keeping all the legal issues and customs in the mind. We must know that the medical & health services are also covered under consumer services. It is also important to provide better services utmost satisfactory of the patient to withstand in the competitive world.

Rogi Devo Bhava (Sanskrit word): (A patient, must be treated as God)

The father of Nation Mahatma Gandhi said “A Customer is the most important visitor on our premises. He is not dependent on us. We are dependent on him. He is not an interruption on our work. He is the purpose of it. He is not an outsider on our business. He is part of it. We are not doing him a favour by serving him. He is doing us a favour by giving us an opportunity to do so”. Here our customer is our patient. If we keep these words in mind, we can better understand how a Patient is important to us.

Communication and Education: A Patient visits the Radiology and Imageology department for various diagnostic examinations. Some examinations may require preparation hence may need an appointment and some we can perform on the same day. And some we need to attend very urgently in trauma in acute emergency cases. Our quick attention and service helps to save the patient lives. Before any procedure it is important to educate the patient about its preparation, type of examination and duration in their local language, so that he/she can better understand and cooperates. So that better results can be achieved.

Patient care and Safety during X-ray examinations: It is very important to observe shifting of the patient on to the x-ray couch, patients on stretchers may not be shifted easily on to the X-ray Couch. They may have spine injuries or fractures etc., In such case, it is very essential to shift the patient on to the X-ray couch very carefully. Before positioning a patient, we must read the requisition properly what a consultant expecting or suspecting or interested. Don’t expect the patient to turn up as per your standard positions and think how best you can produce better images without or least troubling the patients. Please forget the word “Patient is not cooperated”. He is a patient, not a healthy person to cooperate as you desire. Don’t handle the patient as a tool and explain about the positioning while doing so. Handle gently with Human touch. For example use Trans-lateral techniques instead of rotating the patient especially in trauma cases. Modify the technique, better equipment and reduce the difficulty for the patients.

Digitization - Advantages and Disadvantages: After digitalization in radiology, it is unfortunate that selecting the parameters like KV and mAs are given less importance. The images can be manipulated/adjusted with the advance in software. For Centring and positioning also paid less attention. Fortunately the Patient doses are tremendously decreased due to Digital Radiography but Repetitions are increased. The image quality tremendously increased. Newer modalities Digital Mammography, MDCT, PET, SPECT, MRI, PETMRI, Bone Densitometry and DSA have a vital role in diagnosis and therapeutic in Diagnosis Radiology. The scan time tremendously decreased with MDCT and Patient Radiation doses also reduced. But the workload increased with increased patient input.

Srinivasulu Siramdas
Working General Secretary
Society of Indian Radiographers
Indonesia

Current Situation of Magnetic Resonance Imaging Services in Indonesia

ABSTRACT

Background: For the next five years the government will establish more than 500 centers for increasing services related to heart disease, stroke, cancer, and renal failure. MRI examination is one of the important diagnostic tools to rule out these diseases. This study tends to find out MRI services profile and how PARI (Indonesian Society of Radiographers) supporting the government’s program.

Methods: Data was collected using an online survey that was conducted in the first semester of 2022 through a questionnaire filled out by the MRI radiographers, as well as representatives of the regional board of the PARI for Focus Group Discussion, and the data is analyzed qualitatively.

Results: The questionnaire had 26 questions with total respondents 209 MRI radiographers. Most respondents came from the island of Java (71.3%). The educational qualifications of the respondents are Bachelor of Applied Science degree (49.8%), 3 years Diploma degree (47.8%), and Master of Applied Science degree (2.4%). Most respondents have less than 10 years’ experience in MRI services (81.3%). Most of MRI machine is close magnets (86.1%) and 1.5 T magnets (71%). Indonesia has ratio 1.11 MRI units per million population. The MRI service hour is mostly 8 hours/day (52.2%), for around 10 patients (62.2%). Radiographers rotate daily (31.6%) and others rotation systems. The duration of MRI radiographers training experience varies, mostly is less than one week (40.7%). Further Radiographer need for training is about post processing, advance software, management of MRI examinations with/without contrast and MRI safety.

Conclusion: The number of MR scanner compared to the total population of Indonesia should be considered increase to facilitate MRI examination accessibility especially outside of Java Island. Improving quantity and quality of radiographers who responsible for conducting MRI scanning through education and training.

Key words: magnetic resonance imaging, education qualification, training

Introduction

The Ministry of Health of the Republic of Indonesia initiated a transformation in the health sector. There are 6 (six) types of transformation that will be carried out, namely the transformation of Primary Services, Referral Services, Health Resilience Systems, Health Financing Systems, Health Human Resources, and Health Technology. The Ministry of Health has plans to develop 528 existing hospitals in Indonesia for improving services related to heart disease, stroke, cancer, and renal failure (urology), as the four diseases that cause the highest mortality rate in Indonesia. Establishing more centers throughout the nation it will improve people access to the hospital facility. This of course will require facilities, infrastructure, and human resources, including radiographers who are able to answer the needs of these services. In line with the transformation carried out by the Ministry of Health, PARI or the Indonesian Society of Radiographers considers it important to conduct a study of the imaging modality services used by radiographers in functioning the latest radiology services. One of these modalities is Magnetic Resonance Imaging (MRI). MRI is one of the important diagnostic tools to rule out of the heart diseases, strokes, cancer, and urology. Several studies on the management of MRI services have been conducted in several countries, such as in Japan, Australia, New Zealand, US, Canada, UK, Ireland as well as in West African countries. In developing countries, the use of MR scanners with a high magnetic field needs to be balanced with an increase in the quality and quantity of radiographers as users of the equipment. This initial study is needed to determine the current condition, which will be the basis for planning and developing radiographers in the future. This initial study covers the profile of MR scanners, radiographer qualifications, competencies, and directions for developing MRI services in Indonesia.

Method

An online survey was conducted by asking 26 questions to MR radiographers and PARI regional boards in Indonesia. A total of 209 respondents participated in filling out the questionnaire in first semester of 2022. Data processing was in the form of narratives and descriptions, followed by data analysis with literature studies and Focus Group Discussions of the PARI Central Board.

Results

1. Respondent profile

Total respondent is 209 MRI radiographers across the country. Most of the respondents’ profiles are graduates of Bachelor of Applied Science degree (49.8%), 3 years Diploma (47.8%) and Master of Applied Science degree (2.4%) respectively. Respondents have been working in MRI services less than 10 years (81.3%), more than 10 years (18.7%). Working location of respondents mostly in Java Island (71.3%), mostly came from DKI Jakarta (34.9%), and the rest from outside Java (28.7%) see figure 1.

2. Hospital profile

Distribution based on hospital category, from government hospitals (51.7%), the rest from BUMN/private hospitals (44.5%) and Army/Police hospitals (3.8%) (Figure 2). Based on hospital qualification according to Ministry of Health, there are type B (59.3%), type A (30.6%), the rest type C (9.1%) and type D (1%). Based on the number of bed capacities, 101-249 beds (36.4%), 250-500 beds (35.4%), more than 500 beds (20.6%) and 50-100 beds (7%).
3. Profiles of MR Scanners and Examination

Most of the hospitals that provide MRI services only have 1 unit of MRI in 1 hospital (87.1%) and the rest (12.9%) have more than 2 MRI devices. The population of the top 3 MR scanners brands are Philips (31.9%), GE (30.3%) and Siemens (26.9%). Other brands in Indonesia are Hitachi, Toshiba/Canon, Esaote, Bruker, and Casio (Figure 3). Magnet type of scanners are closed magnets (86.1%) and the rest are open magnets (13.9%).

The distribution of MR scanners based on magnetic field strength is 1.5 Tesla (71%), 3 Tesla (18.7%), <0.5 Tesla (9.8%) and 1 Tesla (0.5%). The number of daily examinations in the MRI unit was less than 10 patients (62.2%), 11-20 patients (28.2%), 21-30 patients (4.8%) and more than 30 patients (4.8%). The operating hours of MRI are during working hours (52.2%), 13 hours (33%), and 24 hours MRI services (14.8%). The length of waiting time for MRI examinations varies, with a waiting period of 1 day (27.8%), 1-7 days (26.3%), without waiting (23%) and those who must wait more than 7 days to schedule an MRI examination (23%). The five major types of examinations are MRI spine, brain, musculoskeletal, liver imaging and gynecology.

4. Radiographer human resources Profile

The total number of radiographers who perform radiology services is 10-20 people per hospital (56%), less than 10 people (21.5%), 21-30 people (12.9%) and more than 30 people (9.6%). From that number, the radiographers who served MRI examination were less than 5 people (47.4%), 5-10 people (34.9%), 11-15 people (12.4%) and more than 15 people (5.3%). Radiographers with Bachelor of Applied Science degree who perform MRI examinations are less than 5 people/hospital (78.5%), 5-10 people/hospital (20.1%) and 11-15 people/hospital (1.4%). The rotation pattern of radiographers in providing MRI services are daily rotation (31.6%), no rotation [radiographers remain on duty at MRI only] (24.9%), rotation without pattern (21.5%), monthly rotation (9.6%), weekly rotation (9.1%), rotation every 3 months (2.4%) and rotation every 6 months (1%) as figure 4.

5. Training Profile

MR radiographers stated have attended MRI training (90.4%), the remaining have not (9.6%). Training followed by a duration of less than 1 week (40.7%), between 1-2 weeks (28.7%), 2 weeks-1 month (15.8%), more than 1 month (5.3 %) see Figure 5. In the last 1 year, radiographers attended 1-3 trainings (75.6%), more than 4 trainings (15.8%) and 8.6% of respondents who have not attended a webinar/workshop related to MRI in the last 1 year. When asked about the theme of training needed to support services, most of the radiographers answered post processing, advanced software, MRI examination management with/without contrast and MRI safety. Interesting topics for Indonesian radiographers to explore are Pediatric MRI, Neuro advance (Diffusion, perfusion, DTI, fMRI), MR Spectroscopy, MR Cardiac, and MRA with/without contrast.

Discussion

The survey conducted by PARI is the current condition as a preliminary study that examines the profile of MR Scanners, MRI
service patterns, radiographer education qualifications, training that supports competence and the direction of future service development that can be carried out by PARI in Indonesia. In general, the MR Scanners used in Indonesia has a magnetic field strength of 1.5 Tesla, with varied examination. The distribution of MR scanners is still dominated by 6 provinces in Java, but in provincial capitals outside Java, MRI services are also available. Approximately, there are 300 MR scanners in Indonesia. Globally, it is estimated that there are around 36,000 MRI machines in the world with a total production of 2,500 units annually⁴. Japan had the highest ratio of MR units per million population with 55.21, followed by the United States with 40.44 units/million population. Germany has 34.71, Korea 30.08, Greece 29.35, Turkey 11.24 units/million population⁵. When referring to other Asian countries, such as Qatar which has 9.22 units/million population and Saudi Arabia 0.97, Indonesia as a developing country have ratio 1.11. Health transformation lead by Ministry of Health expected to elevate the number and distribution of MR Scanners in hospitals so that it reaches cities/districts throughout Indonesia. Thus, later it will also be necessary to increase the number of competent radiographers who can operate MRI equipment.

The pattern of radiographer rotation in MRI services shows the variations during on duty. Based on survey, daily rotation is the most. But there is chief of MR radiographers that still on MRI service, not involve in rotation. Important things to be considered here is the competence/ability of the radiographer on duty. The development of MRI will demand the ability of the radiographer to not only be able to produce images that show anatomical perfusion, DTI, fMRI), MR Spectroscopy, MR Cardiac, MRA with/without contrast, where these topics become their frequent cases clinically. From the legal aspect, there have been regulations that regulate the authority and duties of radiographers in the Professional Standards of Radiographers which is set by Ministry of Health⁶. This provision is also strengthened in the Indonesian National Work Competency Standard (SKKNI) which regulates the details of MRI service activities carried out by radiographers in Indonesia⁶.

The role of professional organizations in addressing issues and needs for developing the competence of radiographers is very important. PARI is expected to be able to direct the planning of student radiographers starting from the aspect of curriculum preparation that ensures the achievement of graduates’ abilities in operating the MR Scanners. The population of three years Diploma graduates currently still dominates radiology services in Indonesia. In the future, of course, it is hoped that the number and distribution of Bachelor of Applied Science degree to be increased, concordance with the legal aspects and health service’s needs. Radiographers in his/her profession, must have license that called Surat Tanda Registrasi (STR). STR issued by Health Workers Indonesian Council (KTKI) and valid for five years, after the student pass the national examination. To extend the license, radiographers must complete 25 credits of continuing professional development. One of the activities is get involved in certified training. For radiographers who have worked in the MRI unit, they need training or knowledge updates related to MRI modalities, as well as technical aspects of examination and patient safety. PARI has been conducting webinars aimed at refreshing members’ knowledge. During the COVID-19 pandemic, quite a lot of these activities have been carried out. To improve the technical aspects of skills for radiographers, structured training is needed. This professional activity can answer the needs of the latest advance MRI competency development. Based on this survey results, PARI can design standardized training needs and achieve training objectives so that MRI radiographers have technical and managerial skills to perform quality MRI services. The training has a curriculum according to professional standards for radiographers and SKKNI, both in terms of material, practical tools, and the duration of the training.

![Figure 5: Respondents’ training duration.](image-url)
Conclusion
The number of MR scanner compared to the total population of Indonesia should be considered increase to facilitate MRI examination accessibility especially outside of Java Island.
Improving quantity and quality of radiographers who responsible for conducting MRI scanning through education and training.

References

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The Actions of the Panhellenic Society of RTs about Patient Safety

RADIOGRAPHERS, as health professionals, have a crucial role in medical issues, especially patient safety. Radiographers’ knowledge and communication can improve practices that raise the issue of patient safety. Moreover, they are responsible for safety issues such as exposure to radiation, contrast use, data protection, and communication issues which are less apparent topics. On the other hand, lack of communication and knowledge, both internally and externally, can increase risks for patient safety incidents. A complex chain of activities represents risks in the radiology department. Of course, it needs to point out that it is not always the activities in the radiology department that cause the harm.

According to the WHO, «Patient safety as a healthcare discipline aims to prevent and reduce risks, errors, and harm that occur to patients during provision of health care. Clear policies, data to drive safety improvements, leadership capacity, skilled care professionals, and effective involvement of patients in their care are all needed».

As said, patient safety focuses on reducing the risk of those potential errors, injuries, or infections, however “Healthcare workers, medical associations, and individual hospitals may have different definitions of patient safety—but it becomes obvious what patient safety isn’t when patients find their health compromised due to ineffective hospital procedures.”

Entering patient safety initiatives in various healthcare facilities and medical associations is a significant effort because someone must revise hospital procedures, and staff must train to work as a team to reduce errors and protect patients. No magic pill fixes patient safety issues, but several factors have proven to help.

“No matter how you define it, patient safety is nothing to take lightly. Every person who works in a healthcare facility has a part to play in keeping patients safe. Read up on these factors to discover what you and your healthcare facility can do to help.”

Some Factors that can help improve patient safety in hospitals are the following:
- Use monitoring technology
- Make sure patients understand their treatment/the examination
- Verify all medical procedures
- Follow proper handwashing procedures
- Promote a team atmosphere

The small actions staff take on the job daily can significantly impact hospital patient safety. Safety culture is a complex phenomenon that hospital leaders do not clearly understand. There are some subcultures of patient safety culture were identified:
- leadership,
- teamwork,
- evidence-based,
- communication,
- learning,
- patient-centered

A key aspect of maintaining the safety of patients in diagnostic and interventional radiology is radiation protection. The three fundamental principles of radiation protection of patients are justification, optimization, and the application of doses, according to International Commission on Radiological Protection (ICRP), clarifying how they apply to radiation sources delivering exposure and to individuals receiving exposure.

The Panhellenic Society of RTs has indicated the importance of patient safety with defined webinars because inappropriate radiation exposure is a central

Figure 1: Online webinars for justification, optimization, and DRLs and examples for patient safety.
part of the responsibility of radiographers, and patients’ safety must always be paramount.

The Panhellenic society of RTs made online webinars with educational characters. The title of one of these webinars was “The three pillars of radiation protection.” That webinar had four parts with the following subjects (Figure 1):

- Justification
- Optimization
- Dose Limits-Dosimeter
- Dose Limits-DRLs

They focused on promoting the radiation protection rules and had an educational character. Many examples of patient safety were presented to students and radiographers. All of them dedicated around two hours for each session to watch and ask essential questions to the speakers. Some of the questions were about the safety culture.

The Panhellenic Society of Radiological Technologists (RTs) mobilized immediately by producing and delivering safe practice guidelines for RTs during the era of pandemic and as a consequence for the patients. [Fig2] The team’s effort included a daily three-hour online meeting to collect and share information from WHO and our National Organization of Public Health (EODY) and, of course, update each other colleagues. In almost a week, our team developed by adapting and communicating instructions and rules to support radiographers on the frontline in every modality of medical imaging.

After preparing relevant material for COVID-19, the Panhellenic Society of Radiological Technologists uploaded the guidelines for good practices during the pandemic for Radiological Technologists on its website [www.pasyta.gr]. These guidelines concerned how a radiological technologist can protect themselves from a non-symptomatic patient, not for a known COVID-19 patient, and how to keep one patient protected from another after an examination.

With this in mind, the team of editors decided to communicate these instructions by exploiting a more dynamic approach by organizing live seminars, hiring, and using the WebEx platform. The Greek society completed all this effort by achieving four webinars per week for a whole month and participating in RTs beyond our expectations. It gave particular importance to videos presenting how to protect themselves by donning and doffing and disinfecting medical imaging and therapy systems.

Radiographers, as part of a team caring for patients and specifically trained users of the imaging modalities involved, pay attention to the importance of patient safety by ensuring a safe environment for their patients.

So, the radiographers are not only the persons who generally:

- use x-rays to see inside a patient’s body,
- to help in the diagnosis of what is wrong with them,
- to be responsible for their medical equipment and how to open and keep them clean,
- to ensure radiation used is safely monitored and the critical information is recorded after each examination, including all the images they have saved.

But they are also undoubtedly an essential part of the healthcare system and have a crucial role in patient safety.

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Figure 2: Online webinars every week with guidelines concerned how a radiological technologist can protect himself from a non-symptomatic patient COVID-19, and how to keep one patient protected from another after an examination.
Radiographers at the forefront of Patient Safety

THE Radiology department has a steady stream of a wide variety of patients each day. Patients are referred from ambulatory care, from the emergency department and several dozens are inpatients.

All patients that seek healthcare services, such as radiologic examinations, usually look for a diagnosis that could lead to a relief from their suffering. Patients arriving at the Radiology Department will be given the first look or the follow-up of a certain pathology, disease or condition that will define their future. It is unimaginable that the healthcare provided could be the origin of their suffering or even the cause of death, but sadly this is a reality in some cases.

Most of these errors causing suffer, or even death, are preventable. These are due to a set of several contributing elements such as poor processes, poor methods, improper setting, fading equipment’s and/or poor management.

To deliver healthcare without any kind of error is what can be understood as safety. Objectively, patient safety is the prevention of errors and adverse effects to patients associated with healthcare.

Many of the errors that occur are honest errors. This means that a good professional, with the best intention will fail because the setting where the healthcare is provided will lead to that error.

This idea leads to the error theory. In a brief version of this theory, errors are due to a set of various contributing elements, such as unsatisfactory processes, inadequate methods, inadequate configuration, aging equipment and/or inadequate management. It should also be in our mind that most errors in healthcare are preventable.

The Swiss cheese model (figure 1) was created by James Reason and explains why accidents occur in a system. If we look closely to this model, we can see that it is completely applicable to Radiology Departments.

In this model, defenses occupy an important position in the organization’s tactics. The purpose of the barriers that are created is to protect patients from potential risks. However, there are always weaknesses or flaws. Each barrier is meant to be a shield that protects the patient from error. However, these shields, or barriers, are not perfect and are represented as slices of Swiss cheese, with their traditional holes. These holes should be seen as opening, closing, and continually changing their location, rather than being static in the slice. Only one hole, or gap, in a barrier does not harm the patient, as the absence of holes in the other slices and in the same alignment will prevent the error from reaching the patient. However, when many holes in many barriers line up, even briefly, in such a way that they allow a straight line to pass through them all at the same time, a chance of accident arises, an error occurs, and patient harm happens.

Holes or gaps in defense barriers occur for two reasons: active failures and latent conditions. This model supports the theory that the accident area is predominantly caused by “good people” who carry out their work in “bad systems” or in poorly planned health processes.

Active failures are dangerous acts performed by the healthcare team, which is in close interaction with the patient. Active faults thus take a wide range of forms, such as errors or even inappropriate procedures. Latent conditions facilitate the occurrence of active faults because these are part of the system. These conditions can have several causes, ranging from the design of the facilities, the builders, or the management of the healthcare unit. The causes of

Figure 1: Swiss Cheese Model created by James Reason. (Source: Adapted from Reason, 2000)
latent failures emphasize the importance of management and are responsible for creating the conditions for an error to happen, for example, keeping the number of workers below needs, putting pressure on the team to produce more or simply because the physical space was not designed the function.

Despite the importance of latent failures in the occurrence of errors, these are not directly responsible for the error itself and, because of their role in the unfolding of events, they are also called blunt end.

However, unlike active faults, latent conditions can be corrected when identified in time, and this correction can be made before an error occurs.

The immediate causes of accidents are often identified as human error or technical failure, but research and analysis of the circumstances surrounding serious accidents involving planes or trains or even nuclear incidents show that in addition to the immediate causes, there are several issues that are related, with broader aspects. These aspects are related to the entire organization.

Basic flaws in organizational structure, culture and procedures can lead to an accident. This environment is increasingly described in terms of perceptions, beliefs and behaviors that are generally shared by workers within the organization.

Thus, the concept of safety culture emerged as a set of principles, attitudes, perceptions, skills, or standards, individually or in groups, that determine an organization’s commitment or style of proficiency in management and safety.

As part of the solution, healthcare organizations may choose to adopt organizational models and strategies from other high-risk industries to minimize errors and reduce patient harm as much as possible, drawing on a consistent standard of improving the safety of care that pay.

Radiographers are, in Imaging Department, the healthcare professionals that will receive the patient and perform the imaging procedure that will define the near future, or even the long-term future, of the patient.

Some examples of errors in direct patient care were identified and are given below as also, some recommendations, are made.

- **Inadequate technique** - Negatively affects the outcome of the procedure, leading to misdiagnosis. The recommendation is to ensure that all professionals keep an active continuous professional development.
- **Wrong patient** - Leads to unnecessary exposure of patients to ionizing radiation and could lead to misdiagnosis of a severe pathology or even lead to an unnecessary intervention to a patient. The recommendation is to double check the clinical indication and the correlate the clinical information with the patient signs and symptoms.
- **Healthcare associated infections** - Transmission of infection within a healthcare setting is a major concern and can lead to high significant patient illnesses and deaths. The recommendation is to refresh the formation on hand hygiene procedures and in environmental cleanliness to all the professional groups.
- **Poor professional communication** - Critical information must be accurately communicated between the Radiology Department staff and the staff from other departments or within the Radiology Department professionals. The recommendation is to promote standardized open communication within the Radiology Department and with other departments such as SBAR (Situation, Background, Assessment and Recommendation).
- **Handoffs meeting** - Between shifts changes, important or critical information can be lost, arising gaps in patient care. The recommendation is to try to adapt shifts to the circadian cycle, avoid followed night shifts, use of rest breaks, use bright lights outside the radiology or reporting rooms.
- **Contrast material administration** - Radiology use of contrast agents can cause adverse events or side effects. The recommendation is that an extensive allergy background check must be done to ensure the safety of that administration. Always check the kidney function. Additionally, if possible, ensure that there is the minimum fasting period.
- **Professionals fatigue** - The staff have, sometimes, extended work shifts or insufficient resting time between shifts that may affect patient safety. The recommendation is to try to adapt shifts to the circadian cycle, avoid followed night shifts, use of rest breaks, use bright lights outside the radiology or reporting rooms.
- **Lack of error reporting** - Reporting errors is fundamental to error prevention because it will reveal hidden dangers and will contribute to institutional learning. The recommendation is to adopt error reporting mechanisms, assuring the confidentiality of the professional. Encourage error reporting and make clear that there is a non-punitive action towards the professional error.

Of course, depending on the settings, some of these ideas will not fit exactly. Also, as part of problem solving, brainstorming meetings can be encouraged to find solutions for some of these errors that fit each institution.

In conclusion, patient safety should be a priority for each Radiographer. Indeed, only when all feel the need to follow institutional, local, national and/or international guidelines or recommendations on patient safety, this topic becomes a cultural aspect of the organization. Only when this happens, patients will be safer.

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Implementation of Medical Radiation Exposure Quality Assurance to Ensure Patient Safety

RADIATION protection is regarded as an important aspect of maintaining patient safety in diagnostic and interventional radiology. There are three core elements of radiation protection of patients - justification, optimization and the application of doses as low as reasonably Achievable (ALARA). Medical exposure quality assurance program is a management of medical radiation optimization. Quality assurance personnel is responsible for ensuring quality assurance tests that meet established standards so as to im-prove the medical radiation quality and reduce unnecessary radiation exposure for patients. Atomic Energy Council (AEC), the safety authority over safety supervision in radiation workplace, promotes quality assurance program of medical exposure in accordance with Article 17 of the Ionizing Radiation Protection Act. Quality assurance program is a crucial part of radiation safety in medical field. Its goal is to ensure equipment stability, patient safety, and to obtain the best image quality with reasonable radiation dose.

With the advancements and high demand in medical technology, medical institutes have purchased a great amount of diagnostic medical imaging equipment; thus, radiation dose for a patient is increasing generally. Mammography equipment was first incorporated in the QA program in 2008, and computed tomography was included subsequently in 2011. When it comes to fluoroscopy X-ray machine, Atomic Energy Council has undertaken a long period research of the QA program since 2014; however, due to the fact that the application of fluoroscopy is complex in clinic, the exposure impact of cardiac catheterization and angiography X-ray machine is noticeably important in terms of radiation protection. The trials of the QA operation procedure have been implemented since 2018. Diagnostic medical imaging equipment included in QA project is as follows:

Computed tomography (CT)
1. System safety evaluation
2. Slice positioning accuracy
3. Slice thickness accuracy
4. High contrast resolution
5. Low contrast detectability
6. Evaluation of image uniformity, noise and artifact
7. CT number accuracy and linearity
8. Radiation width
9. Image display device evaluation
10. Dosimetry

Mammography
1. Beam quality assessment
2. Automatic exposure control (AEC) reproducibility
3. Radiation output rate
4. Compression
5. Phantom image quality evaluation

Fluoroscopy (cardiac catheterization and angiography)
1. System safety evaluation
2. AEC reproducibility
3. Collimation assessment
4. Image display device evaluation
5. High contrast resolution
6. Low contrast detectability
7. Beam quality assessment
8. Entrance exposure rate
9. Integrated air kerma rate due to reference point

As for our diagnostic quality assurance project which was supported by Atomic Energy Council in Taiwan (project number: AEC10812047L), we inspected 100 sets of mammography equipment, 100 sets of computed tomography scanners and 200 sets of X-ray machines used in cardiac catheterization laboratories and angiography rooms for medical exposure quality assurance from 2020 to 2021. We conducted advanced researches on quality assurance projects for mammography and computed tomography equipment; meanwhile, we guided medical institutions to implement quality assurance program for X-ray machines used in cardiac catheter laboratory and angiography and proposed specific suggestions for improving medical exposure quality assurance regulations. The complete detailed description of required work which has been done from 2020 to 2021 are as follows:

1. There were one expert consulting team and three professional teams of medical exposure quality assurance composed of diagnostic radiographers, university professors international scholars, a total of four teams.

2. Through the discussion of relevant foreign literature and the online conference of international experts, the relevant quality assurance regulations, items, allowable values and quality assurance procedures for international mammography, computed tomography, cardiac catheterization and angiography X-ray equipment were aggregated so as to explore the difference between international and domestic medical exposure quality assurance program.

3. Published relevant results of the plan implementation as a reference for scholars in important related fields.

4. A consensus meeting of expert committee members was held to establish standard operating procedures for the hospital visit process and quality assurance management precautions to ensure the stability of the quality from the visit results.
5. Completed two sessions of computed tomography scanners (Figure 1), two sessions of mammography equipment (Figure 2) and 4 sessions of X-ray machines used in cardiac catheterization and angiography (Figure 3) for medical exposure quality assurance courses.

8. We offered nationwide radiation safety training, and there were two PhD students and two master students who have completed the training.

9. According to the 2019 and 2020 quality assurance operating procedures, there were 100 computed tomography scanners (Figure 4), 100 mammography equipment (Figure 5) and a total of 200 X-ray fluoroscopy systems from cardiac catheterization laboratories and angiography rooms (Figure 6) which were inspected for quality management.
We collected and analyzed 100 sets of computed tomography scanners and mammography machines from field survey in 2020 and 2021, and we also conducted further analysis and discussion. The data of X-ray fluoroscopy used in cardiac catheterization laboratories and angiography rooms were collected from field visit. In addition to that, the data of the pilot scheme from 2019 to 2020 and 2020 to 2021 were analyzed and discussed, a total of 200 sets.

A database is established based on the field visit results of quality assurance procedures between 2020 and 2021 so as to set up an important reference material. Moreover, we have formulated three new versions of the quality assurance operating procedure teaching materials that can be used for reference with current clinical status, and proposed specific suggestions of regulations for enhancing medical exposure quality assurance. Annual meeting from last year selected this topic as the theme, and conducted online continuing education course for radiological technologists. This course was presented by prominent speakers from Thailand, Korea, America etc. With the repaid development of medical imaging equipment, the methods to perform a quality assurance procedure with accuracy and efficiency for the equipment is an issue worth focusing on. Safety updates and the availability of new equipment, supplies and techniques can enhance the diagnostic ability of X-ray and reduce dose to patients.

We have investigated these diagnostic medical imaging equipment described above from 2020 to 2021 and acquired related data and experience in quality assurance. In addition, we disseminate information about quality assurance project to healthcare personnel and radiologists. In order to have adequate preparation in promoting quality assurance regulations, we will proceed diagnostic medical equipment field survey in medical institutes according to quality assurance procedures formulated by the Atomic Energy Council and optimize the reliability of the database.

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Perceptions on patient safety: A survey of radiographers on the frontline in Zimbabwe

Overview
This paper explored the perceptions and experiences of Radiography Professionals in Zimbabwe on Patient safety during the Coronavirus disease (COVID-19) pandemic to a) understand working conditions in frontline roles b) assess the level of training and knowledge on safety practices, c) assess changes in adaptation to the pandemic and d) propose an optimal pathway for care in private and public care systems. Although there were numerous studies among frontline health workers in Zimbabwe (Moyo, et al., 2022; Chingono, et al., 2022; Dzinamarira et al., 2021) very few have reported the perceptions of Radiography professionals. Therefore, this investigation primarily focused on Radiographers, Sonographers and X-ray operators in Zimbabwe.

Introduction
The COVID-19 pandemic which has persisted for more than three years has been a scare for both health workers and patients (Chingono, et al., 2022). Initially, the fear emanated from high transmission rates and associated mortality risks because little was known of the disease and most health systems were ill-prepared (Chersich et al., 2020; Mackworth-Young et al., 2021). The fear that many people had is slowly declining because the health fraternity is now more prepared than before. Although morbidity and mortality rates have decreased significantly there has been a heightened awareness of patient safety throughout the world. Moreover, questions on risk and safety took priority for civic organisations, professional associations and governments. Challenges continue to rise due to complacency, work overload and inadequate resources in most institutions (Moyo, 2022). Despite these inadequacies, the responsibility for patient safety still lies with frontline health workers. Imaging professionals such as Radiographers and Sonographers are among the frontline workers where this huge responsibility lies. For years these imaging professionals have been custodians of radiation safety and are well aware that their role in all aspects of patient safety is of great importance.

Although frontline workers have a role to play in patient safety, many were infected and succumbed to the disease (Moyo, et al., 2022). Frontline workers were predisposed to the disease because they never took breaks during lockdowns, as a duty to serve and fight the pandemic. Others due to limited resources especially in low-income countries which had suboptimal personal protective equipment (PPE) in place, greatly risked spreading the disease and being infected (Moyo, 2022; Kavenga et al., 2021).

Even with the emergence of telemedicine, due to the nature of their work, Radiographers do not have the privilege to maintain the recommended social distances, when they are positioning patients, assuring them and spending considerable time with those receiving radiation treatment. So far, no studies had been documented on how they adapted their techniques in such dire circumstances on the war front to ensure patient safety.

Research methods
Experiences of Radiographers practising in Zimbabwe from January 2020 to date were captured using an online questionnaire over two weeks in June 2022. The survey was administered via social media platforms using Qualtrics. The questionnaire comprised 26 mixed questions. It was designed based on the literature review of frontline health workers and focused on themes of protective equipment, work environment, workloads, and mental health. The data was analysed using SPSS version 16 and descriptive statistics were used to present the data.

Results
A total of 92 Radiographers participated in the study and of these only 92% consented. The Majority (72%) of these participants ranged from 26 to 45 years of age. About 65% were employed full-time during the period 2020 to date while 20% were students. Although 7% were in academics, 80% were in clinical practice. The scope of practice ranged from General Radiography (34.8%), Computed Tomography (19%), Ultrasound (31.65%), Nuclear medicine (2%), Magnetic resonance imaging (6.3%), Mammography and Radiation Therapy (6.3%). About 44% worked in the private sector while 38% were in the public sector. About 14% worked in both private and public institutions. The majority (68%) worked in the Metropolitan province, while a handful (8%) was at the district level and the rest (24%) worked at the provincial level.

Perceptions
In the fight against COVID-19 90% of the respondents believed that Radiographers are frontline workers and that other health workers including their managers and employers recognised that Radiographers are frontline workers. However, a significant number 27% felt that this role was not recognised. More than 50% agreed that when dealing with COVID-19 patients, they are alert to the safety of that patient, other patients, themselves, colleagues, and the public. The other 35% always felt COVID-19 patients should be isolated and attended in their own clinic and whoever gets to attend them should be given extra financial benefits.

Personal Protective Equipment
More than 55% reported having inadequate PPE being provided. And the remainder had adequate PPE. The quality of the PPE was reported by the majority to be of an average quality which conforms to the minimum...
WHO standards, 18% reported having received poor-quality PPE. 50% of the departments had a PPE policy while the other half was split into two between those who were not sure and those who had no policy. Those with the PPE policy outlined the following major components: Donning and Doffing of PPE; Type of PPE; Reasonable use of PPE; hand washing; COVID-19 patient isolation; SOP for imaging COVID-19 positive patients. 30% were consulted in the development of the PPE policy. Of those who were not consulted but given one, 35% felt the policy addressed issues that made them protect themselves and patients. While 28% felt the policy lacked some aspects to adequately protect themselves and patients. About 68% of the Radiographers were given training on their PPE policy. The PPE which was provided comprised gloves, masks, visors scrubs, and gowns.

As for the factors, they felt compromised patient safety, limited space and overcrowding, infection control, sharing wards with COVID-19 patients, lack of patient screening, no social distancing, no dedicated X-ray machine for COVID-19 patients, and poor scheduling of patients.

The participants requested the Radiography Association of Zimbabwe (RAZ) to raise awareness for patient safety, engage employers, to have standard protocols for modalities and guidelines for infection control. It was also tasked to have standard safety policies, conduct audits to assess general conditions of hospitals and train professional advocates for water, sanitation and hygiene (WASHI).

Over 45% tested positive for COVID-19 and 38% tested negative. The rest never had any tests done. Of those who tested positive about 33% tested positive twice. 34% were fully vaccinated and had a booster, while 53% had two doses only. About 8% were not vaccinated. The majority did not have challenges with their mental health. However, about 18% were affected. Those that were affected were stigmatised, felt lonely and depressed, lack social support and other were distraught because of bereavement. About 59% reported their usual workload to have been decreased due to COVID-19.

**Discussion**

A study was performed online amongst Ghanaian radiographers for six weeks in which they were assessing the impact of Covid-19 in a low-resource setting through the use of a questionnaire (Akudjedu et al., 2021). This was a similar approach to the current study, given the global pandemic online surveys have proved to be reliable in carrying out data collection since participants and local regulations still give importance to social distancing. Their findings pointed out that the majority (75%) experienced high levels of work-related stress. In the current study, although Zimbabwe had gone through the fourth wave, less than 20% had mental challenges related to the pandemic. In a narrative review done by (El-Hage et al., 2020) they cited stress during the pandemic as being caused by depletion of PPE, rapidly changing information, shortage of ventilators and intensive care unit beds and lack of access to up-to-date information, being isolated, feelings of uncertainty, social stigmatization and overwhelming workload and lack of social support.

**Training**

A key function of the health system is to ensure workers are trained to a level which allows them to handle emergencies and reduce the risk of infection. Careful donning and doffing of PPE remains a key defence but requires considerable training and supervision. In this study, the majority of the respondents indicated being adequately trained on how to face an infectious disease outbreak (Zervides et al., 2021, p. 19).

**Provision of PPE**

With regards to the provision of PPE, the findings of this study are in contrast to what was discovered amongst medical imaging professionals in a study done in the republic of Cyprus where they reported their workplaces to be sufficiently provided with PPR, clean supplies and equipment for 3 months in advance (Zervides et al., 2021). The radiology workforce in India, 8 countries in the middle east and North Africa is reported to have adequate PPE (Elshami et al., 2021). Since the study was done amongst southern African radiographers the differences in economies could be a factor that led to inadequate PPE provisions since the study site is a low-income country. In their study Zervides et al., they concluded that there were clear protocols concerning Covid-19 protective measures. In this study, only about 50% had a clear policy concerning Covid-19 measures. The reviewed studies were silent with regards to Radiographers being consulted on the Covid-19 policy. However, a study from Italy recommended the standardisation of policies from management to protect patients and workers (Martini et al., 2022). The lack of clear infection control policies raises the possibility of suboptimal preventive practices that can affect patients.

**Workload**

Among Ghanaian radiographers, 50% of the respondents cited a decline in the workload due to Covid-19 cases (Akudjedu et al., 2021). Similar trends were reported in the current study, which could be owing to the regulations that emphasised social distancing hence fewer people were seeking urgent medical care.

**Adopted Measures**

The majority of radiographers (87%) were fully vaccinated heeding calls by the government to take preventive measures and put safety first. This is
particularly important since both health workers and patients are vulnerable to infection.

**Conclusion**
This study revealed that Radiographers in Zimbabwe are playing a major role at the front in the fight against COVID-19. Despite their increased risk of infection due to the nature of their job, they were committed to upholding high patient safety standards. Although some challenges have been addressed through training, vaccinations and good safety policies, some concerns remain regarding the provision of adequate PPE and policy making.

**References**


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CONTRIBUTING STAKEHOLDERS VIEWS

Be accepted – A step towards empowering patients, radiologists and radiographers

IN A world where everything has to be bigger, faster and newer, radiology as a specialty has a comparably short history, beginning with the discovery of X-rays by Wilhelm Conrad Röntgen in 1895. Within this specialty radiologists are being increasingly challenged to adapt to new systems and stand firm as medicine’s gatekeepers between patients, referring physicians and their own personnel. The problematic perception of radiology as nothing more than a numbers game makes the need for radiologists to demonstrate the value that their discipline adds to the healthcare value-chain more imperative than ever before.

Value-based healthcare (VBH) is a conceptualisation of healthcare centred on quality, rather than quantity. The focus on the patient’s outcome in terms of costs of delivery of healthcare and on the patient’s well-being has shifted significantly. On the one hand, every medical institution has to fight rising cost structures and seeks to improve chains of actions; on the other hand, it has become clear that patients need to be put at the centre of the care model. VBH is not a facultative model, healthcare institutions will be obliged to apply these principles in the future.

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Impact on patient outcomes, and therefore “value”, is delivered in all aspects of radiology, ranging from screening and disease prevention to detection, diagnosis, evaluation of patient progress during treatment, the provision of high-level decision support, imaging biomarkers, radiation, interventional radiology and teleradiology. Radiology is home to the entire scope of imaging processes, which enables a direct exchange with referring physicians and clearer communication in what exactly is needed to treat their patients adequately.

In 2017, the ESR published a concept paper on value-based radiology, highlighting five key principles that put patients’ wellbeing and relations with patients and referring physicians as the main focus:

1. Appropriateness of an imaging request: this step ensures the appropriate use of radiation, avoiding unnecessary exposure and related risks, contributing to correct protocolling of exams.

2. Attention to radiation protection measures: all major radiological societies and organisations are aware of this necessity and have launched
Radiologists make the first diagnosis within a value-based healthcare system. Why radiology has to be highly visible to policymakers. They also make it clear that patients in various countries expressed a degree of dissatisfaction with the availability of radiologists for personal consultation, and also with how the results of their examinations were communicated to them.

3. Reporting: Reporting should be correct, concise, clearly structured and easily comprehensible to the referring physician. Every radiology report should use standardised terminology, provide specific recommendations about further imaging or treatment, give full contact information and should ideally be available to the patient via an online portal.

4. Relationship between patients and radiology personnel: The availability of detailed instructions for different examinations, the distribution of patient satisfaction questionnaires, as well as formal relationships between radiology departments and patient organisations are factors and possible metrics of the radiologist’s availability and thus visibility to patients. The ESR conducted a study in 2019, which made very clear that patients in various countries expressed a degree of dissatisfaction with the availability of radiologists for personal consultation, and also with how the results of their examinations were communicated to them.

5. Continuous professional education, research and innovation: the radiologist’s qualification and expertise is of utmost importance, especially in a medical discipline that changes faster than any other discipline and that, on top of everything, uses Artificial Intelligence (AI) – which again presents a field in itself that undergoes constant changes and has very short technological life-cycles.

These five points are just the main factors through which radiology may contribute to enhancing value for the patient, the referring physician and health policy makers. They also make it clear why radiology has to be highly visible within a value-based healthcare system. Radiologists make the first diagnosis and radiographers carry out the imaging process. They need to install trust and understanding, in order to guide their patients towards the next time-sensitive steps.

A story of trust, empowerment, support and understanding is that of ESR Patient Advisory Group Chair and founder of Be Accepted, Caroline Justich. A cancer patient herself, Caroline started this new tool to support female cancer patients and radiologists. She wants to provide filtered, scientifically proven and summarised online and printed information and support in one medium – information and support for patients, radiologists and radiographers.

She considers herself lucky that her radiologist, Professor Michael Fuchsjäger, Chairman of the Department of Radiology at the Medical University of Graz, Austria, and Chairman of the ESR Board of Directors, prepared her for all the upcoming steps and helped her find the right mindset it takes. “He told me this would be a rollercoaster ride and my job was to put my focus on the end of the ride and have faith I will come out of the ride ok”, Justich says. It was this support, she states, that helped her make it through the hard times. This life-saving brace is precisely what many women lack when diagnosed with cancer. “Be accepted” was designed for female patients as a safety net during the initial shock, to support their mental and physical wellbeing by providing answers to the many questions they might have. It helps them through times of despair, giving life-hacks, coaching advice, and a feeling of community, highlighting that there are many others out there struggling, and offering a perspective to hold onto, as well as a stream of additional positive information.

However helpful it will be for patients, Be accepted will also bring enormous benefits for radiologists and radiographers. The way the radiologist informs the patient about the diagnosis makes all the difference in the patients’ next steps. Furthermore, radiologists and radiographers will profit from a well-informed, active and positive thinking patient, whom they can communicate with on an eye level. The level of information also makes a fast communication process possible, which not only saves time and money for institutions, but often contributes towards a better outcome in therapy. To summarise, the radiology staff acts as first mover and strengthens the central role of medical imaging in the chain of medical disciplines – a win-win situation for patients and their imaging team in a seemingly hopeless situation.

Be accepted will launch on July 15 during the European Congress of Radiology in Vienna. A whole day of interesting presentations, interaction with specialists and the opportunity to take home the newly printed magazine awaits attendees. Expect something great to happen!
Leading the way: The EFRS’ efforts to improve patient safety across Europe through radiographers

By Jesse Clarijs-de Jong, Holland and Ricardo Khine, United Kingdom

Introduction

The European Federation of Radiographer Societies (EFRS) represents, promotes and develops the radiography profession within Europe and across all radiography specialisations. With 45 national/professional bodies as members and 66 academic institutions that deliver radiography education also as members the EFRS actively supports over 105,000 radiographers and 8,500 radiography students.4

Radiographers play a crucial role within medical imaging, nuclear medicine and radiotherapy. Radiographers combine their interpersonal and technical skills to work together with patients and (ever evolving) medical technology. Central to the role is effective communication skills and an understanding of the importance of patient care and safety aspects. The EFRS publishes a number of statements, research publications and delivers webinars to further develop the profession and to build a stronger culture surrounding patient safety within the radiographers’ practice all across Europe.

Patient safety and radiography professions’ development

Developments in medical technology for radiographers in all fields have changed the way patient care is delivered. These developments contribute to increase the efficiency in healthcare services, but also provide more effective and less invasive procedures for patients. To understand the impact of these developments’ further collaboration between professional societies and educational institutions is required. In response to the urgency the EFRS published a white paper containing a set of consensus statements exploring the future role and requirements for the radiography profession over the next 10-15 years grouped in categories education, research and practice.5

The technical (r)evolution taking place demands the educational institutions to be proactive and to adapt accordingly. Even more so, looking into the coming decade. As educational institutions are educating radiographers to play a vital role between patients and technology, the curricula will need to be developed to focus on the importance of patient care and safety. Educational institutions should provide skills for life-long learning, the use of technology and develop postgraduate education to prepare future radiographers to embrace the evolving technology. Thus, preventing compromises to patient safety by enhancing adaptive learning skills and science-based practice of new radiographers.

Within 10-15 years a research culture will be embedded into clinical departments with patients as partners. This partnership will ensure research is effectively developed, led by radiographers and includes the patients’ perspective (for instance on priorities, projects, methods and design). The technical (r)evolution will allow radiographers to lead on vital research to assess safety aspects, quality of care of the patient and be valuable to the members of public.6

Looking ahead, continuous professional development and adaptation of skills and procedures within the radiographers’ practice is of utmost importance. Each procedure must be optimised to maximise...
benefit and minimise risk to the patient and the public. From the fundamental role radiographers play within each patient’s individual pathway it will increasingly be expected of the radiographer to holistically tailor procedures to the patient.6

Continuous Professional Development
Radiographers have the responsibility for patient care during examinations and treatment and need to assure safe practice and a high level of quality of care to the patient. As the continuous change and technological advancements in radiography can potentially result in gaps between ‘best practice’ and ‘actual practice’, it is crucial that healthcare professionals continuously build upon the knowledge and skills gained during their undergraduate education.1 Knowledge and skills attained by healthcare professionals during their undergraduate education provides the foundation for their career, but it will be insufficient to fully support them throughout their career. This emphasises the need for continuous professional development (CPD), especially in radiography due to significant technological developments far greater than many other professions.1

The EFRS defines CPD as ‘the continuous learning process required to maintain, develop and improve one’s knowledge, skills and competences to work effectively and safely’.1 CPD can be viewed as a holistic philosophy with a broad focus, acknowledging the multifaceted nature or professional practice and emphasizing the importance of personal and professional development.

Patient safety is featured throughout the radiographer’s journeys through education, practice and research. CPD is essential to ensure patients receive safe care of high quality from competent professionals1 today and in the future. Outputs generated by the EFRS cover topics on education, research and professional practice.

The EFRS promotes the importance of continuous learning for radiographers by providing webinars and statement documents, by encouraging radiographers to lead on research projects and inspire radiographers to promote and engage in research within their profession.

The EFRS webinars and documents cover a wide variety of subjects, for example:

- Webinar series on incident cases, promoting the implementation of incident learning systems across European nations;
- A webinar on Patient and Public Involvement (PPI) within research and innovation projects;
- EFRS statement on the importance of the patient engagement and the patient voice within the radiographic practice.

Importance of patient involvement in radiography
The EFRS recommends the involvement of patients in education, practice and research in radiography. The patient voice and engagement is beneficial to all aspects in radiography and is important in supporting delivering a high quality health care.1 An engaged patient does not only help chart their own health course, they also play an important role shaping decisions made at every point in the healthcare process. (2) Thus, patient involvement can significantly improve patient safety.

Acknowledging the value of patient involvement in radiography, the EFRS has developed clear recommendations for patient engagement and including the patient voice within service delivery and innovation, education and radiographer-led research.7 These recommendations are also further extended into radiotherapy-specific recommendations on patient involvement in process (re)design, decision making, safety management and radiographer education.2 Where appropriate the EFRS will also actively consider the patient voice within its strategy and activity plan.2

Patient Voice and Patient Engagement – an hot topic for the major stakeholders
In line with the World Health Organisation global strategy on integrated people-centred health services 2016-2026, and consider the patient, care, and moreover, the patient-centred care, as one of the major pillars in the future for the healthcare professionals, Radiographers won’t be aside from this topic.

Both EFRS PPC Awards 3rd edition (as the first two editions) and Elsevier Radiography Journal (EFRS official Journal) with a Special issue, will play a key role in the Patient Voice and Patient Engagement, enhancing the role of Radiographers, either on diagnostic and therapy.

Since 2021, the EFRS patient-centred care awards has recognised, celebrated and promoted the work of radiographers in improving care through a patient-centred approach. The care improve can also include quality and safety. This year’s winner of the Patient-Centred Care Award 2022 was Rad Chat, the first therapeutic radiographer led oncology podcast.

Entries for the Patient-Centred Care Award 2023 can be submitted in the beginning of 2023. Deadlines and openings will be communicated through the EFRS website and platforms.

From the point of view of Radiography’ Editors “patient voice and patient experience are of growing importance to the radiography profession to ensure medical imaging, nuclear medicine, and radiotherapy services meet service user’s needs”.4 In addition “listening to the patient voice and gathering feedback about patient experience provides valuable insights into how radiography service delivery and educational provision should be structured”5, leading this topic to a special issue and a specific call for nominations, which will end by December 5, 2022.

References