Reflections on the COVID-19 pandemic

Edited by Ken Holmes and Peter Hogg

ISRRT
INTERNATIONAL SOCIETY OF RADIOGRAPHERS & RADIOLOGICAL TECHNOLOGISTS

Front cover and artist

I created the artwork for the book cover after reading a number of research papers about radiographer experiences of working during the pandemic.

My overarching impression was that radiographers were exhausted and I tried to reflect this in the radiographer's body language on the image. The mobile x-ray machine shines a spotlight on her plight and the exposure button has been cast aside in exhaustion.

Radiographers have reported feeling unprepared and unprotected, lacking in Personal Protective Equipment. The figure is therefore bare-footed to represent this vulnerability.

To illustrate the impact the pandemic has had on the world community of radiographers this solitary, vulnerable and exhausted radiographer sits on the top of the 'earth' as a symbol of radiographers across the globe.

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Preface

Donna Newman, ISRRT President

The COVID-19 global Pandemic has had an impact on many professional settings in the medical imaging field globally. Radiographers/Radiological Technologists, Advance Practice Professionals, Radiographer/Radiological Technologist Educators, and Radiographer/ Radiological Technologist Managers/Administrators are just a sample of some of medical imaging professionals that have been affected in their daily practice due to the COVID-19 pandemic. Each of these frontline healthcare workers have had to deal with unforeseen challenges that have affected all areas in the profession. As professionals they have adapted current practices and engaged in optimal strategies to contribute to patient safety precautions and a safe environment, to prevent infection transmission during our procedures, and to provide the best care for our patients while keeping ourselves healthy and safe.

The COVID-19 global pandemic has also impacted threw delivery of higher education in university settings globally from the immediate onset of the pandemic as well during the prolonged lock down. Traditional in person learning has had to adapt to on-line teaching models. Student clinical education has had to move to modified with a delay in traditional placement settings. Research within our profession as has suffered delays or come to a complete halt due to the COVID 19 pandemic. The ISRRT recognizes our members as key frontline healthcare works and thanks them for their sacrifice of their family time and their dedication to our patients care worldwide.

'Radiographer reflections on the COVID-19 pandemic' presents a collection of 29 chapters with interesting and personal accounts from expert radiographers/radiological technologists from around the world. This collection of individual and collective authors gives a snapshot describing the personal impact the COVID-19 pandemic has had on the Radiographers/Radiological Technologists' daily practice including the impact on universities delivery of education and training as well as research. One of the ISRRT key strengths is the diversity and expertise of its members and leadership around the world.

As ISRRT President and on behalf of the ISRRT Board of Management we thank Emeritus Professor Peter Hogg and Ken Holmes for undertaking this global project for the ISRRT called, 'Radiographer reflections on the COVID-19 pandemic'.

Just to highlight, you will read about reflections from radiographers/radiological technologists from around the world who discuss how they adapted clinical practice in health intuitions to deliver a first-class imaging service while preventing spread of the virus. Additionally, you will hear from educators who adapted face to face lectures and teaching practices to facilitate online theory and practical modules despite the restriction of the pandemic.

I am immensely proud of the work that has been undertaken and thank each author for their valuable contribution and reflections to this historic journal in the history of ISRRT. You will both enjoy and learn from the experiences of colleagues.

Contents

Introduction

Ken Holmes and Peter Hogg

The rationale for producing this book is twofold. First, the International Society of Radiographers and Radiological Technologists (ISRRT) has not previously published a free to access book using a Creative Commons License [1]. Using this altruistic approach to publishing avoids the costs incurred by publishing companies, which can be large, and the payments to editors and authors. It therefore makes the publication freely available to anybody who needs to access it. A level financial playing field is therefore created which enables those who are at a financial disadvantage with a chance to access learning and information on the same footing as those who are financially secure. The approach taken here placed a zero financial burden on the ISRRT, as the authors, editors and reviewers worked for free. This book is a pilot for ISRRT to help them determine whether they would be willing and able to produce further publications on the same free to access basis.

The second reason for producing this book relates to COVID-19. During the first phase of the pandemic, the ISRRT worked in collaboration with European Federation of Radiographer Societies (EFRS) to produce a COVID-19 chest x-ray website, housed on the ISRRT eLearning platform and partly on the UK eLearning for Health (eLfH) facilitated by the UK Society and College of Radiographers (SCoR). The website(s) addressed an urgent need to provide free to access information, decision support and learning materials about taking and interpreting mobile chest radiographs on people suspected of having COVID-19, while at the same time protecting those who performed imaging from contracting the disease. The chest x-ray website was used in 157 countries and was said to have saved numerous lives across the world. On behalf of ISRRT and EFRS, we led the development of this initiative and towards the end of its development we agreed it would be valuable to follow on with a publication about radiographers' reflections on the pandemic. We felt a need existed for reflections to be captured from individuals who held a range of roles at local (e.g. hospital), national and international levels. We agreed that an initial compilation of such reflections could help

[1] https://en.wikipedia.org/wiki/Creative_Commons

radiographers start to identify lessons learnt from the pandemic for posterity's sake as well as helping to identify the kinds of proactive steps that might be needed in the event of another pandemic. On this basis we approached the ISRRT in October 2020 about a book proposal addressing radiographers' reflections on the pandemic and following their support a call was put out for people to contribute chapters to the book.

Returning to the ISRRT/EFRS chest x-ray website for a moment, it is worth mentioning that it was nominated and shortlisted for two major awards: 1. Times Higher Education (THE) Award for UK and Ireland. Here it was shortlisted from 600 nominations into the top 5 within the highly competitive 'International' category. To give some understanding of how prestigious and competitive the THE Awards are, it is worth noting that the overall winner at THE event was Professor Dame Sarah Gilbert[2] - Dame Sarah and her research team developed the Oxford/AstraZeneca COVID-19 vaccine. 2. Smarter Working Lives Awards (UK). Here, out of 300 nominations the website was shortlisted into the top 5. For both Awards, the nominations came from any subject and not just medically related fields, thus making both awards even more competitive. At this stage we would like to identify and thank all those who made the chest x-ray website and the two nominations possible – we have named all 60 people at the end of this introduction section under the heading 'Acknowledgement and thanks to those who made the COVID-19 chest x-ray website and its awards' nominations possible'.

This book contains 29 chapters from individuals and collaborations. Its 44 authors emanate from 13 countries and include contributions from the perspectives of student radiographers, radiography teachers/educators, radiography researchers, practicing radiographers, radiographer managers and retired radiographers, with the book *preface* being written by Donna Newman - President of ISRRT. Many of the authors are new to publishing and their contribution within this book, in some cases, represents their first publication.

Within this book, authors outline personal and professional experiences and perspectives about the COVID-19 pandemic, including lows, highs and perceived learning points. Most chapters have been written in collaboration with colleagues except personal reflections on

[2] https://www.timeshighereducation.com/news/times-higher-education-awards-2021-winners-announced?utm_source=newsletter&utm_medium=email&utm_campaign=editorial-daily&mc_cid=d3f904397f&mc_eid=fc1fd17c85

the pandemic. Chapter authors range from 1 to a team of 7. On examining the chapters, with education in mind, we note that teaching transferred quickly from face to face to online learning and brought with it several challenges and opportunities. One common opportunity involves the use of videoconferencing, which seems to have become commonplace. Clinical placements were disrupted, and learning challenged, and various solutions had to be put into place to enable this form of learning to continue. Access to learning resources and learning was very challenging in some countries during the pandemic and this was especially true in situations where internet access was poor or even non-existent. New clinical skills had to be developed in challenging environments for mobile chest radiography imaging and other roles within the hospital and sometimes outside the radiology department. Some frustrations with accessing clinical resources (e.g. Personal Protective Equipment (PPE)) is noted and the way in which COVID-19 vaccines have been administered to radiography staff could have been problematic if an unacceptable number of reactions had been encountered. Overall, it seems that many countries were not adequately prepared for the pandemic, both clinically and academically.

A reflection on producing this book

Given this is the first time the ISRRT has produced a free book we felt the need to reflect on the process which led to its production, to assist the ISSRT reach a decision on whether further books could be created on a similar basis.

Following approval from the ISRRT to create the book, the ISRRT advertised the opportunity for its members to be a contributor ('chapter author') to encourage people to put themselves forwards with a view to writing. As editors, we made suggestions to indicate what chapters they might focus on (e.g. including clinical, personal, student, teacher, researcher, manager) – however these were only suggestions, and anybody could write anything they wanted within reason. Once potential authors had identified themselves, we sent them guidance on how they should approach writing. We indicated that the 'writing style' would be down to authors and dependent upon what they had to say, thus first and third person were equally valid, and references were only needed if a more academic approach was to be adopted. Authors had to sign a disclaimer about their chapter, prior to publication, indicating the need for previously published work not to be included and in the event of a figure / photograph /

image having been already published then they would be responsible for seeking formal copyright permission to republish it in this book from the 'owner' (see 'author agreement disclaimer form', below).

Once chapter authors were identified we asked them to produce a simple bullet point list of the things they wished to include within their chapter. We then reviewed the lists and added comments for authors to consider as they developed their chapter. The process of commenting was completed again for penultimate versions of chapters, when Peter, Yudthaphon Vichianin and Stewart Whitley reviewed chapters and inserted track comments and track changes for authors to consider. Again, this was returned to the authors for them to consider when editing the final version of their chapter. When the final versions were returned, we reviewed chapters again, making final adjustments to prepare them for formatting into the book. The final edited versions were returned to authors to make sure they were happy and to request the author agreement form be signed.

Unlike all other stages of writing and publishing, compiling the book into the formatted style is something we had no prior experience in as this is normally completed by a publishing company. This part of the development process was a step into the unknown for us and something that concerned us throughout the whole process. We considered several freely available software tools for publishing this book [1,2] and in the end we took a pragmatic approach, using the facilities within Word (Office 365) to create it. The final product was exported from Word and saved in .pdf format. Our reason for selecting Word was pragmatic - we know many people who use Word on a regular basis and because of this we could ask them for help and pointers. This was not the case for the free software options. However, the free software options appear to give a more professional finish and if ISRRT move forwards to produce further free books then it might be valuable to select one of them and develop expertise in using it.

The book was ultimately published in two places:

- ISRRT eLearning platform
- University of Salford Open Access Information Repository (USIR).

Publishing the book into USIR allows compliance with international publishing law and good practice, as UISR complies with the required standards.

Author agreement disclaimer form

Author Publication Agreement ISRRT

Radiographer reflections on the COVID-19 pandemic

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This document should be signed by all chapter authors to indicate compliance with the above criteria.

Disclaimer

The views and opinions outlined in this book do not necessarily reflect those of ISRRT or the book Editors.

Acknowledgement

We should like to thank Stewart Whitley and Yudthaphon Vichianin who helped the book Editors (Ken Holmes and Peter Hogg) review draft book chapters. Stewart and Yudthaphon were appointed by ISRRT to take on this role not only to ensure information accuracy and appropriateness but also to ensure compliance, as needed, with relevant ISRRT policies. Thus, the review process was a quality control step to ensure information accuracy and appropriateness as well as ensuring chapters' contents conformed with cooperate ISRRT policy.

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Impact of COVID-19 pandemic on radiographers in Palestine

Hussein ALMasri, Anas Khateeb and Omar Rimawi

COVID-19 Pandemic in Palestine

The novel coronavirus (COVID-19), which started in Wuhan, China by the end of 2019, has caused a widespread concern. The COVID-19 pandemic posed a major health effect on the Palestinian community, especially among young people, women, those with lower economic status, and those living with high-risk people. Healthcare workers (HCWs) have great worries regarding their health and the health of their families. Additionally, they are worried about getting infected with the novel virus.

According to United Nations UN (2020), the ability of the Palestinian health system to cope with an expected increase in the number of patients remains severely deficient due to long-term challenges and critical shortages, particularly in Gaza Strip. As in the case of other places, the most vulnerable groups are whose conditions may warrant intensive medical care which include elderly people suffering from high blood pressure, lung disease, kidney failure, cardiovascular disease and diabetes. People living in refugee camps and other poor and densely populated areas across Palestine face a great risk of infection due to overcrowding and poor sanitation systems [1].

The UN (2020) report added the most urgent and indispensable, and still in shortage, items to contain the spread of COVID-19 pandemic and reduce the risk of death among vulnerable groups including: personal protective equipment (PPE), basic supplies for infection control, consumables and medicines for treating breath shortness, ventilators, heart monitors, recovery vans, portable X-Ray machines, and COVID-19 testing equipment. Hospitals across Palestine are facing a shortage of specialized intensive care unit staff**.** Radiographers, as a major force working in producing diagnostic images, are at a great risk of acquiring and transmitting infection due to direct contact with patients and imaging equipment.

This chapter focuses on the readiness of radiography departments in Palestinian hospitals during COVID-19 pandemic from a point of view of Palestinian radiographers. Additionally,

we shed light on the psychological impact of COVID-19 among Palestinian radiographers working within COVID-19 quarantine centers in Palestine.

Radiology Department Preparedness

It is found that the reality of the Palestinian health system is not isolated from the pandemic that has affected the world. Whereas the spread of COVID–19 viruses in Palestine was confirmed on March 5, 2020, when the Palestinian Ministry of Heath stated that the cases were first discovered in a hotel in Bethlehem between a group of Greek tourists visiting the hotel in late February and later on, two of them were diagnosed COVID–19 positive.

In order to tackle the pandemic, the government set its strategy based first on preventing the epidemic from reaching Palestine, then limiting its spread. The government sought to make this strategy flexible in making decisions focused on preventing the spread of the pandemic.

In order to achieve the principle of transparency, the Ministry of Health (MOH) worked to provide the public with accurate and continuous information about the pandemic in order to reassure citizens and prevent rumors. Accordingly, WHO praised the performance of the Palestinian government that took advanced measures to combat the spread of COVID-19.

Additionally, the MOH linked implementation mechanisms with the standards crisis management by planning and updating epidemiological maps, examining samples at the national level on a daily basis, and preparing quarantine centers to treat and follow–up cases. Also, MOH followed WHO health protocols to deal with infected cases and their surroundings and took the necessary measures to equip the medical staff including public safety measures.

The Palestinian MOH, like other world health organizations, was surprised at the second phase which began more fiercely and with faster spread. The MOH did not think that it would face such a challenge, especially in light of difficult conditions that the Palestinian Authority suffers from. Such a challenge requires huge capabilities, greater resources and large medical staff in addition to well- developed infrastructure.

However, the Palestinian MOH faced the challenge with efficiency that the world witnessed. The crisis was managed with great wisdom and tremendous efforts made by medical practitioners, nurses, paramedics, and health staff on a basis of a coherent plan aimed at increasing test capacity to reach 20,000 samples, increasing hospital capacity by 200

additional beds, in addition to disseminating guidance and awareness messages showing preventative measures and how these effectively protect against virus infection**.**

In times of disasters, epidemics and pandemics, schools and universities are disrupted countries announce curfews, air traffic and travel stop, markets stagnate, and warning shouts rise: "Stay at home, and protect yourself." Cries that may work with some, but not for health sector workers. Medical practitioners, nurses, radiographers, and administrators find themselves in the front lines, on the line of fire.

The infection that healthcare workers may be exposed to is one of the important health issues that outweigh other sectors. Healthcare workers move between patients; thus, the disease might be transmitted to uninfected populations. Moreover, they might transmit the infection to their families upon returning home. Therefore, protecting health care workers from infection is an utmost necessity.

The world celebrates the efforts of health care workers in COVID-19 whose role can't be denied. The radiology department plays a significant role in COVID-19 diagnosis through chest X-rays radiography and to a lesser extent chest CT scans. On the national level, Palestinian hospitals whether in the West Bank or the Gaza Strip, have not been able to rehabilitate radiology departments or increase the equipment required to confront COVID-19.

Departmental Protocols and Guidelines

The location of a radiology department in most hospitals, in some countries and in Palestine is found mostly in the basement, which lacks ventilation or the entry of sunlight and hence providing a fertile environment for the COVID-19 to live and spread.

The MOH took several measures and requested healthcare workers to apply the following actions during their presence in hospitals**:**

- The MOH held several sessions explaining how to deal with suspected or infected COVID-19 patients.
- The MOH worked to provide the supplies needed by radiographers such as protective clothing, facial masks, and medical gloves.
- Continuous sterilization of hospitals and departments using sterilizers and disinfectants.

- Reduce friction between medical staff though adopting instructions on how to move between departments and the importance of spacing between medical staff.
- Making it compulsory to use a protective suit when making an X-ray or a CT procedure.
- Focusing on disposing of radiology department waste according to the protocol of the Palestinian MOH.
- Sterilizing the radiography room after each patient, whether suspected or confirmed infected.
- Removing some seats from the waiting hall in order to achieve accountability for the spacing between patients.
- Allowing only necessary patient companions while they are in the radiology departments.
- Washing hands frequently after each radiography procedure, and applying sterilization inside the imaging room.

Personal Protective Equipment PPE

The MOH provided hospitals with PPE including: medical protective clothing, surgical cap, N95 mask, gloves, face shields, and goggles to all health care staff. In case of interventional radiological or neuroradiological procedures, the following PPEs are always available: double sterile gloves, facial masks, waterproof gown, sterile surgical gown, and using a transparent facial mask for eye protection.

Radiology Equipment Availability

Chest X-ray imaging

A chest X-ray is used to assess the status of COVID-19 for patients suffering from respiratory symptoms**.** The suspected patients were identified according to the Diagnosis and Treatment Program of the Novel Coronavirus Pneumonia, mainly based on epidemiological history. X-rays are also used to monitor disease progression and make decisions about treatment and follow up such as hospitalizing a patient or sending a patient with severe symptoms for a CT scan. All Palestinian MOH hospitals are equipped with routine general purpose and portable X-ray machines.

Chest Computed Tomography

Chest CT plays an important role in both diagnosing and categorizing COVID-19 on the basis of case definitions issued by the World Health Organization. Suspected COVID-19 patients may undergo chest CT. Isolation and barrier procedures are necessary to protect both the radiographers and other patients. All Palestinian MOH hospitals are equipped with CT machines. One of the problems of CT was its limited availability and the length of time each procedure took for imaging COVID-19 patients as the machine and its room also had to be decontaminated carefully. Thus, while CT played an important role it was chest X-rays, particularly portable, which had the lion's share of radiology's contribution to diagnosing and staging the disease.

Emergency Training and Isolation Centers

The MOH followed WHO health protocols to deal with cases and their surroundings, and took the necessary measures to equip the medical staff including public safety measures**.** The emergency management and infection control measures implemented in the radiology department during the outbreak have been approved by the infection control committee of MOH hospitals. These measures are in accordance with relevant laws and regulations to protect patients as well as radiographers. The radiology department staff working in isolation centers received emergency training and shared the following responsibilities:

(1) coordination between the hospital's management, infection control division, and radiology departments; (2) collecting up-to-date protection-related information to educate and train radiology department staff; (3) reallocate radiology staff according to the real situation; (4) establishing CT procedures for COVID-19 patients; and (5) establishing an emergency management plan for the radiology department to assure smooth workflow.

In order to provide medical care for confirmed and suspected COVID-19 patients, all hospital staff were required to wear complete PPE: medical protective clothing, surgical cap, N95 mask, gloves, face shields, and goggles. Wearing and removing of the equipment must be performed in accordance with the MOH procedures.

Working in the contaminated area poses much situational pressure on radiographers and other medical staff, therefore, a periodical off duty could lower their physical and mental

stress levels. Radiographers working in isolation centers worker for an 8-hours-shift, five shifts per week, then provided a break once a week. In addition, they were closely monitored for the symptoms of COVID-19.

Psychological Stress among Radiographers

The COVID-19 outbreak caused a huge psychological stress for healthcare staff who worked under great pressure during the pandemic. Frontline health care workers (HCWs) have come under tremendous stress and risk of contracting COVID-19 since the start of the quarantine. At the beginning of COVID-19 pandemic, 29% of all hospitalized COVID-19 patients were infected healthcare workers. This situation forces health care workers, including radiographers, to undergo an essential reorganization in the form of staffing, resources, working processes, and job allocation, which is similar among reported radiation oncology professionals.

Dealing with COVID-19 Patients and Overcoming Stress

Radiographers as healthcare front liners, undergo huge anxiety and stress while serving the community, in addition to the fear of getting infected with COVID-19. Stress among 61 Palestinian radiographers working at various quarantine centers was assessed using a stress-induced cognition scale (SCS) questionnaire. Stress among radiographers was higher than average. Results show statistically significant difference between radiographers who work directly with COVID-19 patient when compared to those who work indirectly (T 4.61, $p = 0.00$)[2]. The level of stress increased for married and parent radiographers compared to single or non-parent radiographers. Additionally, radiographers who worked for longer periods with COVID-19 patients showed higher levels of stress (F 5.79, $p = 0.005$)[2]. It is essential to provide psychological aid for radiographers who are working in COVID-19 quarantine centers to reduce and relieve stress.

Stress Assessment in Palestinian Radiographers Working in COVID-19 Quarantine Centers

The level of stress among Palestinian radiographers working in COVID-19 quarantine centers was above the average. Increased levels of psychological stress, fear, and anxiety is expected in radiographers working directly and closely in the diagnosis and treatment of COVID-19 patients compared to radiographers working in other radiology divisions, since direct work

with COVID-19 patients means high risks for healthcare workers and apparent symptoms of depression, anxiety, insomnia, and distress[3, 4]. Also, since it is a new virus which spreads in a pandemic way, there were no national previous knowledge, training, and arrangements for radiographers to work with infected people, which consequently increased stress levels among radiographers. Additionally, radiographers involved in the diagnosis and treatment COVID-19 patients face various sources of stressors related to virus spread, own and their family's health, and changes of the work environment[4-8].

Available Psychological Support for Radiographers

It is important to provide counselling for radiographers working in COVID-19 quarantine centers. Palestine has no psychological support and counselling services for healthcare workers. An available method for offering psychological treatments is the form of cognitive behavior therapy (CBT) delivered to healthcare workers via the internet, which can help in preventing the spread of infection. According to[9], CBT can improve stress management by coping with stressful situations and avoidance of hostile confrontations. Internet CBT was found to be effective in treating individuals with depression symptoms such as post-traumatic stress disorder [10]. It is expected that Internet CBT could be expensive to implement. However, it can be performed using Moodle, which is an open-source learning environment used to deliver electronic forms of therapies [11]. Our study was shared with the Palestinian Ministry of Health to illustrate the importance of providing psychological counselling and support in the form of Internet CBT for radiographers working in COVID-19 quarantine centers, which will assist in keeping their mental and psychological health, both currently and in the future [2].

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Researching in a pandemic – a non-starter or unmissable opportunity?

Andrew England and Alexandra Partner

Introduction

The challenges of the SARS-CoV-19 virus and the resultant global pandemic are all too familiar. Responding to the threat of the virus has become the everyday role of the radiographer. Initially, there was widespread anxiety and speculation that healthcare systems would become overwhelmed[1]. For most countries this has not been the case, however, coronavirus has led to a significant change in how we practice radiography and how we teach student radiographers. With dedicated COVID-19 hospitals being established in record time[2] and the implementation of national vaccination programmes[3], the availability of radiographers to undertake frontline COVID-19 related activities was a priority. Government based healthcare research organisations, such as the United Kingdom (UK) National Institute for Research, recommended suspension of all but only essential COVID-related research[4]. Radiography education also required rapid redevelopment to facilitate a need for remote learning and to help manage a reduced access to clinical placements[5,6]. As a result, and early in the pandemic, there was a real threat to the continuation of radiographic research.

Despite prior concerns, radiographic research in the pandemic has flourished and journals such as Radiography have seen an enormous increase in the number of submissions, 223 in 2019 versus 420 in 2020, up 88%[7]. Many of these were COVID-19-related, however, a significant contribution to journal submissions was from non-COVID-19 related research. What looked like a pause in radiography research has resulted in a surge of research activity. Submissions to Radiography came from all around the world and included the full range of subspecialities (medical imaging, radiation therapy and nuclear medicine).

Despite the increase in the number of submissions and resultant publications, research during the pandemic has been far from easy. Many non-COVID-19 studies that had been planned immediately prior to the start of the pandemic had to be postponed. In many cases, priority

for resources has been given to COVID-19 related research[8]. Those that continued are likely to have experienced difficulties in recruitment, availability of cases and restrictions due to additional COVID-19 safety precautions. Studies may have failed to meet recruitment targets or have become vastly behind schedule. The COVID-19 pandemic may have further affected the way researchers conduct their projects, with suspension of data collection or re-design of projections allowing for social-distancing measures or removal of face-to-face methods all together[9]. Financial support may have been withdrawn, suspended or reduced as organisations tried to mitigate the effect of the global pandemic. By way of an example, Cancer Research UK cut £45 million from its research budget in 2020, this was a consequence of the charity battling the effects of COVID-19 and the resultant reduction in income[10]. Alongside the challenges with the practicalities of conducting research, clinical radiographers were found to be suffering with burnout from working during the pandemic[11]. Front line clinical service staff were not the only ones to suffer, the demands of continuous cognitive and emotional stress, academics have been under increasing pressure due to redundancies, increased workload and financial restrictions[12] creating a less than optimal arena for research to flourish.

The COVID-19 pandemic has also brought with it questions about the demand on radiology services, the safety of radiology staff members and the utility of imaging in diagnosing and managing COVID-19. Many global radiography practitioners were quick to share their experiences[13] and also investigate wider health and wellbeing issues[14,15] relating to working in healthcare during the pandemic. The rapid pace of COVID-19, in many cases, did not permit prospective formal evaluations of new initiatives, such as personal protective equipment (PPE) efficacy. Despite this, a number of retrospective evaluations have been submitted and subsequently published (Table 1).

Table 1. Sample of COVID-19 related publications in the Radiography journal.

Author(s)	Year	Area	Title
Strudwick, Cushen-Brewster, Doolan, Driscoll-Evans	2021	Education	An evaluation of the experiences of academics and practice educators who supported radiography students working on the temporary HCPC register during the COVID-19 pandemic.

Clough, Sanders, Banfill, Faivre-Finn, Price, Eccles, Aznar, Van Herk	2021	Clinical (Radiation Therapy)	A novel use for routine CBCT imaging during radiotherapy to detect COVID-19
Yasin, Barlow, Milner	2021	Professional	The impact of the COVID-19 pandemic on the mental health and work morale of radiographers within a conventional X-ray department
Ng	2021	Education	A review of the impact of the COVID-19 pandemic on pre-registration medical radiation science education
Akudjedu, Mishio, Elshami, Culp, Lawal, Botwe, Wuni, Julka-Anderson, Shanahan, Totman, Franklin	2021	Service Delivery	The global impact of the COVID-19 pandemic on clinical radiography practice: A systematic literature review and recommendations for future service planning
Pereira, Silva, Freitas, Salgado	2021	Professional	Burnout among Portuguese radiographers during the COVID-19 pandemic
Vicini, Panvini, Bellini, Rengo, Ciotola, De Vivo, Gambaretto, Caldon, Del Borgo, Carbone	2021	Clinical (Medical Imaging)	Radiographers and COVID-19 pneumonia: Diagnostic performance using CO-RADS
Brogna, Bignardi, Brogna, Alberigo, Grappone, Megliola, Salvatore, Fontanella, Mazza, Musto	2021	Clinical (Medical Imaging)	Typical CT findings of COVID-19 pneumonia in patients presenting with repetitive negative RT-PCR
Alsharif, Qurashi	2021	Clinical (Medical Imaging)	Effectiveness of COVID-19 diagnosis and management tools: A review
Ruiz, Llopis, Roman, Alfayate, Herrara-Peco	2021	Professional	Spanish radiographers' concerns about the COVID-19 pandemic

Reflecting on our own experiences of undertaking COVID-19 research, questions should arise when implementing new initiatives into clinical practice. These evaluations are especially important when there is the potential to alter the radiation dose and resultant image quality from X-ray examinations. One important consideration was the effects of undertaking mobile X-ray imaging through side-room doors and windows. Outside of the COVID-19 pandemic this would not be considered normal practice without well accepted justification. Several authors[16,17] have suggested that irradiating through glass partitions within side-room doors is

acceptable and could be a valid initiative to reduce the risk of cross-infection. Whilst supporting the notion of protecting staff and additional patients, this should not come with a cost of increasing the radiation dose and / or reducing image quality. Our study, therefore, sought to evaluate a new technique which resulted from the additional need to prevent cross-infection during COVID-19. Despite an overarching need to evaluate this intervention, research integrity was still a priority and a fundamental professional responsibility. Not wishing to add to the burden of hospital ethics committees, and also accepting the guidance of only focusing on essential COVID-19 studies, we opted to undertake a bench experiment using a phantom. Dose and image quality optimisation studies have a long track record of being conducted in similar circumstances. Our research team believed that a successful study could be undertaken away from clinical practice, but still provide valuable and meaningful practice data.

Our study 'Modifications to mobile chest radiography technique during the COVID-19 pandemic – implications of X-raying through side-room windows' was published in February 2021 (**Figure 1**)[18]. Results did appear to broadly support those who had reported this initiative earlier in the pandemic. Irradiating through side-room windows is feasible but does require an increased X-ray tube output and there is empirical evidence of a slight reduction in physical image quality. The clinical significance of such reductions will require further evaluation and emphasizes our concerns regarding 'appropriate' evaluations of any changes to clinical practice. Such questions that still remain include 1) evidence that such modifications to radiographic technique do reduce the risk of cross-infection, 2) the life of the X-ray tube is not prematurely reduced and 3) that subtle pathology is not masked or mimicked on the resultant image.

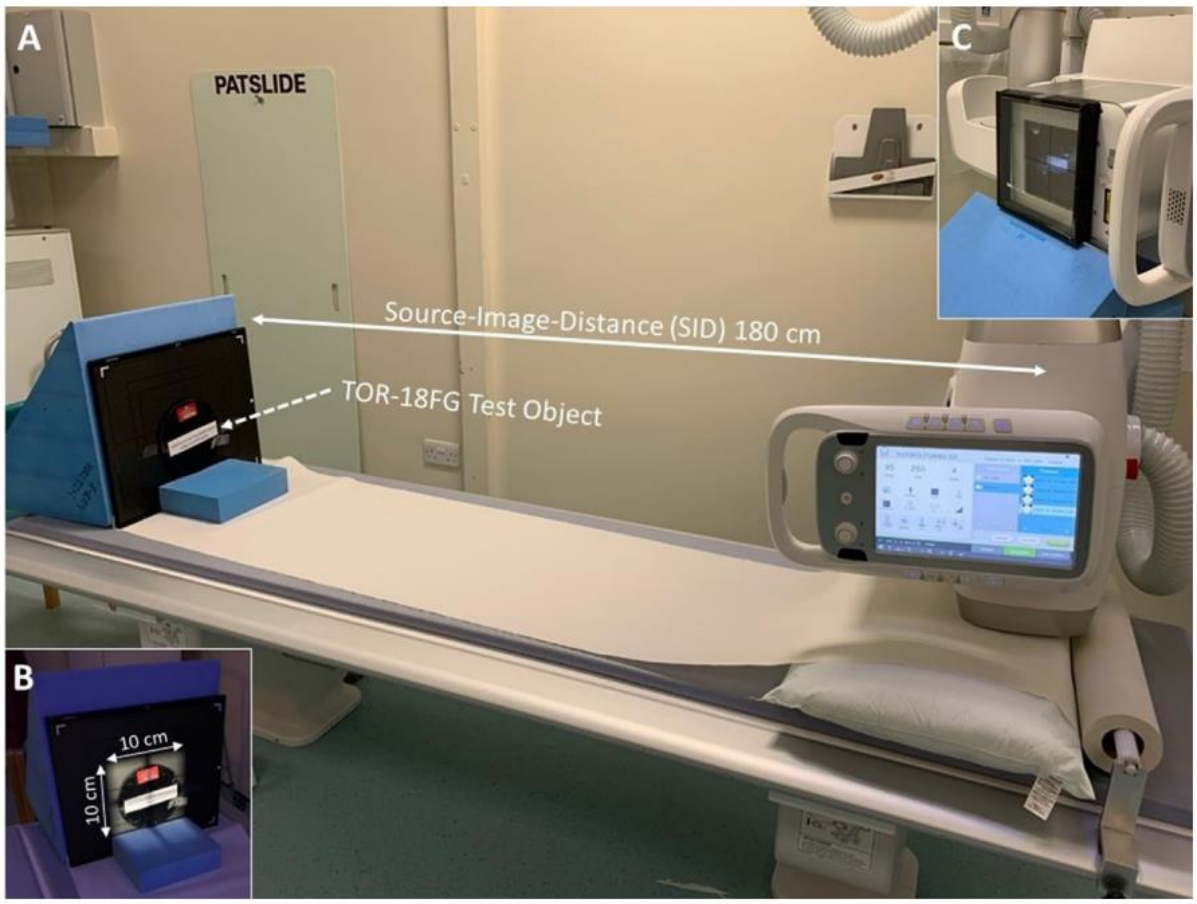

Figure 1. Experimental set-up of the equipment for the experimental study evaluating the efficacy of undertaking mobile X-ray examinations through side-room door windows. *Reproduced with permission from Elsevier (images from Radiography).*

COVID-19 has brought and continues to generate challenges for the radiographic community. One of the huge successes from COVID-19 is that it appears to have acted as a catalyst for radiography research. Journals, such as Radiography, have seen huge growth in the number of quality submissions and these have been both COVID-19 and non-COVID-19 related, covering our entirety spectrum of practice. It is encouraging for our profession that when faced with the many obstacles the pandemic has provided, our colleagues grasp opportunities for development and push forwards. It is hoped that such growth and prominence will act as a driver to help continue the development of the evidence-base for radiography. Such developments will increase the standing of our profession but more importantly drive up the quality of care for our patients. In conclusion, the COVID-19 Pandemic has provided an unmissable opportunity for radiographic research, and long may this research journey continue.

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Investigation of Radiography student experience of working and studying during a pandemic

Deirdre Attinger and Julie Woodley

Introduction

Clinical practice is an important aspect of all Allied Health Professional courses. Practical experience as a source of learning is underpinned by the seminal theory of Kolb[1]. This is referred to as 'Experiential Learning' and is defined as the process of learning through 'hands-on' or 'actually doing tasks'. The value of this teaching is well documented as being superior in comparison to didactic teaching alone[2-4.] Placement nurtures 'practical wisdom'[5] and students benefit from experiencing a 'community of practice', providing an opportunity to watch, learn and carry out tasks under supervision.

Any disruption in placement hours may adversely affect student learning outcomes, satisfaction, and ultimately the timing of their graduation. Placement change decisions, made as a result of COVID-19 may have had a profound impact on the future supply of radiographers and health care professionals. Any significant losses could ultimately weaken healthcare systems[8].

In response to the UK-wide lockdown, universities continued their teaching programs online and also carried out practical sessions in a COVID-19 compliant manner at the university campuses. Thus providing an approach which utilises 'Blended Learning'[9].

As a result of COVID-19, conditions on clinical placement were very different, so it seemed sensible to seek the opinions of the students whose normal routine was affected by the pandemic.

Method

This project conducted focus groups, due to time limitations and the richness of the data that they generated. Students were able to share experiences and opinions, adding a more meaningful and rich understanding of the topic.

The main topics of the focus group schedule were:

1) Exploring students' feelings about experiencing an abrupt end to radiography placement and missed hours within clinical placement.

2) Investigating any thoughts or comments in relation to completing remote or online learning.

3) Discussing any concerns relating to returning to placement during the COVID-19 pandemic.

Participants were selected from the 2018 cohort of radiography students at UWE. These were the students on placement when the first UK lockdown commenced. They had the required experience needed to answer the set questions and recordings were made of their discussions. The recordings were transcribed verbatim and then the Braun and Clarke[10] framework for thematic analysis was utilised, as this is a widely recognised approach. The method is flexible and capable of providing a rich and detailed account of focus group data.

Results

The data from the transcriptions were analysed and themes and subthemes emerged. To understand the main issues the data was organised into pictorial mind maps:

Figure 1: Mind map demonstrating phase 3 thematic coding (section 1)

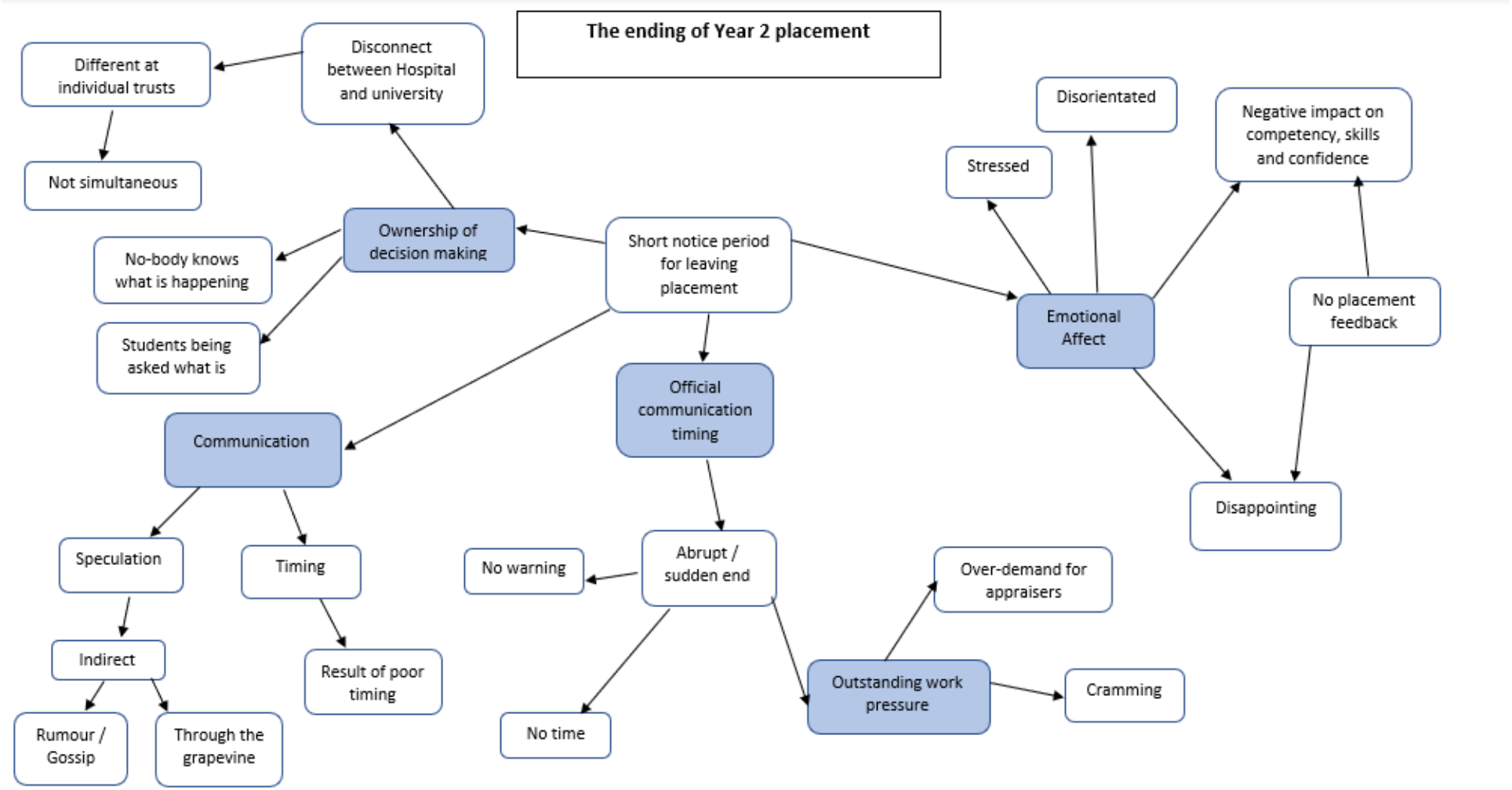


Figure 2: Mind map demonstrating phase 3 thematic coding (section 2)

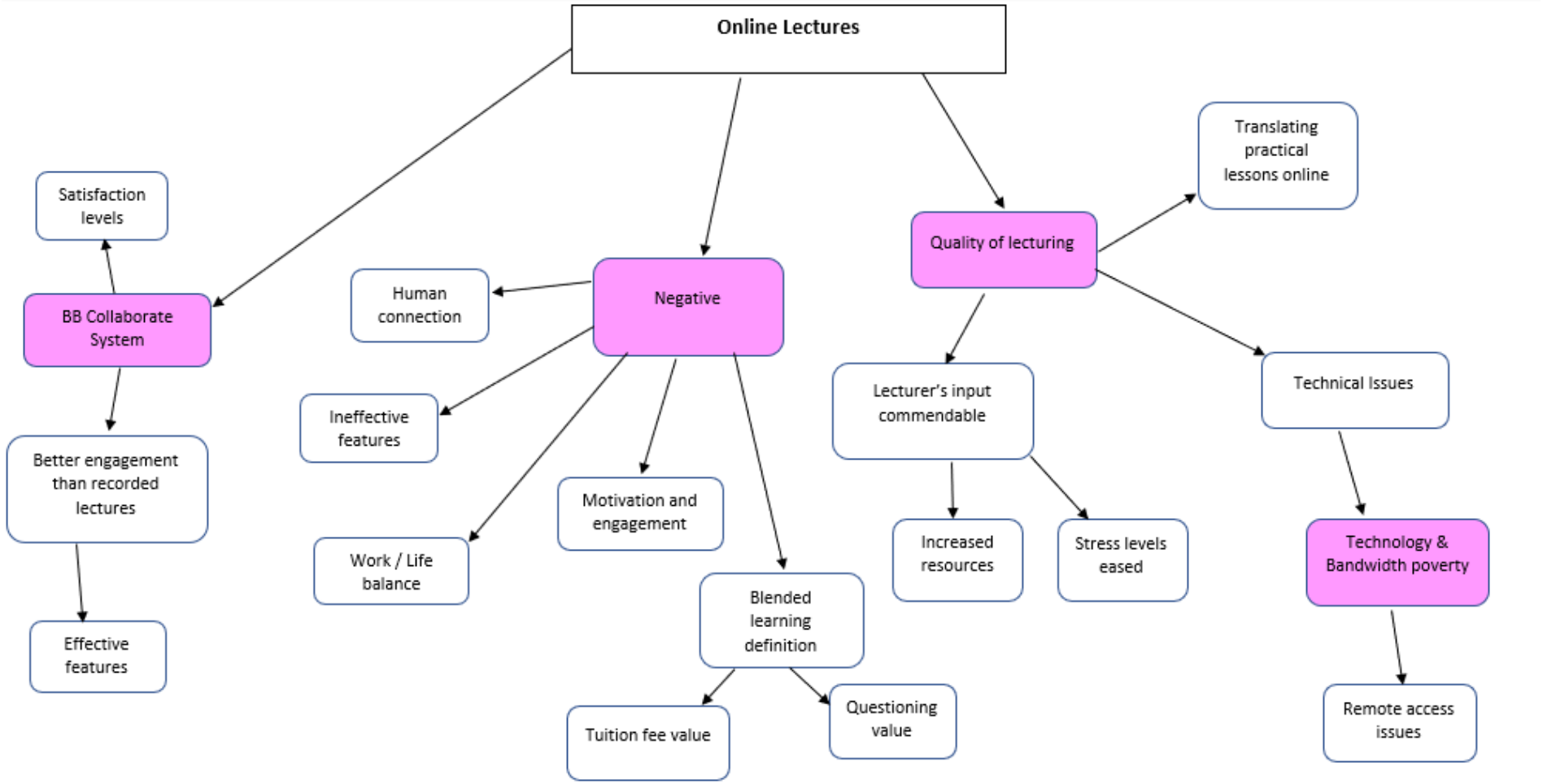
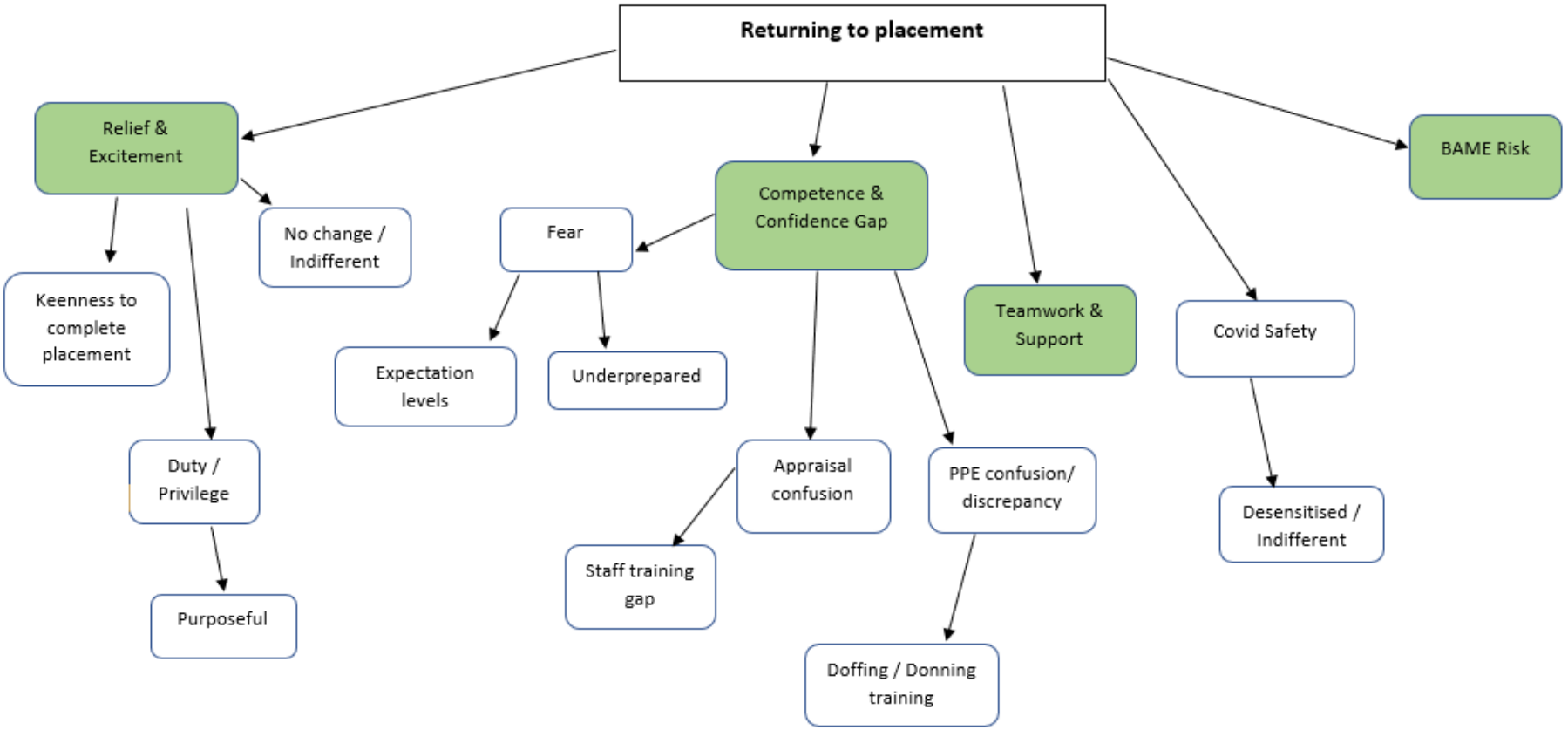


Figure 3: Mind map demonstrating phase 3 thematic coding (section 3)



The mind maps suggested 3 main topic areas which were then supplemented with indicative quotes.

Theme *A: End of Placement*

Analysis into how students felt in relation to an early end to clinical placement and missed placement hours revealed three main themes: (1) decision making absence; (2) clear communication wish; and (3) anxiety.

A1 - Decision making absence

Many students felt that they were waiting on either their placement hospital or university to take ownership of deciding whether students should leave placement or not. They spoke of there being no 'connect' or a 'miscommunication' between the university and hospitals, adding that they wanted a definitive answer regarding what was to happen and for someone to take charge.

"The university said it was up to the trust that we were on placement with, and so we just kept waiting on the trust, and the trust told us that we should wait on our lecturers."

A student even discussed emailing the university themselves:

"This is what the trust has said, this is what you've said, can you communicate for us."

Students were also aware of either being sent home from placement before other students and feeling that this was 'unfair' or 'quite difficult'. They reasoned that there had not been a 'solid decision' that was consistent across all placement sites.

A2 - Clear Communication Wish

Students described receiving information regarding placement indirectly. Rather than from university or placement management, it was via 'rumour' and 'through the grapevine' from other staff members. The students expressed that they wanted official communication, however described 'a lack of communication' or it eventually arriving very late without 'any warning'.

"I just think it was [sic] lack of communication, just the suddenness of things. It left everybody scrambling and it just wasn't a good way to finish really."

The timing of the official communication was criticised as the students felt that it was 'abrupt', with very short notice and leaving them feeling 'disorientated'.

"We got that email literally the day before telling us to get out."

A3 - Anxiety

Students unanimously discussed feeling 'anxious' or 'stressed' during the closing end of placement. This was mostly attributed to feeling rushed to complete placement and finalise any outstanding work, however being unable to achieve this due to the lack of available appraisers.

"Anxious about getting everything done, like the appraisals, the academic work."

Another element that caused anxiety in was feeling that leaving placement early would have a negative impact on their 'competency' in practice. This resulted in a student feeling 'concerned' about going into third-year placement, as their confidence had been knocked. Furthermore, one student in particular felt 'disappointed' that they had not received their individual placement feedback from their key practice educator too.

"I feel that not having that feedback, you went into third-year placement not knowing if you were competent or not really."

Theme B: Online Learning

Analysis of comments regarding remote learning revealed two main themes: (1) online adaption issues and (2) online quality.

B1 – Online adaption issues

Firstly, most students discussed difficulties with adapting to online learning, for several different reasons such as: issues with 'motivation', 'engagement', having to balance learning with family commitments, and even simply missing 'face-to-face problem solving' whilst being alone with learning.

"I really struggled to engage with any of it to be honest. When you've got children at home and you've got to do exams and lectures, it's just really hard."

Also:

“I think they've done a good job of trying to get the content out to us. But I think it's just really hard to motivate yourself.”

Secondly, all students unanimously agreed that they were not receiving blended learning and that it was online learning only. In response to this, some also questioned the value of the lectures in terms of the tuition fee costs. The perceived value of course delivery was lowered, one student even described the whole student experience being lowered.

“Completely online kind of takes away from the experience of being a student. I don’t really feel like I’m getting what I’m paying for. I don’t think it’s terrible, but it’s just not worth it”

B2 - Online quality

Most students agreed that lecturers did a ‘commendable’ job delivering the required content. Discussion was positive on this topic however they noted that some topics simply did not translate well to online learning, specifically practical learning subjects. Overall, teaching was found to be ‘satisfactory’, ‘effective’ and ‘convenient’ due to its flexibility. Furthermore, students recognised that lecturers were doing the upmost to relieve stress and have ‘increased resources’ available to students.

“I do commend the lecturers for doing their best and still showing that they are always there to support students who are struggling.”

Also noting that:

“I think they're doing the best they possibly can really under the circumstances.”

Despite the best efforts of lecturers, students reported several technical issues with the main online system. One student also mentioned that the internet within their student accommodation could not meet the ‘bandwidth demand’ of all housemates. The term ‘IT poverty’ was also mentioned.

Theme C: Returning to Placement

Analysis of any student concerns relating to returning to placement revealed four main themes: (1) relief and excitement; (2) competency worry; (3) effective teamwork and; (4) Black, Asian and minority ethnic (BAME) risk.

C1 – Relief and Excitement

Students shared their 'excitement' and 'relief' about returning to placement. Additionally, realising that there would be no delays to their course end date was 'pleasing'. One student worked as a hospital care assistant (HCA) therefore felt prepared for working in hospital. Other students felt 'indifferent' working during a pandemic, and one even stated that it was 'a great privilege' to work too. Apart from one exception, students felt 'de-sensitised' about the COVID-19 risk.

"I'm not worried about COVID. I think we all don't have any concerns about that… it's part of the routine it's just, it is what it is now."

C2 – Competency Worry

Despite the excitement of returning, students mentioned they would be expected to work more autonomously with a higher level of clinical competence. This resulted in pressure and apprehension. Additionally, placement staff had not been correctly briefed on new continuous appraisals, resulting in staff 'confusion' and students having to explain the new documentation. A level of worry was also discussed when noting a noticeable reduction in 'patient footfall' whilst still needing to meet logbook requirements.

"A bit nervous going back in. I felt because we're third years, we're supposed to know a lot, I didn't feel like I knew enough - I would be judged by that."

C3 – Effective Teamwork

Although students initially were apprehensive about returning to placement, they discussed being 'very lucky' with how supportive the staff were, and felt their time there was more purposeful. Students were given the option of whether they wanted to complete examinations with patients who were COVID-19 positive, allowing them to feel safe.

"I think because of everything that's going on, everyone pulls together a bit more work, people work more of a team. So, for me, it's almost been a better placement due to COVID."

Despite feeling 'indifferent' regarding the COVID-19 risk whilst on placement, according to most students, confusion regarding what items and how much personal protective equipment

(PPE) was common. Students noted a mismatch in the radiology department, on wards and in theatre. It was apparent that they felt this should have been more 'consistent'.

"They go on about PPE all the time and I felt as radiographers we wore all the PPE, like we were coming from another planet, if you would go to a ward where there were COVID patients, the nurses wore hardly anything."

C4 – BAME risk

One student suggested that due to their ethnicity, they experienced more anxiety regarding a return to placement than the 'average person'. The cause of this was attributed by media coverage of COVID-19 as they felt that they were 'more susceptible' to the infection.

"Because I am a black girl, a black woman, I was quite anxious about coming in contact with COVID patients."

Discussion

Firstly, this study set out with the aim of exploring students' feelings about experiencing an abrupt end to radiography placement and the subsequent missed clinical placement hours. COVID-19 had both a negative and positive impact on students. As a result of leaving placement abruptly, the negative impact of this was reported in three key themes: poor communication, high levels of anxiety, and reduced clinical competency.

Students expressed a negative impact on their mental health and confidence, this result builds on existing literature findings by McAnulla et al.[11]concerning poor clinical placement experience. Her research findings suggest attrition is most likely to be multi-factorial, therefore, themes such as an absence of decision making and a wish for clear communication to be provided, could indeed contribute to an increased student attrition rate. However, in this instance, the positive themes reported from this study are more predominant. Students valued the strong team relationships and collaboration on placement, suggesting that it was more apparent than on previous placements. A key theme in this study was 'effective teamwork', this demonstrates the importance of vocational experience in radiography. This result is consistent with the literature by Kolb[1]relating to his 'experiential learning' theory precisely.

Students expressed that collaborating with staff members during such difficult circumstances provided a sense of belonging that the whole team was 'pulling together'. Additionally, as a result of expressing fears relating to imaging patients who were at high risk of COVID-19 and being given a choice of whether they were happy to or not, demonstrated how this consideration by placement staff contributed to students feeling important and valued. These aspects resulted in an overall opinion that placement hours were purposeful. Thus, supporting evidence from previous observations regarding clinical placement value[2-4]; The importance of placement is clearly expressed by the students in this study, this result contributes a clearer understanding of this.

Gill et al.[12] described medical students in this period as the 'COVID-19 generation' and suggested that students are embedded, welcome students in healthcare settings. The findings of this study also corroborate this positive impact. Students are strongly invested in their learning, were keen to fulfil their competencies, and were eager to graduate. A key theme from this study was 'relief and excitement' which supports the literature, furthermore, students expressed a sense of pride in working during COVID-19. An implication of this is the possibility that these radiography students may be a more resilient, tenacious and an experienced medical workforce in the future.

The second aspect of this study aimed to investigate student feelings on switching to remote or online learning. A key theme identified was online adoption issues, this result is consistent with the barriers discussed in the literature published by Vavvasseur et al. and Regmi and Jones[13]. The authors identified 'poor motivation and expectation' as a barrier to online studying, and students of this study agreed. Regmi and Jones[14] did not identify a further reason expressed in this study however, concerning online learning whilst providing family care and home-school commitments during the lockdown period. This finding supports the association between parental status and raised anxiety levels in alternative observations by Savitsky et al.[15].

Regmi and Jones[14] also identified a barrier concerning some disciplines as being unsuitable for online learning, such as 'practical or demonstrative' subjects which are difficult to execute remotely. In agreement with this, the students expressed that some topics did not translate well online too. This is a factor included in the 'online quality' theme in these results. This

finding is also consistent with the Jowsey et al.[16] study suggesting that well-planned and purposeful lessons are imperative for making a positive impact online.

Several socio-economic factors discussed in this study such as 'IT poverty' and bandwidth issues in shared accommodation, contributed to the theme around 'online quality'. These correlate with findings in the meta-analysis completed by Fontain et al.[17]. He discussed that insufficient technical resources prevented students from meeting learning goals. This highlights the importance of the extra resources made available to students during this period from UWE such as the 'Digital Capability Scheme'[18]. The students in this study noted the increased assistance available to them.

The 'online quality' theme also suggested that students had an affinity towards the course providers, commending them for their efforts in delivering the course despite the circumstances. However, refuted the suggestion that UWE had provided 'blended learning' during the lockdown period. Sadeghi et al.[19] concluded that effective blended learning increased student satisfaction levels, therefore as the students in this study unanimously agreed that they were receiving online lessons only, this may explain their dissatisfaction and even undervaluing the course and student experience. These findings may help to understand why there is a record number of student complaints made against universities in 2020[20] and the statistics concerning dissatisfied students found in the COVID-19 Insights Survey[21].

The final aspect of this study discussed concerns relating to returning to placement during the COVID-19 pandemic. One theme identified was 'BAME risk'. A student expressed worry about being more susceptible to COVID-19 due to their ethnicity, causing anxiety and fear in returning to placement. Evidence suggests that currently, COVID-19 has a disproportionate impact on BAME groups[22], the student's fear was therefore justified. This finding is consistent with Savitsky et al.[15] concluding that fear of infection caused a reluctance to attend clinical placement.

Evidence from Savitsky et al.[15] and Surrati et al.[23] suggest that a lack of clear infection control measures and training caused anxiety in students attending clinical placement, this is supported by the findings in this study. Within the 'effective teamwork' theme, students expressed confusion regarding the correct level of PPE to employ and noted confusion experienced by other hospital staff and different departments too. These findings are

disappointing as having consistent PPE protocols may have easily prevented this anxiety and lower the risk of infection.

Competency worry was a further theme concerning the return to clinical placement. Students expressed factors such as a perceived expectation to work more autonomously and noting the reduced level of examination requests. This issue was evident in findings by Teo et al.[24] that suggested understaffed departments with lower cases may reduce the time available for training and practical experience. This supports the importance of effective teamwork and collaboration at placement sites.

The study findings in relation to negative themes such as 'BAME Risk', 'Competency Worry', 'Anxiety', and 'Clear Communication Wish' may be an implication to why the Society of Radiographers[25] expressed the importance of ensuring the emotional wellbeing of student radiographers on placement. These themes also form the basis of the subsequent study recommendations.

Conclusion and Recommendations for policy, practice or further research

This study identified key themes that negatively impacted students; the following recommendations may mitigate against these if a pandemic scenario such as COVID-19 or a national emergency lockdown occurring again in the future.

- The creation of a clear, synchronized communication channel for disseminating information and placement instructions to radiography students on placement at all hospital sites.
- A UWE PPE pandemic protocol, a standardised list of equipment that all UWE radiography students must adhere to across all placement hospital sites.
- An online de-brief session included - on the placement module - where the cohort of students can be advised on circumstances relating to the course and an opportunity for questions and answers.
- Relevant hospital site staff to have comprehensive training and/or briefing on new appraisal documentation.
- Raise awareness of extra funding opportunities for students such as the UWE Digital Capability Scheme.

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Continuing Professional Development (CPD) and the Implications

Azizah Mohamed Afif

The COVID-19 pandemic changing education

COVID-19 emerged at the end of December 2019 and was declared as a global pandemic on 11 March 2020. The severity of COVID-19 symptoms varied from asymptomatic to life-threatening conditions for the elderly and those with chronic illnesses. The condition resulted in the initiation of lockdowns in many countries worldwide following the recommendations of the World Health Organization, in their attempts to flatten the epidemic curve. Hospitals struggled to cope with capacity limitations, dwindling medical resources and enduring pressure for optimal management in the delivery of care. Physical segregation of care teams was initiated in many hospitals to prevent cross-transmission.

With diagnostic imaging emerging as an integral component for COVID-19 diagnosis and treatment protocols, diagnostic radiographers faced vast changes to their roles as frontliners. During the pandemic peak, non-urgent work was reduced in many countries to support the need for frontline activation. Radiation therapists adopted fractionisation techniques and new protocols to reduce the possibility of cross-transmission.[1, 2] As the workforce faced manpower shortages due to segregation, retired and locum Healthcare Professionals (HCP) were requested to return to support the workforce. Despite their wealth of experience, the return of retired or senior HCP into the workforce warranted the need for them to keep up with the current advancement of medical technology along with updates in imaging and therapy protocols. Retired or senior HCPs also needed additional orientation and training on the use of online webinar and virtual meeting platforms. However some institutions may not provide formal training on online meeting platforms. Many countries were able to offer assistance with available learning centers for seniors to support them on new technology and learn on the use of online platforms.

By combining different learning methodologies, Continuing Professional Development (CPD) is catered for learners of varying needs and is essential to ensure all HCP can keep abreast and competent in practice. However, the large degree of social distancing within workplaces

affected physical meetings, training and learning programmes vital for CPD. Many institutions struggled as the familiar physical platforms through which CPD has always been delivered prior to the pandemic were no longer feasible. In addition, the disruption of hospital clinical placements occurred in many countries in a bid to reduce vectors for cross-transmissions and reduce risks to students.

This chapter aims to review the effect of COVID-19 on CPD for diagnostic radiographers and radiation therapists and the implications that emerged.

Healthcare professionals in response to the pandemic

As this is the first global pandemic occurring during the digital era, the advancement of technology paved a new direction to the adoption of accessible video-conferencing applications.[3] The widespread usage of smartphones and the availability of 4G allow access to various video-conferencing applications. Post graduate education moves to virtual platforms and educators learnt to use blended learning techniques by incorporating pre-recorded talks and online assessments. Several institutions began conducting CPD sessions such as journal clubs, clinical rounds, and case-based discussions, using video-conferencing tools, to ensure learning still occurred whilst maintaining social distancing. Senior HCPs had to embrace the digitization opportunities and adapt to the use of E-learning platforms with virtual CPD sessions, to keep themselves updated at the workplace.

Virtual CPD

The use of Zoom® (Zoom Video Communications, San Jose, California, USA) or other in-house video conferencing software for CPD talks and webinars had been gaining traction for its convenience. Presenters can utilise interactive slides, videos, polling functions and chat functions to make the presentation stimulating. Further adoption of electronic evaluation, attendance-taking, and assessments using Google Forms (Alphabet, Mountain View, California, USA), Survey Monkey (Momentive Europe UC, Dublin, Ireland), and other online survey methods enables CPD providers to retrieve such electronic data remotely. CPD presenters can also apply interactive web-based or smartphone application audience response systems to improve audience engagement.

As CPD providers relearn and grow accustomed to these available virtual platforms, they stepped out of their comfort zone by offering virtual talks, and purchasing video-conferencing platforms account licenses. Participants can register for online CPD sessions organised in the workplace or by subscribing to the external CPD providers. After attending the sessions, participants can complete electronic feedback forms and obtain a certificate of attendance from the CPD provider. However, these registered sessions have a limited capacity depending on the license purchased by the CPD provider. To mitigate this limitation, the virtual CPD session can be shared to a wider range of audiences as a live free session on Facebook, or Video-on-Demand (VOD) format on websites and YouTube platforms. The drawback to these non-registered sessions is that they do not provide certificates of attendance.

Within the workplace, to ensure HCPs have the latest knowledge and relevant skills to stay ahead, course providers use E-learning platforms with live Zoom presentations and assessments. Within schools, E-learning platforms are integrated into the curriculum with blended learning for students to watch lecturer presentations, perform tutorials, and online assessments. Synchronous class meeting is made possible on these virtual platforms where students can meet and have collaborative work and projects together. [3, 4]

The digital landscape allows conferences to be held virtually. As overseas delegates are unable to travel safely and conference spaces are costly when applying social distancing measures, virtual conferences sprouted. Web agencies compete to provide customised formats for virtual conference platforms, comprising of electronic poster gallery, and pre-recorded or live track talks with moderated question and answer segments. Overseas content experts are solicited through emails, and communication is performed via video-conferencing during planning stages. In order to keep costs at a minimum, some virtual conferences offer low live participant volume, with complimentary attendance. Some HCP societies display contents of the webinar freely to public, in the endeavours to make CPD and learning available for sharing. Participants for virtual conferences are able to watch the recorded session of these virtual conferences after the event, depending on the VOD storage capabilities of the organisers. The benefits of the VOD options are that participants will able to view the videos at their own time.

The implications

The convenience of virtual CPD has made many CPD providers embrace the phenomenon. COVID-19 pandemic made us inevitably change the focus to more locally conducted virtual activities and webinars, rather than hands-on workshops. The implications involved may be multifaceted.

As many CPD providers offer virtual CPD sessions, a tsunami of available virtual CPD becomes apparent. CPD providers with annual subscription video-conferencing tools, leveraged on conducting multiple CPD sessions regularly, to make virtual platforms worthwhile. These resulted in the excessive burn-out or fatigue in the CPD organisers and participants. Some HCP societies host the CPD sessions after working hours to reduce disruption of clinical time. Given the abundant CPD sessions offered by many CPD providers, HCPs would spend excessive screen time to be participants in CPD sessions which spark interests in them. Conflicting CPD times can occur and sessions may not be scheduled at convenient timings, such as during staff lunch hour, rest hours and leave period. Over time, participants may also face burn-out from the abundant CPD sessions and have to prioritise sessions that are most beneficial to them, leaving some CPD sessions poorly attended. The availability of post-event CPD sessions will inevitably reduce live session attendance. Organisers will have to limit certificate of attendance to only live attendance, which may pose extra work to CPD providers, to encourage live attendance. The unavailability of certificate of attendance for CPD sessions leaves no evidence of participants' attendance and learning hours for their records.

Learning engagement may not be substantial in the virtual platform. It only involves the use of visual and auditory learning without the kinesthetic segment. This may not be ideal for some learners who gets easily distracted. There is an inherent challenge for the speaker to ensure the design of their virtual CPD would simulate face-to-face learning. In a virtual platform, overseas industry experts may not be able to engage their audience well as they are unable to conduct hands-on workshops due to the limitation of travels and workplace segregation. The workshop participants may have limited nonverbal communication or engagement as they can disengage themselves from the speakers or facilitators when their videos are turned off. In some instances, participants may choose not to partake the poll or

chat functions during the sessions. Cognitive understanding of learners cannot be fully ascertained despite having online quizzes, although it is undeniably an important component to ensure that learners truly acquire the knowledge.

The lack of a conducive environment is an obstacle for optimal learning. Not every individual has a private space to learn during a scheduled CPD session. When the CPD session occurs after office hours, an individual may be multi-tasking on shift work, juggling with work-life balance, or with small children at home. Listening to talks on mobile smartphones on-the-go, may lack the full attention span needed to optimally retain information. HCPs will have to weigh the benefits of attending CPD sessions and managing their time. Speaker time-zones influence the timing of the CPD sessions. CPD organisers will have to accommodate the most appropriate schedule that fits both overseas and local speakers who are required to be available for a live moderated session. Attending CPD in solitary has its drawback when participants will not be able to interact or even consult with their peers during the session. The social isolation reduces the possibility of active team-based learning, and confirming key learning points together.

The possibility of poor infrastructural deficits can cause technical glitches, making CPD sessions disruptive.[5] Slow internet speeds are a huge problem for participants in certain countries as a higher internet bandwidth is costly and may not be easily accessible. The use of home-wired internet would be preferable than WiFi, however under-developed regions may not have sufficient internet speed. Furthermore, there may be a need to invest in a full or corporate E-learning account to accommodate participants and maintain adequate internet cyber security.[4, 6]

Another key implication is that conference venues may no longer be relevant. When lockdowns occurred globally, many venues closed and there were massive cancellations of planned conferences and events. The large economic loss has led many companies to close their conference venues permanently. The revenues in which countries could incur from tourism would not be obtainable. Due to this, local conference organisers cannot acquire their country tourism board benefits which in tenet, assist organisers to capitalise on a conference programme set-up and provide country tours for foreign delegates, indirectly boosting the economy of the country.

The final implication is the inability for physical networking and collaboration. HCP societies and conference organisers leverage on attending physical conferences to network with vendors, the society executive council, board members and other industry experts. As a result, the conference organising committee is not able to seek new speakers through these methods, and become heavily reliant on personal connections which are limited. Some organisers solicit speakers through published manuscripts, however, these random email solicitation may go to junk or remain unresponded as the sender is not recognised. Essentially, a majority of the speakers who may engage in virtual conferences may be of a slightly younger age group, whom can operate the virtual platform easily. This may reduce the engagement of more veteran speakers in the industry.

Adaptation for the future

The increased use of hybrid learning techniques are being developed to embrace the digital era. Without access to hands-on workshops, and carbon-footprint free adaptation of CPD, the use of simulation and virtual reality may take over. Simulation-based learning and real-time extended reality can offer immersive experience without the need to be at the physical site.

Hybrid conferences can become a norm. As safe travel gradually resumes, overseas delegates can attend conferences physically. Healthcare institutions may have more options for their staff to attend conferences in a virtual or physical manner. This also depends on their hospital guidelines, or their limitations on registration, travel, and accommodation costs. Organisers can also save on stipends to bring in delegates as talks can be offered as pre-recorded sessions or VOD. There will be a need for on-site operational consciousness and strict infection control measures of public area. This will increase the operational costs and financial burden borne by the organisers[7].

Conference organisers can consider the optimal platform recommendations for virtual conferences such as optimizing pre-recorded talks streaming, live question and answer segments and panel discussions during sessions, early accessibility for participants to plan their preferred session schedule, viewing gallery for electronic posters, virtual booths for participants to explore, ability to provide networking with speakers, and the ability to view video-on-demand lectures after live session ends.

Finally, the pandemic facilitated the emergence of international collaboration and the use of resources such as E-books and E-learning materials, allowing various content experts to come together to create CPD contents. The accessibility of such material expands CPD outreach to many HCPs. CPD can advance in the future with adaptation to the 'new normal' whilst ensuring more ingenious measures to be taken.

Conclusion

After the COVID-19 pandemic hit, CPD conditions took a huge impact and the implications that may occur would affect the quality of CPD and the consumers or participants involved. CPD providers are recommended to minimise the potential implications that can arise and also learn to adapt to the new norms in the future.

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Utilising video for a physics module during COVID-19 to adhere to social distancing.

Belinda van der Merwe

The academic project had to continue during the pandemic for the Bachelor of Radiography fourth year students to complete not only theory modules online, but also the required attendance in clinical practice. This was imperative since in South Africa, the students are required to complete one year of compulsory community service after graduation. Staff and student flexibility and adaption became key concepts during the global lockdown restriction levels. It was comforting to learn about the clinical placement strategies for safe resumption in other countries for instance Singapore[1] and the impact of the COVID-19 pandemic on radiography practice from a United Kingdom radiography workforce survey[2]. Our year planner was adjusted, and students could return in June of 2020 to campus provided that a 14-day self-isolation period was implemented.

In preparation for the workplace, one of the assignments in the physics module is to demonstrate to the class, the quality control (QC) tests of diagnostic x-ray machines. Due to the institutions' social distancing guidelines during the pandemic, the assignment could not be executed due to the limiting of student numbers per venue. My involvement in the scholarship of teaching and learning (SOTL) empowered me to articulate a consistent philosophy to align teaching and learning with assessment methods. This guides constant reflection to adjust to every group of students in order to attempt to engage each learner so that meaningful learning can take place. The pandemic intensified this reflection on how to apply theory in practice taking into consideration the dilemma of restricting face to face lectures. I realised that I need to find a solution to the educational problem concerning the demonstration of the quality control tests in clinical practice. A design-based research approach was utilised to find a solution that involved different phases[3]. The first phase is to analyse the problem, the second phase to develop a learning environment as a possible solution, the third phase to implement and test the solution in cycles and the fourth phase to refine the solution. The last phase involves that the lecturer must create a design principle

based on the practice and reflection of the previous phases. The outcome of the adaption of this assignment is to provide real-life situations.

Students were in previous years divided in groups to demonstrate to the class, 12 of the quality control tests of diagnostic x-ray machines required by the South African Department of Health. Students were however instructed (Figure 1) to create a video of the content, in groups of no more than 8, and to submit the edited final version of no longer than 10 minutes, on the Blackboard platform. Due to the restricted access of staff and students in the hospital x-ray departments, the x-ray room on campus was available for bookings, considering the sanitizing of the venue between the visits of groups. Strict rules applied for instance the wearing of Personal Protective Equipment (PPE), sanitising of hands and the wearing of masks. Some of the groups preferred to conduct the assignment, after their scheduled shifts, in an x-ray room at the hospital where they were scheduled for clinical placement.

All the final year students (n=58) participated in the assignment, even those in self- isolation contributed their part remotely. The assignment on video compelled each one to be engaged in the whole process from the planning to the usage of video software and the recording of each one's demonstration of the quality tests contribution.

The students were instructed to watch the videos of all the groups and to learn the content of all the quality control tests in preparation of an assessment. The lecturer instructed students in the post assignment test to describe for example what they have learned about the QC tests. The accurate responses confirmed successful completion of the assignment and are proof that the outcomes were achieved. For example, students accurately described the use of copper plates, selection of automatic exposure control chambers, the steps of the QC tests, when to call a service engineer, accuracy of the measurements, the method of the dark noise test, SMPTE pattern, frequency of tests, interpretation of the test results, the equipment used, the lifespan of the machines and patient protection.

As part of normal teaching and learning activities, students are surveyed on their experiences. The post assignment survey indicated that students were very satisfied (45%) or satisfied (36%) with the group participation. The majority (91%) did not experience difficulties with the software to record the video. The free software that students searched for and selected to record and edit the videos were: Inshot, Viva Video and Power editor. Most groups made use

of the video applications that were available on their cell phones. The challenge for some students was to submit the assignment whilst at home without the availability of cell phone data or internet connectivity (45%) The solution was that the lecturer was flexible with the assignment due date to allow students the opportunity to submit the video once they had access to Wi-Fi. Lessons learned were that if the video size was larger than 100 MB, the students could not share it on WhatsApp. To overcome this challenge the students either emailed the assignment to their own Email accounts, or compressed the video files before they uploaded it on Blackboard.

The accuracy and care to research the facts of the quality tests were evident during assessment of the projects. The effectiveness of the videos as a learning tool is confirmed by 90% of the students' remarks such as:

- "It's easier to comprehend all the tests when they are demonstrated by peers using a relatable language"
- "This gave us a chance as students to actually do our own tests and also to learn the need for these tests."
- "You learn while you demonstrate"
- "The added details and written instructions on the video is much easier to remember than just being explained in class without a video especially since a student can watch it again."

In these extraordinary times, lecturers and students are standing tall to adapt and to build a new scholarship that is kind and flexible towards students unable to attend due to quarantine or travel restrictions. The effectiveness of the project to engage students in the project assessment process, the skills acquired to self-record videos and the ability to communicate the essence of the learning unit content in a limited duration of 10 minutes, will be taken forward.

INSTRUCTIONS: Quality Control Test - Group project

Explain the routine Quality Control (QC) test for diagnostic X-ray equipment to the class by means of a demonstration-presentation. The following objectives must be achieved:

1. **Deliver a practical demonstration of the QC test.**
2. **Provide documentation (records of the test as example).**
3. **Interpret the test to detect non-compliance of the equipment.**
4. **Propose corrective action and effective reporting of the results.**

During the COVID pandemic (2020) meet in groups of 6-8 to record the presentation on video with mobile phones. Submit the video on the Blackboard platform instead of the class presentation.

Group 1	
Test 1:	X-ray Tube Warm-Up Procedure
	General Tests: Indicators, Mechanical and other safety checks
Test 2:	Gonad shields, lead rubber, aprons and gloves
Group 2	
Test 3:	Appropriate technique chart displayed at the X-Ray Unit
	Grids
Group 3	
Test 4:	Alignment of centre of the x-ray field & the centre of the Bucky
Test 5:	X-ray Field Dimensions
Test 6:	Congruence between the X-ray field & the light field
Group 4	
Test 7:	X-ray light / Beam centering
Test 8:	Alignment and collimation to the film changer /Bucky
Group 5	
Test 15:	Condition of cassettes and screens
Test 20:	CR Reader: Condition of Cassettes and Image Plates
Group 6	
Test 18:	CR Reader: Detector Dose Indicator
Test 24:	Detector Dose Indicator Monitoring
Group 7	
Test 19:	CR Reader: Image Uniformity and Dark noise
Test 25:	Image Uniformity
Group 8	
Test 23:	AEC Device (CR) – Sensitivity
Test 27:	AEC Device (DR) – Sensitivity

Figure 1: Group project instruction

RUBRIC FOR QC Group demonstration

Group number:_____ Tests numbers _____
Names: ……

	Assessment criteria	5	4	3	2	1	0	Comment
Practical demonstration	*Concise representation of the content (all steps)*							
	Indicate the frequency of the test							
	Present the content in a logical manner							
	Described the challenge (problem) that the test represents							
	Describe what is the rationale behind the test							
	Responded to questions correctly							
Documentation	Provided the documentation (table) to be completed							
	Included an example of the test executed (document completed)							
	Recommendations to change/update the provided documentation							
	Indicate where the results will be kept / stored in the IER							
	Provided written instructions							
Interpretation of results	Present results of the QC test in a systematic manner							
	Present and discuss the data collected in an understandable manner							
	Indicate correct test results							
	The discussion includes a critical assessment of results							
	Indicate how to correct / or when to report							
Subtotals								Comment
Total							**16x 5 = 80**	
Percentage								%

5=All criteria met 4=Minor shortcoming 3=errors in relation to criteria

2=Shortcoming and errors 0-1=criteria not met and failure to participate

Figure 2: Rubric for the scoring of the video demonstration

Figure 3: Radiography bachelor's degree graduates of 2020

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Impact of Pandemic on a Diagnostic Imaging Services Director

Beth L. Weber

In my forty years as a Radiology professional, I have encountered many major healthcare issues in the emergency and operating rooms as a radiographer and sonograper. I also have seen the impact and after effects of 3 tornadoes with up to 100 mile hour winds hitting our hospital campus in one night[1].

In March of 2020, suddenly there was a very contagious virus sweeping around the world producing a pandemic. I had not experienced this magnitude of an impact on our healthcare system and world. As the Director of Imaging Services for a 55 bed for profit / private cardiovascular hospital with an Emergency Room, my leadership skills and experiences were heightened. Without solid information about the COVID-19, we recalled the SARS virus and the infection control measures needed to treat and prevent the spread. We put our emergency preparedness and infection control plans into effect immediately.

Some of the duties and responsibilities as Diagnostic Imaging Director impacted by the Pandemic included:

Staffing

The decision was made to temporaily close an outpatient cardio / vascular screening program to limit traffic in the hospital. Reallocating staff to other work areas was needed, the nurses were trained to monitor the doors and screen individuals' temperatures and ask COVID-19 symptom screening questions. We also kept people supplied with masks. The sonographer was asked to stay home using vacation hours or work in the supply department to help keep inventory levels stocked in all the departments. Six months is a long time to be out of your normal work routine with no projected end in sight.

Suspending the Radiology student clinical rotations slowed their ability to complete competencies, their education and graduation date were extended in some situations. Vacancies were difficult to fill due to the unavailablity of resources as well as the shortage of

radiologic technologists in our community. The available applicants were fearful of all the Pandemic unknowns.

Encouraging and staying vigilent with the essential frontline workers consumed most of my days as department director. Some of the day was spent sharing time with coworkers talking about hope for the vaccinations, sharing appreciation that they remained healthy and assuring they were aware not to take the virus home with them by practicing good hygiene and using personal protective equipment (PPE) appropriately.

Our health system set up crisis lines for anyone needing to talk to a professional about fears or concerns. A daily communication with the Center for Disease Control and Prevention (CDC), updates were sent out electronically to all staff. I was fortunate that only one of my coworkers tested positive for COVID-19 during the initial fourteen months and they recovered without hospitalization.

Supply Allocation

Fitting staff for PPE and instructing them on the proper use needed to be done very quickly. Finding department space for cleaning and storage of PPE reusable items was a task that required an imagination. Everyone was assigned a plastic contatiner to store their clean reuseable respirator hoods. The containers were stacked in the image reading room on the counter, limiting the work space. Our healthsystem and facility was able to find adequate supplies. Resterilization of N-95 face masks using ultraviolet lights was an on going activity. As an additonal duty I was assigned to the daily pick up and distribution of the face masks.

Communications

Maintaining current knowledge of the reccomendations from the CDC[2]; while keeping employees up to date of the changes became a minute to minute challenge. The world's focus was on the Pandemic, however life and health situations continued to be needing attention. Patients had shortness of breath and came to the Emergency room, the first test was to rule out COVID-19, sometimes CT scans for Pulmonary Emboli were ordered before the COVID-19 tests results were available. Taking a patient to CT with COVID-19 precautions required the patient to wear a mask, which being short of breath compromised their breathing. The technologist spent more time encouraging and reassuring the patient that they would be able

to lie down and get through the scan. The CT room did not have a negative air exchange which meant that the room had to remain closed for 2 hours after cleaning prior to the next scan being done. CT exams did require a lot more planning due to the extra precautions taken to prevent the spread of the COVID-19 virus. The number of CT scans we could perform were limited.

Meetings

We learned to use ***Zoom*** and ***Go to Meeting*** software rapidly to particiapte in Virtual meetings. The department computer technology for our Personal Conputers were not equipped with microphone or camera access. Many meetings required the staff to be on the land line phone to talk while logged onto the web. Since the use of the internet was in high demand, it was not unusual to lose connection or hear a lot of background noise when participants didn't mute their microphones.

I felt not as many questions were asked as the individual had to type in the on line chat box or raise a virtual hand to be acknowledged during the on line meetings. Disruptions during the meetings included the hosts not knowing the computer software, some participants needing to be on the internet joining late and leaving early, some participants working from home and others in their offices. It was entertaining to see the family pets and the makeshift home offices.

Equipment purchases

We had just started to undertake the selection of a new ultrasound system that included hands on evaluations, when the pandemic impacted our facility. Our selection process required that the vendor set up the equipment in a class room instead of in the department. Staff could demo the equipment with the applications person while wearing PPE masks and maintaining social distancing. Delivery of the ultrasound system was delayed due to heavy demand on the trucking / freight companies. When the equipment arrived, the orientation training of the staff was limited to an overview of the equipment functions since the vendor application staff could not be in the patient care areas of the hospital.

Although it is difficult to imagine the impact a Pandemic would have on the Healthcare system and the world, during the first twenty months, we have remained united as essential frontline

workers imaging and treating patients who have tested positive for a virus with so many unknowns.

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Lessons learned and personal experiences of adapting to and working within a pandemic. Educator perspectives on the delivery of programmes and student impact

Bimali Sanjeevani Weerakoon

Following the World Health Organization's (WHO) declaration of a new coronavirus (COVID-19) pandemic on March 11, 2020[1], most countries throughout the world announced a state of emergency and imposed social isolation measures in an effort to contain the spread of the virus. The education sector is one of the most crucial areas affected by the COVID-19 pandemic across the globe. Educational institutes such as schools, universities and other public and private institutions are widely regarded as susceptible places for COVID-19 transmission in the community. Therefore, this disease caused educational institutions to close around the world as a preventive measure, affecting millions of students in different countries[2]. This situation has compelled educational institutes to foresee and develop strategies to reduce disruptions for all levels of education. It is a well-accepted fact that there is no other teaching strategy that can substitute the success of direct student-teacher interactions[3]. However, due to the physical distancing rules and lockdown, undoubtably the use of technology became a necessity for keeping the education system functioning in many countries around the world. Therefore, this widespread virus has prompted the abrupt and rapid transition of teaching and learning activities from traditional to online distance modes at all levels of education[3,4]. This has a critical impact on resource-constrained communities, particularly the lack of technological infrastructure related to online education[5].

Sri Lanka is one of the countries in South Asia that has been impacted by the COVID-19. On January 27th, 2020, the first patient with COVID-19 infection was discovered in Sri Lanka[6,7], and the Sri Lankan government immediately began implementing tactical surveillance measures to limit the spread of the virus. As an initial response, the Sri Lankan government segregated the districts where COVID-19 patients have been reported and placed them under lockdown as a matter of urgency. Following a spike in COVID-19 cases, the authorities issued a state-wide curfew and travel restrictions. In this situation, the Sri Lankan government closed

all the educational institutes, including universities in the country, on 12th March 2020[8] and ceased all academic activities. As a result, all 15 state universities and around 40 state and non-state tertiary education institutions were closed across the country[8], posing numerous challenges to the higher education sector of Sri Lanka. Continuation of the academic activities was the major challenge encountered by almost all the universities. Apart from that, the admission of the new students to the universities and graduations were also disrupted. However, after a while, the Government of Sri Lanka has introduced a concept known as 'working from home', which enabled all academic staff at universities to continue their academic activities from their home. During this time, most Sri Lankan universities began their educational activities with the support of digital platforms and online tools such as massive open online courses (MOOCs), Moodle-based learning management systems, and various types of video communication software (e.g. Zoom and Google classroom)[8].

The demanding nature of radiography application in patient diagnosis, management, and monitoring provides a significant place for radiography education in medicine and healthcare. The Department of Radiography/Radiotherapy at the Faculty of Allied Health Sciences, University Peradeniya, is the only institution in Sri Lanka that offers a BSc (Hons) in Radiography program under the Ministry of Higher Education. This Radiography program provides students with a wide range of teaching and learning activities, including lectures, laboratory and practical classes, small group discussions and clinical sessions in a traditional learning environment. Unfortunately, as previously stated, the COVID-19 pandemic poses significant challenges to this traditional face-to-face radiography education setup, necessitating the conduct of all teaching and learning activities via digital platforms in the sense of online education. Introducing online education as an alternative to the traditional educational setup is considered to be a significant structural transformation in the higher education system. At the same time, online education is a novel experience for the majority of academics at the universities of Sri Lanka. Thus, there have been many obstacles for academics, supporting staff members and students in the university community who lacked the latest technology and expertise. Despite the fact that there were numerous challenges in online education, the Department of Radiography/Radiotherapy, Faculty of Allied Health Sciences, has made countless efforts to implement and continue the online education system.

Delivery of the program - continuation of academic teaching and learning activities

The fundamental difficulty was to continue teaching and learning when students and staff were physically unable to be present in the university. Before the COVID-19 pandemic, the Department did not use the Learning Management System (LMS)/ Moodle effectively to facilitate the teaching and learning process and it was only used for course management. Therefore, as a preliminary step, the Department of Radiography/Radiotherapy has established Moodle accounts for all lecturers and students and provided access to the theory-based subjects. Several initiatives have been implemented to improve the communication between lecturers, mentors and students, including the use of social media platforms (Facebook, WhatsApp and Viber) to facilitate this connection.

Initially, the Department instructed lecturers to upload all learning materials to Moodle in an asynchronous method (recorded sessions), but later on, online education was supposed to be conducted in a synchronous method (live session) via various video conferencing platforms as it can ensure that all students learn the same materials in the same way. However, lecturers were asked to instantly covert their lessons to online format without providing enough training or infrastructure. Because of this, it was initially difficult for all lecturers in the Department to initiate their academic work and effectively utilize digital platforms. Eventually, students and lecturers were given access to online tutorials to help them improve their skills for using Moodle and other video conferencing platforms effectively. However, this situation presented many additional challenges for both lecturers and students. Sri Lanka is a middle-income country and, therefore, does not have highly developed technological infrastructure facilities. This BSc in Radiography program has students from all over the country and half of them were from economically depressed rural areas. Therefore, most of the students lacked reliable and stable in-house internet connections and adequate technology to participate in online education. Further, the high expenses of internet services were a top challenge encountered during online education. The Sri Lankan Government made many efforts to reduce the cost of online education for both teachers and students. As a part of this effort, the Government was able to come to an agreement with all internet providers to provide free access to university web services through the Lanka Education and Research Network (LEARN)[8]. This created the opportunity for all the university lecturers and students

to continue their academic activities through Moodle and Zoom applications without any charge. Following this, a high usage rate of Moodle and Zoom applications was observed, resulting in limited bandwidth and overloaded network connections. As a result, teachers and students were confronted with a number of technological obstacles, including low video quality and logging-in difficulties. Therefore, in order to avoid these problems, it was necessary to schedule the lectures at off-peak hours.

It is essential to incorporate a student response system to get feedback from students during or after lectures in order to figure out their challenges and identify their perceptions [9,10]. Additionally, given the remote online opportunities, it is essential to evaluate their feasibility, the degree to which the intended learning outcomes of the curriculum are met, and the appropriateness of continuing online education. Unfortunately, the Department established a student response system after continuing some time of the online education. According to the responses received, it was realized that the students perceived that online education saves time and mode of easy access for timely submission of assignments. However, most students stated that they feel lonely and have difficulties paying full attention during the online lectures. Therefore the Department tried to engage more with the synchronous delivery method since the asynchronous delivery method does not allow for teacher-student or student-student interactions during the lecture time. The synchronous lessons were also created in a more student-centered, interactive manner using various tools available in video conferencing platforms such as polls and digital flashcards. Some students indicated that their financial situation made online learning challenging as they require modern communication and technical devices to be better involved. Students from low-income families found it particularly difficult to gain access to modern and advanced technological devices, and the Department continues to have a challenging task in addressing this issue.

Delivery of the program - continuation of research activities

The COVID-19 epidemic had a significant impact on the research that the students were undertaking. The supervisors did not have a chance to meet their students physically, and the supervision and communications were done entirely online via Zoom, WhatsApp and e-mails. Therefore, as previously, it was difficult to understand the real needs of a student. Further, the data collection process from the laboratories, patients, and hospitals was interrupted due

to the travel restrictions and health guidelines of the country. Therefore, most of the supervisors guided the students to conduct their research using image archives in the hospitals and online open databases available online. It was, however, able to host several online webinars for students on various aspects of research and medical imaging with many experts from other countries. That was an excellent opportunity for students to encourage and build collaborative work with other countries.

Delivery of the program - laboratory-based teaching and learning activities and hospital-based training

Even though online education works well for teaching theoretical components, it has some issues in developing university-based practical-based skills of students. Practical skill development in the BSc in Radiography program at the University of Peradeniya is centered on hands-on learning in laboratories and hospital-based training. However, all laboratory and hospital-based teaching activities were temporarily halted due to the pandemic.

Several types of laboratory sessions are associated with radiography education, including those on radiography instruments and anatomy. The Department had a significant challenge in delivering at least some laboratory-based knowledge since it lacked the necessary facilities and resources such as simulation labs or virtual labs. However, as practical knowledge and skills were developed and imparted to students to some extent, it was beneficial to incorporate pictures, images, and all sorts of videos with actual equipment and instruments into the theory lectures. The use of video-based lab sessions has been identified as a viable alternative when students are unable to physically attend practical sessions. These video-based lab sessions are beneficial because students can visualize the step-by-step introduction to a real hands-on session, its environment, and the entire practical process. The usage of virtual lab sessions hinders the development of problem-based learning skills, critical thinking ability, situation analysis skills, interpersonal skills, adaptability and communication skills among students. Therefore the Department took every attempt to overcome these challenges by giving different types of assignments such as case scenarios and student presentations.

While there are many approaches for imparting practical skills virtually, there is always a dearth of valuable practical understanding into conducting radiography techniques and

dealing with the intricacies of such an environment. Therefore, as a health care worker, completing the hospital-based training components was essential. After opening the country, the radiography undergraduates had to acquire their clinical training as quickly as possible to make up for the time they lost while the country was lockdown. Otherwise, they would be unable to resume their regular academic schedules and complete their degrees on time.

Delivery of the program - conducting examinations

The Department faced a significant challenge in conducting examinations via online. Conducting exams online necessitates the use of tools such as a safe exam browser as well as technical expertise to set up a proctored exam environment. In addition, it is necessary to ensure that the power failures should not cause the examination process to be disrupted. But unfortunately, the Department did not have the required facilities, knowledge and training for conducting exams online. There were few webinars conducted by the Education Unit of the faculty on this topic. However, they were not sufficient to get the competency of conducting online exams. Therefore the Department had to wait for the universities to open to conduct the exams for students. As a result, the students had to face a large number of exams concurrently, which impacted their academic performance and increased academic stress.

Summary

The effectiveness of online education is always contingent on its ability to overcome its limitations. Online learning has had a dramatic impact on students as it prevents them from participating in in-class interactive education, laboratory training, hospital-based training and a proper exam schedule. Initial costs of setting up the context, low level of motivation of the students and the teachers, and the necessity for technical expertise are additional constraints that need to be considered. However, if these limitations can be overcome through appropriate stakeholder involvements, online education has emerged as an unexpected means of achieving various benefits, including time-saving, access to a wide range of global education events, and the ability to retrieve the digitally recorded lectures and practical sessions. Furthermore, to promote skill-based online education, it is critical to emphasize the importance of building and designing simulation laboratories, enhancing simulation laboratory infrastructure, and making virtual learning and teaching facilities available.

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Knowing what we know now, how might we approach a pandemic differently in the future.

Wilfried Hunziger

We know in the light of the COVID-19 pandemic that we need some time until a vaccination is broadly available. To bridge this time we had to minimize the spreading of the virus as much as we can. This could be achieved by blocking all known pathways the virus uses to spread. In my Country (Germany) decided to do so with the three well known methods to achieve this:

- washing hands in accordance with established policies
- practicing social distancing, in-line with national guidance
- wearing a face covering in daily routine, in-line with national and professional guidance

All this sounds very simple, but as I observed, it´s not. There are people who came together with shaking hands, people who sat coughing on public transportation without any kind of a face covering and much more. I had always up to five FFP2 / KN95 masks in my bag to be prepared if something like this happens. If so, I actually asked people to use a mask which I gave them as a gift but with phrases like: 'Please, use this fresh mask'; 'That´s good for you, because you don´t risk a fine' (in Berlin, Germany, at this time the use of a FFP2 mask was compulsory in public transport); and 'it´s good for me, because I work in a Hospital and I see enough people dying at the Intensive Care Unit'. Speaking this, people sometimes looked a little annoyed at me, but usually they were speechless. However, you can easily see in their faces that they are not amused. So, this is maybe not the politest way, but I found it to be an effective one. On the other hand, sometimes people gave me a round of applause in the underground/subway when I offer people a mask and ask them to use it.

To keep the next pandemic at bay it might be an important part of what we do - to speak with those in your social surroundings, your family members, your friends and neighbours, your colleagues at work etc. about the importance to protecting yourself and others, with, for example, the wearing of masks. But this topic is not only related to my private life or in public places. It leads to heavy discussions in my own radiology department as well. In the first

months of the pandemic we only used masks if the patients we examined were at risk of having COVID-19. As the pandemic progressed, we would wear a surgical mask every time we have a contact with any patients, whether they had COVID-19 or not. We wore FFP2 / KN95 masks exclusively for the examination of COVID-19-patients and eventually for every contact with patients; we also changed masks after we had contact with a known COVID-19-patient. Every time my hospital updated its policy on wearing masks the latest policy became more stringent. Interestingly, some of my colleagues said that masks are ineffective because we breathe in air from around the mask as the seal to our skin isn't that efficient for certain types of masks. However, the FFP2 / KN95 masks have a better fit to the skin, but even these are not always close enough at every point of the face, especially the part between nose and cheek.

Other colleagues appeared to care more about the environment and were disappointed with all the waste that was produced as a consequence of using disposable face masks. In the end, we all agreed that next time it would be best to start with using FFP2 masks instead of using surgical masks. But there is another reason to wear FFP2 / KN95 masks right from the beginning and by each and every contact with patients. When the pandemic was in the early phase it happened to me personally, when I received a call from one of the leading medical practitioners (doctors) of a ward for internal medicine. She asked me which radiographer had processed an X-ray image for a particular patient. I checked the system and said that I did it. She ordered me to get a PCR-Test because this patient had developed symptoms for COVID-19 and was now isolated. The quick-test of this patient, which was processed earlier, was negative but the PCR-Test which was processed later shows a positive result. From this I deduced not all tests for COVID-19 are 100% accurate; subsequently this has been borne out in practice and the literature. Fortunately, my test was negative; unfortunately I spent Pentecost 2020 alone and isolated in my apartment waiting for the results.

Another ambitious aim in my hospital was that every new patient should be isolated until a PCR-Test is processed and proven negative. This way the responsible staff of my hospital tries to detect asymptomatic patients faster because the very last thing wanted was that it spreads around the whole hospital. As a radiographer you have a lot of contact with many patients in a wide range of clinical settings. Radiographers therefore could become vectors for spreading

the virus if adequate steps are not taken by the radiography workforce. For this reason, it´s crucial that you stay informed about the COVID-19 status of the patients you examine. Because my Dept. of Radiology was very close to the Emergency Unit, I noticed that sometimes they had difficulties to write the actual COVID-19 status into the System (HIS) because they just don´t know it by themself. The reason for this is quite simple. Much too often they just haven´t got the time to wait for a test result, even if the lab staff always do their best.

To handle that, my hospital decided to use the following plan:

The Emergency Unit was separated into three parts. One isolated part to handle the COVID-19-positive tested patients exclusively and an open part for the negative tested ones. This means the first action you proceed to on arrival of a new patient is a quick test in parallel to the standard procedures like anamnesis, first basic check up´s and all the paperwork needed for further treatment. You do all this in the third part (the unknown part) trying to decide as fast as possible in which of the other two parts each patient will be allocated. A PCR-test is undertaken only if the 'quick-test' gives a positive result, or a decision is made based upon the existence of symptoms or other reasons leading the treating doctor to require one. In theory every patient should get one, but we also know that the Lab always run on the maximum limit of their capacity.

What is also well known in my radiological dept. is we still have to treat the patients suffering under the pandemic in addition to our daily work e. g. car accidents, or strokes don´t stop because of COVID-19. All this other work still happens anyway and this is why some of my colleagues are running out of capacity and energy and, in some instances, are no longer able to work. This creates personnel shortfalls. For the next pandemic it may be helpful to acquire additional staff for the administrative work like register patients' data and terminate it in the system/worklists, import and export of CD-images and so on. This way the medically qualified staff, like radiographers, can focus on medical tasks like doing an X-ray examination, CT-Scan, MRI-Scan or whatever is needed. However not all administrative tasks can be undertaken by them, because some tasks are specific to radiology e. g. the whole process of documentation for a particular examination, writing dose reports etc.

Another way to prevent COVID-19 spreading is the rule that isolated patients should stay isolated. But this is not always applicable e. g. if a CT-scan is needed as you have to transport the patient to the department of radiology. This task is not easy to manage and can be very easy for the virus to spread by the fact that a lot of the staff who undertake this task of transporting patients might get infected. During the pandemic my colleagues and I found ways to deal with it. We used special, so called 'closed beds', for the transport. These are beds with a foil which covers the bed as a whole like a child's buggy, similar to that you use with babies on prams in the rain. Additionally, the transporting staff wear full personal protective clothing. Our radiologists implemented a very restrictive policy to prevent unnecessary patient transports to our department for imaging, the justification procedure therefore adapted and asked referrers to consider alternative imaging techniques that could be done by the bedside in the ward instead of having the patient imaged in the radiology department. Thus, where possible, every X-ray imaging procedure should be undertaken on a mobile machine with similar conditions as you will expect on the ICU. For the next pandemic it will be helpful to keep in mind that the concept of closed beds was quite effective enough to protect the transportation team.

Even in the next pandemic the day will come where a vaccination is possible. Then it could be very helpful to divide your staff in groups. Something like radiology 1 and 2. Because the vaccine was rare and our team leader found it hard to prioritize which member of staff should get vaccinated first. So, they decided to take one good opportunity to vaccinate all of us at the same day. But as some side effects may occur it can, indeed did, lead to personnel shortfalls; so next time it might be wise to divide staff into groups to minimise the impact of personnel shortfalls due to vaccination side effects happening again.

COVID-19 Pandemic Preparedness: Roll up your sleeves and getting ready for the battle

Ravi Chanthriga Eturajulu

COVID-19 pandemic, caused by the novel coronavirus (SARS-CoV-2), was something that many did not "see it coming" and it continues to reshape the globe. A viral outbreak of this magnitude has never been seen before in the human history. Many of us, if not all, were caught off guard by the unseen adversaries. The first wave of the pandemic still lingers freshly in my mind, with the first case of COVID-19 reported on 25 January 2020 in Malaysia. Fast forward, on July 1, 2020, during the second wave of the pandemic, Malaysia recorded just one new COVID-19 case and no cases of infection. However, at the time of writing, Malaysia was facing its third wave with thousands of cases reported daily, 1 year after we successfully flattened the curve. The third wave began in September 2020, and it is still on-going with healthcare facing tougher tasks in managing the COVID-19 pandemic compared to the previous two waves. Our institution, University Malaya Medical Centre (UMMC) is a teaching hospital, now designated as a COVID-19 response facility, with admissions increasing daily.

During the wake of the global pandemic, in March 2020, as part of preparedness to look into new challenges and changes in the service delivery, a COVID-19 Task Force Committee (TFC) was formed in the Department of Biomedical Imaging, UMMC, Kuala Lumpur, Malaysia. The TFC, together with the hospital COVID-19 Task Force Committee scrutinised and evaluated the new challenges to service delivery, planned meticulously and implemented new changes. The TFC also monitored and ensured that effective communication was undertaken through email, online meetings, social media apps such as WhatsApp and Telegrams and video conferencing services such as Zoom and Google Meet to all the personnel involved whilst at the same time working processes were streamlined. These strategies were then strengthened and improved from time to time according to the pandemic situation in the country. *"Change is the only constant" – Heraclitus.* The only certainty we have in life, according to Heraclitus, is that everything is continuously in motion and evolving. While change is constant, those who can adapt to changes will manage better outcomes.

As radiographers, we are one of the first lines of health professionals that require regular contact with suspected, probable, or confirmed COVID-19 patient presenting with respiratory symptoms requiring imaging. As such, radiographers are more predisposed to the COVID-19 virus. This has naturally heightened the radiographers' fear and anxiety level and is more so with information and control strategies frequently evolving as new evidence becomes known on the virus.

Role of medical imaging and services: breaking the boundaries

Imaging plays a critical role in COVID-19 patient management. Imaging examinations, typically chest X-rays and computed tomography (CT) scans of the chest are essential in assessing the severity and progression of COVID-19. When medical imaging is required, radiographers play a vital role in performing and producing optimum quality images to assist decision making in the clinical diagnosis, management, and treatment of COVID-19 patients.

One of the most significant challenges associated with the COVID-19 pandemic was the high demand for imaging requests, particularly mobile radiography performed on the designated COVID-19 wards. Fortunately, the digital mobile radiography units available facilitated increased workflow efficiency, with increased patient throughput and streamlined mobile radiography operations throughout the hospital. Besides performing chest radiographs in the emergency departments and wards, we performed mobile radiography in the forensic department as well to those who were brought in deceased. In addition, there were marked increase in the requests of CT chest as well, thus warranting strict adherence to Standard Operating Procedures (SOPs), such as appropriate use of personal protective equipment (PPE) with proper donning and doffing by radiographers and other multi-disciplinary staff to reduce risk the spread of the virus. As such, the TFC was in close communication and discussions with the hospital Infection Control Team (ICT) to determine the list of PPEs that should be worn with correct donning and doffing methods to reduce the potential risk exposures.

Challenges and changes in medical imaging service delivery

Radiographers play a major role in imaging service delivery. As such, they are not spared from facing the changes and challenges in battling the COVID-19 pandemic. In terms of preparedness to face the new situation, changes were implemented to existing work processes, including screening and scanning body temperature of each patient prior to the

imaging examinations or interventional procedures, management of human resources (divided into teams in anticipation of accidental exposures to COVID-19 patients and the need to undergo quarantine processes, if necessary) and handling of imaging equipment (e.g., prior preparation and post examination disinfection process).

As this was an unprecedented experience for all of us, there were minor setbacks along the way, such as equipment breakdown, lack of resources and others. Despite this, everyone stood united in support, and changes to the standard operating procedures (SOPs) were made to manage the new challenges. As Albert Einstein stated, *"The world as we have created it is a process of our thinking. It cannot be changed without changing our thinking."* COVID-19 pandemic has warranted for changes in our thinking, a paradigm shift, from our routine workflow, hospital protocols, patient care, training, assessments, and business models.

The new norms in medical imaging

Radiographers carrying out mobile radiography played an important role in performing bedside imaging (e.g., chest X-Ray) at the designated areas in order to prevent potential transmission during patient transfers to the imaging department. Prior to mobile examination, the equipment (tube head and arm only) was covered with plastic, especially when handling patients being nursed with a high flow mask / intubated / nebulizer. The image receptor (e.g., imaging plate / digital detector) was wrapped with a zip lock plastic bag and into another plastic bag to ensure double protection. The equipment was then disinfected post examination.

Furthermore, CT scans were also performed to monitor the disease progression of COVID-19 patients. These patients were scheduled at latter part of the day after completion of non-infectious cases, except in emergency cases. As part of preparation, non-essential equipment was removed from the CT examination room. The contact surfaces of equipment in the CT examination room, such as gantry control panel, monitor, contrast injector and other items were covered with plastic. Post CT scan examination total cleaning of the room was performed by the cleaning services staff (outsourced) before proceeding with the next patient for examination. The duration of waiting time in between patients were approximately 30 minutes to an hour. As part of the new workflow, after handling COVID-19 patients and disinfecting, the radiographers would shower. It is essential for radiographers to adhere to the new SOP to avoid viral contamination between patients and other patients or professionals.

Preparation for CT scan

Total cleaning in process post scan

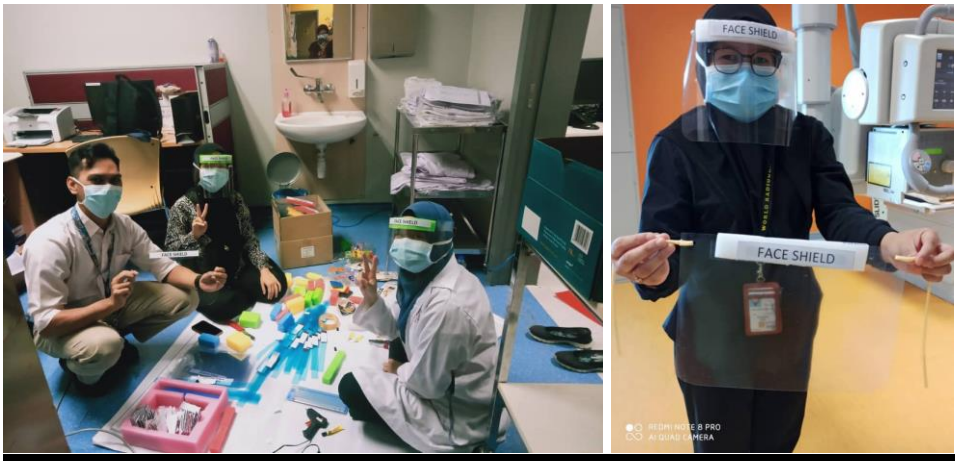
Mobilisation of medical imaging personnel

Staffing was the next major issue. With the additional requirements, ensuring adequate staffing was paramount for the smooth flow of the imaging service and this was overseen by the TFC. The staff were divided into two teams in anticipation of accidental cross infection to COVID-19 patients. Whilst one team standby at home, the other team rotated working between three shifts comprising six to eight hours per shift. The standby team member would step in to cover staff members who have to undergo quarantine process to ensure the service delivery was not interrupted.

Personal Protective Equipment (PPE)

During the first wave of the pandemic in March 2020, we had to ensure the availability of PPEs and hand sanitizers for our staff. Besides the supply provided by the hospital management, the demand for PPE was overwhelming during the COVID-19 pandemic. As we were stretched thin in many aspects, our resource allocation and management skills were also put to the test. *"Necessity is the mother of invention" - Plato.* In coping with the increased demands of PPEs, in the true spirit of *#kitajagakita* ('we take care of us') we saw many radiographers and other staff members being innovative in preparing the PPEs (e.g., head covers, gowns, shoe covers & etc.) from non-woven fabric and diligently taking turns applying their sewing skills.

In addition to this, self-made face shields made from easily available items such as clear plastic sheathes, sponges and strings were prepared creatively to ensure sufficient stock was available to carry out their duties safely and confidently during these precarious times.



Radiographers preparing self-made face shields

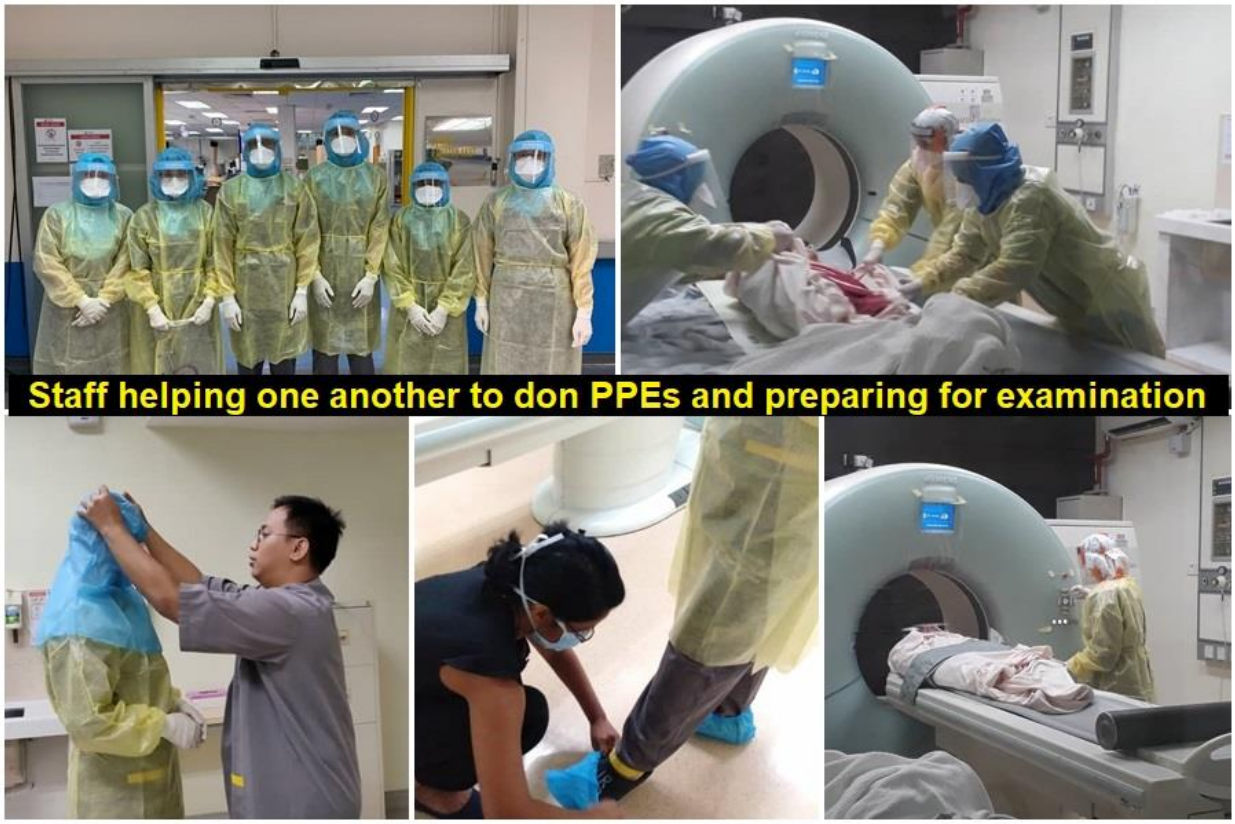
Risks Management and safety: The Importance of Handwashing and Compliance to Hand Hygiene

In healthcare, hands are the most common source of infection. The rising use of digital appliances, such as mobile phones and tablets in everyday use has increased the potential for contact between hands and the environment. The repetitive contact of hands or fingertips, with or without gloves on mobile phones, workstation consoles, monitors, computers, or switches of electromedical apparatus, turn these items into mode of transmission of infection. This was a challenge as there was evidence of the risks of transmission following contact with a contaminated dry surface. Therefore, constant reminders on hand hygiene practices were disseminated to all staff. Besides that, audit surveillance was also conducted by the hospital infection control team randomly at the wards to check whether radiographers complied with the 5 Moments of Hand Hygiene adapted from the World Health Organisation (WHO), particularly during mobile radiography examinations.

Educational activities and demonstrations: 'We learn, and we share'

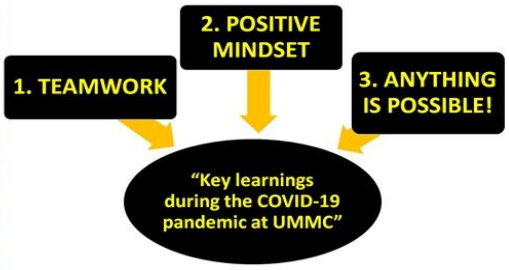
Several simulation sessions on donning and doffing PPEs and handling of COVID-19 patients were conducted, and preparedness on crisis management was organised as well. These educational activities and demonstrations were carried out periodically to ensure that the staff were empowered with the necessary knowledge and awareness regarding COVID-19. In addition, many continuous medical education sessions were carried out at the hospital level

to improve COVID-19 awareness among the healthcare staff, alongside COVID-19 safety posters and signs displayed at strategic locations as reminders.



Reflections: Key learnings during pandemic

Despite the new challenges, every department and hospital management remained steadfast and provided to their best ability to manage the demand. It's hard to imagine that in spite of being the first experience for most of us, the situation was well organised and managed. The SOPs were evolving to ensure that no one was overburdened during the process, keeping in mind the best care to patients received and not compromised. Despite the new protocols, new strategies in handling patients, new guidelines, I saw great teamwork, selfless acts, and sincerity among the radiologists, radiographers, nurses, porters, and other staff members of the department in adapting the new norms. Together we performed our roles and responsibilities efficiently to face this new challenge, COVID-19. I am happy to see all staff of UMMC stood together in solidarity in their relentless fight against COVID-19! Together, we can win the fight against COVID-19! As Saint Mother Teresa quoted, *"None of us, including me, ever do great things. But we can all do small things, with great love, and together we can do something wonderful."*



In summary, three key learnings during this COVID-19 pandemic were, it's important to work as a team, essential to have a positive mindset and "Together with great teamwork and positive mindset", anything is possible!

What's next?

A year and a half into the pandemic, COVID-19, is still a big part of our lives, causing destitution, lifestyle adjustments, bringing out the worst and the finest in humanity. The COVID-19 pandemic is progressing continuously. What is apparent is that imaging will persist to play a pivotal role in assisting in the clinical decision-making process. Therefore, having a positive mind set is important. Radiographers, as frontline staff, should be conversant with the key challenges associated to imaging patients with COVID-19. This is essential so that they can fulfil their role in ensuring patient and personnel safety, patient care and production of optimal quality images for accurate diagnosis.

Conclusion

The radiographers should practice situational awareness and be informed of ways to keep themselves and their colleagues protected and well during this unprecedented time period by adhering to the new normal (e.g., social distancing, hand hygiene compliance etc.), using the appropriate PPEs and ensuring all their workplaces are adequately disinfected to minimise

the risk of further infection. While we perform our best in ensuring a safe and conducive environment when rendering our imaging services, we must continue to practice necessary measures to reduce transmission and mortality. The fight for COVID-19 is not over yet! *"There is nothing to fear, because you cannot fail ... only learn, grow, and become better than you've ever been before" - Hal Elrod.* We should have the humility to listen, learn, change, invent, and grow. We can win this together! Here, from the Department of Biomedical Imaging, UMMC, KL, Malaysia, our journey continues…!

Acknowledgements: Ms Kathy Wui Ai Leng, Miss Siti Nur Aisyah Zolkaplie, Mr Mohd Zukhairi Che Romly, Ms Lilian Yap Poh Poh, Mr Mohd Kamil Mohamad Fabell, COVID-19 Task Force Committee, Infection Control Team, and all staff of the Department of Biomedical Imaging, UMMC.

Patient experience (a radiographer who had COVID-19)

Deborah. A.L. Whiteside

I am a Clinical Lead Radiographer in PET/CT who qualified in 1987 and obtained a postgraduate qualification in Radionuclide Imaging in 1992. I have worked in a variety of fields including Diagnostic Radiology, Nuclear Medicine and MRI. I currently work full time, 12-hour days plus extra days to cover staffing shortfalls, in a busy regional PET/CT Centre situated in the North West of England. The majority of our patients being urgent Oncology referrals, with some Non-Oncology 18Fl FDG scans together with Amyloid plaques and Tau Protein Brain Imaging for Dementia trial centres.

With the emergence of the COVID-19 virus, it was decided that due to my medical history of cancer treatment and rheumatoid autoimmune disease, requiring continuous immunosuppressant therapy, I should work from home and "shield", to stay at home and isolate in order to prevent infection. This was a very upsetting time for me, as I do not take time off work for illness and despite my health issues; my sickness absence record was exemplary. Therefore, with reluctance, I set about revising and re writing the PET/CT Training and assessment scheme for the private healthcare provider I am employed by, along with numerous office-based projects at home for three long months. At first working from home was a novelty and not venturing outside my home environment I did feel a sense of security being totally isolated from the world outside.

In June 2020 I could stand it no longer, I am a dedicated clinical Radiographer and needed to be "hands on", accustomed to being on my feet all day and I was now being given tasks that were not even remotely relevant to my role, so I begged to go back to the PET/CT unit to recommence clinical work. Occupational Health agreed after risk assessments were completed, and I had been fit tested for high protection masks and full Personal Protective Equipment (PPE) was provided for all patient contact.

I worked my full 40 hours per week in full PPE for a further five months, being extremely vigilant and taking every precaution to keep myself and others safe. I felt very "out of the loop

“at work, my colleagues had worked throughout the first wave and I felt isolated and alone. Many things had changed whilst I had been away and I felt lost.

Then suddenly one Sunday lunchtime 1st November 2020 following a busy, stressful week, I felt dreadful, shivering, aching and an awful headache, my temperature was 39 degrees. I took to my bed and my daughter booked a drive through PCR test online for later that evening for my husband and myself.

The text with results arrived the following morning, my test was negative and my asymptomatic husband’s test was positive. Convinced this was a mistake I ordered a postal test but again tested negative. By now, I was becoming increasingly poorly, very short of breath, a strange scald like rash and very severe chest pain, which became so bad I could not move or breathe without feeling extreme agony. After waiting eight hours for my GP to call me back I could not speak to him the pain was so severe, and at this point, he called a paramedic crew who immediately transferred me to A&E at the Cardio Thoracic hospital.

I begged with the ambulance crew not to take me to hospital, firstly because of the high volume of patients admitted and the fact that my family would not be allowed to visit, this was a very lonely and frightening time, but the pain was the worst I had ever experienced, there was no option but to go.

Blood tests revealed a very high D Dimer, very high CRP, raised white cell count, Chest X-ray appeared normal. Suspecting a Pulmonary Embolism associated with COVID 19 I was admitted to the “COVID-19 Ward”, commenced anti coagulation therapy and sent for a CT scan, this was a very surreal experience being on the patient side of the scanner. Former colleagues whose worried faces increased my anxiety scanned me. This revealed pneumonia in all lobes, bilateral pleural effusions, atelectasis in both lung bases but no sign of P.E.

I was given IV antibiotics, fluids, anti-inflammatory drugs nebulizers and strong analgesia and remained in isolation for ten days, until my blood results improved sufficiently for me to be discharged. I was so relieved to be home and see my family again, they were convinced they would not see me again as so many families had experienced during the pandemic, our only contact had been phone calls.

My relief and improvement were short lived however as after only being at home for a week my symptoms worsened and GP blood tests revealed the onset of sepsis and Acute Kidney Injury. I was once again taken to A&E and admitted to the “COVID-19 Ward” in isolation. Further rounds of I.V. antibiotics, anticoagulants, nebulizers and analgesia continued for over a week. The respiratory Consultant performed an ultrasound chest scan and said he could see Kerley B lines in both bases, a term I recalled from my student days but had never heard since.

After cannulation for I. Vs became near on impossible due to collapsed veins it was decided to switch me to oral drugs at which point I seized my chance and asked to be discharged as the loneliness in isolation on the COVID-19 ward was becoming very difficult. I was surrounded by patients with dementia, who were obviously confused and distressed and cried out during the night, sleep was impossible and it was very upsetting to hear. The food was very limited, there was a shortage of fruit that was attributed to the lockdown restrictions and the lack of healthy options was not conducive to a speedy recovery.

I managed to convalesce at home for almost 3 weeks until my blood test on Christmas Eve morning revealed a very high potassium level and reduction in renal function. A call from the out of hours General Practitioner (GP) doctor insisted I attend the Medical Assessment Unit some 40 miles away. As Christmas day arrived, the staff hurriedly treated me so I could at least spend most of the day at home. I suffered many long-term effects, cardiac arrhythmia, tachycardia at rest, chest pain shortness of breath and dysphagia. I continued to try to build up my stamina by walking, gradually increasing the distance despite the ongoing fatigue.

I was absent from work for a further three months, resulting in the feelings of isolation returning, before an Occupational Health assessment allowed me to trial a phased return to work. As happy as I was to be returning to some form of normality I continued to struggle with fatigue, chest pain and shortness of breath exacerbated by the fit tested masks and the visor I had to wear. Communication with patients and colleagues was very difficult and exhausting initially and still can be a challenge today.

My Rheumatologist insisted my GP refer me to The Long COVID-19 Clinic for support and treatment of my ongoing chest pain, cardiac arrhythmias and breathing issues. I had all the pre referral tests done back in February 2021 and received a letter to say there is a long

waiting list for the clinic and as of August 2021 still have not had any communication from them.

The time away from work and the isolation has taken a toll on my mental health, self-confidence and self-belief and I have high anxiety levels with regard to the emergence of new variants. The fact that being double vaccinated does not guarantee immunity is very worrying. We are still finding COVID-19 positive images on CT scans in asymptomatic patients which to me reinforces the need to treat all patients as COVID-19 positive and maintain our high levels of hygiene, distance and wearing of PPE for the foreseeable future. This is more imperative because of the lifting of government restrictions on mandatory mask wearing, social distancing and social gatherings.

I was extremely careful wearing full PPE, having meticulous hand hygiene levels and shielding at home but still managed to contract COVID 19.

Increased and high levels of hygiene can only be a positive to take forward in Radiology for our patients, many of whom are immunocompromised or vulnerable.

Who knows when the next novel virus will appear, I do worry a lot about this, given my experiences of COVID-19?

Hope

Hafsa Tareq Momoniat

Reminiscing: December 2019

On 3rd December 2019 I returned home from a lovely holiday in Morocco. The following day I attended my graduation at the University of Bradford, for completing my PGCert in Medical Imaging (Medical Image Reporting – the interpretation of x-ray images). Two days later I found out that I was expecting my second child. I had been told that it was highly unlikely that I would conceive another child without excision surgery for my endometriosis. Therefore, this new baby was a miracle.

I knew my pregnancy was not going to be easy because I developed Hyperemesis Gravidarum (severe pregnancy sickness) when I was expecting my first child, but I felt prepared. By March 2020 I had treatment planned for my Hyperemesis Gravidarum, Pelvic Girdle Pain [PGP], endometriosis, and plans were put in place to prevent pre-term labour.

I remember having a discussion with some of my colleagues about reports of a new virus discovered in China. We talked about the potential spread of the virus and the possibility of it arriving in the UK. Little did we know that the word “potential” would soon become “actual”, and the word “possibility” would be replaced by “certainty”. We talked about the impact such a virus would have on us.

December 2019 was a month of celebration. But the New Year would bring major disruption to the way in which we lived our lives. It would change our norms, values, and social interactions. COVID-19 would arrive in the UK and a pandemic would hit the world. And as we discussed the virus, we underestimated the impact that it would cause.

2020! Where do I begin?!

My husband travels abroad frequently for work. In January he returned from Australia and then travelled to Atlanta in February. He has been grounded at home since his return from Atlanta (due to COVID-19 restrictions, not by me!).

My 4-year-old daughter attended Nursery, but it shut once lockdown was declared. I have an approximately 40 miles commute to work from Yorkshire to Manchester, so I batch cook meals. However, my daughter, like many other children, developed a much larger than usual appetite while she was home-schooled. Therefore, before I set off on my journey to work, I used to fill a Bento box with snacks for her. I would leave some raisins, nuts, fruit, a chocolate bar, sweets, and a small stack of Pringles. As an essential worker, I was required to go to work, unlike many other people who were asked to stay at home. The snacks kept my daughter occupied while her dad worked from home. Everything seemed to be quite orderly.

Outside, people went into panic mode and began stockpiling anything and everything, from milk to toilet roll. When we went to Tesco the shelves were bare. No toilet rolls. No tinned tomatoes. No eggs. No rice. No flour. I craved a Pot Noodle- for some odd reason, I could keep this down despite having Hyperemesis. There were no Pot Noodles either. I had severe pain due to my PGP and endometriosis and was advised to take paracetamol. There was no paracetamol in the shops either! I cried because I felt frustrated. I had managed to have one manual physiotherapy session, but the remaining sessions were cancelled. I would wake up in the middle of the night and I could not physically move due to my PGP. The pain was excruciating first thing in the morning, and I needed paracetamol to ease my pain.

We discussed the difficulty of shopping at work. By the time many of us had finished our shifts, the shopping aisles would be empty. One of my colleagues could not find pasta in Manchester, but it was available in Yorkshire, so I brought them a packet. I mentioned to my manager that I had run out of paracetamol and I was struggling to find some in the shops. He said that there was a box in his drawer which I could have. I have never felt more grateful to receive painkillers. I ended up rationing the paracetamol tablets.

I was moved away from frontline healthcare due to my high-risk pregnancy, but I was still able to attend work because I had recently qualified as a Musculoskeletal [MSK] Reporting Radiographer and I spent my time reporting x-ray images for several weeks. Each morning I would thoroughly clean the equipment at the reporting station including the keyboard, mouse and microphone. I would turn the computer on and review MSK radiographs and subsequently write a report, describing the findings to help the referrer to decide on the patient management. It became a mundane repertoire; very different to the dynamic clinical

environment I was used to working in. Although I felt socially isolated from the main team, I could communicate with colleagues who were also in the reporting room. I worked closely with one of my colleagues who was also moved away from the frontline. There was a significant reduction in the number of MSK cases to report, therefore we helped to update documents like the imaging protocols. The main highlight for me was when a consultant radiologist gave me a Crème Egg. I thought this was a very kind gesture.

When I was 22-23 weeks pregnant, I began having contractions. I was told that nothing would be done to save my baby if he was born at this stage because 24 weeks is the threshold for viability. I attended the hospital's maternity unit again a couple of days later because I was having continued pain. My manager was at the Nightingale Hospital, so I wrote him a letter to explain what had happened and enclosed my sick note in an envelope. As I left the department, I thought about the uncertainty I faced; I did not know if I would return to work after maternity leave with a healthy baby.

A few months into my maternity leave, I received messages from some of my colleagues informing me about a Clinical Tutor vacancy. They thought it would be the ideal role for me. I decided to apply for the position, and I was invited for an interview. As I walked into the hospital on the interview day, the uncertainty from months ago had disappeared and I felt blessed to have a baby at home.

I noticed a lot of changes. Everyone had to wear a surgical mask upon entry to the hospital. There were no cups of water in the interview room. Technology was being utilised to overcome the challenges of social distancing. One of the interviewers attended via Microsoft Teams. It felt strange not being able to see faces which made it difficult to pick up on unspoken cues to see if the answers I gave were along the correct lines.

I wanted to be vaccinated against COVID-19 before I returned to work. It took me a while to decide if I wanted to take the vaccine because I am still breastfeeding my son. The nurses who vaccinated me fully explained the risks and benefits. I have already had 2 doses of the Pfizer vaccine. I had no side effects after the first dose, but I had quite a bad endometriosis flare up after my second dose. In my opinion the benefits outweigh the risks.

July 2021: Returning to work

Several people told me COVID-19 would be gone by the time I returned from maternity leave.

I made my 40-mile commute to work today. COVID-19 exists. It is evident that there is an ongoing pandemic. Surgical masks are still required upon entry to the hospital. People talk about isolation and Lateral Flow Tests. The work environment is a stark contrast to what I would see if I made a trip to the supermarket where masks are no longer a requirement.

Many people keep stating how lucky I have been to have missed COVID-19 at work, however there is a dark reality about having a high-risk pregnancy and giving birth to a premature baby during a pandemic. I was expecting my baby before the pandemic was declared so I did not know what I was getting myself into.

Shortly before the first lockdown myself and 2 of my colleagues went to Costa to have lunch. It was the last meal that I have had with friends since 2020. Throughout the year I have felt isolated from the outside world. I Facetimed my parents and spoke to my closest friends regularly. Not being in the presence of other people was difficult despite my preference for introversion.

When my son was on the Neonatal Unit myself and my husband could not be together at the side of his incubator at the same time. My husband could only visit us for 1 hour per day when we were transferred to the Maternity ward. Not having access to your own poorly baby is heart-breaking. We were not allowed to be together as a proper family until we were discharged. Many Trusts still have these restrictions in place.

In addition, there were no premature baby clothes available to purchase, and the tiny-baby-sized clothes were scarce. We had to use the donated babywear at the hospital. A fellow Mum on the ward gave me some of her son's premature baby clothes because they did not fit him.

These are some of my struggles that I want to talk about when someone calls me "lucky". Instead, I laugh and all I choose to say is that I am not lucky because it is difficult sitting at home for 6-8 months without going out. This is also true. I did not go out of the house, unless I attended appointments. Going to Tesco for the first time after my son's birth was like a vacation!

Today was the first time that I was required to wear a surgical mask for a whole shift. It was as uncomfortable as I had expected. My colleagues mentioned how they had struggled with the requirement of Personal Protective Equipment [PPE]. The masks which we felt protected us against COVID-19, also caused us some issues. Some had developed acne. I was reminded of the problems many faced due to the requirement of PPE for theatre cases before I went off sick. Last year, one of my colleagues had returned from theatre with marks on her face from the mask she had worn for hours. It wasn't long before the media had shared images of healthcare professionals with marks imprinted on their faces as a result of wearing masks. Those images are rarely seen now.

My colleagues have worked exceptionally hard during the most challenging times. I feel very lucky to be part of an amazing Radiology team and I look forward to returning to work full-time in September.

My 8 key learning points

1. COVID-19 has affected us all differently. Everyone has experienced different challenges and neither challenge is easier because we all have different values, different norms, different lives, different perceptions of each moment that we experience. Some individuals may not feel comfortable sharing their experiences. Therefore, we need to remain mindful of this. We should avoid comparing our situations and lend a listening ear to avoid invalidating others' struggles as they speak of them.
2. Keep checking up on those in your social circles. I always appreciated messages from people asking me how I was. Do not be afraid that you are bothering them. Personally, I would much rather someone asked me how I was rather than not saying anything at all.
3. Please do not stockpile items. I, myself, have become wary of the number of items I buy. For example, if there are 2 boxes of paracetamol left on the shelf, I will only buy 1. Someone else may need the last box more than me.
4. The best thing about my first day back at work was being around people. I have missed working with my friends and colleagues. As an introvert, I never thought I would enjoy people's company. Has COVID-19 had an impact on my personality traits? Pre-COVID-

19 I would choose the indoors over going out. But now, I look forward to something as basic as a shopping trip. I wish I had utilised my social freedom more before the pandemic.

5. I do not like it when people refer to my son as “lockdown baby”. He was born during lockdown- fact. But he had a difficult start to life, and he fought his own battles. He is completely oblivious to COVID-19. He was my light during what was a dark time. He is my miracle baby. He is a fighter. My little preemie. We need to stop labelling babies with names associated with COVID-19.
6. I don’t always agree with the phrase “Don’t look back”. In my opinion, we should not be afraid to look back in order to see all the things that we have achieved. It is nice to reminisce. We should hold onto the happy memories we experienced before and during the pandemic.
7. Remember to keep looking forward as well. One day many of us will share our experiences with the future generations. COVID-19 will be history. We will be able to enjoy all the things we used to do pre-COVID-19. I have already arranged to go for lunch with my colleagues when social distancing requirements end.
8. There may have been days over the past year where I lost hope, mostly during my son’s hospital stay. It has not been an easy year for anyone. But things will get better. It is important that we never lose hope. Hope is what keeps us going. Over the past 18 months, many of us have experienced loss, isolation and grief. I hope that the next 18 months will be filled with hope, happiness and restoration.

Each working day I will leave my home in Yorkshire to embark on my 40-mile commute to my workplace in Manchester. At the end of each day, I will make my 40-mile journey home. I have done this for the past 6 years (minus the time I have been on leave). My 80-miles of commuting each day does not faze me. I thoroughly enjoy my new role as a Clinical Tutor and will continue to report MSK radiographs each week and care for patients as I obtain radiographs. Most of all I feel lucky to be a part of a wonderful Radiology team. Working there is worth every mile of my daily travel.

Postscript

After I agreed to write this chapter, my Grandma contracted COVID-19 and passed away in India. She was delighted when I told her that I got the Clinical Tutor job. I dedicate this chapter to my Grandma for believing in me and for always providing me with words of encouragement. COVID-19 has claimed so many lives and the world will never be the same without their presence.

Rethinking of Instructional Designs

John Mark De Vera

The onset of the pandemic affected the industry and business, more so the academic environment with the disruptions in the delivery of instruction. The sudden change in the mode of instruction delivery, to online, has greatly impacted the way course instructors administer the teaching-learning activities and assessment strategies of the professional courses they handle. This abrupt change also affected how students cope in their learning environment. In the pre-pandemic classes, teachers and students turned to Learning Management System (LMS) applications as alternative means in the transfer of learning using technology. LMS also served as an intervention in giving teaching-learning activities in case of class suspensions and other reasons as an alternative for the on-campus classes. Unfortunately, the pandemic forced the schools to adopt these LMS not just as an alternative approach but as a primary option to continue the education.

The University Department heads, and teaching faculty members of the Radiologic Technology program searched for online applications, free and open access learning management systems, and other means to be utilized and implemented as a resource of emergency instruction delivery. The initiatives were necessary as the first phase of the pandemic was only seen as a temporary disruption of the academic activities at that time. The learning management system and online training of the IAEA website, PEP connect of Siemens Healthineer, and the online courses of the ISRRT were some of the most useful for the student and teacher to utilize. These acted as substitute approaches to supplement the activities of the students to still achieve the intended learning outcomes of the courses.

Our radiography school adopted an instructional design that is based on the constructivism learning theory. This became the foundation for the direction of the learning plans we prepared for the radiologic technology professional courses to ensure that the intended learning outcomes were attained. Also, this instigates the students to play active participation in the construction of the knowledge and skills they need to achieve – enforcing the role of teachers as facilitators in the teaching-learning process and not an absolute source of

knowledge in the class. This strategy was cascaded to all teaching faculty members so that the content of the learning plans and modules, that is, topic outline, learning outcomes, teaching-learning activities, and assessments are constructively aligned. Furthermore, the approach enforced and strengthened the Outcomes-Based education framework implemented.

The journey to the adaption of our approach came about when the teaching faculty members brainstormed for a more appropriate way of delivering the instruction using technology and flexible learning approaches that could be applied to the radiologic technology courses. One example of this is how the 'radiographic 'positioning course' will be administered. This course requires skills development in the different radiographic projections and their associated methods on how to properly image different body parts. In the in-campus setting, we can easily teach the theoretical foundation of the course and the assessment of positioning skills through the simulation and demonstration inside the X-ray laboratory and evaluate this through Objective Structured Comprehensive Examination (OSCE).

In an online setup, students need to read the modules first, then submit performance tasks equivalent to laboratory activities that act as an alternative way of achieving the skills-based learning outcomes. Some of these tasks are positioning video simulations, checklist making, and problem-based cases. Other activities include a creative return demonstration where students must devise their make-shift imaging accessories and devices to simulate some of the radiographic positioning procedures. The students were also made aware of the nature of the instructional design so that they understand what outputs and level of attainment they need to achieve, according to the expected learning outcomes to be accomplished.

Rightsizing the learning outcomes

The radiography school instigated an instructional design to serve as a foundation in developing the contents of the learning plan. We also reviewed, recalibrated, and streamlined the learning outcomes to be achieved by the students throughout the school year to respond to the challenges and limitations in the online teaching-learning. Rightsizing of the learning outcomes means choosing the most appropriate learning outcomes that are achievable through the online-flexible learning strategy. This was also performed to devise the most appropriate authentic assessments and learning activities in the setup. The idea behind this

initiative is to target the attainment of multiple learning outcomes with a few but effective assessment methods to evaluate the students' performances. This aided both the students and the faculty to not be overwhelmed with so many activities, avoid pressing deadlines, video conferencing fatigue, and other untoward effects of online learning.

What we observed during the online learning approach is that the students learn at their own pace and time, and the working and studying time is stretched throughout their day. This is different from the traditional in-class teaching and learning where we can easily give tasks to the students and measure the different learning outcomes through different methods. These undertakings were because when the method of instructional delivery changes, it might be that the assessment strategy and assessment methods may need to change too.

Coming up with streamlined learning outcomes of the various professional courses is not as simple as classifying the primary learning outcomes, nor the most essential learning outcomes in the course, but rather an all-encompassing approach. The instructors meet to do a course audit session which includes a thorough review of the learning outcomes of the curriculum map. This is performed to identify what outcome is to be included in the respective courses to be taught, so as not to duplicate contained with other courses, or worse, still to accidentally omit an important outcome. The learning outcomes are then carefully and appropriately mapped out with the corresponding assessment method to check its constructive alignment and to see it could target several outcomes.

This initiative is carried out because of our experience and reflection as we go on with the online learning setup. Our personal understanding of what we are going through with the instruction delivery and the feedback of the students who are the recipients of the implementation of the programs proved its essentiality. Continuous monitoring of the students' academic performances and re-calibration of the learning plans, and the never-ending search for a more appropriate way of evaluating and measuring students' knowledge and skills to prepare them as future frontliners is a must for educators.

Challenges and innovations in clinical education during the pandemic

Disruptions to medical and allied health fields (e.g., radiography) education is obvious worldwide during the pandemic. This showed that protecting the students from being at risk of contracting COVID-19 is of high importance in this current situation. Consequently, the

clinical education for the medical and allied health students may lack actual exposure to the clinical sites. Hence, clinical skills may be reduced or will not be fully achieved. With the current technology used for online learning, the Radiologic Technology Program initiates the utilization of these technologies to continue the Clinical Education Training Program in an online mode. Additionally, to give a value-added approach to the Clinical Education Training Program, the BSRT department adopted the Telepreceptorship model. This was integrated to supplement the cognitive skills enhancement of the student interns with input directly from the qualified radiologic technologists – giving the clinical knowledge they need through teleteaching and mitigating the clinical/practical education dilemma.

The idea of an innovative strategy for the pandemic-challenged clinical education for radiologic technology program came from the concept of telemedicine and telehealth. In telehealth, the medical and allied health practitioners take advantage of technology such as web conferencing in conducting medical assessments, education, and consultations with the patients. This concept was adopted in line with the preceptorship model of teaching to come up with a teleteaching approach which is the telepreceptorship.

As indicated by Mian & Khan[1], the delivery of Teleteaching using technological devices on hospital sites was seen to be effective in engaging students and contributes to improving core competencies, medical knowledge, and overall learning. Furthermore, Teleteaching is a potential alternative for clinical-based teaching during the pandemic[1]. Student and preceptors can communicate without risking exposure to COVID-19 – not wasting PPE, no frequent and mandatory RT-PCR/swab tests for the student interns during the internship program.

As instruction delivery through the online mode became a huge challenge for educators, we cannot deny that the theoretical or lecture component of the course can be easily administered via web conferencing, may it be in a small class or a big lecture session. The most challenging part is devising a way on how to continue the clinical education training program or internship, because when an actual hospital duty or even limited face-to-face encounter is not yet permitted by the regulatory body of Higher Education Institutions (HEI) and local government authorities. Pre-pandemic, the students are deployed into the different health institutions with facilities that offer different imaging and therapeutic radiological

modalities to gain the clinical skills necessary to complete the degree. When the pandemic came, our university schools closed for on-campus classes, since strict community quarantine in different localities and stringent compliance with health and safety protocols were implemented.

The program heads were all worried about how to start doing the learning continuity plan for the clinical education training program. In our context, other allied medical health professions like nursing, medical technology, respiratory technology, and medicine were already given guidelines from the higher education regulatory body to implement and enforce. On the contrary, others like the BS Radiologic Technology program were still waiting for their guidelines to be released. The challenge for us in autonomous HEIs is to come up with our set of policies for limited face-to-face classes and clinical education considering the previously released guidelines for flexible learning during the pandemic while benchmarking on the policies from other allied health professions. Autonomous HEIs demonstrate exceptional institutional quality and enhancement through internal quality assurance program. Thus, may offer programs and may carefully craft their curriculum that is above the minimum requirement and standards of the regulatory body.

We continued the partnership with our host training institution, the hospital facility for the internship program with a different mode of teaching clinical knowledge and skills. This time, the preceptors are on site while the learners are remote in their homes. The preceptors prepared their asynchronous teaching-learning activity in the form of video presentations or tutorials, which tackle relevant topics such as the hospital and radiology information system, infection control protocols, radiation protection measures, radiographic image production and evaluation, and imaging procedures from general radiography up to the different radiologic science modalities. The synchronous session with the preceptors is held on a certain day in a week where workloads in the hospital are manageable. This is the opportunity for both students and the radiology staff to interact via web conferencing in discussing the synthesis of the video tutorials and sharing additional information needed for the achievement of the learning outcomes for the specific week. So far, this mode of online internship receives good feedback from our students as they are excited about learning the clinical knowledge shared with them by their preceptors.

Student experiences

An undergraduate study by Catacutan, Soriano & Roque[2] entitled "Lived Experiences of Radiologic Technology Students in Online Learning during Corona Virus Disease 2019 (COVID-19) Pandemic," captured the experience of students in online learning during the pandemic. This study conducted by the mentioned level 3 Radiologic Technology students in our school, Holy Angel University, identified the following themes and subthemes that reflect both the positive and negative experiences of the students. Among the favorable experiences is that students have the flexibility of schedule in accomplishing their tasks at a time frame they decide to work on their requirements and in their own pace, given the availability of recorded lessons that they can watch anytime they want[2].

Another striking positive experience of students unfolded in the study is that they feel valued through the considerations given by their instructors. To quote:

Despite having difficulty communicating because of the new learning setup, the instructors provide time and attention to the students' queries and clarifications by responding to their questions and replying to them using different social media platforms.

Instructors also provide supplementary videos to compensate for other skill-based courses.[2]

Due to the gradual adaptation in the online learning setup and its limitations, one way to ensure that everyone is not left behind is to give due considerations to the students who are also struggling to cope up with the new learning environment. These considerations may vary and are not limited to extension of deadlines; limiting the number of requirements; allowing them to be off-camera during the synchronous classes to prevent high consumption of internet bandwidth, and granting of requested mental health break after the major examination week.

Students exert effort for independent learning. They study at their own schedule and rate of progress; develop the discipline of doing self-study by searching for the answers to their module; watch video tutorials and recordings, and accomplish the assigned performance tasks on their own. In contrast, there are also chances that other students are still not comfortable in doing self-study, but learning the lessons online with their peers, cooperative

learning is initiated. Some students may even spearhead group online discussions with their peers or groupmates or conduct tutorials among their respective class groups or peers.

Though it seems online learning promotes independent learning, the learning environment would not be effective if internet connectivity is impaired. Other issues may arise when the medium to which the online instruction delivery is too dependent on internet connectivity available. A moral code in the academe – academic integrity, must be upheld. Everyone is always expected to be honest, fair, and truthful in every endeavor in building the necessary skills and competencies, and be reflected in the daily operations and transactions. Academic integrity issue also arises in the online setup since much of the information needed by the students to learn can be almost searchable over the internet.

Common infractions committed include plagiarism and other forms of academic fraud. Despite the known issues, there are safeguards that we implement to avoid a breach in the academic integrity of the examinations, and other outputs the students are expected to deliver. First of which, we subject the student output to plagiarism scanning applications; we ask them for proper citations and referencing; and as an institutional mandate, we ask them to always adhere to our University Code of Honor so that they observe the core value of integrity in everything that they do.

In conclusion, our educators have acknowledged the values and challenges of the flexible, distant, online mode of instruction delivery, may it be as an alternative for emergencies or long-term implementation. This will help so that they may appropriately plan, organize, and direct the administration of instruction to the learning needs of students, considering the demands and challenges unveiled. Being proactive and creative are the qualities and skills that we need to master, for us to think of programs, services, and processes to efficiently deliver the quality education that the students deserve, even amidst a global crisis. While we expect the worst scenarios to come and disrupt our current practices, we need to still continuously plan for the best possible solutions to help our students achieve the learning outcomes in the most appropriate means during prevailing situations – whether there are exceptional (during the pandemic) or in more normal times. There are pieces of literature to search for as a reference in extracting the most applicable approach to our context, and a lot of learning from our experiences. These come, both from educators' and students'

perspectives and shared best practices from other institutions – all towards making a conducive teaching and learning atmosphere. Furthermore, we must consider the welfare and wellbeing of the students who are the recipients of our services when we implement strategies in a pandemic-challenged education. Their feedback as the primary stakeholder must be considered as they are our partners too, in shaping the direction of instruction delivery.

My final note as an educator

Accepting and being content with the current limitations brought by the pandemic and not searching for the best and alternative solution is a defeatist mindset that needs to be minimized in the mind of an educator. If we want to thrive, we must continually improve education and training in our field whatever the circumstances are – to best serve our profession and ultimately help provide our patients the service they deserve and need.

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Students' perspectives on the impact that COVID-19 had on the academic program

Mable Kekana and Kathryn Malherbe

Introduction

The disruptions on the academic program brought up by the COVID-19 pandemic affected both the undergraduate and post graduate students. Impact on contact classes which had to be suspended and replaced with on-line sessions was felt mostly by the undergraduate and honors students. The masters and doctoral students were not impacted since they are conducting full research and do not attend classes. Their contact with study leaders has always been via email or telephone. The ability of the students to carry out their research projects was also impacted. COVID-19 further provided an open picture of the different social classes among the student population. There were students who have been completely dependent on the facility in the institution that lock down and advent of studying from home was a complete blow. Challenges faced by some students was lack of computer devices and internet connection. To others their personal living conditions were not conducive to study. In as much as some students were inconvenienced by the decisions to study from home and on-line, there were others who were happy to be back in their comfortable homes with their families. The authors present students' perspectives in relation to the different challenges and experiences as they observed them. These perspectives are not limited to radiography students, but include nursing, physiotherapy, medicine and occupational students in the Faculty of Health Sciences.

The decision to go back home.

The call to close the residences and send all students home was made at the end of March 2020. Students had a certain unease of what the pandemic entailed and how this would impact them for the upcoming study year. Some students prefer campus environment because their houses would not provide the privacy and space needed for study. In all these financial, social and economic challenges the university provided support in the form of educational psychologists who worked tirelessly in supporting students during these trying

times. The only downside was that the students needed money to be able to contact the psychologist by phone or online.

Unconducive study environment

This was another example that exposed the different social classes – the have's and have nots. Students who came from the less privileged households had some serious challenges with studying from home as compared to the ones from privileged households. This became a reality that South Africa still have a big economic divide. Economic status impacts on the ability of the students to achieve their goals of studying towards their chosen careers.

The examples of unconducive study environment as related by the students who applied to be reinstated in residences were:

- Overcrowded homes and struggle for study space.
- Family providers losing their jobs due to the economic crises during the pandemic, leading to many students not able to continue their studies due to financial constraints.
- Family members expected students/children to help with house chores
- Overstretching family budgets by staying for long hours on the internet
- Having more mouths to feed now that the students were not in residences
- Having young children and babies who either needed minding or their crying was a distraction.
- Learning to learn online (devices to use).

Assessment for speed or for knowledge

This expression came from the feedback on the test that was written by the honors students. Of importance to note about this group is that is a mixed generation. Some of the students qualified some time back and have just decided to come back and further their studies. What this means is that some of them have not used computers before. There might be computers in the working environments, but those are used for basic management of the department. Coming to study on-line and write assessments on-line posed different challenges to the students. Having to work on blackboard collaborate for the first time was a challenge to some of the students. Lecturers attempted to research different students by setting different kinds of questions. These related to essay, short question and multiple-choice questions. The less

computer literate students needed some time to read and reread the questions and associated instructions. It happened that some of them could not complete the tests. This was not because they did not know the answers, but needed time to know how to navigate the system. Having raised this concern in the first on-line test, students appreciated the allocation of more time for the subsequent tests. Other problems related to the types of questions asked. The example is having too many matching questions. Students complained that they scroll down that screen and even move onto the second page trying to locate the matching answer. This was resolved by having a smaller number of questions in a table. This way, navigating for answer was less cumbersome.

Impact on community engagement projects.

The policy on community engagement at the University of Pretoria defines curricular community engagement as a program-based approach to the integration of community-based and/ or work-based engagement in the curriculum of a formal academic program. This includes the activities that are undertaken in communities as well as the clinical training environment. During the onset of the pandemic and the subsequent lockdown restrictions, communication was coming from both Department of Higher Education (DHET) and the regulatory Authorities like the Health Professions Council of South Africa (HPCSA) and the South African Nursing Council (SANC) as to how students should be accommodated in meeting their clinical training hours. There were also messages coming from the regulatory councils providing guidance on how the stipulated clinical hours could be adapted or noted. This created a state of anxiety in students that they started fearing that they will not be able to meet their obligations to register as professionals at the end of their study times.

When nursing students learnt that some higher education institutions have actually called back the students to the clinical training environment to continue with clinical training, they started making demands that they be allowed to return. This demand was sparked by the fact the SANC has not adjusted the clinical training hours. As these students started making demands, as lecturers we knew that the radiography students will also demand that they be given a chance to resume their clinical training. There were however the challenges in the institution with regards to accommodating the students in residences. The DHET had also

pronounced restrictions and indicated that the residences should also be filled up to the 60% capacity.

Impact on Research projects.

The COVID-19 pandemic also impacted on research projects which were conducted either for degree or for non-degree purposes. This further relates to experimental and non-experimental research projects. Experimental research on animals or the ones that were conducted in the chemistry or anatomical pathology laboratories needed constant checking and monitoring by the researchers. In the advent of the lock-down restrictions, people needed special permission to travel and enter certain premises. There was great risk of not completing the research because of the lockdown. The researchers could not travel to the laboratories to carry out their experiments as planned.

Regarding the non-experimental research projects, challenges also related to the data collection. Proposals were approved in some instances for hand delivery of questionnaires, personal interviews or even observations of research subjects in their natural settings. Research participants like patients in a particular clinical setting could not be accessed due to the need to maintain social distancing. Urgent applications were then made to the research ethics committees to allow for adaptation of the data collection methods and procedures. This was fortunately granted for most projects. For example, personal interviews could be changed to on-line or telephonic interviews, hand delivery of questionnaires could be changed to email or on-line distribution. Even with this adaptation, researchers still had another hurdle, which related to the availability of resources and the ability of some members of the community to continue with the participation in the data collection process. The other possible impact would be the response rate. Hand delivered questionnaires and face-to-face interviews tend to yield better response than the mailed questionnaires and telephonic interviews. One would say the personal touch and verbal communication tend to contribute to better response rates.

Intake and registration challenges in 2021.

The COVID-19 impacted the start of the academic year. The COVID-19 pandemic had impact on all educational sectors, including the basic education. Basic education refers to school years up to matric. The 2020 matriculants were forced to take their final examinations at the

beginning of 2021. This meant a shift in the calendar for the higher education institutions. Registrations could only commence in March, instead of January. This was fine for the institutions that could not complete the 2020 academic year in December. The impact of COVID-19 on the socio-economic aspect of the communities resulted in a number of students not being able to pay their tuition fees for 2020 and therefore could not register for 2021 academic year. This culminated in some departments in the faculty struggling to meet their registration targets. This was due to the many uncertainties.

Applicants seem to be comparing the institutions according to their management of the crisis. Selection lists were populated according to the regulations as it was in the past. There was a list of accepted students, those on the waiting list and those who were not accepted. It was my first experience to see the departments calling everyone was selected, going through the waiting list and even requesting permission to reconsider the students who were not accepted, but still met the entrance requirements. It was a long a tedious process.

Society was very unsure whether the educational activities would be restored in the year 2020. There still appeared to be the need to maintain social distancing and putting on of the masks. Maybe less students' intake would be a blessing that overcrowding will be lessened. The impact on the universities' income could not be ignored.

Conclusion

The presentation of the students' perspectives would be better if it were taken directly from their words. This is however not possible at this stage due to time constraints and in due course we hope to do that. phase If ISRRT plan a further book about COVID-19, we recommend that it could contain empirical work and focus on the actual experiences of radiographers and radiography students and the communities in which they live and work.

Challenges experienced by lecturers and students at a University of Technology transitioning from classroom based to online Teaching and Learning activities as a result of COVID-19

Merlisa Claudia Kemp and Florence Elizabeth Davidson

Introduction

When the pandemic first hit South Africa in March 2020, the President announced that the country will be on lockdown level 5. At this level drastic measures are taken to contain the spread of the virus and save lives. Each person is confined to his/her place of residence unless it is strictly for the purpose of performing an essential service. Retail shops and shopping malls are closed except where essential goods are sold. As a result of lockdown level 5, all Higher Education Institutions across South Africa had to transition from classroom-based teaching to online teaching. Ways in which to share teaching and learning material with students also had to be considered. In order to comply with the lockdown restrictions, university management requested that lecturers change their pre-COVID-19 planned Teaching, Leaning & Assessment (T, L& A) to better align with the online delivery of courses. These changes had to be carefully documented and presented to the faculty Teaching and Learning committee and then approved by the Senate executive committee of the institution.

We describe challenges experienced by the Department of Medical Imaging and Therapeutic Sciences (MITS) which offers four professional 4-year BSc programmes (Diagnostic Radiography, Diagnostic Ultrasound, Nuclear Medicine Technology and Radiation Therapy) at the Cape Peninsula University of Technology. This institution serves a culturally diverse group of students from different socio-economic backgrounds.

Technological challenges

With the sudden transition to online remote academic teaching and learning activities, many challenges were faced by academic staff and students navigating the online system. The pandemic has highlighted the issues experienced by the citizens of a third world country, South Africa. Due to the issues with the electricity power system, the South African society

had to endure load-shedding (power interruptions) which impacts negatively on the services in healthcare, education and the business industry. Each zone in the specific region of the various provinces in South Africa are scheduled for load shedding at specific times of the day. As a result of these interruptions, certain students were without electricity and could not access the internet to engage in teaching and learning activities on the online platform. In order to overcome this, the online lectures conducted on Microsoft Teams were recorded whilst engaging with the students who had connectivity and then the link to the online lecture recording was shared with all students via the learner management system (Blackboard), WhatsApp and email. This provided students with an opportunity to access the recorded online lecture sessions at any time and allowed them to go back to the recording if they were uncertain of a particular concept. Furthermore, internet accessibility and network coverage also remain a challenge for certain students as some reside in rural areas and have limited network coverage, resulting in intermittent access to the internet and online classes.

To further compound the issue of connectivity, students could not access the internet to part-take in online classes and access teaching and learning material due to the lack of an appropriate computer device. In addition to this, the lack of a computer prevents students from adequately completing assignments, case reports and engaging in online assessments. These students either need to borrow a computer from their peers or visit an internet café, thereby incurring additional cost. Where possible, hard copies of all the teaching and learning material were posted to those students via the postal service to ensure that they were not left behind in the higher education (HE) system.

Students who had access to an appropriate computer device (e.g. laptop) and a mobile phone, were provided with e-copies of teaching and learning content via various platforms such as WhatsApp, email and Blackboard. All platforms of communication were exhausted to ensure that all students received the teaching and learning content for successful completion of the 2020 academic year.

Affordability of data was another challenge that had to be solved. To this end, the university provided all students with a 30 Gigabyte mobile internet data bundle every month, to be used for academic teaching and learning purposes. In order for students to be recipients of the

data, they need to register their mobile number on the digital system and provide their updated personal information.

Academic staff working remotely from home need data and access to the internet, however not all staff have internet access at home (e.g. fibre internet). Hence the university furnished all staff with USB Wi-Fi dongles to enable staff accessibility to the internet and conduct online teaching and learning activities. The primary platforms used for online teaching and learning activities are Blackboard and Microsoft (MS) Teams.

Constructive alignment and assessment

The four BSc programmes all have a large clinical component. We faced challenges in how we were going to achieve constructive alignment between teaching, learning and assessment of clinical outcomes. We needed to ensure that methods used would be an authentic reflection of the world of work. The typical (pre-pandemic) methods of teaching and assessing clinical competence are small group tutorials/demonstrations in clinical skills laboratories and on the clinical platforms. Assessment methods would then be a combination of simulated patients and an objective structured clinical exam (OSCE) using standardized 'patients' and actual patient examinations on the clinical platforms. The department of MITS at CPUT decided to prioritise clinical teaching and assessment for the senior students, namely the final year 4th year students. As lockdown levels eased, we then extended the clinical teaching to 3rd years and more junior students (1st and 2nd years).

When we re-visited the learning outcomes and associated assessment criteria for clinical subjects, we had to firstly see how we would adapt T&L and secondly what impact that would have on the assessment of our students. As academics, we had to rapidly learn all the capabilities of the university online Learning Management System which up till then, was mostly used as a repository for teaching materials. Furthermore, we also had to consider what resources (both hardware and software) the students had access to. A survey was conducted with 62 second year students to determine what resources they had available to access online T,L&A (computers, mobile phones, internet access, mobile data, internet and WhatsApp data). The results of the survey indicated that 60 out of 61 students had WhatsApp access, 11(18%) did not have computer access, whilst 23 (37.7%) did not have internet access. Additionally, we had to consider the computer literacy skills of our students.

Due to severe COVID-19 lockdown restrictions in the 2020 academic year (AY2020), students were not able to enter the clinical platforms. This resulted in T, L & A of clinical outcomes being changed to written assignments such as worksheets, case studies and questions on journal articles instead of the simulated and actual patient clinical assessments. In the AY2021, we were able to improve the alignment between T, L&A as we made use of several online software packages (RadCrit, 'Primal pictures' anatomy). Virtual environment (e.g. VERT software) programmes were used and well as ultrasound imaging phantoms. When lockdown restrictions eased, we were able to offer small group tutorials, applying strict COVID-19 rules for small gatherings.

We have had our share of challenges regarding issue of integrity of online assessments and have learnt to ask questions in a much more applied way in order to minimize the student's chances of finding 'model' answers through an online search. For assignments, we saw an increase in plagiarism, when students 'misunderstood' instructions for group work and what constitutes submitting individual work. In an attempt to clarify any 'misunderstandings' we wrote very specific guidelines for groupwork which was then included in the students study guides.

Conclusion

We suggest that it should be mandatory for all students entering our undergraduate programmes to have access to a computer. A large proportion of our students receive bursaries from the National Student Financial Aid Scheme (NSFAS), a portion of which could be allocated to the purchase of a computer. Another option would be to issue students with computers, the cost of which could be debited to their account and paid off over the duration of their studies. Furthermore, to circumvent students behaving unethically in assessments, we have instituted the use of an 'honour pledge' in which students commit to ethical behaviour during assessments.

The rise of the isolation society and the loss of human interaction: South African educators' perspective.

Kathleen Naidoo and Gerhardus George Visser Koch

Lost in the midst of a pandemic, I started up my computer and the keyboard was as cold as ice. No truer description of how I felt inside. I want to say it was a normal winter's morning, but something felt amiss. Looking at me square in the eyes, was a lifeless computer screen with a black background. White blocks filled the screen and a prolonged, deafening silence filled the room. I took a deep breath in, unmuted myself, and so began another day of online teaching.

It was the dawn of a brand-new academic year. A proactive tone was set for 2020. Learner guides, lecture schedules and assessment guidelines were distributed at the beginning of the academic year. Feelings of excitement and innovation circled the air. We remember sitting in the tearoom discussing the news about the novel coronavirus (COVID-19) outbreak overseas and being completely shocked by what was happening in other countries. Little did we know that on Thursday, 26 March 2020, South Africa (SA) would enter into a national, hard lockdown, in the hope to contain the spread of COVID-19. What does this even mean and what do we do now? Before we knew it, we lost the power of touch. Most of our teaching philosophies and learning plans were forced out the window. With only a moment's notice, teaching and learning, as we once knew it, dissolved into an era of the unknown. This was not like a fire drill whereby we knew what steps we needed to take. It was like nothing we had ever experienced before: complete online learning. No time for planning, no time for supporting students with the transition, no time for acquiring resources and absolutely no time at all for comprehending what was happening to the world at large. Feelings of uncertainty and anxiety began to take over, leaving both ourselves and our students' mental health exposed and at risk.

As a country, being in a hard lockdown, we were subjected to many unknown factors in our lives. We were restricted with our movement and were only allowed out of our homes for essentials. The news was filled with death and tragedy and we were forced into isolation. On

the one hand we had the pandemic which was disrupting our personal lives and on the other hand we were faced with extraordinary academic challenges. All of which took place within a moment's notice. There were times when our “to-do-lists” just overflowed and we just sat there numb, unable to think or move, just simply glaring into space. The shift of our current programme from face-to-face teaching and learning to being completely online, seemed impossible. We had numerous virtual discussions with colleagues about the uneasiness we felt and very real panic attacks we suffered. We literally just focused on taking it one day at a time.

While the academic year started off in what we would refer to as pretty “normal”, that feeling was very short-lived. The start and rise of the COVID-19 pandemic in SA forced both the radiography educators and students into isolation, losing that interactive, human connection. The rise of the isolation society had begun. Universities were completely shut down and residences were closed. This meant that students needed to vacate the university residence and travel back home. Our student population includes representation from different walks of life and provinces within SA. A direct implication for students of the lockdown regulations was the inaccessibility of resources such as on-campus WIFI and computer laboratories. From the very onset of online teaching and learning, the great divide within our country became dreadfully obvious.

Major challenges we encountered were, a lack of active involvement from our students, not knowing if they were on the other side of the computer screen and whether they understood the teaching content adequately. It was also especially difficult for our students, in the Diagnostic Radiography programme, who have a work-integrated-learning component embedded in their curriculum. This component requires placement in the clinical environment, on a two-week rotation. This practice, however, was short-lived, and in the midst of these unprecedented times, alternative teaching and learning methods were necessary to combat and cater for their practical and clinical skills. Due to a lack of funding, we did not have the luxury of using virtual reality tools to aid in the simulation of the clinical environment. We were at the disposal of the government and the regulations they imposed on higher education and training. The massive implication of this was us extending our 2020 academic year into 2021 to make up for lost time.

Teaching during COVID-19 can be described as nothing short of overwhelming and a highly pressurised experience. We had to reinvent the wheel and redesign our individual modules to ensure that quality education was not compromised despite the major constraints we faced. For example, we had to redo the academic timetables as no students were in the clinical environment and this meant that we had to see to all four years of students at once. This was necessary to avoid clashes for individual lecturers who taught across levels 1 to 4. Due to clinical placements being postponed, we had to resort to the use of available online resources without compromising clinical competency. Examples of these resources included the use of preselected YouTube demonstration videos, free image interpretation websites and the World Health Organisation (WHO) Personal Protective Equipment (PPE) donning and doffing online course. We had to attend emergency workshops in order to survive this new environment; learning new skills within a very short space of time. Some examples are creating online content using Blackboard discussion boards, conducting live polls, developing online assessments and engaging in breakaway rooms for interactive discussions. In most cases, self-teaching was necessary. Our curriculum shifted from the traditional method of face-to-face (classroom-based) teaching and learning, to being fully online. Subsequently, we had to re-evaluate our teaching practices. Once we acquired the much needed confidence in our ability to work fully online, we gained momentum.

South African radiography students faced challenges from having no data, poor internet connectivity, to the inaccessibility of technological resources and a major economic crisis. Some students made us aware that they had no money for food let alone money to purchase data to access online lecture notes. The great digital divide in our country became so much clearer and was staring us dead in the face. Educators were tasked to use a multimodal approach to ensure that no student was left behind. In other words, what used to be one simple lecture in a classroom now had to be made available in various formats such as recorded narrated lectures, hardcopy notes, PDF versions and separate audio/visual files. Needless to say, this accounted for anxiety and many sleepless nights. Also, after having been through this, we were faced with dialogues of self-doubt and despondence. At a time when the only access we had to students was online, we had to be very mindful of the data issues students faced. Our file sizes had to be minimised to allow transfer via social media platforms (e.g. WhatsApp) and emails. The university management team worked hard to find ways and

means to assist as many students as possible. Plans were put into place to deliver laptops and internet data to those that were disadvantaged. Workshops were arranged for students to assist them with the use of BlackBoard. This was done as an institutional initiative offered by our Faculty Centre for Innovative Educational Technology. The majority of students were able to adapt to the new learning environment. Online platforms such as Blackboard, proved extremely valuable, especially for larger class sizes. This platform aided in the critical dissemination of lecture notes and the conducting of assessments. While trying to convert all teaching and learning material was challenging, the greatest challenge was not being able to see the students face-to-face.

Online teaching is phenomenal and technology is amazing, but we missed our students. We were able to deliver lectures from the safety of our own homes. This especially enabled us to reach out to those students who had to travel back home to other provinces. There were many challenges encountered along the way from developing content in various formats to learning how to use online resources, and this was a huge learning curve for us. In retrospect, the pandemic forced us out of our comfort zone and made us engage with technology on a level that we might never have explored before.

As educators, we rely on face-to-face interactions to observe students' body language and facial expressions as we teach in order to ascertain whether or not they understand the theories that were explained. With radiography education in particular, there are certain concepts, such as localising anatomical landmarks, which require a more practical, hands-on approach. Such an approach at a time like this, was not possible. When using online platforms, we were confronted with students' becoming more reserved as they switched their cameras off and muted their microphones. Thought provoking realisations such as "if I post a comment on the discussion board or chat box, can everyone see it?" or "I am too shy to ask questions during live lectures". Feelings of shock and confusion filled our minds as these comments were made by students who we considered to be extroverts in the classroom. If they felt this way, then what were the others going through?

Multiple platforms were provided to students to engage with educators. We often found in cases where internet data access was an issue, some students were unable to ask questions immediately as they reviewed the lecture content. This resulted in them forgetting their

queries and not communicating with us at all. If there is no communication, or a break in communication, students are at a disadvantage. This left us not knowing where our students were mentally, physically and emotionally. As educators, we began to experience major feelings related to “fear of missing out” (FOMO). Those around us were getting sick and some of us even lost loved ones. We were confined to the lockdown rules and regulations and we felt helpless. Often we think of a consoling arm around you or a warm hug to know things will be okay, but now those are associated with fears of contracting and spreading the virus. What was once considered a kind gesture, now evoked great anxiety and fear.

Like all other life experiences, with time we make progress and conquer our fears. Innovative technology applications such as breakaway rooms, interactive polls and fun quizzes, have now added life to the computer screens and the students' laughter has warmed up the room. No more do we have that lifeless computer screen with the black background staring back at us. The white blocks are now filled with some familiar faces and also, feelings of hope. While we are far from conquering this pandemic, many lessons have been learnt and immense knowledge has been gained. This pandemic has made us fearful, scared, worried and anxious. However, we find ourselves living in a new era where adaptability is key to survival. We have to constantly reflect on our teaching and critically evaluate our methods of teaching. If something does not work, change it. If something does not feel right, change it. If what you are currently doing does not yield results, change it. Change is inevitable. If we fail to do this, we are failing our students. Overall, we have learnt and grown both personally and professionally. The future of radiography education looks brighter than ever before, now with many more avenues and multimodal teaching opportunities emerging.

“If we teach today’s students as we taught yesterday’s, we rob them of tomorrow”.

John Dewey

Coping with home and professional life

Kleanthis Konstantinidis

Initial reactions to COVID-19 pandemic

In the beginning of 2020, humanity faced the beginning of the COVID-19 pandemic. Its rapid spread and the number of those deceased it was leaving behind, caused shock and fear all over the world. For the healthcare systems and healthcare professionals (HCPs) around the world the shock was also massive. Healthcare systems were unprepared for the need of treating so many infected persons. Many HCPs had never been faced with a pandemic. Thus, the difficulties in dealing with the infected persons soon became apparent, such as the initial inexperience in managing and treating them, the lack of intensive care infrastructures and personal protective equipment (PPE) [1].

Radiographers/radiological technologists (RTs) have also faced and continue to face many challenges, as they must manage increased workload under the fear of infection [2]. Coping with home and professional life is a serious matter and the factors that affect it, are analyzed below.

The stress and fear of infection and transmission of COVID-19 to family members

Radiographers/RTs, as HCPs are at a high risk for exposure and disease from COVID-19. HCPs are more likely to get sick from COVID-19 than the general population, as they are called upon to manage COVID-19 patients daily. Therefore, the fear of radiographers/RTs transmitting the COVID-19 virus to their family, while being asymptomatic, is one more concern added in the occupational stress they suffer.

During the first wave of the pandemic, when there was still insufficient information on the transmissibility of the virus, the following findings were often observed in discussions between colleagues. Colleagues who lived with people in high-risk groups, such as children, pregnant women, cancer patients, and the elderly, decided to live in a controlled area, usually isolated from the rest of the family, as a precaution to avoid transmitting the virus to the rest of the family members[3]. The use of household goods and shared areas, such as the bathroom,

also caused great concern. This led many family members to frequently disinfect spaces and objects, causing irritation and fatigue at the same time[4-6].

Also, the fear of transmitting the virus to the elderly led to their estrangement from younger ones in the family. Thus, grandparents were estranged for a long time from their children and grandchildren, which led these age groups to social exclusion.

Dealing with those family members infected with COVID-19 while trying to stay healthy as healthcare worker

Although radiographers/RTs, such as all HCPs have been forced to live in terms of isolation from their own family, many of them have had to deal with one or more patients in their family circle. The combinations are many, one or more family members who got slightly sick and recovered in home isolation. One or more members, who got seriously sick and needed hospital treatment resulting in recovery or death, as well as a combination of the above cases. In any case the radiographer/RT is called upon to manage a series of events, which are as follows:

- The anxiety and fear of the disease for the sick relative.
- The uncertainty whether he/she transmitted the virus himself/herself or was infected by a relative.
- The management of a family member loss due to COVID-19.
- Maintaining and controlling his/her good health and well-being, to fulfill professional duties and not to transmit the virus to patients.
- The management of physical and mental fatigue from the home care of a relative with COVID-19 in combination with occupational, physical and mental fatigue.

Family support to infected healthcare workers

A significant and crucial matter is the support of the family to the HCP. Whether these persons stay isolated from the rest family due to infection control precautions or got infected, physical distance can cause distress to the family [7]. Strategies for the family to support the HCP are the following:

- Everyone needs to know that distress is logical reaction to these circumstances and is a temporary condition.

- Maintaining family routines is an effective way to keep everyone calm.
- Regular rests and a healthy diet are important. The avoidance of drinking alcohol and smoking is also important, to maintain physical resilience.
- Trust reliable resources for COVID-19 information, such as World Health Organization (WHO) and the European Centre for Disease Prevention and Control (ECDC).
- Develop family rules to manage the infected person and avoid infection. Proper hygiene procedures are needed, like washing hands, cleaning surfaces, avoiding contact with face, taking a shower after work and covering the face when sneezing or coughing.
- Engage children in family rules, help them to contribute to family routine and inform them that this a temporary situation. Keep them calm and help them to fully understand the underlying situation.
- Maintain frequent communication, even inside the same house. Social media, smart devices and the Internet offer a variety of communication tools and are very comforting for everyone.
- Request assistance when needed from neighbors, friends, relatives or professionals.

Personal and family activities after a long and exhausting shift treating COVID-19 patients

Undoubtedly, this last year has been quite difficult for all HCPs. Many of them being in the frontline against COVID-19 are still working covered with PPE for several hours, which is really exhausting. So, another issue for the frontline HCPs, including radiographers/RTs, is their stamina to fulfill family obligations or do personal and family activities after a trying hard shift[8].

Regular occupation with children, physical exercise inside and outside the house, reading, avoiding many hours of watching TV, rest and proper nutrition are just some of the recommendations of the WHO and national public health organizations to maintain physical and mental health, especially during lockdowns. Unfortunately, these recommendations are not always possible to implement after returning from a long, tiring shift, wearing PPEs for several hours.

Staying-home kids, tele-education and both working parents

Another issue that arose during the pandemic lockdowns was children staying at home, due to the interruption of school and extracurricular activities. This worried the parents of younger children, who need constant supervision at home, when they normally should be at school. Thus, if both parents were working, one parent would either work remotely from home, if possible, or be absent from work on special leave to supervise the child or children. Of course, this becomes impossible if both parents are HCPs and their physical presence in the workplace is required. In this case, several parents either received special leave, if this was possible, or worked in different shifts, so that one of them could be at home and take care of the children. Alternatively, they resorted to the help of grandparents or nannies.

E-learning was also a challenge for parents and children, as it was implemented so that students did not miss the school year. The extended stay in front of the computer or tablet screen and the lessons through a video conferencing platform, such as WebEx Meetings, was an unprecedented experience for the young students. In the end, it was a puzzle for both young students and parents, as they had to combine staying at home during winter months with online lessons, study and home activities. This caused great fatigue both to the young students and the parents, who had to help the children to fulfill their school obligations after an already tiring shift.

Living with elders, chronic disease or mentally ill patients

Living with an elder, cancer, chronic disease or mentally ill family member raises important emotional pressure on the family. Every person and every family are going through a period which is characterized by anxiety, fear and panic about the disease from COVID-19, stress about their financial situation and the days following the pandemic. So, these two situations combined, increase the mental and physical exhaustion of persons who take care of patients inside the family.

Many HCPs must manage the physical and mental fatigue of taking care COVID-19 patients in addition to taking care of an elder or a patient at home. Such persons are usually at high stress. Assistance from all family members is necessary, so stress and fatigue are equally shared.

Maintaining well-being inside and outside the house during lockdown

Maintaining the well-being of HCPs is crucial during the period of COVID-19 outbreak. Lockdown is a period and measure used to limit dispersion of coronavirus in society. Unfortunately, the isolation of people in their homes, the controlled movements from place to place, the forbiddance of social gatherings and the interruption of leisure activities brought mental fatigue, obesity due to lack of exercise and conflicts between family members. In-house exercising, reading, walks, rest and healthy diet are the most usual recommendations of WHO and national public health organizations to maintain well-being during lockdown [9].

The role of social media and technology in friends and families' communication

The forbiddance of social gatherings was and continue to be a major problem for all people during lockdowns, for the reasons mentioned before. Also, HCPs must manage the risk of transmitting the virus in society and family. So, they usually tend to be self-isolated, when they daily treat COVID-19 patients, or they met an unconfirmed case, to protect relatives and friends in high risk. The role of social media, communication technologies and Internet is important, because they help healthcare workers to stay connected with friends and family, anytime from any place.

Also, social media and communication technologies restored the forbiddance of educational or training gatherings of radiographers/RTs and all categories of HCPs, assisting the continuity of lifelong educational process. It is worth mentioning that the pandemic crisis highlighted and promoted the potentials of the Internet and communication technologies for remote work and distance learning[10].

However, the frequent use of communication technologies and social media by young people and children was a challenge, causing addiction in some cases. Parents must be aware of that and be able to recognize the signs of addiction, to prevent and protect the physical and mental health of children.

Remote work and distance education during COVID-19

During the COVID-19 outbreak many organizations and employers implemented remote working from home for these employees, whose physical presence was unnecessary in the workplace[11]. As the physical presence of healthcare workers is essential for the management

and treatment of patients in most cases, likewise radiographers/RTs must be present in the workplace to perform any diagnostic or therapeutic activity. On the other hand, radiologists have the choice to work remotely, using a PACS network. Also, HCPs who choose to attend educational programs and academics who deliver these programs can also use web conference platforms and learning management systems to interact remotely[12]. In cases where remote work and distance learning is preferred or required, the pros are:

- Daily travel costs and time saving due to stay home.
- More time for personal activities.
- Work in the comfort and coziness of home and scheduling depending on personal needs.
- Some cons arise as well:
- The isolation from colleagues and other people.
- Physical and mental issues, associated with a long stay at home, like musculoskeletal issues, obesity and depression.
- Family conflicts and technical issues, which arise when trying to combine family life with work at the same space.

Conclusions

Coping with home and professional life is not an easy task when a public health crisis comes in the form of a contagious virus. Many people were forced to interrupt many of their daily activities, while quarantines and lockdowns aggravated the mental health of healthy people and of people with an already known mental illness. To be a frontline HCP is even a more significant challenge in both professional and personal life activities for the reasons stated. Maintaining a good physical and mental condition is important both for HCPs, their families and social environment. The same interest for good physical and mental health must also be shown for those who live alone, as they may have not support family outside the workplace.

In the last year, Greece has faced consecutive lockdowns, which negatively affected the economy, society and human relations. The Greek national health system (NHS) faced a lot of pressure, with Greek HCPs submitting endless efforts to respond to the challenges of the pandemic, despite the problems and shortcomings that plagued the NHS. Worldwide, radiographers/RTs were from the beginning at the frontline of fighting the pandemic,

discovering everyday new ways of operating their equipment, to protect themselves from infection and return safely to their families.

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Radiation therapy educators' perspective: Adapting to the changing clinical practice environment during a pandemic

Krista Dawdy and Renate Bradley

Introduction

The pandemic has changed the way that education has been delivered for health care practitioner (HCP) learners as they work towards meeting the competency standard of their Program. The changes have been dynamic and continue to occur, most visibly in the clinical environment where hands-on interactions are required with learners, educators and patients. As the learners moved from the academic world into the authentic practice environment, they have had to continually modify their approach to meeting the challenging demands of their Programs and the restrictions of current healthcare practices due to the pandemic. The challenges were multiple and grounded in the physical as well as teaching and learning abilities. The challenges included perspectives on the adaptations to clinical supervision and the facilitation of learning within the restrictions while bearing in mind the learning that was meant to occur. This chapter will reflect on our experiences, lessons learnt, strategies used to support learning and on the outcomes.

The Michener Institute of Education at the UHN and the University of Toronto Medical Radiation Sciences (MRS) is a jointly administered three (3) year degree Program, inclusive of didactic and clinical preparation. One of the disciplines under the MRS umbrella is Radiation Therapy, where the learners complete their Program in the real-life practice environment interacting with cancer patients, educators, and other professionals. The clinical aspect includes an eight (8) week introduction to radiation therapy in the first year, a four (4) week transition to clinic in second year, and the third year comprises of a thirty (30) week final practicum where students are able to demonstrate the published Program outcomes in order to graduate and be eligible to write the Canadian national certification examination. The Program outcomes are a list of broad expectations of the MRS graduates that are publicly available. Traditionally, during their clinical practicum the learners spend a 7.5-hour day, 5 days per week under direct supervision in the radiation therapy department at clinical sites

across Ontario. When the first wave of the pandemic (COVID-19) arrived, it was the beginning of the many changes to the curriculum; the way we taught and engaged learners in radiation therapy and the way we interacted as a Program.

Each wave brought their own unique challenges due mainly to different restrictions enacted within the different waves. At the time of writing, we are in wave three, Radiation therapy learners were re-introduced into the clinical environment in wave 2 after multiple decision-making consultations. Most learners had a background of learning through simulation in the didactic setting and required a transition into the hands-on clinical practice activities that they are expected to learn. Challenges to the transition included the limitations imposed by factors such as distancing, use of Personal Protection Equipment (PPE), patient, and team interactions. All learners required a comprehensive training prior to transitioning into the clinical environment that included PPE instruction, infection, prevention and control practices and review of clinical policies and COVID-19 restrictions.

To engage the learners, the educators were required to adapt their approach to facilitating the transition, for example by increasing feedback, tutorial support and educational counselling. This was continuing with the principles of social constructivism, particularly Vygotsky's Zone of Proximal Development (ZPD)[1,2]. Social constructivists believe that individuals construct knowledge during social interactions with others including their teacher. Vygotsky's ZPD is the idea behind scaffolding, where support is provided to take the learner to a higher understanding[3,4]. Continual discussion with the MRS Program at the university level aided in the facilitation of the workplace learning.

Response to dynamic changes during the pandemic

The first wave of the pandemic resulted in learners being removed from the clinical environment due to the impending severity of the pandemic and implementation of province wide restrictions. To support the radiation therapy learners who were mere weeks away from their completion date, the clinical and didactic faculty worked together to identify and adapt strategies that could successfully address the Program requirements and facilitate the learners to write the upcoming national exam certification. The challenge as always, was that learners work at their own pace and have different motivation and self-efficacy drivers [5]. To that end the starting point in supporting these learners meant we reviewed each learner's

outstanding requirements. While this was challenging due to a class size of 35 learners spread across the province, it was a necessary undertaking to allow for a fair process ensuring learners could complete the course requirements and graduate, ready to practice as an entry level radiation therapist.

Faculty were now placed in a position where they were expected to foster competent students that were well-versed in both psychomotor skills and the underpinning theory. As a program we reviewed and categorized the outstanding competencies. Those that were deemed common were addressed first to find adaptations within which the students and educators could work. The learners who near the end of the practical component, had previously completed their clinical rotations except for this, their final one. This signified they had previously had opportunities to observe a variety of radiation therapy cases. This helped us as faculty, to shape the development of realistic case studies that could address both components of competency; the psychomotor and the theory. We felt that these case studies should be comparable to the national examination assessment in terms of content domain and the expectation of critical thinking. One challenge, however, was developing comprehensive virtual assessments for the more complex competencies, since traditionally these have been assessed less often in the clinical environment. One example would be planning and simulation for a hematology site, a case such as this tends to be less common in the clinical environment, more complex, and requiring active clinical judgment and clinical reasoning in the moment. Within a virtual environment, it required innovative solutions to enable the simulation and practical achievement of these cases that would happen on-the-fly in the clinical practicum. Learners were given case studies, utilizing a virtual platform and an oral examination of the case, the clinical faculty were able to complete assessments of their clinical reasoning in a diverse set of scenarios.

First year learners, who traditionally would engage in an 8-week introduction to radiation therapy clinical practicum, instead continued their didactic component virtually and the practicum component was deferred to a later date. The Program curriculum was restructured to allow students to complete didactic courses to ensure that time was not lost overall.

During the second wave as learners were allowed to return to the clinical environment, there was increased anxiety around the uncertainty of completion of the practical time. This was

due primarily to the resurgence in COVID-19 cases, and unfortunately the limited PPE supply challenges at that time. The clinical faculty worked with the students not knowing what the next day would involve. This anxiety could be debilitating for learners and faculty alike, and in preparation the learners were advised to maximize their day-to day-learning opportunities and to strive for competency completion with an emphasis on the more *difficult* competencies that were not easily transferrable to a virtual learning environment[6].

Additionally, the pandemic related continual adjustments in departmental practicum, contact tracing, and the real potential of exposure from anyone including the patients with whom they were required to interact, led to daily ongoing stress for both groups. The health protocol was that if learners were exposed to a positive test patient, the learners would need to self-isolate. While it was difficult for the Program to address the familial and other (psych-social) issues, other than offering virtual counselling, the Clinical Coordinators (CCs) tried to address the missed learning time. Faculty essentially developed a playbook from which the learners could address learning activities in the absence of the physical presence of the clinical faculty, during the 14-day isolation. These novel approaches were dependent on the activities completed, for example some clinical sites used videos and/or connected with the student virtually through various meeting platforms for tutorials. CCs shared their own approaches to learning with each other to ensure consistency as a program, all the while discussing ideas to allow for a holistic approach to engaging learners.

The strategies outlined in the previous section were used to support and comfort the learner, it is important to note that the faculty at the clinical sites also required support to deal with many stressors including some indicated above. In their position as CCs, they were still tasked with developing supportive strategies and role-modelling a calming presence for the learners. Some CCs and faculty staff were redeployed due to the increased need for healthcare support throughout the hospitals and healthcare centres. These challenges led to much needed support from the MRS program faculty. To address these, in concert with the didactic faculty, the CCs focused their thoughts on the tasks required ahead of time and thereby were able to minimize the learners' stress and ensure that we were meeting both the program and the learners' needs.

Throughout the clinical practicum, CCs would have touch points to ensure learners were coping well and were able to achieve objectives as per the practicum requirements. Limitations had to be set and explained to learners for us to ensure there was an ability to do contact tracing, pursuant to the organizational restrictions whilst achieving program goals. In essence, during this time, there were more meetings with the learners; checking in individually and ensuring that faculty were available virtually on Teams™ (video meeting platform) or by telephone. This was a significant addition to the faculty's personal stress. Faculty supported each other, and as it was for the students, they were all one phone call or Teams™ call away from each other when needed.

Conclusion

Our adaptations meant thinking and working differently, as in providing the learners the ability to work more independently and affording them non-traditional opportunities to achieve their competency goals. Adaptations in patient teaching in a virtual format, virtual tutorials, virtual meetings with other healthcare professionals including departmental rounds and education sessions were introduced to ensure safe practices while encouraging engagement in clinical learning. Some of these approaches have transitioned formally as a standard of care but also as a tool to compliment learning moving forward.

In reflecting on the lessons learnt, we experienced some readjustments as all learners were not at the same level of readiness and were difficult to engage virtually. The ongoing touch points both as a group and individual, supported transitioning in a milieu of constant change. Also noted, was the value of using reflection to learn during periods of ongoing adaptations, and to enable the learners and the faculty to move forward towards their goals. As a program we, the faculty, were learners too, developing our skills with the various virtual platforms and coping with the stress of converting the curriculum *tout de suite* as it were. In addition, we increased our understanding of how to better utilize software programs to focus on the curriculum objectives by maximizing the advantages they offered.

We recognize that these were global challenges and collectively looked at how this pandemic has changed the delivery of higher education of all health care practitioners. Some of the strategies have been kept such as the case studies and the independent studies. This chapter was written from the perspective of one site however, similar processes were employed at

other radiation therapy clinical sites across Ontario. We presented the activities that were employed to optimize the learning for our students and to enable them to move to graduation and eligibility to be radiation therapists. We, the authors, recognize that there is nothing that can replace the interaction within the authentic practice setting, but we feel there is room to further develop the curriculum through brainstorming various virtual learning ideas and that by doing so we may be able to further foster competent practitioners. Finally, we would like to say that we are proud of the work of our colleagues and our graduates as we travelled through the 1st and 2nd wave of COVID-19.

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Educator's perspectives on the delivery of programmes and impact on students

Tay Yi Xiang

The dawn before new changes

At the time of writing this chapter, many of us were living through a silent scream as we battle against an invisible and silent enemy. The World Health Organisation (WHO) declared the COVID-19 outbreak a pandemic early last year, and it was no surprise as the world reported alarming levels of spread. Yes, indeed the characterisation of COVID-19 as a global health emergency was not taken lightly. COVID-19 is arguably one of the most significant global crises in history and the impacts and changes caused will be profound and long-lasting.

As the world struggled with rising number of community cases and resurgence of COVID-19, countries were introducing measures in response to the pandemic. The responses of the governments were broad, fast action – the speed and scale of these responses had been remarkable. Globally, heightened regulations were implemented, with many governments pursuing a full/partial lock-down of their country or individual states to halt COVID-19 surge.

Education had been hit particularly hard by the COVID-19 pandemic, with partial or full school closures across the world. Higher education was severely impacted as universities closed their premises and countries shut their borders. Coupled with the unavailability of teachers in these unique circumstances and dual roles of healthcare providers as an educator and practitioner, the pandemic created the largest disruption of education systems in human history. As a result, billions of learners, including radiography students, had their learning process heavily disrupted.

Higher Education

Due to the closure of institutes of higher learning (IHL), classes had to be shifted from traditional classroom delivery to full home-based learning (HBL), and assessments were administered with the use of online software. With the advent of COVID-19, the trajectory and velocity of digital transformation were changed. Lessons are now delivered live streamed

online or via pre-recorded videos. Web-discussion and discussion boards are utilised as other modes of lessons delivery. In tandem, provision of feedback has evolved to giving feedback remotely as a result of the transition to HBL.

With increased movement restrictions and heightened social distancing measures introduced in the community, some radiography students had their practical lessons removed from the curriculum. Fortunately, essential in-persons sessions such as labs and practical were still permitted in certain countries, but with strict safe distancing measures in place. For students who had their practical lessons removed, simulation training was an alternative to augment learning. This includes skills training through simulation-based learning via virtual reality, augmented reality or mixed reality. Moreover, with the implementation of stringent measures, students were required to embrace remotely delivered assessments such as virtual objective structured clinical examination (OSCE) and online test applications. Similar to practical lessons, clinical placements were also subjected to changes. In instances of suspended clinical placements, IHL responded by repositioning academic modules in the curriculum to fill the missing gap.

Clinical

Like other healthcare professions, radiography students experienced disruption of clinical placement. Many IHL made the difficult decision to delay or cancel their students' clinical placements. These decisions were often made in consideration of the health of students, with students on placement identified as a potential vector for transmission of the virus. IHL had considered the challenges of ceasing placement and had attempted to mitigate the clinical placement crisis. Some IHL had shortened the duration of their students' clinical placement, hoping that the pandemic would be abated in a matter of weeks and the world would then go "back to normal". However, with many guilty of this kind of optimism, COVID-19 had taken over the world with increasingly uncontrollable disease incidence and resultant deaths. Statistical tipping point was reached in many countries, resulting in unveiling of new lockdowns, quarantines and curfews. Many local and international students on clinical placement were affected by these restrictions as their placements were halted with immediate effect given by the hospitals[1]. Both students and educators were caught by surprise due to the immediacy of the decision.

Clinical placement is a cornerstone in the development of competent healthcare professionals. Radiography being a hands-on profession requires substantial actual clinical experience which is often only achievable through patient interaction during clinical placement. With prolonged suspension of clinical placement, there were growing concerns over the impact of postponing clinical placement – delay in graduation of healthcare professionals and the pipeline of healthcare professionals to support the increasing stretched healthcare systems.

With this in mind, some countries made a deliberate and careful decision to resume clinical placement amid the pandemic. This called for a coordinated response from the hospitals and academic institutions. There was clear emphasis from all stakeholders for students to be compliant with hospital safety measures. Beyond that, students had to be well prepared for the upcoming clinical placement amid an unprecedented pandemic. Infection control and contact tracing were strongly advocated and students were refreshed with the updated infection control measures prior to their pre-clinical briefing[1]. This included donning and doffing of personal protection equipment (PPE) and ensuring that the students were mask fitted prior to their arrival at the clinical placement site. Similar to pre-clinical briefing, a curated orientation programme was prepared for students at the clinical placement site. Sick management was highlighted to the students and special considerations were made to the students' roster to facilitate cohorting and controlled movement.

In addition, clinical sites and academic institutions had reached a common consensus for modification to the students' clinical performance evaluation – removal of high-stake summative assessments and reduction of formative competency assessment. These were necessary in view of the workload changes and manpower deployment amid the pandemic – reducing the burden on the educators and students. Other strategies that were proactively adopted at the clinical sites included deploying of technological tools for teleconferencing and the use of clear and frequent communications. In tandem, to maximise students' learning experience, learning contracts were used – developed in collaboration with educators to encourage student-centric learning[1]. The well-being of students was also of utmost importance and strategies were in place to safeguard their well-being while on placement. There were regular check-ins during their placement and like all healthcare professionals,

they were given appreciation gift packs and thank you notes[1]. Strong social support was evident throughout the duration of their placement.

The importance of every radiography educator in nurturing the next generation of radiographers is undeniable. Clinical educators play a crucial role in boosting students' engagement in clinical education affected by the COVID-19 pandemic. With the incoming generation Z students, considerations must be made to meet their needs. As independent active problem solvers, generation Z students are technologically integrated, but they have an increased risk of suffering from psychological distress[2]. Therefore, mental well-being of the students was a concern for the clinical educators throughout the placement duration. Furthermore, educators had to constantly create learning opportunities for students who had suffered loss of practicum due to the various restrictions[3]. This was a herculean task for the clinical educators who were already overwhelmed by the rising cases of transmission in the community. They must now educate students while working with minimum manpower and ensuring quick turnaround of the medical imaging services.

While it may be expected for faculty in the IHL to be able to easily embrace the digital learning, clinical educators often struggle with such a paradigm shift in delivering education. Many were not prepared to deliver online teaching and learning and scrambled to come to grips with the practicalities of teleconference tutorials. This is a timely reminder to all clinical educators to start gaining more exposure to online teaching so that they can be more comfortable with their individual virtual teaching skillset when called upon. As if struggling with digital learning was not enough, clinical educators also had to grapple with teacher's ethical dilemma – 'failing to fail' students. The fallout from failing to fail is too great as it can be a patient safety risk when we fail to fail[4]. However, failing a student is sensitive and constantly leads to ethical distress in the clinical educators.

Clinical educators often emphasise on enduring relationships and social networks with the students and to fail a student can be challenging[5]. Nonetheless, authenticity and validity of the assessment can only be maintained through an objective evaluation of the student's performance. Using evidence-based best practices to guide clinical educators' teaching and evaluation would empower and increase their confidence in assessing their students'

performance. As gatekeepers to our profession, clinical educators will need to assail the practice of 'failing to fail'. Ultimately, it is the clinical educator's call.

Students' Impact

The pandemic had led to myriad changes for faculty, clinical educators, and students across the globe. Some of these changes had a severe impact on the education systems and had affected many students. Clearly, while some enjoyed the opportunity to study from home, not everyone relished it. Many students had to adapt to the abrupt transition from fixed, timetabled based lessons to flexible, HBL.

Students no longer had to adhere to a rigid schedule as required from classroom-based lessons. At first, this greater amount of freedom and choice felt good. As one student noted - *"Finally I get to decide what I want to do and when I want to do!"* In a short time, it was easy to fall behind. Students will now need to adopt strategies to self-regulate and monitor their own learning progress while preventing burnout. In addition, with the implementation of HBL, there was a need for a safe and conducive learning environment. It was not unheard of whereby students were detracted from their learning due to the numerous distractions. Indeed, keeping focus would require a combination of motivation, strategy, and support.

HBL also brings an additional shortcoming - lack of physical lessons. There is loss of opportunity for constructive engagement with classmates due to varying study pace among peers. With the looming potential for dissonance among students' comprehension of the lessons, students could also experience the challenge of establishing a better linkage between the theories taught as virtual learning often lacked face-to-face immediacy[6]. This has impact on student motivation and their learning experience.

One of the biggest concerns for the students was the removal and shortening of practical lessons and/or clinical placement. Students without practicums to supplement and augment learning had reported suboptimal learning outcomes. This could be attributed to the lack of opportunity to bridge the theory-practice-gap. There was also concern over students' clinical competency due to reduced time and experience in clinical settings. Many clinical sites experienced changes in workload due to the evolving pandemic. Countries under lock down had reduced elective procedures and subsequently led to lack of procedures for students to have hands-on experience. Additionally, some clinical sites had strict restrictions on

procedures that students could performed – participation in high-risk cases such as aerosol generating procedures and patients with acute respiratory infection symptoms were prohibited. Clearly, there are implications on professional competency and future progression from student to novice professional.

The outbreak of COVID-19 may be stressful, and the pandemic has brought about greater attention for psychological health. Confusion and frustration were expected responses from the students who had to face with uncertainty amid the pandemic[6]. Most students are adaptive and innovative, and over a period, they develop stress management and adopt new learning strategies as previous strategies may be more suited for traditional teaching and learning. However, one should not neglect the impact of COVID-19 on students' emotional, mental and interpersonal well-being. There are various reports on the pandemic affecting mental health of the population, including students. Students can also be subjected to additional emotional impact from their failure in assessment during clinical placements. Coupled with the need to maximise learning in the clinical setting despite various restrictions and limitations, this can take a significant toll on the mental health of students.

Undoubtedly, during a coronavirus outbreak, it is paramount to understand the impact of such changes on the students and what it means to all educators. Only then can we better support our students' social, emotional, and learning needs after the huge disruption of COVID-19.

New Norms

With COVID-19 a universal crisis, the impact will be lifelong. The aftermath of this pandemic will also see emergence of new norms. Indeed, many of these new norms are a result of our response to the students' specific needs which can enact the most impactful changes.

Right now, the coronavirus pandemic is forcing tectonic shifts in the delivery of education. With the rise of virtual learning, there is a notion for such learning to be better integrated with traditional lectures to deliver more value-added teaching. One can also integrate videos into teaching materials to keep students fully engaged. Similarly, interactive tutorials and social media can also be utilised to augment learning. Such resources can provide bite size portions of information that can support learning and clinical care. Alternatively, online game-

based learning is another feasible option to enhance students' learning objectives through an engaging and interactive format.

The pandemic has demonstrated that digital technologies can be deployed at scale, though necessary hardware and software issues must be addressed before such advancement can really take off. With these in place, learning is no longer isolated to the classroom. Video conferencing can be used to provide simulation-based medical education and students can practise intraoperative X-ray imaging through 3D virtual reality simulation. Similarly, video conference technology can be used in the supervision of students – ensuring safe distancing within the examination room. Certainly, remote learning is the future, and we can expect to reap continual benefits from its implementation.

A final thought

As the world marked the first anniversary of the COVID-19 pandemic, resurgence and new coronavirus strains have surfaced. This has led to various leaders and experts painting scenarios of the virus being here to stay – from pandemic to endemic. Strategies are required to be in place for the education system to support our students during the pandemic and beyond. Incontestably, as shared by Professor Klaus Schwab, Founder and Executive Chairman, World Economic Forum - "the pandemic represents a rare but narrow window of opportunity to reflect, reimagine, and reset our world". With the looming endemic and lasting effects of COVID-19, it is imperative for educators to plan for a future with COVID-19; enabling us to safeguard and better prepare our students for this fast-changing environment.

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Educators' experiences adapting a simulation-based course to an online learning environment during the COVID-19 pandemic.

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Introduction

Since 1999, the Michener Institute of Education at UHN and the University of Toronto have jointly administered the Medical Radiation Sciences (MRS) three-year advanced diploma and accredited degree Program in Radiation Therapy. In this program, clinical training is introduced at the end of the first year and is completed in year three starting after the twelve-week Clinical Simulation Semester (CSS).

The CSS was introduced into the Program in 2009 and is intended to assess the student's readiness for their final clinical training. The CSS is divided into the Patient Communication, Treatment Delivery, and Treatment Planning streams, reflecting the main areas of clinical practice. Integration of didactic knowledge and skills was assessed with identified semester outcomes.

The first presumptive case of COVID-19 in Canada occurred in late January, 2020, in Toronto, Ontario and a provincial emergency was declared on March 17, 2020. With the imminent provincial emergency looming, the Program faculty and students were mandated to quickly pivot to an all-online learning environment on March 16, 2020, in order to complete the winter semester as scheduled.

As the winter semester concluded in April, the faculty discussed the adaptations that would be required for the CSS due to COVID-19. Three main issues required our attention: videoconferencing tool, adaption of labs to an online format, and student support and assessments within a virtual realm.

Developed strategies and innovation

In reflecting on the course competencies, faculty felt that it was possible in a virtual environment but with specific conditions. First, the technical infrastructure had to be

supported to ensure functionality was maintained. Secondly, the online procedures and protocols that supported the same pedagogical principles had to be available. Keeping this in mind, faculty strived to align to the principles of good teaching-learning methods matching up to curriculum and objectives, promoting teacher-student interactions, encouraging critical thinking and communication skills, fostering teamwork, and providing online formative and summative assessments.

Best practice was aided via videoconferencing platforms to provide student-to-student interactions with the availability of breakout rooms and the close interactions of faculty guiding the students. Social constructivists' approach to learning was aided by supporting student engagement with others (online community) and the learner being actively involved in their experiences. The sense of community, understanding of the expectations and interactions with faculty during the learning activities fostered critical thinking which was more explicit in the online verses the face-to-face format.

Patient Communication

In the patient care stream specifically, the use of standardized patients (SPs) helped us to prepare each student for real life interactions with cancer patients in weekly sessions. The SPs provided feedback to the student on the relationship and communication style, while the faculty member's feedback was specific to content following the interaction. Post-interactions, debrief of the patient care scenarios was conducted with all the students in a large group. Based on student feedback, the debrief was a crucial step in students' learning.

The assessments consisted of formative and summative evaluation. Faculty recorded each student's interaction with the SP and shared it with the student to encourage reflection. Faculty advisors were assigned to each student to meet with and devise a learning agreement. Using the SMART goal (Specific, Measurable, Attainable, Realistic, Timely) model, students could celebrate their successes and determine a plan to help bridge gaps in areas of improvement. It promoted accountability and an understanding that learning in a professional setting is a continuum and not done in silos. This process prompted students to learn at the level of synthesis in Bloom's Taxonomy.

When converting to an online medium, we wanted to ensure that delivery reflected our historical delivery goals. We therefore developed the Patient Care stream of the online course

to enhance students' communication skills, incorporate reflective learning, and promote their understanding of the integration of content across their previous courses in radiation therapy. The faculty leads decided to use Blackboard™ learning management system as the primary delivery platform.

The SP Program provided training for the SPs to enable use of the online learning platform. There were a few exceptions to traditional delivery, one exception was the format of the interactions, where we aimed to limit the distraction potential caused by the observers, hence, only the SP and the student participating in the interaction would have cameras on. The assessment formats were as before including the reflective component and the development of the learning agreement. The exception was that instead of having each student complete three patient care interactions, they completed one due to logistical challenges in an online environment.

In our online training, students were able to have the planned patient care interactions in an innovative way that both met the program outcomes, and prepared students for their clinical practicum. Initial concerns were on evaluation and providing feedback on students' nonverbal communication skills, but we were pleased with the quality of the assessments by having the SP and the student interacting with their cameras on. By having the SP look directly at the camera and the student looking at the SP on the screen, we were able to mimic real eye contact between the two parties. Students' feedback noted that they felt that the patient was looking at them during the interaction. We, as faculty, found that the students had a higher level of engagement, as the observers felt the need to make their own notes. The course evaluation expressed students' satisfaction, for example, one student commented "I was not sure how we could do this online, but I must say I am pleasantly surprised with how well it went". There were a few similar sentiments noted, including an appreciation of the faculty work in designing these innovative changes. Anecdotal feedback from the clinical sites at which the students were assigned for their practicum indicated ~~t~~hat the students' communication skills met the clinical expectations~~.~~

Treatment Planning

In the Treatment Planning stream, students accessed our in-house treatment planning system remotely and worked independently towards achieving competency at the level of an entry

level therapist. The treatment planning system was populated with a variety of anatomical disease sites for students to plan, including head and neck, gastrointestinal, breast, genitourinary, CNS and lung cases to plan. Previously, students would schedule sessions to collaborate with their peers while creating plans in the treatment planning classroom. This collaboration fostered teamwork and communication skills as they worked in a similar fashion as therapists in a dosimetry department. Each student received a case scenario with most treatment volume contours completed. They would create organs at risk (OAR) contours and design the appropriate beam geometry to complete an optimized plan. Using clinically based protocols each student could compare their plans to an acceptable one.

Students then met individually with the faculty on a weekly basis, in the virtual environment, to present their plan and discuss rationale for their decision-making process. The *Plan reviews* assessed the student's competence in dosimetry. Plans were optimized to satisfy clinical protocols while integrating knowledge from each of the courses across the program. Students had an opportunity to share strengths and challenges encountered during the planning process, and to receive faculty guidance. The assessment was based on the entry-to-practice benchmark since the program faculty were signing off on dosimetry competencies from the national competency profile.

The students and faculty were no longer able to meet in the treatment planning classroom. The faculty searched for a solution where the students could still create optimized plans, participate in plan reviews, and demonstrate competencies. The program was able to accommodate remote access to the treatment planning system for all students to enable them to work on their weekly plan activity. There were many technical challenges as part of this process including students' technical computer requirements being compatible with the treatment planning software. Michener's information management team and program faculty collaborated to ensure minimum impact to the students. In addition, we created an online centralized collaboration forum to allow students to work together. Blackboard Collaborate™ was the platform of choice for virtual interactions and allowed us to create separate rooms for the student presentations at plan review. In the private room, the student shared their treatment planning screen during the discussion and faculty used Socratic

questioning to promote their critical thinking. The pivot existed in a paperless environment where Blackboard Collaborate™ held the submission box for the plan documentation.

Anecdotally, students reported positive feedback at the end of the CSS confirming that the change in delivery allowed students more access to and time interacting with the treatment planning system. Faculty and students were also able to work collaboratively, offering seamless facilitation within the treatment planning stream.

Treatment Delivery

At the Michener institute we have two fully functional Elekta LINAC emulators that include CBCT, but without megavoltage generation. Our system includes an XVI imaging system, a record and verify station, and a MOSAIQ® electronic medical record system customized for our methodology labs. Prior to the pandemic, students performed treatment setups and delivery in pairs following provided protocols. One of the innovative aspects of CSS was that students were patient models from which they could experience the patient perspective during setup and treatment. This experience addressed learning in the affective domain by enhancing growth in patient empathy. Debriefing occurred after each session with students sharing their reflections. Faculty used formative and summative objective structured clinical evaluations (OSCEs) to assess the student's readiness for clinic in areas such as communication, coherence in workflow, clinical skills, and verification and delivery. In the virtual classroom (GoToMeeting™) that we selected, the equipment could not be utilized in a comparable manner as the pre-pandemic classroom.

As student demonstration of the psychomotor skills in treatment delivery in an online format was not possible, faculty focused on the critical thinking aspects, employing weekly online meetings with small groups of students. In preparation for these sessions, faculty prepared a template for patient case studies for students to use for discussion and analysis of clinical situations. The cases were site-based and integrated concepts from oncology, radiobiology, anatomy, and patient care. These concepts drove the discussion format for the technical delivery aspects of radiation during simulation, planning, and delivery. The cases included a bank of discrete decision points to promote student preparation.

To simulate treatment setups online, the Virtual Environment Radiation Therapy software (VERT™) became a critical teaching tool for the radiation therapy techniques. As we had never

used VERT™ for online before, faculty evaluated the performance over GoToMeeting™, prior to the launch. We also evaluated the performance of MOSAIQ® information system over a remote connection. We found after using MOSAIQ® for a few sessions however, that while it worked for the testers (students and faculty), reading the display was a challenge for some students who were using laptop computers with smaller screens.

Treatment instructions/setup notes were documented to enable students to position and align the patient to the LINAC and to verify and deliver beams within VERT™. Faculty controlled the VERT™ system to avoid distraction and the potential stress of students learning the "buttonology" of the system. In addition, VERT™ allowed us to display dose clouds to assess target coverage and OAR doses against accepted target and tolerance doses. For some cases, we used the image matching feature on VERT™ for treatment verification.

The assessments for treatment delivery took place online maintaining the format of the weekly in-class sessions, where the students used the case studies and were expected to perform the associated treatment setup in VERT™. Students worked in paired teams with faculty directing and marking the assessments in real time.

Some of the challenges encountered with the Treatment Delivery stream were:

- latency in the response of VERT™ during poor Internet connections and/or users in distant geographic locations
- Adaptation of some patient files from the VERT™ system to the CSS generated cases.

These issues were relatively minor, however, and overall, we were able to achieve the treatment delivery outcomes completely online.

Moving through to 2021

Treatment Delivery

In the spring of 2021, the Treatment Delivery stream returned to sessions being delivered in-class adhering to strict infection prevention and control measures. However, with the successful learning achieved through case studies, and the positive feedback from the

students regarding the pandemic CSS format, the case studies were incorporated into CSS 2021 as a new and separate stream (Integrated Case Studies) delivered via online sessions.

Treatment Planning

2021 CSS delivery was delivered in a hybrid model, with the treatment planning stream remaining in an online format. The focus of the treatment planning stream did not change therefore, faculty expected the students to demonstrate the planning skills they had acquired by integrating the learning from across all the courses to which they had been exposed in the past two years.

Patient Communication

We felt that the feedback received, and the successful completion of the pandemic model was phenomenal thereby impacting how we viewed delivery of this stream in CSS 2021. It was incorporated in a new model, and we consider it a valuable advancement for the profession.

The model affords student education and training to be virtual and as such can also be adapted by clinics to conduct patient education sessions in this format. We feel that providing patient care education and training virtually, when planned appropriately, is an innovative and evolving model which could be adapted across many settings.

How my professional role has changed (from a student to a qualified radiographer) in the face of COVID-19

Mohammed Bhana

The transition from being a student to a qualified radiographer is a well-documented, difficult process. By utilising techniques such as a preceptorship programme can help the process to flow smoothly at a speed comfortable for each individual. That is, if the situation was the same as the years prior to the COVID-19 pandemic. Although COVID-19 brought about many changes, it also added insurmountable pressure to the national healthcare system (NHS). COVID-19 resulted in newly qualified staff working in an ambiguous and intense environment (more so than it would have been prior to the pandemic) whilst also meeting the demands of the service – despite its many changes - and provide excellent healthcare for all patients.

Under normal circumstances, the preceptorship programme maps out a systematic, strategic process which enables the newly qualified radiographer to apply and embed the skills learnt throughout their 3 years in training to become a competent, confident autonomous practitioner. In addition to this, the process to support a newly qualified practitioner is built on the foundation that the new member of staff would be assigned to a designated experienced radiographer – the preceptor. However, during a global pandemic the circumstances became anything but what was once considered 'normal', which immediately affected the workflow and workload in NHS Trusts across the UK. This changed suddenly and it would be very difficult to find someone dedicated to mentor the same person, hence working effectively as a team with anyone experienced would enable a newly qualified radiographer to develop and apply their skills. Where once a preceptor would support a newly qualified radiographer, the support network evolved to what it had become as a two-way pattern; the preceptor would support the newly qualified radiographer to develop their skills and the newly qualified radiographer would support the team by working with anyone to help support the workload and carry out tasks in areas they were confident in. What was considered routine examinations had been superseded by an immense number of patients who were either suspected or confirmed COVID-19, this was anything but routine.

As the majority of these patients required hospital treatment, most were admitted to the wards, and the patients who had become acutely unwell/deteriorated would need urgent chest imaging. As these patients were too unwell to come down to the department, the inevitable result was an increase in the number of mobile examination requests.

Working in an extremely busy NHS Trust in the North West of England, in a profession that is nationally recognised as being short staffed, can affect ones mental and physical health. Coupling that issue with a disease that had manifested itself across the world did not just result in uncertainty regarding its transmission but it also added to the mental and physical stress that had been transmitted to frontline healthcare professionals. Radiographers had to try to cope with the ever-increasing workflow, for example, the number of mobile chest x-ray examinations as it was unsafe for most of these patients to be transported and x-rayed in the department. One solution to tackling this sudden increase in workload was to send more than one radiographer on a confirmed COVID-19 portable chest x-ray procedure, which resulted in a more efficient workflow. For example, one radiographer would perform the examination, whilst the other would be assisting the other healthcare staff to position the patient and then preparing to clean all the equipment in a rigorous manner following advice from infection control procedures. Mobile chest x-ray examinations were usually conducted as a team effort on the ward before COVID-19, however, when imaging COVID-19 patients the need for a team approach was amplified even further as these sorts of patients would be in serious ill-health and several healthcare staff were needed to assist imaging. The addition of one more radiographer was particularly useful when x-raying patients who were prone as this was a non-standard chest x-ray position and it meant the task of positioning the patient and the equipment was shared and essentially more efficient. Before entering the COVID wards, staff from any area of practice would ensure effective infection control protocols were met for the safety of the team, in this case the entire healthcare team. For example, staff would check the person entering had donned the appropriate Personal Protective Equipment (PPE) by making sure gowns and masks were securely fastened and for those who were unable to use the masks, staff would ensure they had been appropriately trained to use the air-powered hood.

To add perspective, a 3rd year student who had to rush through their final few months of university (where the key skills for post-qualifying are revisited) was now a newly qualified radiographer working on the frontline face to face with COVID-19 patients trying to apply all of their skills to deliver the best level of care to their patients whilst trying to protect themselves and their team contracting the virus. Nevertheless, they were in the meanwhile trying to find their feet in the department and become familiar with their team.

One of the most intimidating, daunting, and harrowing areas of practice for a newly qualified radiographer would be imaging in theatre. Although working in theatres is something student radiographers experience, it was the same type of theatre work that had become nearly non-existent whilst they were on the last few months of their placement. All elective surgeries had been cancelled. Patients who required emergency surgery would receive surgical treatment, however, precautions were put in place where patients who were either suspected or confirmed COVID-19 would result in having surgery with all staff members fully equipped with Level 3 PPE. The challenges associated for a radiographer would be trying to ensure radiation protection measures were still being followed, effective communication would take place both speaking and listening, for example, being able to hear the surgeon when they ask for an x-ray whilst there was an air-powered hood with an air flow rhythm humming directly above the head. Considering the equipment that provided protection from COVID-19 would surround the entire head and was battery-power operated (and very loud), the radiographer would have to be prepared during longer surgery cases to be able to make their way quickly and cautiously to a 'safer area' to replace the battery if it ever ran out as the only thing protecting them from the disease would be the air filtered hood.

Departmental radiography workflow had been changed drastically as well. As X-ray imaging is the primary diagnostic imaging modality of choice for A&E patients the department in this NHS Trust in the North West had to change to suit the needs of both COVID-19 and non-COVID-19 patients. Therefore, one of the primary A&E X-ray rooms had been changed to accommodate COVID-19 patients when they required plain X-ray imaging. Due to the increased incidence of chest x-ray imaging within this room, both radiographers and radiology assistants had to receive training in effectively cleaning the entire room to include all surfaces as well as mopping the floors to significantly reduce the transmission of any microorganisms.

The domestic role of cleaning the rooms was positively taken up by both radiographers and assistants as it would mean one room would be out of action until surfaces had dried, this would essentially have had a negative impact during the busier periods when the waiting rooms would fill (more rapidly with social distancing). Nonetheless, through effective leadership, when required, the rooms usually allocated for inpatient/outpatient imaging would take on the A&E workload for non-COVID-19 patients and at particularly busier periods some patients would be relocated to have their imaging in the orthopaedic department, which was in close proximity to the Radiology and A&E department. This is one prime example where the radiography workforce would demonstrate exceptional team working skills all for their patients.

On the one hand, the re-organisation of the department aided in workload management and patient experience. However, on the other hand, some patients would be anxious due to the uncertain nature of COVID-19 and would not perceive this in the same way. Therefore, strategies had to be implemented so that they would feel at ease. One way this was tackled at this NHS hospital Trust in the North West of England was by implementing a cleaning record in the patient waiting area, where patients could see the radiographers tick off where rigorous cleaning had been completed, patients were also re-assured that the equipment had been cleaned in between patients either through verbal communication or by physically cleaning in front of them. This was essential for the radiographer as it brought a patient-centred approach to their practice, which in turn helped the patients feel safe, at-ease, and experience excellent care by reducing their perceived threatening stimulus due to their interpretation bias.

Upon completion of patient imaging, the images were interpreted by the radiographer for any pathological findings that would need to be communicated to the referring clinician through a ‘red dot’ scheme. This applied to musculoskeletal conditions primarily as these are the skills the newly qualified radiographer would have developed as a student through university training and education. As the pandemic emerged, COVID-19 appearances were evident on chest x-ray images. This type of pattern recognition and image interpretation was most definitely not taught to newly qualified radiographers. The process of independently recognising these appearances confidently and communicating the findings with the referrer

was an intimidating process. This is because the chest x-ray acquisition is almost immediate and much quicker than other clinical tests for COVID-19 such as a swab lateral flow test/PCR test. Interpreting and communicating these findings places a lot of responsibility on a radiographer especially one who is newly qualified and may still need time to develop their pattern recognition skills. Gaining a thorough understanding of these appearances resulted in the patient being transported safely to a designated area, the room would then be cleaned thoroughly, which effectively increased patient care for both the patient that was imaged and other patients that would come into the room. Developing this type of pattern recognition so rapidly for a newly qualified radiographer was extremely beneficial as it determined a key aspect of the patient care pathway. For example, if a non-suspected COVID-19 patient came for a chest x-ray and yet their x-ray appearance was consistent with COVID-19, their entire pathway changed with others around them kept safe; communication with other radiographers in this instance would mean immediate cleaning can be taken place in the room and in areas where the patient had been waiting.

Evidently, the role of the radiographer has developed a lot of extra responsibilities due to the ever-changing nature of the COVID-19. Hence, with the additional responsibilities accrues additional stress, which can be effectively managed with coping mechanisms. For example, adapting perspective of the stress in a more positive way by engaging with the rest of team in a supportive workplace enables the human body to produce hormones to trigger eustress, thus creating a drive for people to help.

An effective team member is someone who can work to a flexible degree covering shifts when required, due to the incidental additional staff sickness, or proactively seeking out areas where they can offer their skills and attributes. A newly qualified radiographer who can recognise their own strengths and limitations and asks for help when required can benefit the entire team as this demonstration of professionalism can take some stress off the other team members so they can focus on areas where the newly qualified radiographer may need extra support.

Enabling oneself to work to a flexible degree particularly when the provision of service has been redesigned to meet the needs of different patients (in this instance COVID-19 and non-COVID-19 patients) greatly benefits the impact COVID-19 has caused on service delivery, in

particular, the backlog of outpatient and GP referrals. Developing and adapting a service to fulfil the backlog of patients in this particular NHS Trust in the North West helped identify cancer patients that were put on their designated care-pathway.

Whilst the COVID-19 pandemic has brought about many challenges with its many changes, the radiography workforce in this NHS hospital Trust in the North West of England have kept up with the demand that has been put on the services with newly qualified radiographers trying their best to become confident, competent autonomous practitioners in the face of this global pandemic. Whilst receiving support from colleagues and providing support for them during these difficult times has enabled them to become established members of the team albeit in a different way than ever before.

Educator Perspectives on Delivery of Programmes and Student Impact

Raymond Keshwan

The coronavirus disease pandemic has become a global issue causing an unprecedented crisis worldwide. This emergency has forced sudden transformations in almost all sectors of the global community, accelerating long-lasting if not permanent changes that would have taken decades to take place. To encourage social distancing and control the spread of the disease, a widespread suspension of non-essential businesses and face-to-face classes at academic institutions has prevented millions of students from attending schools and colleges. Still, the break from classes without suspending schooling has forced a significant modification of teaching strategies.

Educational Inequality in a Developing country

Medical imaging education is far from uniform across the globe. This difference is not surprising as the employment needs for graduates vary amongst countries due to different radiographer roles, responsibilities, and scopes of practice. While the types of programmes, programme outcomes, graduate attributes, and durations vary, the primary goal of all programmes is to ensure that graduates are 'fit for purpose.' Radiography is indeed a very technologically driven field. We have always been at the forefront of innovation and showcasing our educational enhancement examples, but the sudden transition to online learning has impacted vulnerable countries and communities in disproportional ways. In trying to meet the curricular requirements, care must be taken that we do not go overboard with technology so as to disadvantage vulnerable students. Many students depend on university digital resources, particularly in developing countries, to fulfil their learning obligations. With remote learning, the students are distanced from these essential resources. Whereas ideas are being generated for effective use of technology in the developed world, the developing world students still lack access to basic technology. The educational destiny of students is, in essence, dictated by wealth, not talent.

Digital Competence of Learners and Teachers

The pragmatism borne of emergency has placed us from the traditional to online classes. Our old model of classroom teaching with modest accommodation of online education has been significantly, if not entirely, replaced by online teaching through synchronous and asynchronous methods. As teachers, we are now faced with the additional challenge of delivering content through means and techniques that we are new to. In our pursuit of learning and teaching, we are being frowned upon by students who may think they are more digitally competent than us. Our reluctance, as educators, to accept change in pedagogy before the pandemic maybe has become our downfall. In my experience, I have also found that students know much less about online learning than they think they do, although their learning curve is less steep than the teachers. Students can use technology confidently and creatively but not necessarily effectively for learning. Therefore, effective curriculum delivery requires that the teacher learns how to teach using technology and learners learn how to learn using technology.

Teachers need to learn to maintain the delicate balance between using technology for maximum learners' engagement while not disadvantaging learners who may not have the same resource privileges. A gradual shift with learner feedback is essential.

The Changing Role of Teachers

To complete the curriculum, we must never forget that an educational experience requires the learner, the learning community, and the teacher. The digital innovations that have taken students away from campus can easily take them away from their would-be community if teachers do not provide a holistic educational experience. We can very easily be distracted by the recent advancements in technology and adopt them for the sake of innovation in our teaching, forgetting that we are a community of learning and collaboration. We can easily turn into B grade video editors and not even realise that we may be killing the soul out of education. Suspension of interaction amongst learners and teachers will upset us academically and emotionally. Digitisation should bring us together, not divide or separate us from our colleagues and students. A good teacher will do their best to fulfil their teaching contract and assist and support the students in fulfilling theirs.

Engaging Disengaged Learners

Engaged students persevere despite challenges, but with the continually changing circumstances and the stress and trauma associated with the uncertainty and switch to remote learning, it is not uncommon to come across students who are not doing more than a bare minimum. A teacher's contract with the student is bilateral, and success depends on both parties fulfilling their side of the bargain. It may seem almost impossible with the large class sizes to keep a tab on each student, but each learner is important and their situation and learning style unique. A teacher, therefore, should not just do a bare minimum in fulfilling their duties. A simple phone call to find out how the students are fairing and to identify the issues that affect their learning and well-being can assist us in providing relevant support and bringing them back on track. The pandemic has isolated learners, and unguided study in isolation can easily cause us to shift attention to the intellect more than the person of the student. In our rush to complete the curriculum, we should not forget that we are not merely concerned about the intellectual growth of our students but the growth and development of the whole person.

Reemphasising Constructive Alignment

Biggs[1] has stated that knowledge is constructed by the learner's activities rather than being transferred directly from the teachers . In constructive alignment, the learning outcomes, learning and teaching activities, and assessments are aligned and explicit. This is a well-known concept in education, and curriculums are developed based on this concept. The pathway to the completion of a medical imaging qualification has been relatively predictable. Students are required to demonstrate their knowledge and skills in acquiring medical images safely and ethically. Students usually need to gain specific competencies through studying, shadowing, and participating in practical and clinical activities. The pandemic, however, has disrupted this pathway suddenly and considerably. The practical and clinical training has been suspended and has jeopardised students' readiness for progression to advanced learning and graduation. To minimise these negative effects, alternative strategies such as simulation based learning are beginning to be explored but herein lies another problem if our assessment strategies do not match our teaching and learning activities, causing a breakdown in constructive alignment. To maintain constructive alignment, teachers need to ensure that the modified

assessment modalities best assess student skills that are expected to be achieved through the modified learning and teaching strategies and activities.

A modified curriculum in which complex concepts are packaged into bite-sized content and assessed progressively instead of one high stakes exam may promote student learning by not overwhelming them. It also allows teachers to test concepts in detail through various assessments that suit different learners while discriminating the superficial and deep learners. This form of planning and implementation of assessments facilitates early identification of at-risk students and provides room for timely feedback that can improve student performance. It also makes provisions for assessment retakes if students face difficulties and technical problems such as device or internet connectivity issues during the assessment.

It must still be recognised that there is no replacement for face-to-face clinical training. The curriculum should be dynamic enough to allow these competencies to be assessed in later years of study, especially for those students who are not in the final year of their studies. Universities and the regulatory and professional bodies need to work hand in hand to ensure that students who lack clinical exposure are supported during the internship years.

An Approach to Teachers' Selfcare

A lot of attention is being given to students during the transition to online learning and teaching, but perhaps the biggest burden is on the teachers who were just as unprepared for the pandemic. Institutional directives and guidelines do not necessarily allow teachers to teach online and be remotely effectively. Our work has become boundaryless as we are expected to be available throughout the day while simultaneously tracking down on non-participating students and taking care of our own. We need to learn as we teach and explore co-teaching models since remote learning has generated a large group of teachers who may feel more like novices than professionals. Implementing a buddy system in which a colleague accesses our learning management space and offers advice on tools and techniques for effective learning while facilitating learning and teaching can be helpful.

Final Thoughts

Necessity is the mother of invention and the current pandemic has led to the development of multiple tools for learning and teaching. There is an overwhelming amount of resources and information on online and remote learning that may be meant for good, but in reality, can cause a sense of panic. Keeping the student engaged is the key to keeping them learning. We need to be prepared and planning for remote teaching and not wait for a crisis or disruptor such as the COVID-19 pandemic to push us to change or embrace this method. In the healthcare field, remote learning is not a replacement for the traditional method but a balanced blend between the two will be an education equaliser. We are only restricted by our own imaginations on how we can create opportunities for new ways of learning and teaching and delivering health care.

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Lockdown: exploring life beyond radiography

Leslie Robinson

What happened to me during the pandemic and lockdown? I ate too much, moved too little, developed a craving for rum and coke and, at the age of 58 and following a successful career as a diagnostic radiographer, I became an artist. I've been asked to tell you this story; how I have gone from radiographer to artist and, in particular, how the COVID-19 pandemic has helped me find my voice through art.

I must have displayed some kind of a talent for drawing when I was a child as I remember my dad buying me an oil painting kit. I was about 12 years old. I don't remember asking for the paints but he clearly recognised potential and decided to see where the oil paints would take me. He was that kind of dad. I had no idea how to use oil paints and there was no such thing as Youtube. I had to learn through experimentation. The same way, years later, I would come to learn how Magnetic Resonance Imaging works – using eggs and pate (but that's another story).

I remember the first thing I ever painted was an African village scene (fig 1). People were just standing and talking. It was a copy of a photograph I had found. The painting was crude but it captured the essence of what I felt and that's what's important in painting. I was captivated by the light, the long cast shadows and the muted earth colours which are prevalent in that part of the world. I was especially intrigued by the people, what were they talking about? Their body language was interesting; how they leaned into each other to listen. Imagine, a 12 year-old being interested in such things.

Figure 1

Subheading: *My first painting at the age of 12. Oil on canvas panel board*

With fascination I now reflect back on my life and see how these interests have been a recurring theme. As well as visiting Africa three times as an adult my professional life has involved the study of people from both physical and interactional perspectives. As a radiographer I've become a scholar of the human form, developing a working knowledge of radiographic anatomy on a daily basis. Then in the second half of my career, as a radiography lecturer, my research involved observing how students from different cultures interact to become a group of interdependent learners and also how patients and practitioners experience clinical relationships. It's remarkable how looking back my career and life choices are reflected within that 12 year-old's painting.

Of course, as a 12 year-old none of this was apparent and my subsequent life choices were never planned but rather, like most people, I responded to opportunities as they arose. However, a career as an artist was never on the cards. Despite it being one of my favourite school subjects and the only 'O' level for which I was awarded an A grade, I was dissuaded from taking the subject further. "Very few people make a living out of art, Leslie".

I wandered into Diagnostic Radiography by happy accident. The father of a 6th form friend happened to be the Principal at the Bradford School of Radiography and so I heard about it

by chance. The technology depicted on the marketing materials was somewhat off-putting as I'd failed physics at school and it all looked a little too technical but the images of anatomy were interesting enough to persuade me to take a chance.

So in 1980 I started my career as a radiographer. In my first week as a student, I was rostered into 'the library' – where students were expected to undertake self-directed work, not easy when you're in your first week and you don't know what you don't know. Thus, whilst my peers were taking their first x-rays, I did what I enjoyed most. I retrieved a Gray's Anatomy from the shelf and made a drawing of the heart. I was having a jolly good time when the principal came into the library and asked me in a rather disparaging way whether I really thought drawing was a good way to learn anatomy.

Unfortunately, the Principal, Mr Naylor, passed away a few years back, but I'd love to sit down with him now and discuss that question over a pint of beer. As a radiography lecturer I have studied how people learn and even gained a doctorate in education so I think I'd be able to present Mr Naylor with a strong evidence- and experience-based argument for the value of student-centred learning. Tapping into a learner's emotion and joy is much more likely to help them make sense of a set of facts than rote-learning [1-10]

Nevertheless, shame-faced, I consigned my coloured pencils to the bottom of my bag, got out my pen and started to write about the relations of the heart so that I might regurgitate these facts in the exam. Don't ask me to do that now although, unsurprisingly, I could draw you a diagram (fig 2)!

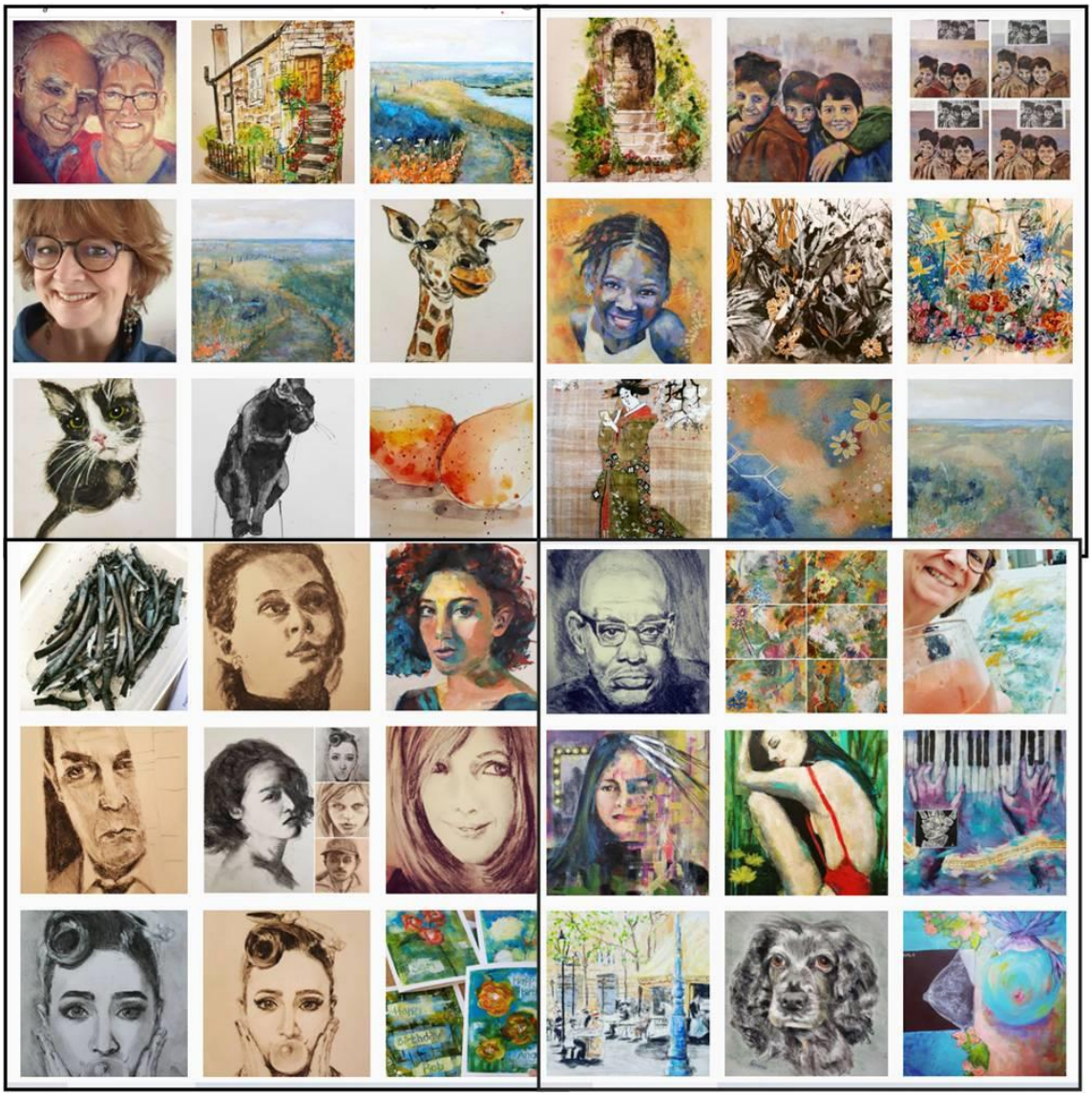
Figure 2 My interpretation of the heart: ‘Coronary Angio’ from my Subjectify series which has also been used this year by the UK Society of Radiographers on one of the World Radiography Day posters. The caption on the poster reads, “Radiography: where science and art collide”.

Despite my shortcomings in both physics and the regurgitation of dry facts, I qualified in 1983 and enjoyed a fruitful career as a Diagnostic Radiographer working in the UK and Saudi Arabia, eventually specialising in CT and MRI. In 1999 I went on to become a radiography lecturer and researcher at the University of Salford in the UK. I presented all over the world and published widely. I've also enjoyed working on collaborative projects with the UK Society of Radiographers receiving the Radiographer of the Year prize (regional and national) on two occasions. This year I was thrilled to be awarded the prestigious Fellowship of the College of Radiographers. I don't say this to brag but to point out that success has to start with the right mindset regardless of knowledge and skills.

Then in 2018 I retired and it wasn't too long before my art brushes started calling. My initial steps were tentative, the muscle memory was weak and I wondered whether I would ever regain my childhood passion. But in March 2020 lockdown happened in the UK. Radiographers were about to experience one of the worst times in their working career. I felt extremely guilty, not only at the relief of knowing I was not working on the frontline at this terrible time but that the pandemic had given me the opportunity to hide myself away in my studio and do what I loved most – paint. I am mindful of being insensitive here but, on a personal and selfish level, lockdown was a happy time for me.

I painted and drew almost every day, scouring the internet for help, advice and inspiration. There were so many free resources available that it was overwhelming knowing where to start. Having worked in what is now a much-commercialised Higher Education culture, I was amazed at the generosity of the online art community and those who were happy to share their knowledge, skills, experience and wisdom for free. I think the lockdown and pandemic fuelled this thirst for online sharing; another positive to come out of the chaos.

Figure 3. Variety of work taken from my Instagram account: instagram.com/leslierob10/



My work is mainly sold to raise money for charities including: The Society of Radiographers' Benevolent fund, Action for Pulmonary Fibrosis, Cancer Support Yorkshire, Rowley Projects and the two choirs I sing with: the Eccles Community Choir and the William Byrd Singers. I only retain enough money to pay for materials and courses. Everything else is given away. Using my gift

in this way has assuaged some of the guilt I still feel at not being able to be more directly involved in healthcare during the pandemic.

My subjects have been varied: portraits, landscapes, florals, abstracts and animals. However, I love painting people most. Although working with patients and looking at images of the body for 40 years could explain this interest, it's clear from my very first painting at the age of 12 that people were going to be a source of fascination to me.

Other experiences from my radiography career have also influenced my choices as an artist, in particular my current 'Subjectify' series (fig 4). This attempts to entwine the person behind (in front of?) the image, in all their abstracted individuality, along with their objective medical image. These are the two worlds in which imaging professionals are required to practise, the objective and the subjective, and we must never forget that they are both equally important.

Figure 4. Pictures from my Subjectify series

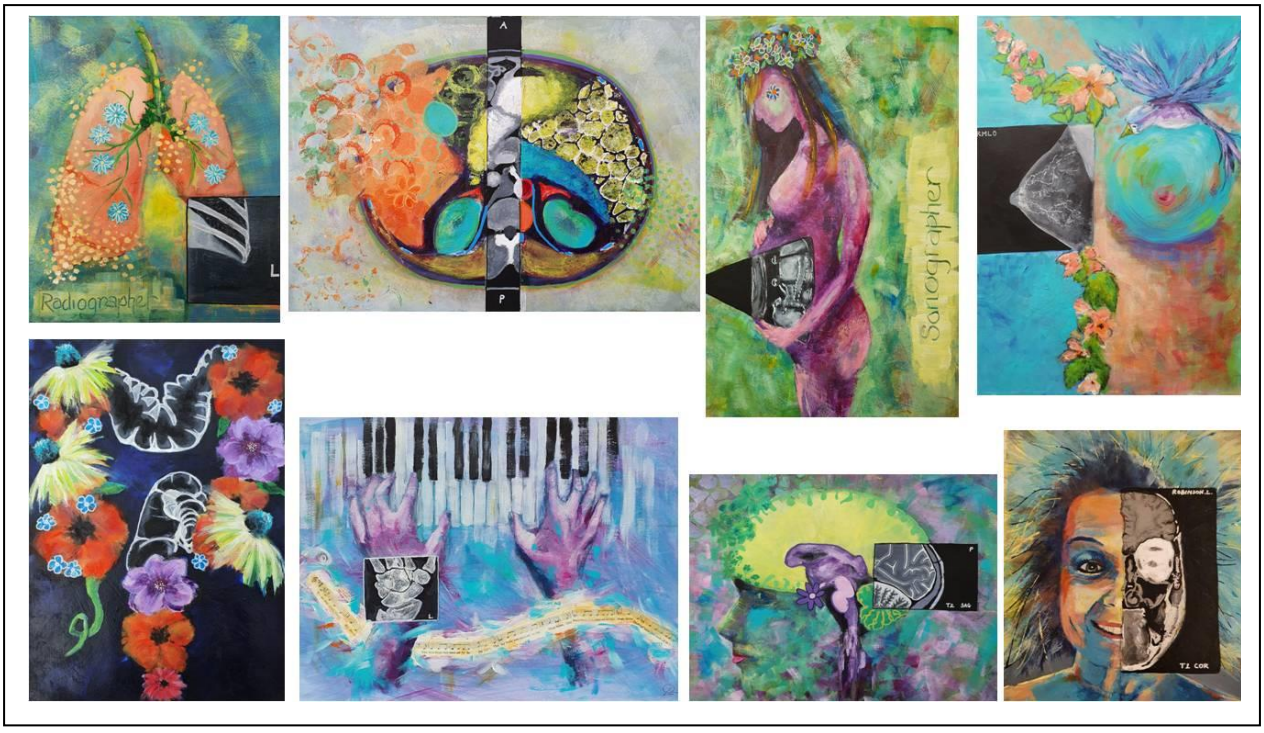
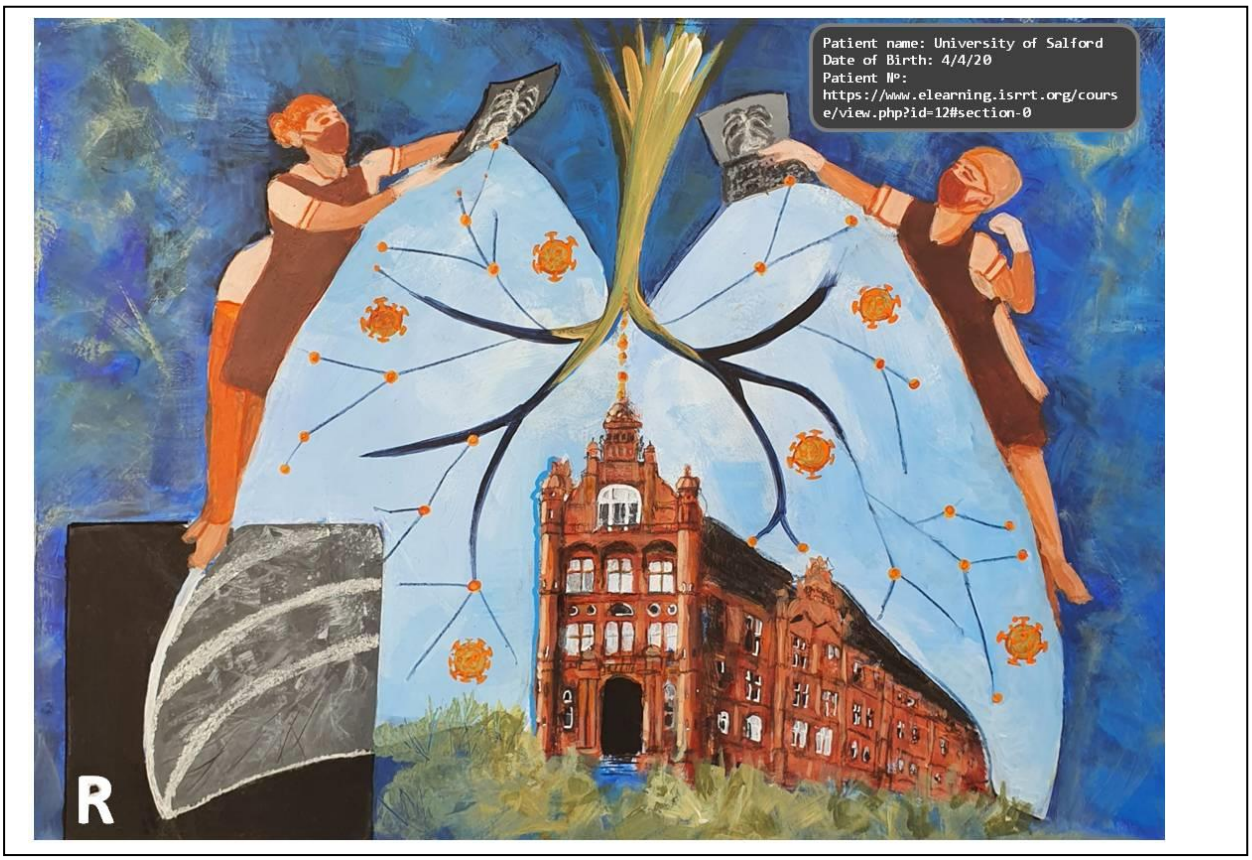


Figure 5. COVID-19 chest cover of ISRRT special issue

In this painting (fig 5), which was created as the cover of the 2021 ISRRT World Radiography Day Special Edition on Radiographer in a Pandemic (https://www.isrrt.org/special-edition-2021), I've chosen to create the lungs, heart and mediastinum from a bunch of nasturtiums. I chose flowers because they are oxygen- and life-giving, and also because I had a lovely pot of nasturtiums growing on the patio outside my studio. The radiographic image is from a reconstruction of a CT scan showing the typical appearances of COVID-19 infection on the lung.

Figure 6. Pandemic Practitioners



This next image (fig 6) was painted for two colleagues, Peter Hogg and Ken Holmes, who created a COVID-19 support resource. This online platform would help radiographers adapt their practice and develop their skills and knowledge with regards to the pandemic. Peter, Ken and their team were nominated for a Times Higher Education international collaboration award for this work which was based at the University of Salford. The painting was created to support this nomination. So the imagery includes a heart in the shape of the university building, lung vessels connected via connectivity 'nodes', a section of lung as seen on a chest

radiograph and the virus SARS-CoV-2 as lung nodules. The two figures encasing the lungs are radiographers, one of whom is looking at a radiograph and the other is accessing the on-line resource. The connectivity nodes link to these two figures. These figures have been modelled on the muses which can be found on the University of Salford building but which, on the building are holding art and technical drawing tools.

So the pandemic and, in particular, lockdown has been useful for me as an artist (and for many other artists I know) but how does this help working radiographers? Hopefully we won't be having another lockdown soon and if we do you may be too exhausted to care about what to do when you're cooped up inside. However, perhaps with its enforced social isolation it's useful to consider lockdown as a proxy for retirement. Everyone who is working now will experience retiring from their life as a health professional sooner or later and it is a well-researched fact that the transition between working and retirement can be a difficult time with many people struggling to manage their identity and fill their time[11]. There already exists a large body of psychosocial research which explores the topic of transitioning into retirement, the exposition of which is beyond the scope of this article. Nevertheless I posit 3 suggestions from my own experience of retirement during lockdown:

- Try to remember what you loved as a child. It is likely that these are still the things that will interest you as an adult. Try to do a little of this now if you can. If you can't, plan and look forward to revisiting your childhood joy when you retire. You may be surprised to find the simple things you loved doing as a child can still make you buzz.
- Reach out to find your new tribes; like-minded people beyond radiography. This is possible even in a lockdown scenario. I found online art groups to be a great source of support. The importance of groups for connecting with others during retirement is backed up by research [12]
- Don't sacrifice all the things you are for your career. I was flabbergasted to re-discover 'Leslie' again, where had she been all these years? In conforming to the rules of our working culture my professional face had suppressed and silenced my inner spirit [13] and I'm a little sad about that.

So my metamorphosis is complete and I am now (nearly) comfortable to call myself an artist. However, in writing this article I acknowledge all the brilliant radiographers and imaging and

therapy practitioners who have worked tirelessly during the pandemic. They have also supported and encouraged me to paint, bought my art work and proved to be a never-ending source of inspiration.

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Lessons learnt and personal experiences of adapting to and working within a pandemic

Lisa Jane Field

The beginning of 2020 started positively for me, from a professional point of view, speaking at a local conference about consultant and advanced practice, attending a 'falls' conference and attending a book launch following my contribution to a chapter in the book. The book launch was a lovely occasion at Liverpool Albert Docks with a lovely reception for approximately 30 people. Back in the hotel I remember watching some of the TV news headlines which were focussed on this virus that had started in Wuhan China and was slowly sweeping across the globe. I remember thinking it makes a change to headlines about Brexit! However, I still did not accept that this virus was on its way to the UK and I slightly dismissed that this was not going to happen and it would all blow over. I still did not feel worried or scared about the virus, as it had not reached our shores.

Personally, my year did not start well after finding that my father had been diagnosed with prostate cancer. Of course, as a family, we were all very worried after my father had lost 2 other brothers to advanced stages of prostate cancer. After having a biopsy in January, he was diagnosed with very early stages of the disease that did not require treatment just regular monitoring. However, following his hospital visit he began to feel unwell with respiratory symptoms including a cough, shortness of breath and fever and rigours, and because of a sudden worsening of his symptoms my mother rang 999 for an ambulance as he couldn't catch his breath. He was treated and recovered within 3 weeks but was this COVID-19 contracted whilst in hospital having his biopsy? It wasn't a given to test all patients back in January 2020 for COVID-19 and there must have been numerous patients like my father that contracted the virus before it was fully acknowledged.

Valentine's Day 14th Feb 2020

I spend my Valentine's Day evening doing a charity bag pack at a local food store for a cancer charity. I really enjoyed meeting many people in such a short period of time (3 hours to be

precise) and having a general chitchat. Some people took me up on my offer to pack their shopping neatly in a bag with bread and eggs at the top. And whilst the coronavirus was all over the news nobody mentioned it or spoke of it, nobody wore facemasks and hardly anybody was using hand sanitiser. There was still an air of **"Keep Calm and Carry on".** In hindsight, I did observe that lots of prosecco, chocolates and flowers were purchased but no toilet rolls. During the pandemic for whatever reason toilet rolls were purchased in high numbers and nobody could explain why

Week Commencing 9th March 2020 – The Cheltenham Festival

It was only when my husband (who works in horse racing) was attending the Cheltenham festival in March 2020 that I started to think about his safety in a huge crowd – what if somebody had the virus? This worried me as my husband has asthma and we had spoken about if he ever contracted the Illness he would probably end up hospitalised due to his respiratory impairment. However, he had been unwell 2 weeks previous with what we thought was a head cold, temperature and cough so we guessed that this bout of illness would have probably strengthened his immune system. Therefore, off he went with his bags packed for a week away with gallons of hand sanitiser but no facemasks - as that was not stipulated in UK guidance in early March 2020. Luckily enough he returned unscathed after having quite a successful festival and did not suffer any effects of being in a large crowd. Since then, we have found out that an acquaintance that was at the festival, who was with a group of friends having a day out were not so lucky – one of the group unfortunately contracted COVID-19 and subsequently died from it. There was now the sudden realisation that this was a really dangerous situation!

Week commencing 16th March

This week was spent mainly making arrangements and getting everything organised. I was watching what was happening in China, Italy and Spain and observing, remotely, their clinical practice, as we would need to do the same here! I encouraged all staff to make sure that their resuscitation training was up to date and in line with new corona virus guidelines, that everybody was PPE fit tested and that we had enough PPE in the department for the start of the wave of patients that were coming our way. I sent a group of radiographers to go and get PPE fit tested on a ward only for all of them to be turned away and told they did not need fit

testing, as they were not “front line”. After escalating this and my frustrations to my manager we sent all the radiographers back to get trained and they did but for some reason there was still a constant battle of trying to get radiographers recognised as “frontline staff”.

Who was going to be first on the scene in Emergency Departments when these patients arrived providing mobile chest x-ray imaging, who was going to provide CT scanning of these patients to assess the severity of the disease and who was going to provide regular mobile chest x-ray imaging of the sickest COVID-19 patients whilst on the high dependency and intensive care units – RADIOGRAPHERS! Since this initial PPE fit testing I have been re-fit tested about 4 times. This is because supplies of the FFP3 masks kept running low and so the Hospital Trust had no option but to find alternative sources. A new type of mask needs all individuals to be re fit tested. FFP3 masks are used when entering a clinical environment in the Emergency Department when the patient is suspected of having COVID-19 as this type of mask offers more protection that the standard surgical face masks normally worn in the theatre setting. FFP3 masks are also worn as part of standard PPE if there is an aerosol generating procedure taking place. The fit testers were amazing and I really do think they need a massive pat on the back for getting everybody safely fitted for FFP3 masks.

We set up daily conversations as a modality team (X-ray) to discuss what we were going to be doing, expected to do and to continually inform every one of changes and advice. Also, these daily communication hubs were a support mechanism to help and steady everyone’s nerves and lower anxiety levels before the cusp of the wave was ready to hit.

Living and working through a pandemic is not good for individuals that already have obsessive compulsive disorders (OCD) tendencies about cleanliness and ensuring everything is clean and I found myself adopting some personal rituals of decontaminating after working clinically in red areas. The “red area” is the term used when referring to areas in the hospital were COVID-19 patients were assessed/treated and kept isolated from other patients that did not have the virus. This including meticulously decontaminating my car with wipes and hand sanitiser even though I did not travel to and from work in uniform as is the hospital and national policy. I then continued this ritual with spraying my shoes before entering my house (again these were not the same shoes I had worn clinically) but it was a precaution I needed to tick off my list before saying hello to my family. A quick “Hello” was then followed by me dashing to the

bathroom to have a shower and wash my hair after every clinical shift. After showering I would then put all my uniform in a separate high temperature wash to ensure a complete decontamination. After about 6 months of this very routine, I decided that I would stop washing my hair after every shift as it really was not having a good effect on my shiny curly hair.

Mother's Day 2020 22nd March - It had finally arrived!

I worked Mothering Sunday and during the shift my mind kept wondering about what provisions I needed to buy on the way home from work and I was beginning to become slightly worried about the public stampede on buying every single toilet roll, packet of paracetamols and tin of soup in the supermarkets. I really needed to go shopping as the fridge was empty and with it being Mother's Day I wanted something nice for my dinner.

In the UK there is an established role for the Advanced Radiographer Practitioner in providing formal radiological reporting immediately whilst the patient is still in attendance in the Emergency Department. This role is extremely successful and has been evidenced positively on immediate diagnosis, reducing misinterpretations in the ED and impacting on the patient's management and treatment. This was a situation that required immediate reporting more than ever in order to help the referring clinician on the findings on the X-ray but also in order to speed up patients' movement and discharge within the hospital.

I provided immediate reporting of all X-ray images referred from ED including chest images on patients that were positive for COVID-19, I soon realised that this was invaluable in assisting ED in deciding what to do with the increasing numbers of patients that required chest imaging that were coming through the ED department. The appearances of COVID-19 on a chest X-ray was still a new and evolving finding but as a team of reporting radiographers that provide immediate reporting of chest X-rays we had already researched the appearances and in collaboration with the consultant Radiologists decided on an number of reporting codes that we were going to use on these examinations to help with patient management and treatment. We also devised an urgency COVID-19 reporting basket on our electronic imaging archive system, EI which highlighted any patient that had had a mobile X-ray for COVID-19 related chest pathology. On a daily / hourly basis we cleared this basket as a priority so that the referrer would have a formal radiological report. An extra provision that we

implemented was that the radiology registrars provided an overnight on-site reporting provision to help immediately report chest and CT images. This provided invaluable support to the clinicians looking after COVID-19 patients.

During the morning a senior radiographer on duty asked if I wanted to assist him on a couple of mobile chest x-ray examinations in ED in the red COVID-19 area. Of course, I wanted to help, as a clinical leader I would never ask the team to do anything I am not prepared to do myself – so off we went. We put the correct PPE on which was in line with the current guidance at that time, however looking back and in hindsight it was not quite as stringent as the guidance was evolving and I remember that all we had on was a surgical face mask, rubber gloves and apron. On completion of the mobile chest examinations, we were returning back to the radiology department when we were met by as entourage of medical personnel escorting an intensive care patient who was being transferred and who was obviously very unwell. All the medical personnel looked to be wearing HAZMAT suits and had respirators and the patient who was in a bed was engulfed in a plastic tunnel. It felt completely surreal and like I was on a film set – All I could think of was the movie "Outbreak" and it made me feel really anxious and nervous about the whole situation. The Corona Virus had well and truly arrived in the UK!

March 23rd 2020 – Officially locked down

Boris Johnston, the UK Prime minister decided to enforce "You Must Stay at Home" apart from key and essential workers. From a family perspective this was initially received positively as my husband was asked to work from home so he was also responsible for home schooling our teenage son who was in his last year of GSCE's. This took some pressure off me as a full time working mother, I could focus on just coming to work and concentrating at the job in hand which was to care for patients with COVID-19 and support my team. So, I do consider myself quite lucky in this respect and the fact that I was going out of the same four walls and working and socialising at work with my work colleagues.

The positives

The positive things I reflect on from the pandemic is how the NHS has improved communication and cut bureaucracy at a time when making the right timely decisions was key to success. Quite often decisions and planning anything in the NHS is confronted with

layer and layer of documentation, consultation and discussion which can take months and months for the end product to materialise. Time is one thing we did not have during the pandemic so it was crucial to have the right people with the right skill mix involved in the pathways and processes from the very start. I think this was a success of the pandemic and we must continue this positive consequence of all the collective work that has been delivered and continues to be delivered in these very pressured times. No decision was made that negatively impacted on patient care from an imaging perspective and patient safety was maintained at all times.

Already established adequate skill mix and well established structures within the clinical and management teams with clear boundaries of responsibilities has been beneficial throughout the pandemic in assisting with the day to day operational planning. This helped with time management and clear delegation of tasks. Daily management huddles were instrumental in ensuring clear communication of daily changes with all staff members in sharing relevant and most up-to-date information. Due to the success of these huddles they are still being used 3 days every week as a method of providing a forum of communication.

Another positive to emerge, but one that is not surprising, is the teamwork and comradery with countless stories of self-sacrifice which drives the central cog of the NHS. Without this we would not have succeeded in getting to the position we are in today. I think everybody that has worked clinically face to face with COVID-19 patients have felt a mixture of emotions from fear, anxiety, uncertainty, anger, frustration, accomplishment, pride, personal resilience, exhaustion and the feeling of being totally overwhelmed. It is no wonder that NHS staff are feeling the effects of the pandemic now not only from a physical impact but emotionally, mentally and psychologically. We must continue to support all staff on this personal and professional road to recovery if we are to have a workforce that is resilient and receptive to the next challenge.

From a personal point of view my positives are I have improved my cooking and baking skills and now feel I have a varied culinary repertoire. I have explored the nature trails locally and realised how many beautiful walks I have been living near for so many years and have never appreciated. I have appreciated my family's company and doing traditional things like jig saws and board games. I also tried to improve my barbering skills as I had to cut my husband's and

my teenage son's hair. My husband hair was easy and as there isn't much- it was a quick glide over and done. My son however, that was a different story, and he wanted some kind of graduated cut around and on top – needless to say he ended up the same cut all over.

Lowest point

I remember that my lowest point throughout the course of this pandemic was driving home in January 2021 listening to the radio which announced the death rate "The UK reports 1,820 more COVID-19 deaths, the most recorded in one day" This was a huge figure in comparison to what had been forecasted at the beginning of the first wave. This literally broke me and I went home and cried, there just didn't seem to be any end in sight! It is hard to comprehend that there have been 5.5 million deaths globally. This has without a doubt been the greatest challenge that the NHS has ever faced and continues to challenge us now with regards to continuing to care for patients with COVID-19, delivering the vaccine programme and trying to clear the back logs that have been the result of the pandemic.

Pathway development

Optimisation of radiology department services has been pivotal in adapting and delivering safe services during the COVID-19 pandemic. The utilisation of established radiographers in advanced and consultant practice roles in imaging has been crucial in providing leadership during the pandemic and adapting working practices to provide flexibility. The breadth of these allied health professionals with many skills enables them to reach across people's lives and organisations making them ideally placed to lead and support transformative change.

We devised a streamlined referral pathway for adult ED patients with fractures directly to the orthopaedic department for treatment and management. With a centralised trauma service the pathway was complementary to the radiographer led ED discharge processes already in operation, which is supported by immediate hot reporting 12+hours a day, 7 days a week. Immediate reporting and radiographer-led discharge (RLD) also continued to be utilised at the other hospital sites. Although ED attendances for suspected bony injury were reduced over the acute phase of the pandemic, opportunities to find ways to reduce the length of stay for patients and minimise return hospital visits were critical. It is estimated that approximately 60% of ED attendances require medical imaging, these are predominately referrals for x-ray.

Rationale

Historically patients with fractures have been returned to the ED with their images and an immediate report for review by the referring clinician. Unstable fractures may either be manipulated in the ED or referred directly to orthopaedics for ongoing management. However, most non-complex fractures require immobilisation and follow up in a fracture clinic. This latter pathway scenario requires multiple patient hand-offs and repeat hospital visit before their definitive treatment is initiated. Utilising the orthopaedic staff, who were not performing elective surgery, 7-day fracture clinics were implemented. This was seen as a way of reducing the pressure on the ED staff and the number of patients waiting, as well as the need for patients to return for changes in their treatment. Using this change a new pathway was designed with the radiographers playing the pivotal role. It is suggested that without radiographer led discharge pathways, the patient can spend up to 50% of their time in ED waiting for a decision to be made by the referring clinician after an image has been taken. Thus development of RLD pathways can significantly reduce patient waits and streamline discharge processes.

Objectives of the pathway

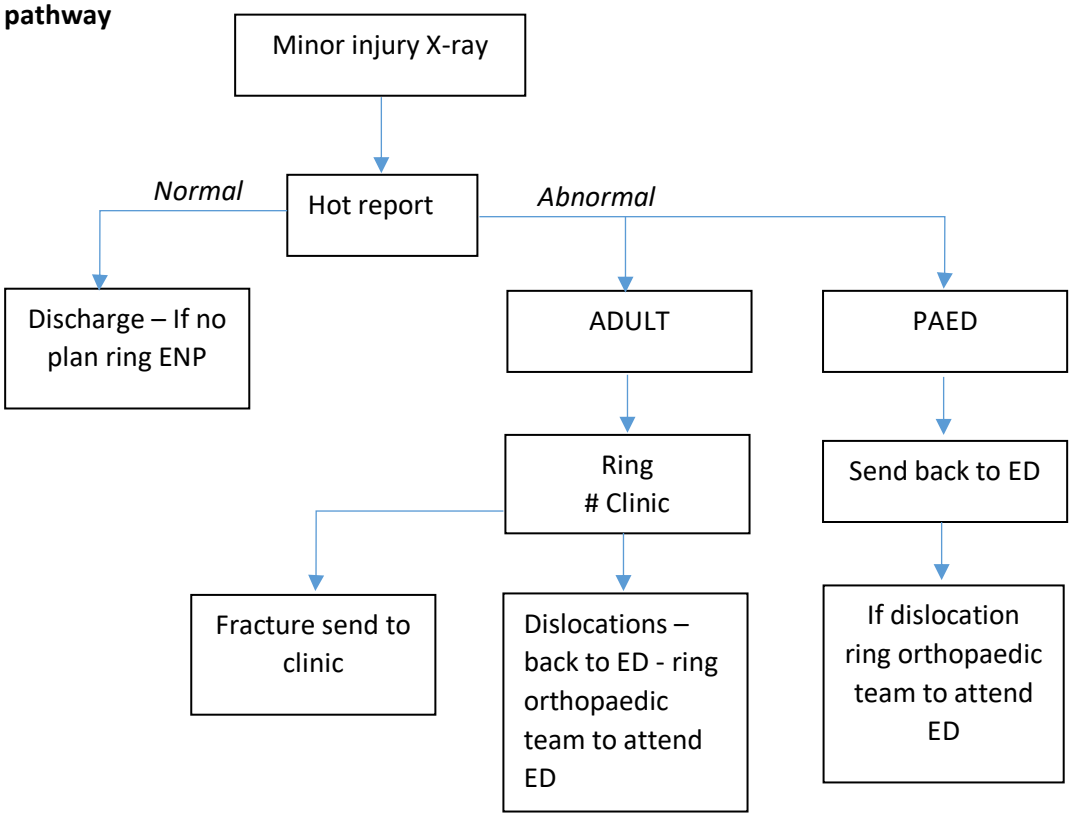
- To continue to utilise the immediate (hot) reporting service
- To reduce the number of patients returning to the Emergency Department (social distancing)
- To utilise Radiographer Led Discharge (RLD) for all patients with normal findings on imaging
- To direct adult patients with a new fracture directly to the fracture clinic
- To utilise orthopaedic staffing to efficiently in the treatment pathway of ED patients

Development of the pathway

The pathway (Figure 1) was developed to stream any adult patient with a fracture directly to the fracture clinic. The advanced (or consultant) radiographer practitioner immediately reported the examination and made a decision on pathway route. The RLD pathway has been in place at the hospital for over 15 years and has become embedded in the service alongside

immediate (hot) reporting. Although the streaming pathway was specific for adults, the radiographers also alerted the orthopaedic team of any paediatric injuries or adult patients that had a dislocation, which would require manipulation or surgical intervention to enable them to attend the ED to improve care. The pathway was implemented in April 2020 and ran for two months at the height of the pandemic.

ED referral pathway



Discussion

This pathway was successful over the pandemic in decreasing the number of re attendances to ED which was essential during the peak of the pandemic in order to prevent overcrowding in an already busy ED and clinical areas and has helped with compliance to the social distancing guidance.

This pathway was initiated during the peak of the first wave of the COVID-19 pandemic in order to streamline patient pathway, reduce patient waits and making more effective use of resources whilst minimising the numbers of patients physically in the ED. At present, radiographer led discharge continues to be in operation across all three hospital sites as a core service alongside immediate reporting. However due to the success of this temporary

initiative there is current discussions with the wider teams to see if we can continue to adapt the pathway and re implement in the future.

Creating different ways of using the talents and skills of the workforce can allow staff to work across traditional professional boundaries, and many organizations have maximized the impact of role developments by appropriate staff utilization and expanded or extended their scope to meet service demands. All the advanced and consultant radiographer practitioners involved in the delivery of this pathway have reflected positively on the impact that this innovative pathway has had on helping to alleviate staff pressures over the pandemic and maintaining patient throughput. The consensus from the team was that this pathway also gave the practitioners better job satisfaction and feeling of helping ED with their work load during this pandemic and cementing a team ethos during this challenging time.

Conclusion

The development of this pathway has demonstrated how advanced and consultant radiographer practice can be utilised to its full potential and have a positive effect on patient management, care and innovatively have an impact on patient waiting times. Whilst this pathway was only implemented for a short period of time, during the peak of the first wave of the COVID-19 pandemic it demonstrates how radiology pathways can directly impact on other areas, disciplines and departments. Unfortunately due to reallocation of the mini C arm and return to normal patient workflow in the fracture clinics the fracture clinic pathway is no longer in operation however there are discussions about developing parts of the pathway and reinstating its use in the future.

Acknowledgement

This chapter is dedicated to my mother-in-law Sue Field who unfortunately lost her valiant and brave battle with cancer on February 26th 2022.

I would like to acknowledge Professor Bev Snaith who helped with the initial set up of the pathway discussed in the text above.

Mobile chest x-ray imaging: Factors leading to the creation of the ISRRT/EFRS COVID-19 website

Peter Hogg

Introduction

This chapter outlines the factors which led to the creation of the chest x-ray website which is housed within the ISRRT eLearning platform. The website's purpose is to help radiographers and radiologists learn how to take and interpret chest radiographs, whilst protecting themselves from contracting COVID-19. The chapter considers the major contextual factors which resulted in an inspirational moment in which I conceived the website idea. The factors stretch back as far as 2009 and as far forwards to include the first 24 hours after which the initiative was conceived. Including this chapter into this book will hopefully highlight the value of professional networking and personal contacts, and the importance of realizing that seemingly disparate pieces of information and experiences can converge to highlight problems and propose solutions, especially in the face of adversity.

The inspirational moment and my proposal

Around 8.30am, on Saturday 4th April 2020, I was having breakfast with my wife, Dianne, whilst watching BBC news. As had become the norm, there was no other news than COVID-19 and it was depressing. I said to Dianne, I felt like I needed to do something to help and pondered on whether my very out of date clinical skills might be of value to the local hospital. In a flash a problem and its solution came into my mind and what my contribution would be.

I surmised mobile chest x-ray would become a common global imaging procedure in the pandemic and I was fairly sure there was nothing about how to interpret the image in the literature with COVID 19 diagnosis in mind. Similarly, there was little available for free on how to take good quality chest x-ray images in a COVID-19 environment in a safe fashion. My proposal was to create a free to access website about how to conduct mobile chest x rays on suspected COVID-19 patients and how to interpret the images.

The enabling factors which led to the proposal and the inspirational moment

The first factor concerns BSc student radiographer learning. In 2009 the University of Salford (UoS), my employer, established a new x-ray laboratory to teach students practical radiography skills. The laboratory included two digital radiography x-ray rooms, a CT scanner and various ancillary equipment. However, within a short space of time, it was clear the laboratory was not being used to anything like its full capacity and this, combined with a lack of clinical places for our students, resulted a novel learning method being implemented and evaluated within the laboratory – 'Research informed Teaching experience (RiTe)[1-13]. RiTe was created and evaluated by Dr Leslie Robinson, Dr Rob Higgins and me and it involved teams of student radiographers working together over an intensive week to design, conduct and write up an experiment which had direct relevance to radiography imaging practice. RiTe became a formal component of years 1 and 2 or our BSc (Hons) radiography programme.

The second factor concerns my involvement with the European Federation of Radiographer Societies (EFRS). Around 2013 I ceased involvement with nuclear medicine and the European Association of Nuclear Medicine and its conferences, and from thereon in my career I focused completely on diagnostic radiography research. Consequently, the European Congress of Radiology became my main conference in which I presented research. This change brought me into very close contact with the EFRS. I became fully aware of EFRS' extensive and highly prolific clinical/academic researchers and journal authors and I started to work alongside many of them on various research and professional activities.

The final factor involves me meeting Dimitris Katsifarakis, Chief Executive Officer (CEO) Support Services of the International Society of Radiographers and Radiological Technologists (ISRRT), at my university. On September 27th 2019, Dimitris came to see me at my university. I showed him the radiography-related teaching and research facilities and we discussed the ISRRT eLearning platform. Dimitris was keen that I developed materials for the ISRRT platform. However, at that time and for the foreseeable future I knew that would be impossible due my professional and work commitments – I had no spare time.

COVID-19 results in RiTe going online

By late March 2020 the UK was locked down and working at home had been implemented. My university required its academics to move all teaching online and as part of this I offered

to help my colleague, Dr Rob Higgins at the University of Salford, translate RiTe for year 2 students into a suitable online format. My proposal was to direct student learning, and the assignment, onto mobile chest x-ray in the context of imaging COVID-19 patients and those suspected of having it. At that time, I knew CT had a role in diagnosing and managing COVID-19, but there was no literature to the best of my knowledge at that time on plain chest x-ray for assessing COVID-19. I knew I was out on a limb with my suggestion but had some confidence that this imaging method would be used extensively in the coming months. Rob and I moved forwards and developed the learning materials to support online delivery, this involved adapting the assessment method to include online presentations by the students. The process of translating to online had to be done quickly, as the students would start the module later in April.

Saturday 4th April 2020 – 'a frantic day'

By 9.00am I had talked through my proposal about a website with Dianne. I explained to her that I was out on a limb – I had no proof that chest x-ray would be used extensively for COVID-19 diagnosis and management. I knew my professional reputation would be on the line if I was wrong, and worse, if I was wrong then radiographers across the world might use the website to guide practice even though chest x-ray might not have value. I was extremely concerned about this, so I sought reassurance from an expert - Dr Nick Woznitza.

At 10.00am I had a phone call with Nick. Nick was a consultant radiographer in London, and he makes diagnoses and writes reports from radiographic images; furthermore, Nick had a formal role in helping one of London's foremost COVID-19 hospitals (Excel) set up its radiology service. Consequently, I trusted his professional judgement. During the phone call, Nick reassured me that I was correct in thinking that chest radiographs do have a role, even though nothing appeared to be documented in the literature at that moment in time. Nick also confirmed almost nothing existed free of charge in the public domain to help radiographers and radiologists take and interpret chest radiographs with COVID-19 in mind. For the rest of the day, I set wheels in motion to contrive a situation which would result in the website being created.

Next, I emailed my line manager Professor Margaret Rowe, Dean of the School of Health and Society at the University of Salford. I asked her permission to lead the creation of the website

and she agreed I could do it. Next, I phoned my friend Ken Holmes, Senior Lecturer at the University of Cumbria, to ask if he would work alongside me to co-lead the creation of the website and he agreed. I knew that Ken and I could not create all the content for the website alone, mainly because of the timeframe the website was needed within. We needed competent and credible authors to write copyright free new content and to create new instructional videos and other materials for the website and we needed an accessible eLearning platform to house the content within.

Given my conversation with Dimitris in September 2019, I engaged him in a Facebook message exchange where I outlined my proposal and what I wanted from ISRRT. Dimitris obliged immediately. He also consulted Donna Newman (the then President of ISRRT); in the message exchange Dimitris indicated Donna to be enthusiastic about my idea. Not only did ISRRT provide the required eLearning platform free of charge, they also offered a web programmer free of charge to put content into the site and to give the site the functionality it required.

My thoughts on getting competent and credible authors would come partly from my international professional network, partly from ISRRT and partly from the EFRS. Consequently, I engaged Dr Jonathan McNulty, the then current President of EFRS, in an email conversation about my idea and he readily agreed to help and would source a range of authors as needed. As a matter of courtesy, and at Dianne's suggestion and again through email, I let my own professional body (Society and College of Radiographers) know what was being planned. I therefore emailed Charlotte Beardmore (Director of Professional Policy at the Society and College of Radiographers), 'for information'. Quite quickly I realized doing this was extremely valuable, as Charlotte became an invaluable advocate and confidante for me and, she allocated eLearning for health (eLfH) resource to the website project, without any charge. In due course we worked with eLfH to produce learning sessions which would link directly to the ISRRT website for COVID-19 chest x-ray imaging and, importantly, complement the learning materials within the ISRRT website.

During the evening of 4th April, I started to sketch out possible contents of the website ready to talk with Ken the following day in a bid to get us into the fast-lane of developing the site.

Self-doubt

I didn't sleep well on the 4th April. My mind was buzzing with everything that needed doing and within such a short space of time. I had serious self-doubts, not least after I had promised several people the website could be done and in a short time frame and that it would have immense value. The truth is, by midnight, I wasn't sure it would be achievable and especially when more and more parts of the world were being locked down - which would make website creation increasingly more difficult as time progressed. Anyway, I got up on Sunday morning and together with Ken we got on with it together with a brilliant and committed team that evolved around us.

Epilogue

Not one single person refused to help us when they were approached for help. All completed their contributions in amazingly short timeframes. If I was to single out one set of contributors, it would be the Italians. At the time of creating the website Italy was in the grip of the pandemic and was suffering immensely. However, despite this, the Italian contributors turned around their website contributions within a single weekend. New artwork was completed by a sheep farmer from the north of England (a close friend of mine) – and he learnt a lot of anatomy and pathology and particularly chest radiography during the website development! New narrated instructional videos were created to demonstrate a range of important techniques that needed understanding or performing as part of the imaging process. Many chest radiographs were collated to demonstrate image appearances of COVID-19. Many more areas of content were produced too. Ken and I peer-reviewed and edited all content prior to it being included into the ISRRT eLearning platform and into the eLfH platform. The website went live within a few weeks of me initially proposing the idea – which is truly amazing.

By mid-2021, the chest x-ray website had been used in 157 countries worldwide and comments from senior international leaders in our profession started to indicate the website's value in saving lives as well as the time saved in helping to retrain and deploy staff into practical roles needed for chest imaging. In the early summer of 2021, the website together with the University of Salford's contribution was nominated for the highly prestigious *Times (London) Higher Education Award*; 600 nominations were received for this

Award in 2021 – the highest number of nominations ever. The Times Higher Education Award is also known as the 'Oscars' (film industry) in Higher Education. All universities in the UK can participate in this annual Award system. At this award ceremony Professor Dame Sarah Gilbert won the top award for leading the team which created the Oxford-AstraZeneca COVID-19 vaccine. The website was also nominated for the Smarter Working Lives Awards 2021, for this there were almost 300 nominations. By September 2021 the website had been shorted listed down to the top 5 nominations for the Times Higher Education Awards in the International Collaboration category; at the same time, it was shortlisted down to the top 5 nominations for the Smarter Working Lives Awards. I feel immensely proud to have worked in the team which created the website and even more proud that a team predominately comprising of radiographers created something which has appeared to be so valuable.

The website can be accessed here - Course: International COVID-19 support for Radiographers and Radiological Technologists (isrrt.org)

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Shifting to online learning and student impact

Aarthi Ramlaul and Hesta Friedrich-Nel

Introduction: learning about what lockdown meant to educators and students

The lockdown measures implemented to curb the spread of the coronavirus in March 2020 necessitated the change from face-to-face to online teaching to ensure the continuity of education delivery. While this posed extraordinary challenges for university lecturers and students, there were also unanticipated benefits. This chapter aims to present the perspectives of lecturers from the UK and South Africa in terms of the change to online learning, the challenges, benefits, and the impact of online learning on students.

The terms 'lockdown' and 'social distancing' worked their way into our new lexicon while the word "unprecedented" found its way to becoming one of the most popularly coined words in these last 18 months. Lockdown has been a measure to restrict people's movement resulting in quarantine in their homes or places of residence. This was seen as an imperative to control the spread of infection. Another measure implemented was social distancing, which involved everyone maintaining a distance of 2m between them except if you lived in the same household. Households became bubbles and support networks over time. As a world, we became familiar with the terms "lockdown" and "social distancing" during the COVID-19 pandemic.

For students living in halls or other student accommodation, however, the lockdown was a time of considerable distress due to them being isolated from their family and peers, mainly due to the delays from the Government granting permission for them to return home during the lockdown. It was a precarious time for academics as students turned to academic staff for guidance. We were none the wiser regarding the pandemic and it was a time of learning for all. Schools and universities were instructed to close but all teaching, learning, and assessment were to continue using online means. There was much uncertainty with ambiguous, often conflicting advice but clear in the message to "stay at home".

Student and staff perspectives on teaching, learning and assessing online

Radiography courses are traditionally delivered as face-to-face courses, however, during the lockdown, we had to learn new ways of teaching using online platforms like Zoom, Microsoft Teams, and Blackboard collaborate, among others. Zoom, with its breakout meeting room facilities, was the most popular online platform used by universities. These and other online platforms have been invaluable in keeping that essential contact and communication with the students and with each other. The online platforms have offered us the potential to change the face and direction of how education is delivered in the future. We were able to share documents during teaching sessions and meetings. During small group breakout sessions, students could share their documents that they have been working on, too.

We suddenly found ourselves embracing a range of new pedagogical practices and new means of connecting with students through online meeting rooms. Although universities provided support, toolkits, and licenses for developing the online learning environment, the tasks and overall burden of ensuring the conversion of otherwise face-to-face delivered content and assessment, and delivering a high quality programme, rested with the course teams. Most radiography courses already integrate online educational technologies to provide a blended approach in their teaching, learning, and assessment practices so many embraced the opportunity to develop the online learning arena further.

New methods to communicate

Meeting the need to continue teaching during the lockdown saw this pedagogical shift from the traditional face-to-face interaction usually enjoyed and valued in radiography classrooms to teaching on virtual platforms. If you asked any academic or student before the COVID-19 pandemic what they know about platforms such as Zoom, Blackboard Collaborate and Microsoft Teams, I think the response, in all but a few cases, would have been a blank gaze. A year later and we are not only familiar with these platforms, but we also know how to use and navigate these spaces. Our new reality consists of online meetings and classes while extensively using email and WhatsApp messages for communication. We have almost become distant from face-to-face contact.

After 18 months post the start of the pandemic, we are seeing a paradigm shift with many students in favour of online learning compared with face-to-face means. Simulation learning

also played a huge part in the education process during the lockdown and was found to be a useful adjunct to learning during reduced in-person contact.

Students, through surveys conducted during the academic year, have indicated a preference for lectures online while prioritising return to campus for hands-on radiography laboratory work and small group tutorials. To emphasise how the students developed self-efficacy in the process, we use a recent example from a SA student who had scheduled an appointment via Microsoft Teams. After greetings were exchanged, the student boldly announced: “mam, I will now share my screen”. And while we discussed the project, it was noticed how she efficiently typed the changes to her document. At the end of the meeting, she was praised and commended on her skills and confidence to navigate this new space.

Reflecting on online and in-person contact - challenges and benefits

The opportunity to switch to online meetings or communicate via social media to maintain momentum and continue with teaching and learning initially created excitement. However, we are now able to reflect on the challenges, opportunities, and benefits, starting with the benefits.

Benefits

As mentioned, the online environment provided opportunities to extend the skillset of academics and students by enhancing innovation and creativity. This resulted in increased self-efficacy and responsibility for creating innovative learning resources. This also afforded us the opportunity for reflective practice and in particular, “why have we been doing what we’ve been doing the way we’ve been doing them all these years?” We were also more productive although maintaining a work-life balance was tricky.

As also mentioned, the online platform assisted with student contact, to keep the momentum in teaching and learning activities and help to salvage the academic year. It was evident that through these actions, students developed attributes such as self-efficacy and revealed that they can take responsibility for their learning. Some students reported that they prefer this environment, as they can engage with the lecturer on a more personal level. They can also work at their own pace and in their own time. Students also showed the ability to engage in

their learning through reflective practice – a very important attribute for a radiography professional and part of the lifelong learning approach of a health professional.

Using these platforms identified other possibilities, such as the teaching of large class groups. Through breakout rooms, opportunities for collaboration of students are possible. Although somehow disappointing, it was interesting to note that students are more willing to switch video cameras on in the breakout rooms while engaging with peers, rather than in the combined session, pointing to the students' willingness collaborate in breakout rooms compared with whole class sessions. Perhaps students experienced a sense of belonging in the smaller groups?

Challenges

Students indicated that they highly valued the online teaching environment as it provided a range of benefits to them, such as convenience, saving on travel costs to university, and were able to care for their families around lecture times. Despite the high value placed on learning online, engaging and motivating students in this setting was a challenge.

One of the most significant challenges we faced was not 'seeing' students online and logged in due to their unwillingness to turn their cameras on and interact. Often, we would be teaching to 100+ blank screens. On multiple occasions, there would be a few students who will not leave the class by the end of the session calling their whereabouts into question and necessitating the closure of the session while they were still logged in.

However, due to the uniqueness of the situation, asking students to turn on cameras could not be enforced.

The fact that students were reluctant to turn cameras on during teaching sessions on Zoom or Microsoft Teams pose a dilemma concerning their motivation and engagement. Motivating students to stay focused was indeed a challenge and the lack of social interaction and community was seen as a reason for this. Furthermore, lecturers, were unable to gain immediate feedback on the effectiveness of the classes. This was a shame as in the face-to-face setting this feedback was spontaneous throughout the session. We encouraged students to turn on cameras at the beginning of the session to say 'hello' and then again at end of the

session to say ‘good-bye’. This strategy was more successful in gaining the cooperation of students to turn on cameras.

Fostering ‘community’ with and among students was a challenge to do using online means. Due to cohort sizes, it was not possible to bring whole classes onto campus, so this further restricted our willingness to integrate the students to create a feeling of community. This was hard to achieve being in lockdown. We nonetheless offered coffee meet online for students to engage with lecturers and each other in an informal manner. These for also useful for disseminating course updates and answering student queries, allaying fears, and providing reassurance. Students found this initiative supportive so we continued to offer the online coffee meets throughout the year.

Greater staff vigilance was required in monitoring student attendance online and following up non-attendees for well-being checks, especially for those living alone in university halls, self-isolating, or struggling with mental health issues. Multiple episodes of exposure to infected persons also meant a constant cycle of students in self-isolation who needed university support.

Practical, hands-on sessions and mandatory training were delivered to prepare students for placement but at a cost of staff time. Changes in teaching room accommodation on campus due to social distancing, however, affected how many students could attend in-person teaching per session. Teaching room and laboratory capacity had, therefore, drastically reduced resulting in lecturers working much harder and through long hours to deliver the same learning to all students.

Working at a distance also affected teamwork among lecturers and the usual camaraderie that one would share with work colleagues “at work” was missing. Prolonged screen time affected eye health and general health well-being due to the very long hours of sitting during meetings and teaching sessions.

Lecturers had to make additional efforts to monitor attendance and then individually had to reach out to the students via alternative methods such as WhatsApp, or email. Lecturers were faced with language barriers, as students sometimes reverted to ‘SMS’ language, often hard to interpret and follow. It also had the consequence that lecturers had to either provide individual guidance and sessions and repeat the sessions several times just to accommodate

all the students. Also, lectures had to be available around the clock to respond to students who manage to interact just before or after midnight. A fair approach was to be appreciative of students' contributions, regardless of the time of submission and the quality. Flexibility with submission dates and submission formats was also essential, not to discriminate against those with less ideal circumstances.

Unfortunately, we also experienced how students 'disappeared' off the courses and this required greater vigilance and monitoring on the part of the tutors to ensure that students were safe. Several students did not respond to messages, did not return calls, and as such, without an obvious reason, were also left behind with their teaching and learning. In line with the lockdown arrangements, the university allowed groups of students to return to campus. This was a great help to assist those students who were left behind by offering additional teaching, learning, and assessment opportunities.

Apart from teaching, all assessment was also conducted through online means using the university intranet. The intranet uses an online system called CANVAS. CANVAS facilities allowed the conduct of timed assessments online. While these were novel to set up and run, the opportunity to sit assessment online resulted in cases where the academic integrity of a small number of students was called into question; disappointingly resulting in academic misconduct referrals and resultant penalties for collusion and cheating.

Due to interruptions in internet connection, load shedding, and limited access to electricity, students reported that they are unable to submit the assessment activities on time, or within the given time limit. As such more flexibility in submission had to be added. This aspect brought several challenges to the fore, such as the integrity of the assessment. We established that students were copying. Although innovative - we learned that some students shared screenshots of their responses with their peers via WhatsApp. While we should perhaps applaud the students for their innovation, the ethical principles in the assessment are compromised. Additionally, there was an increase in the similarities reported via the safe-assign tool on the online platform, pointing to students, not paraphrasing, and perhaps copy text from the internet.

We also faced new issues in terms of access to the required technology; the most prominent being poor internet connection which affected lecturers and students alike. It was also not a

level playing field among students as not all had the necessary resources resulting in digital poverty. From a South African context, engaging in the online learning environment emphasised the reality of the socio-economic circumstances in South Africa. This situation showed that not all the students have equal access to resources such as electricity, data, and devices. It is specifically true for students from rural areas, who usually rely on on-campus facilities, such as the computers and internet. Students who live in areas where they do not have access to electricity, cannot always keep their devices charged. In addition, these students also experienced connectivity challenges. This lack of access created a situation where they were left behind as they were unable to participate.

The university reached out to assist by providing data and devices. The university also made available solar chargers so that students with electricity challenges can keep their devices powered up. The roll-out was slow and filled with challenges. One of the reasons of the slow roll-out, is that the students do not update their contact details.

In addition to the socio-economic factors, mental health issues interfered with students' learning and participation in teaching and learning, like students in the UK. Students reported that they felt isolated from peers due to the lockdown and social distancing. While at home, a student had to take care of home and family responsibilities. There was also the constant possibility of exposure to the virus and losing family members due to the virus that impact their mental well-being.

Although these factors cannot be ignored, perhaps the most significant challenge and limitation were that students could not access the clinical platform to continue with clinical learning and work-integrated learning activities.

Challenges with placement provision in lieu of pandemic

The biggest challenge faced in terms of UK and SA students completing the course was seen in the provision of clinical placement to enable their completion.

The students were on a reduced rotation to clinical placement as most placement hospitals were COVID-19 sites and so could not accommodate all students. This put pressure on the academic team to use other means of teaching practical skills, for example, simulation learning to teach practical and technical skills.

The hospitals were under considerable pressure and it was understandable that we needed to support our clinical colleagues by pulling the first and second-year students from placement and delivering clinical learning through simulation sessions at university. This, however, significantly reduced their clinical learning experience and we have seen evidence of this impact during this current academic year. The feedback received from clinical supervisors indicated that the lack of in-person contact on placement learning negatively impacted students' communication and patient care skills.

The final year students were prioritised and the university held additional exam boards to enable this progression and graduation of this student cohort. This was imperative so that they could complete their clinical requirements and enter the workforce to help support a high-performing but thinly stretched fraternity.

Student impact

We previously mentioned that both students and academics experienced the impact that the COVID-19 lockdown had on their personal and mental well-being. While we do not ignore the academics' circumstances, it is prudent to specifically focus on the circumstances and well-being of the students. It is assumed that academics may already have strategies in place to deal with this matter and may have access to various support systems. As for the students, their abilities and enablers to continue and fully participate in their teaching, learning, and assessment activities given their often challenging home, family and socio-economic circumstances must be noted.

Students experienced that they were divided between their family and their studies. Often, the South African students from traditional and rural families experience difficulties. As first-generation university students, there is a lack of role models in their society. Their family members do not understand the pressures associated with studying during the lockdown. Students were expected to contribute to family chores, many times under challenging circumstances. As such, this interfered with their teaching, learning, and assessment participation.

To participate in their learning, some students had to either visit an internet café, often far away from their homes, or travel to a spot (a hill or mountain) searching for connectivity. Female students informed us that they were often scared of gender-based violence and felt

exposed as students had to search for connectivity at awkward times since the university provided students mostly with night data.

Students also experienced financial challenges. In South Africa, students receive government funding through the National Student Financial Aid Scheme (NSFAS). Being at home and faced with the needs of family members, the students then were tempted to use the bursary money to support their family members e.g., by buying food rather than to use the funds for what it is intended for – to pay their study fees and purchase data to continue with their studies.

Similarly, UK students found the impact of learning online varied. Many students with family responsibilities of having to care for children, parents, or siblings found that it gave them the flexibility to care for their families. Students also found that not having to travel or stay on campus saved them the associated costs.

However, after the novelty of the first few months of learning online, their engagement and motivation started to wane. Maintaining resilience was a challenge. Although university support was provided with regard to learning, teaching, assessment, and robust personal tutor support, the impact on most students was immense. Many students lost their part-time employment or were furloughed resulting in financial constraints. They had to find alternate employment and again this negatively impacted their studies.

Conclusion

It has been a rather challenging period managing change, but, in every crisis there is an opportunity. The opportunity enabled us to learn new ways to teach, learn and assess, and support students through online means. The benefits enabled us to reflect on our previous practices, and in particular to question, “why did we do things the way we did?” Having had our comfort zones stripped, we have emerged stronger and all the wiser for the experience of being forced into the uncertain and unfamiliar lockdown and ‘new normal’.

Educator perspectives on delivery of programs and student impact

Mable Kekana, Hafsa Essop and Kathryn Malherbe

Introduction

Delivery of programs and how this impacted on students during the COVID-19 pandemic is presented from the perspectives of staff members in the University Department of Radiography. In this chapter, the focus relates to problems that emanated due to the COVID-19 lockdown regulations and how these were managed. The era called for urgent decisions to be made, critical thinking in addressing issues that were raised by the different stakeholders, some of which were based on fear and confusion. Collaboration and flexibility became the guiding principles while trying to assure that the academic programs are carried out fully to allow the completion of the academic year and also ensuring that the quality of the graduates was not compromised. The chapter further shares some positive learning outcomes and opportunities that came about during this era.

Embarking on online teaching and learning.

Following on the announcement of the lockdown regulations, educational institutions had to think deeply and quickly about the academic year. Considering the fact that students in the health sciences faculty require both theoretical and clinical training, the change to fully online teaching provided some challenges on how clinical experience and novelty would be achieved. There was a need for the new batch of graduates to occupy employment positions in the following year. The staff members were to continue receiving their salaries and hence were expected to continue with their duties. The students have paid study fees, so if the academic year did not continue there might have been a need to refund them. There was also consideration of the pupils who were in the last year in high school. They would need space in the higher education institution the following year. With lockdown restrictions on, the need to address the abovementioned concerns grew even stronger, leaving very few options for the higher education institution.

Embarking on on-line teaching and learning necessitated that certain things be in place. The first point of concern was whether the students and staff were capable of going on-line, did they have the devices and internet connectivity to go on-line? In South Africa, there is a large divide within socio-economic communities where students reside, which necessitated a rollout of electronic devices and internet connectivity for students alongside corporate entities and procurement processes. This was a mammoth task but was done over a three month roll out period, ensuring all students would have access to the online platforms and other computer systems. Some quick training of both staff and students was undertaken as the on-line teaching and learning facilities were rolled-out. Level five restrictions meant that everyone was at home. Decisions to have senior students back in the clinical training platforms was a very contentious issue. Some people felt that the students needed to be experiencing the management of the COVID-19 pandemic first hand, while others were strongly concerned that the students should not be subjected to the risk of contracting the virus. The shift from face-to-face teaching to on-line programs, was not welcome by all right away. However, as soon as it became evident that the pandemic might be with us for a longer time, the attitudes of both staff and students gradually changed.

Being in middle management between university / students and staff.

Communication between all stakeholders was crucial. This had to change from office phones and contact sessions during lectures to cell phone and email communication. Channels of communication had to be maintained. University management had to wait for the announcements to be made by the state president and the national minister on higher education and training. They would pronounce the university's stance and decision on things like, which groups of students can be allowed back into the clinical training platforms as well as the residences. To this point we would like to highlight that we appreciated the fact that my institution, was somehow prepared in facilitating communication amongst both staff members and students. The institution had developed an Escalation Policy, which forces people from all categories to follow the recommended channels of communication.

Having to deal with parents' questions and concerns.

Parents' concerns were closely related to those of the students, but what came out very strongly was the finances. Study and tuition fees were paid to the higher education

institutions and students were not getting what they had paid for. Was the university going to refund part of the fees? Was the university going to provide devices for the students who did not have and have relied on the institution's facilities, like the library and computer laboratories? The university on the other hand was concerned about the unexpected expenses they were incurring in terms of providing training for the academics on on-line teaching and learning, provision of devices for needy students as well as data for the students to connect on the on-line classes and associated activities. It is important to note that when it came to parents' fears, concerns and confusion, the fear of their children/students in the medical faculties, accessing hospitals working in close relation to the COVID-19 wards, was warranted. Lecturers had to play both the role of "in-loco parents" and academic teacher.

Achieving a work and personal life balance:

During the lockdown restrictions, not only did students have to adjust their living arrangements, but educators also had to create virtual classrooms in their homes to continue teaching online. This virtual classroom often encroached on our personal space, which was shared by spouses, young children and aging sickly parents. Due to lockdown restrictions, assistance in the form of domestic workers, caregivers and relatives was limited, placing an increased burden on us to not only share a space with, but also care for our dependents. Students were also learning to navigate their way through this new way of life. No question was silly, even if they asked it a hundred times. Just as a mother would, we had to check in on absent ones and make sure no one was hungry during the lockdown. All this while attending to admin, webinars, meetings, narrating for an international conference and even recording a YouTube video.

Clinical training amid COVID-19 restrictions – residences etc.

Lockdown restrictions and the need to maintain social distancing had to be taken into consideration as the students were gradually allowed back in the campus and clinical training facilities. What complicated the clinical training further was the availability of patients to practice on in the clinical facilities. The numbers were very low because of the imposed clinical criteria that had to restrict the number of patients. The community members somehow cut down their visits to the healthcare institutions, due to the fear of contracting the virus. This was a challenge as it meant that the students would not be able to do the minimum number

of examinations or procedures as listed in their log-books. Alternative training and assessments had to be devised to address the gap. The need for clinical training software became eminent. This was explored as an alternative to augment the clinical training to help students meet the registration requirements with the health professions council.

Academic offering as registered with Council on Higher Education

As changes were introduced in the academic institutions, to facilitate the completion of the academic year, the regulatory authorities also saw the need to revise their regulations. Besides looking at the professional registration authorities, their requirements and possible amendments to the promulgated regulations, there was also a need to look at how the academic programs were registered with the Council on Higher Education (CHE) and the South African Qualifications Authority (SAQA). Most health professions qualifications, like Radiography, Nursing, Medicine etc. are registered as contact qualifications. The on-line teaching and assessments, somehow presented themselves as if the qualifications were offered at a distance. It was reassuring to see that the CHE relooked at the whole situation as brought about by the COVID-19 pandemic and made provision to enable the students to graduate and enter the professional working environment.

Changes in format of assessments.

As already mentioned, working on-line also impacted on the types and format of assessments used in the different modules. Changes had to make in this regard to accommodate the students and lecturers who were both new to the system of on-line assessments. The changes that were made still remained under strict regulations and had to be documented. All these were necessary to ensure the quality was not compromised and that the assessments remain fair and just. This can further be related to the adaptation in the assessments and examination policies. The 2015 uprising with “fees must fall” movement, got the higher education institutions worried that they could not conduct end of the year examinations. This worry resulted in the amendments being made on the assessments and examination policies to accommodate on-line examinations. During this COVID-19 era, it was easy to look at the amended policies and retrieve guidelines on how examinations and associated moderations should be done.

Do we need more or less lecturers due to online teaching?

During the course of the leadership and management program that we attended during this COVID-19 era the discussion on whether we needed more teachers or not came up. Some arguments were brought forward that since teaching and learning is done on-line, more students can be accepted in the academic programs. There are no space challenges in terms of lecture venues, library or even the skills laboratories. It was further mentioned that since the students are doing most of the work themselves, the number of lecturers could also be brought down.

Contrary to this, it was noted, by the lecturers that their workload tripled during full lockdown as the manner of "in person" engagement was now replaced by both pre-and-post class assessments. Lecturers also had to juggle working from home, family and other responsibilities in the same environment, whilst allowing themselves time for self-care and rest. For academic programs like radiography, teaching and learning as well as the associated assessments, must be diverse to address the different learning styles and the expected learning outcomes of the different subjects. Teaching on-line does not minimize the time that lecturers must take marking essay types assessments and assignments. There is also clinical training that demanded that more staff members be hired due to the need to maintain social distancing in both the skills laboratories and clinical training environments. Students are allocated into small groups, which means the lecturer or facilitator will need more sessions to cover a particular section of the work.

The other controversial point around this, is that the higher education institutions receive government subsidy according to the number of students enrolled in the program. One would be tempted to say that, let the student intake be reduced to accommodate social distancing. However, the university management would not welcome this as it means less income.

Conclusion

COVID-19 continues to bring about challenges to the teaching and learning environment as well as opportunities for growth and development if one chooses to look at both aspects. Lack of freedom to associate in person continues to be a challenge. Technology has however opened doors to other opportunities that can also be cost saving if one looks at the opportunities that came with COVID-19. Time, which is a rare commodity can be saved

tremendously by having electronic communication, meetings and academic contact sessions online. Stress due to travelling to and from the office in heavy traffic has also been reduced. With these, I say, let us look at both the good and bad sides of COVID-19. If we look more on the wonderful opportunities, these might eventually overrule the bad ones.

Enhancing student engagement during online learning: a South African experience

Riaan van de Venter

Introduction

After the World Health Organization (WHO) declared the novel coronavirus (SARS-CoV-2) outbreak a global pandemic on 11 March 2020, a national state of disaster was declared in South Africa four days later.[1-2] Following this declaration, South African universities briefly suspended academic activities and subsequently shifted teaching and learning operations to digital spaces. With this transition, students had to vacate their university residences and return to their homes, and academics had to continue to facilitate and mediate teaching and learning from their places of residence. But, this transition was not necessarily a smooth and easy one.[3]

From a theoretical premise, the digital learning and teaching space is collaborative where different actors (i.e., students and academics) form a community and interact with one another in a variety of ways. These interactions are between the academic and students, peer-to-peer among students, and students' interactions with the module content. These interactions can be structured or spontaneous as well as synchronous and asynchronous. But, for effective learning and teaching to take place the academic must consider the learning outcomes to be met, how these can be best met, and be mindful of any factors that may hinder effective learning and teaching so as to mitigate these. This requires designing the module in such a way that the type of activities used, and presentation of the content, contribute to achieving these learning outcomes.[4]

This chapter therefore aims to provide insights regarding the challenges that impacted effective online learning and teaching and how I tried to circumvent these to optimise student engagement.

Challenges that impacted effective online learning and teaching

Limited knowledge of digitally-oriented pedagogies, resources and time were significant challenges that had to be overcome by both academics and students that are used to contact-based education in order to have a digital space for effective and engaging learning and teaching.

During informal interactions with undergraduate diagnostic radiography students they highlighted four main challenges. For many South African students poor and intermittent internet connectivity is common due to their geographical location, countrywide electricity supply interruptions by way of rotation load shedding and the high cost of internet data. Students also highlighted distractions they experience whilst having to create a conducive learning environment at home since many of them are expected to complete their household responsibilities first before they can engage with university-related work and activities. Hence, they continuously had to adapt to and adopt new learning modes and styles to mitigate the impacts of the previous two challenges. This also had a negative impact on students' time management as they spent more time adapting to the home environment and therefore had less time to focus on their university work. Students indicated that this was very overwhelming and stressful but once they managed to get use to the situation they managed to balance university requirements and home-related responsibilities. Another challenge faced by many students was that they did not have access to adequate, appropriate or even any devices to participate effectively in online learning. The data and device challenges were partly addressed by university-led initiatives by providing resources to students.

The above student challenges have a domino effect since these impact on how academics' teaching and learning activities should be designed and implemented to ensure optimal student engagement so that they learn the required content, as well as enabling them to meet the learning outcomes required. Complicating the situation further was the time pressures of having to cover the remaining syllabus in a shortened academic year due to lost time, as well as presenting each lesson twice to accommodate students across the two learning pathways that the university rolled out from which students could choose. One can therefore appreciate that the transition from campus-based to online learning and teaching can have a great

disruptive effect at a personal, systemic and institutional level for both students and academics.

Strategies used to increase student engagement

I had to take some time for deep reflection on how I will overcome students' concerns without burning out or have students that do not know how to tackle the modules I teach. This was no easy feat. Sometimes I had to address a challenge in the moment as they arose. To follow are strategies that I used to enhance student engagement. Some strategies provided below developed over many iterations as the learning and teaching journey unfolded over the academic year. I also recognise that different strategies are more effective in different contexts but given my context these proved useful and effective to increase student engagement in the online delivery of the modules that I am responsible for. The modules in which I used these strategies were related to pathology, imaging analysis, pattern recognition, and professional practice and ethics.

I used a mix of both synchronous and asynchronous activities. This allowed students to complete asynchronous tasks and activities in their own time with the proviso of submitting any work required by the due date. Synchronous activities held on Microsoft (MS) Teams were recorded so that those students that had connectivity issues or were unable to attend could listen to the recording at a time more convenient to them.

To optimise the synchronous sessions on MS Teams, students had to prepare a specific section of work and come ready with questions. These questions were then addressed during these live sessions. Difficult content was also revised to reinforce learning. The live sessions were also used to apply the theoretical content in practical scenarios so that students could get an appreciation of how and when the content is used in their practice as a diagnostic radiographer.

Students were required to pose any questions that they had related to the module content on a dedicated space on the MOODLE learning management system. This allowed for a single response that all students could access so that other students that may have a similar query had access to a response. It also allowed me not having to respond to the same queries multiple times. This also assisted me to have some more time to direct my attention to other aspects such as lesson planning, marking and so on. Having this section also created a

community of peer-to-peer learning where students started interacting among one another and dealt with queries among themselves. In these instances, I would merely check-in and correct inconsistencies if there were any so that all students had the correct information.

It was also very important for me to have an online presence so that the students did not feel that they were on their own and that I was alongside them in the journey. I designed my teaching and learning materials in such a way that the materials could be utilised for self-directed learning in preparation for the synchronous session on MS Teams. The learning materials were structured in such a manner that the instructions were clear yet guiding the student through the content that they need to cover. In some instances, templates or infographics were developed to help them navigate the content or to help with reinforcement of various concepts. Directing students in a clear manner as to where they could find content was an important consideration so that they spent less time in finding information and focused more on engaging with the content in order to make sense thereof and internalise the important concepts and learning points.

Regular self-assessment through multiple try, untimed, quizzes on MOODLE were also incorporated to help students test themselves to promote increased student engagement with the prescribed work. These regular opportunities allowed for them to assess their knowledge. Specific, formative feedback were incorporated in these quizzes so that students had automatic, timeous feedback in order for them to address any gaps in their knowledge almost immediately before moving onto the next section of the module.

Another strategy implemented was to provide students to simply off-load. These sessions were useful as it allowed me to learn from my students and then to adapt my strategies to enhance their learning experiences even further.

Lastly, I created a weekly schedule in advance so that students could have a plan to help them plan their engagement in module activities. This was done to assist them with managing their time amidst everything else they had to do.

Conclusion

The coronavirus pandemic caused a major disruptive effect for both students and academics which forced adaptation and adoption of new ways of being, learning and teaching without

necessarily being appropriately and adequately prepared for it. However, learning in the moment, being flexible, responsive to the contextual triggers, having an open-mind and being mindful of the task at hand and the intended audience proved to facilitate effective and appropriate implementation of a relatively effective online learning platform to teach undergraduate diagnostic radiography students whilst maintaining increased student engagement in the modules I taught. Finally, it is worth noting that the online learning and teaching experience and platform can be amended over time to increase student engagement even further.

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Lessons learnt and personal experiences of adapting to and working within a pandemic. CPD implications - the experience of the CT head reporting special interest group

Tamsin Arnold

The computed tomography head reporting special interest group (CTHR SIG) was formed *in 2011 by the early pioneers of radiographer reporting to improve communication and interactions between colleagues with an interest in neurological CT. The group welcomes all professionals regardless of experience and members include radiographers (reporting radiographers and non-reporting radiographers), consultant radiologists, registrars, academics and representatives of industry. As an inclusive group it aims to gain support for reporting radiographers and advanced radiographic practice.* The group provides a range of continuing professional developmental (CPD) opportunities, support and a forum for discussion. The group was formed to connect members and to facilitate the sharing of information and professional standards.

Reporting by radiographers is now widely adopted in the UK with a current expansion into cross sectional imaging reporting to support service delivery. This has been driven by skill mix initiatives and a shortage of radiologists. The first CT head post graduate qualifications were offered in the early 2000's. Education and mutual support is of great importance as one founder member recalls how the first radiographer reporters faced 'institutional prejudice, lack of reporting facilities, snobbery and professional elitism'. They acknowledged that in order to advance and progress they had to 'continually read, learn, and educate ourselves and others, to be the very best professionals in order to combat these prejudices'. There is now a small but established team of radiographers who actively undertake CT head reporting in their formal job roles. CT head reporting radiographers are often the sole reporters in their professional setting. In this situation, being part of the community that the CTHR SIG supports is very important. The group is affiliated with the society and college of radiographers who are the professional body and trade union for radiographers in the UK.

When the group first formed they utilised email as their primary form of communication. In addition to monthly written newsletters the group met annually for a one day conference. This enabled members to meet each other in person and benefit from a day of lectures from fellow CT head reporting radiographers. Although the conference was centrally located to be within easy travelling distance for most members it required an overnight stay for the majority. The costs of the course were minimised through the kind support of the venue, but travel expenses had to be covered by the individual. With the advent of social media a Facebook® (FB) group was formed. Initially this group remained quite small with a membership of only 100.

As the COVID-19 pandemic spread around the world, education for radiographers could not be delivered in the traditional way. Courses were promptly cancelled and any in-person interactions were curtailed. Initially radiographers did not have the time or spare mental capacity to focus on CPD due to their essential role on the pandemic front line. Many reporters found themselves not only returning to clinical work but to modalities they had not practised in for some time to provide a flexible workforce. Radiographers were mentally and physically exhausted.

As the world became aware that the pandemic was to be prolonged, it became apparent that CPD opportunities would need to resume. Radiographers need to learn and develop throughout their career, to ensure their skills and knowledge are up to date so that they can practise safely. The longer the cessation of CPD opportunities continued, the bigger the gap in knowledge would become.

The CT SIG group had to adapt its delivery of educational content as face-to-face CT Head SIG meetings were no longer viable. As people started to feel more isolated the membership of the FB group grew rapidly. The group decided to hold a monthly online meeting and used the FB group to advertise the sessions. These online meetings have been remarkably successful with over 60 delegates logging in via Zoom to discuss cases and ongoing issues affecting the CT Head reporting community. The sessions are divided into two parts. The first covers practical solutions to problems that reporters face such as fatigue, visual perception and dealing with reporting errors. The second part is interactive and all members can contribute to case reviews.

A member states that the group administrators have 'risen to the challenge and have developed a remarkably successful monthly Zoom meeting where we review difficult cases, promote discussion and support each other'. They go on to say that the group has been 'instrumental in developing the reporting radiographer community and ensuring we stay connected through these difficult times. We are now almost a year into the pandemic, and the presenter has not lost any enthusiasm or his seemingly endless energy'. Another member says, 'the opportunities the group has provided to me and others (particularly during the current pandemic) have been second to none'. This is further supported by another radiographer who says 'through online meetings the group promotes discussion and dialogue, helping to reduce, I believe, the potential feelings of isolation some radiographers might be feeling right now'.

When discussing the redeployment of radiographers to other modalities to support skill mix one 'displaced' radiographer felt that the sessions are 'a really valuable resource to maintain CPD commitments especially in the current climate. During the pandemic due to a variety of reasons my reporting has been very limited so being able to attend the virtual meetings has kept my brain engaged'.

E-learning has become common place with many educational opportunities available by virtual delivery. When the CT head SIG started out online, education was emerging and the group had very little experience of delivering content on-line. There were many different delivery platforms available, yet the software would need to be accessible to all. This required relatively low processing and internet connectivity levels. The group were mindful of users not needing to download software. Security was also a consideration with the sensitive content of the session. Although patient confidentiality would be maintained throughout the meeting, users needed to discuss their personal experiences in a safe environment surrounded by fellow professionals.

The group receive no funding or sponsorship and this allows us to remain impartial in our approach. All resources that are created by the group are done so free of charge and the contributing members all donate their time. As a consequence, all of the educational content is offered to members at no charge. Without a monetary budget the platform selected needed to be very cost effective. While Microsoft Teams® became widely available for the

employees of the UK's National Health Service it was not accessible without charge to our international colleagues and those that work for private employers. Therefore, we decided to utilise Zoom® due to its accessibility and simple usability.

As our first session took place we waited nervously for members to join the online waiting room. It was a relief to see the numbers rising at least 15 minutes before the appointed start time. We generally have an experienced member presenting the content and the chairperson controlling entry to the session. As the Zoom® details are only accessible from a private FB group, all members are already vetted. The session was successful and it was wonderful to see the faces of our colleagues.

We have not encountered many problems with the delivery of the session. We were unfortunate during one session when Zoom® had an operational outage across Europe. This delayed the start of the session and a minority of members reported that they could not gain access. This was outside of our control and has been an isolated issue. We have also had difficulties with members drawing on the presentation screen. This was easily solved by altering some of the Zoom settings. Considering the administrators had no experience with teaching informally online it was a steep learning curve for all involved. We have gained confidence over time, not to mention some new technical skills.

The administrators explored the advertising opportunities available. The groups FB page already contained a source of potential attendees and became the main method of advertising. The group has built some strong relationships with other FB groups and were permitted to post details of the sessions on their pages. The SCoR posted the session on their social media channels and the group were featured in the Therapy and Imaging in Practice publication. As the FB group grew so did the numbers of attendees at the online meetings.

As the pandemic spread globally our members were increasingly concerned about our colleagues in other areas of the world. The UK could be considered as the most advanced country with respect to radiographers advanced practice in areas such as image interpretation and reporting. We felt it would be appropriate to share our resource with the international community and welcomed members from other countries. As the sessions are free to attend it was an ideal opportunity to develop and enhance the radiography knowledge and skills of the international community of radiographers working in developing countries.

One international member reports ‘I've gained so much valuable information that I'm sure will help me progress further in my career’. Due to the potential problems with live attendance throughout different time zones we decided to record an abridged version of each meeting to ensure members could learn at their convenience.

We were aware that the content of the session should be guided by the members, therefore feedback was gained at the end of every session. The majority of comments were positive such as ‘every session I attend I always learn so much, it’s always time well spent!’ and ‘this group has been a fantastic virtual community and a place to share good practice and interesting cases. During the pandemic my reporting has had to take a back seat to the demands on clinical work and this group, and the interactions, have helped to keep me engaged with the reporting world’.

We have responded to comments that have suggested that we cover specific pathology and have added some recorded videos that cover the different technical aspects of reporting. Other requests included providing information on the use of CT in dementia reporting and sessions on CT angiography. Some members suggested we change the day on which we hold the sessions. After conducting an online poll we found that there was no clear majority, however the start time was adjusted to take into account the majority of radiology departments day shifts. If members were not able to attend the live session, they could still access a recording from the FB group. This meant that as radiographers were working longer hours on the pandemic frontline and later the recovery phase, education opportunities were not compromised.

Some of the more established members of the group asked us to provide some educational resources for their non-reporting radiographer colleagues working in CT. It could be argued that CT head reporting is an area of advanced practice that is not as recognised as others such as plain film reporting or CT Colonography. In an effort to encourage radiographers into reporting we posted a series of ‘basics’ talks. Rather than present these in a live format we felt that a pre-recorded video would allow members to review the content at their own pace. The response to these talks was overwhelming and ultimately increased the attendance at the live sessions as individuals’ interest was piqued. Even if radiographers are not actively reporting they can gain a lot of information from the educational content the group provides.

As the pandemic starts to recede and we feel a sense of normality return, we hope to continue with the online sessions. We feel that virtual attendance has been successful in this situation. Many members are spread across the UK and worldwide. The sessions represent a cost-effective solution that allow reporters in a minority field to network with each other. We feel more connected as a professional group, as rather than meeting only once a year we gather once a month. During a time of adversity we have seen our community grow stronger and more supportive. We hope that our efforts ultimately contribute to continuing professional development and promotion of the radiography profession as a whole, both in the UK and worldwide.

Radiography Education during the COVID-19 pandemic – Experiences from an Academic/Clinical Educator

Gareth Thomas

The COVID-19 virus was first detected in the United Kingdom (UK) in late January 2020. As of 26 June 2021, there had been more than 4.7 million confirmed cases and 128,330 deaths among people who had recently tested positive – the world's nineteenth-highest death rate by population.

On 23 March 2020, the UK went into lockdown. The U.K. government imposed a stay-at-home order banning all non-essential travel and contact with other people, and shut all schools, businesses and gathering places. Those with symptoms, and their households, were told to self-isolate, while those with certain illnesses were told to shield themselves.

From a university perspective there was a rapid mobilisation to online teaching which was a strange, if not uncomfortable time for both lecturers and students. As a lecturer you soon became aware of the sudden realisation how this will impact the student experience. The Diagnostic Radiography programme within my institution was fortunate, due to the ability to use clinical simulation suites in lieu of clinical placements – though this was not a true realistic clinical experience.

Cardiff University resorted to a remote learning approach with one aim; to maintain high quality teaching using a blend of e-learning and assessment. As an educator I soon had a greater understanding of the effectiveness of providing pastoral care for our students who were away from home and their families. Staff well-being was important, and lecturers were fortunate to access Cardiff University's "Employee assistance programme" and "Well-being days". These provided respite to the long days sat in front of a computer monitor teaching, attending meetings compounded the stress us lecturers were gradually facing day by day.

Within weeks we were soon made of aware of the wider ramifications of COVID-19. The Welsh government was liaising with the Welsh higher education sector to provide assistance to the rapid numbers of infected cases that were having a massive impact on our health

service. To make matters worse, our students were all withdrawn from placement and within a week we resorted to weekly tutorials with groups of students to keep them “warm” and engaged. Suddenly we had to work out a plan on how we could provide clinical education via a digital/e-learning format. As a team we decided to group each clinical placement with a lecturer to provide online “clinical tutorials” and online assessments to prevent the students becoming disengaged and ensure the students were equipped with the skills and knowledge for when they were able to return to their clinical departments. We soon had to use strategies to maintain engagement and the consolidation of knowledge within a non-clinical environment. Therefore, the teaching staff entered the clinical departments to record videos of positioning, role play (scenarios) and virtual image evaluation sessions. Student evaluations took place, and we were soon reminded to ensure that sessions were innovated and interesting to keep them engaged. Evaluations revealed that the students felt appreciated and that they were grateful of our quick response to this unprecedented moment.

But it was a seminal moment for not just educators like me but also clinical radiographers on the front line! Radiographers within the National Health Service (NHS) were already aware of the current workforce challenges i.e., huge demand for diagnostics particularly in the specialist modalities such as CT and Ultrasound imaging and MRI imaging[1]. This has caused us to move to a completely different way of working such as the push to working extended days and 7 day working for non-acute imaging. The U.K. already have a huge workforce shortage with experienced radiographers moving into leadership roles and advanced practice roles creating a reduced number of patient facing radiographers. As an educator I know full well the pressure that is placed on universities to increase the output of radiographers to reduce this gap. We know there are many departments operating with significantly outdated equipment [1], with reduced efficiency which subsequently increases the time to image patients compared to modern state of the art equipment. This can cause further stress to both staff and patients i.e., increased waiting times, and demands for radiographers to work longer hours. This is a significant area that needs to be addressed within our healthcare service.

Lots of scoping exercises have been performed to assess what support is available to the current workforce and the resilience that exists amongst the radiography profession, but little

research has been undertaken to understand the impact stress is having on our highly pressurised workforce compared to Nursing [2]. Considering that radiographers are responsible for the delivery of patient care and ensuring patient safety, increased stress, and pressure no doubt decreases the ability of radiographers to deliver these essential skills. These pressures do need to be addressed. COVID-19 has quickly taught us how to think how services are delivered, how we can provide the highest standards of care and work and perform at a high level. The pandemic has changed the process as to how we now must manage our throughput, manage expectations from other teams as well as look after our fellow members of staff in a highly pressurised environment on a tight budget.

COVID-19 has suddenly caused the radiography profession to reflect and how to look after themselves, maintain a healthy work/life balance and more importantly monitor the impact that high workload can have in terms of radiographer's mental health. When we consider the increased working hours that are placed on our fellow radiographers this takes us to a level where staff soon feel the effects of physical and mental exhaustion. Symptoms often regarded as shift work disorder. We are already aware of staff complaining of mild to moderate anxiety. Patients will soon perceive us to be less effective and less caring. In terms of Radiographers themselves, anxiety and stress could cause events such as patient registration errors, patients undergoing the wrong type of scan etc.

COVID-19 has changed the way we work. The use of mobile Chest x-rays and CT imaging i.e., Pulmonary CT angiograms have become to primary imaging for COVID-19 [3]. Additional imaging needs to be provided for secondary conditions to COVID-19 patients which has added to the pressure of non-acute work to our imaging departments. Radiographic practice has changed considerably as radiographers now have to consider social distancing and the constant use of PPE not just within the radiology department but throughout the hospital particularly in theatre and Intensive Treatment Units (ITU). Changes in working patterns – more out of hours staff are required to back fill staff who require more time to don and doff PPE when carrying out mobile radiography. Also, those staff who have been impacted by COVID-19 themselves i.e., shielding or dealing with friends and family contracting COVID-19 caused a detrimental effect on staff numbers and staff wellbeing. It is without doubt that Radiographers have become greatly aware of the importance of infection control and the

increased time required in cleaning equipment between patients. To maintain infection control and control the spread of COVID-19; Staff now must work in pairs to provide imaging for COVID patients. Other stressors to radiographers occurred during the beginning of the pandemic was that PPE was not adequate and not widely available**.** A recent study has shown that only 62.5 percent of Radiographers reported adequate infection control training**,** and a number of radiographers had significant fear of contracting COVID19 [4].

As a clinical academic educator within the university, we have had a great insight in seeing firsthand the effects this has had on clinical departments and their increased workload. Though it was amazing to see students who have qualified during COVID-19 gaining self-resilience in dealing with the stress that COVID-19 has brought. Increased communication and interaction with students have allowed them to be open with the pressure and stress they have had to undertake. This has been an experience we will never forget and will use wisely for future training of radiographers.

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Author Biographies

Azizah Mohamed Afif

Bachelor of Medical Radiation Science (Medical Imaging); Master's in applied science (Sonography); Master's in Clinical Investigation

I am a Senior Principal Radiographer in Singapore General Hospital, Department of Radiography and currently the Clinical Lead in Body Ultrasound where I have been working for 16 years. I am also the current Vice President for the Singapore Society of Radiographers and Deputy Director, Radiography & Nursing Research, Radiological Sciences Academic Clinical Programme, SingHealth. I graduated with a Masters of (Applied Science) Sonography from Royal Melbourne Institute of Technology Melbourne Australia and also hold a Master in Clinical Investigation, from National University of Singapore. I engage in radiographers and residents training in ultrasound, and mentor Master and Bachelor radiographer student research projects. My main interests are ultrasound and radiography and I engage in collaborative research projects within the institution and with the Singapore Society of Radiographers.

Google Scholar: https://scholar.google.com.sg/citations?user=RIXU3lIAAAAJ&hl=en

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Dr Hussein ALMasri

PhD (Doctor of Philosophy)

I work as the Head of Medical Imaging Department and Assistant Dean, Faculty of Health Professions, Al-Quds University, Palestine. I wanted to contribute to this eBook because it is important to shed light on the current status of radiography practice before the COVID-19 pandemic and how it changed afterwards. Additionally, the chapter discusses psychologic impacts on Palestinian radiographers, which is an important issue during stressful events. A list of publications can be reached through my ResearchGate account.

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Deirdre Attinger

Batchelor of Science; ILM (City and Guilds); Postgraduate Certificate.

After a career in digital marketing, I decided to retrain as a Diagnostic Radiographer at the University of the West of England. During my studies, I also achieved my ILM award in effective mentoring and became a PALs leader on my course. This involved supporting fellow students on topics such as exam advice, revision assistance and general peer support. After qualifying in 2021, I accepted a role at the Royal United Hospital in Bath, UK, within the Radiology team. My future aim is to specialise in Ultrasound.

Tamsin Arnold

Bachelors degree with Honours in Diagnostic Radiography; Masters in Medical Imaging (Computed Tomography)

I received my degree in Diagnostic Radiography from the Royal Military College of Science (Cranfield University) and have worked as a Radiographer at the University Hospitals Sussex National Health Service Foundation Trust and its associated legacy trusts within the UK. After completing my Master's Degree in Medical Imaging (Computed Tomography) at the University of Portsmouth I gained extensive experience in all areas of CT advanced practice. I am a Course Director on the established Goodwood Cardiac Course and am a Lead Radiographer for CT Colonoscopy. I currently run a Dementia Head Reporting service for our local Memory Assessment Service. I have achieved accreditation as an Advanced Practitioner from the UK Society and College of Radiographers. I am the Chair Person for the CT Head Reporting Special Interest group and have recently been appointed to the Society of Radiographers Computed Tomography Advisory Group. It is through this work that I have had the opportunity to provide education and support to Radiographers at a national level throughout the pandemic.

Reshika Balakrishnan

Masters of Arts; Bachelors in Neuroscience; Bachelors in Medical Radiation Sciences; Medical Radiation Technologist – Radiation Therapist (Ontario).

I have been a faculty member in the Radiation Therapy Program at the Michener Institute for Education at UHN In Toronto, Ontario, Canada for 14 years. Teaching during the pandemic has been an interesting experience. Many things changed overnight and we, as a team, adapted to the changes it required and found many innovative ways of delivering curriculum

during the pandemic. We may have stumbled upon better ways of doing things and implement changes moving forward. We also become more aware of mental health and its impacts to both students and us. Hence, the idea of this e-book feels like an excellent platform to showcase our success, gaps and learn from each other.

ResearchGate: https://www.researchgate.net/profile/Reshika-Balakrishnan

Mohammed Bhana

I am a Diagnostic Radiographer who has been qualified for over 1 year now and have been working at the Royal Bolton Hospital (UK) since the start of the COVID-19 pandemic. I am someone who is a keen learner and I am aspiring to become a reporting radiographer in the future. One year on from qualifying, I am now helping the cohort of newly qualified radiographers that started a year after me and have been mentoring and supporting them to become confident, autonomous radiographers.

Renate Bradley

Bachelor of Science in Neuroanatomy; Medical Radiation Technology (Radiation Therapy); Masters in Medical Education; Doctorate in Distance Education candidate.

I am Professor and Clinical Liaison, Radiation Therapy, in the Medical Radiation Sciences Program at the Michener Institute of Education at UHN; Lecturer, the Temerity Faculty of Medicine, University of Toronto. I love baking and I enjoy meeting people from other cultures and finding out how we are different yet so much the same. I have amazing colleagues. During the pandemic, I have missed the socialization and their enthusiasm. The idea of this ebook appealed as a perfect way for the clinical and didactic team to participate in sharing the innovations that all of us had to develop in response to the pandemic.

ResearchGate: https://www.researchgate.net/profile/Renate-Bradley

Robert Case

Bachelors in Immunology and Biochemistry; Bachelors in Medical Radiation Sciences; Medical Radiation Technologist – Radiation Therapist (Ontario).

I have been a faculty member in the Radiation Therapy Program at the Michener Institute for Education at UHN In Toronto, Ontario, Canada for 10 years

The pandemic, and the associated closures brought about because of it, required programs around the world to quickly pivot and alter their delivery and assessment methodology to accomplish the program goals in a largely or completely online environment. Now that time has passed, we can now compare notes and learn from both how we as a program and other programs managed their pivot to the online environment. We can see what worked and what did not. This book represents an excellent opportunity to learn from each other.

ResearchGate: https://www.researchgate.net/profile/Robert-Case-6

Martin J. Chai

Master of Theological Studies; Bachelor of Science; Medical Radiation Technologist – Radiation Therapist (Ontario)

Professor, Radiation Therapy, The Michener Institute of Education at UHN; Instructor, Department of Radiation Oncology, Temerty Faculty of Medicine, University of Toronto

Dr Florence Elizabeth Davidson

PhD (Doctor of Philosophy)

I am a senior lecturer in diagnostic radiography at the Cape Peninsula University of Technology, Cape Town, South Africa. I teach on the BSc Diagnostic Radiography programme as well as supervise MSc radiography candidates. I have over 20 years' experience in radiography curriculum design and implementation.

John Mark De Vera

Bachelor of Science in Radiologic Technology; Master of Science in Health Services Administration

I am currently an Assistant Professor and the Program Chair of the Radiologic Technology Department of Holy Angel University, Angeles City, Philippines. Serving in different capacities within the University, I am also the department's Outcomes-Based Education Facilitator, Radiation Protection Officer of the School's Educational X-ray Laboratory, and the adviser of the Association of Radiologic Technology Students. In 2013, I was chosen as one of the members of the Regional Quality Assessment Team of the Commission on Higher Education Regional Office III for the Radiologic Technology Program who evaluates program applications of higher educational institutions for government recognition. In 2021, I am inducted as one of the new Ambassadors of the World Radiography Educational Trust Foundation, joining a team of seasoned professionals in furthering the radiography, radiologic technology, and radiation therapy education. I am a graduate of Bachelor of Science in Radiologic Technology and Master of Science in Health Services Administration, a trained Radiation Protection Officer, and an active member of various professional practice organizations and in the academe. I have been teaching and serving the program for 9 years now and had a 5-year clinical experience in a tertiary hospital.

As an advocate in improving the Radiologic Technology education in our locale, it is a great honor for me to share my experience in our journey to cope with the pandemic-challenged education to better serve and equip future professionals, the students, through my humble contribution to the ISRRT E-book.

Krista Dawdy

Medical Radiation Technology (Radiation Therapy); Bachelor of Science with Honours (Health Sciences); Masters in Radiotherapy and Oncology

I am currently working as the Clinical Educator for radiation therapy at the Odette Cancer Centre, Sunnybrook Hospital in Toronto Canada with an academic appointment as Instructor in the Division of Radiation Oncology, University of Toronto. I am continually engaged in staff and student education. I also enjoy being engaged in educational research initiatives with my most recent participation as co-chair of a leadership workshop in cancer education. I am very passionate about learning and continuing professional development, with publications in both patient and staff education and was most recently awarded the Excellence in Clinical Education from the University of Toronto. As a

front-line healthcare worker and working as a safety officer in long term care during the pandemic, I saw firsthand the impact COVID-19 played in all aspects of care. I am very excited to be a part of this book and share experiences and lessons learnt on the impact COVID-19 has had on education and learning across the globe.

Google Scholar: Krista Dawdy - Google Scholar

Ravi Chanthriga Eturajulu

Master in Business Administration (Distinction, with Academic Excellence Award, Valedictorian); Bachelor of Science with Honours in Medical Imaging; Diploma in Radiography.

My present role as an Assistant Manager in the Department of Biomedical Imaging, University Malaya Medical Centre, Kuala Lumpur, Malaysia, involves performing management and administrative duties. I am supervising the research and quality improvement projects carried out in the department. Currently, I am leading the MS ISO 9001:2015, thus ensuring conformity for Quality Management Systems for the organisation. I am also a Life Member of the Malaysian Society of Radiographers, which is a professional body that caters to the interests of the Medical Radiation Science and affiliated to the International Society of Radiographers and Radiological Technologists. My keen interest in patient safety has led towards the e-book contribution in sharing the challenges and changes in service delivery among radiographers in Malaysia during the COVID-19 pandemic. In addition, the key learnings were included so that our fraternity members can learn from our personal experiences in adapting and working within a pandemic.

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Dr Andrew England

PhD (Doctor of Philosophy); Master's of Science Medical Diagnostic Imaging; Postgraduate Certificate in Higher Education Practice & Research; Bachelor's of Science with Honours; Fellow of Higher Education Academy.

I am a UK Health and Care Professions Council registered Diagnostic Radiographer. Having been an academic for over ten years, I am currently Senior Lecturer in Medical Imaging and Radiation Therapy at University College Cork, Ireland. I have previously worked at the University of Liverpool, University of Salford, University of Keele and

now I am based in Ireland teaching predominantly postgraduate pre-registration students. I am research active, my current interests are digital radiography, computed tomography, dose optimisation, mammography, and patient safety. My passion for improving radiography education and patient care is demonstrated in my work as Chair of the European Federation of Radiographer Societies (EFRS) Educational Wing Management Team and I am also an Executive EFRS Board member. I am Associate Editor for the Radiography Journal and I currently review for several other international imaging journals. I am an experienced external examiner, both nationally and internationally.

I wanted to contribute towards this book as I am passionate about our fight against COVID-19. Having undertaken research on the safe imaging of COVID-19 and also developing e-learning materials for the ISRRT I wanted to continue my work in this area.

ResearchGate profile: https://www.researchgate.net/profile/Andrew-England-3

Hafsa Essop

Masters in Diagnostic Radiography; Bachelor in diagnostic radiography with honours; and another Bachelor in diagnostic radiography.

I am a lecturer at the University of Pretoria, South Africa and teach radiographic imaging science to second year undergraduate students and Computed Tomography to honours. I am also involved with clinical supervision, undergraduate and post graduate research supervision.

I wanted to contribute my experience to this e-book because the COVID 19 pandemic was an event in history that no one was prepared for. It pushed educators to their limits but at the same time unlocked their unknown potential. This valuable insight may one day help and inspire future generations who may also find themselves in the midst of a pandemic, but this time with tools and shared knowledge from colleagues who navigated through uncharted waters to get to this point, of what we may now call as a victory against all odds.

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Lisa Jane Field

Master's degree in Medical Imaging; Post Graduate Certificate in Osteoporosis and DXA reporting; Post Graduate Diploma in Image Interpretation; Bachelors in Science with Honours Diagnostic Radiography.

I am a Consultant Radiographer. I qualified as a diagnostic radiographer in 1997 from the University of Salford, UK. I specialised into image reporting in 2003 and became the Lead Reporting Radiographer at Bradford teaching hospitals in 2005 where I implemented the trusts first radiographer reporting system. I have been a consultant radiographer since 2013 at the trust I currently work at which is The Mid Yorkshire NHS Trust. My main responsibility is to lead the reporting service and a team of advanced practitioners in delivering an immediate 7 day reporting service. I am also the clinical lead for the DXA (Dual Energy Absorptiometry) service and the osteoporosis lead for Radiology. I am an associate lecturer at the University of Derby on the DXA reporting module and the osteoporosis and falls module. I am a member of the Consultant Radiographer Advisory Group at the UK Society and College of Radiographers since its inception in 2009, and a member of the Royal Osteoporosis Society. I have a keen interest in the prevention of fragility fractures in the elderly population and have written a chapter on DXA in the Clark's special Procedures book in Diagnostic Radiography 2020. I am also currently writing a new DXA textbook *Clark's Essential Guide to DXA in Clinical Practice* to help promote the use of DXA and highlight the importance of preventing fragility fractures. I am a huge advocate for promoting advanced and consultant practice in radiography to improve patient outcomes and management. I wanted to share my personal experiences with other health care professionals and promote what we did as a front line profession during the COVID 19 pandemic. I wanted to contribute to this textbook from an historical perspective as hopefully we will never have to live and work through a pandemic on this magnitude ever again and I wanted something to keep forever to share with my grandchildren and their children on how we defeated the deadly virus of 2019!

Professor Hesta Friedrich-Nel

Master's in Radiography (Radiation Therapy); PhD (Doctor of Philosophy) in Health Professions Education, TAU Fellow

I am the Acting Dean in the Faculty of Health and Environmental Sciences, Central University of Technology, Free State, Bloemfontein, South Africa. I teach at undergraduate and postgraduate levels, have published in journals and book chapters as author and co-author and have read papers at national and international conferences.

My research interests include Health Professions Education, assessment and radiation therapy. Professionally I represent South Africa as council member at the International Society of Radiographers and Radiological Technologist (ISRRT). I am also the Regional Coordinator Education for Africa at the ISRRT.

COVID-19 has changed how we conceptualise teaching and assessment. A contribution to the book with my UK colleague, friend and collaborator, Dr Aarthi Ramlaul provided a platform for sharing some of the rich personal lessons and narratives. In addition, it also facilitated a space to share what I have learned from my students.

ResearchGate:
https://www.researchgate.net/search.Search.html?type=publication&query=Hesta%20Friedrich-Nel

Professor Peter Hogg (retired)

I am Emeritus Professor (University of Salford, UK), Honorary Visiting Professor (Hanza University, Netherlands), Honorary Visiting Researcher (Karolinska Institute, Sweden) and Honorary Adjunct Professor (University College Cork, Ireland). Between 2002 and 2020, I was Chair [full] Professor [of Radiography] at the University of Salford, UK. Over several years at Salford I held many roles, including Academic Head of Radiography, Director of the Health Sciences Research Centre, Master of Science Programme Leader (Nuclear Medicine), Diagnostic Imaging Research Lead and Research Dean for a large multi-professional school. During my career I have published / presented over 650 journal articles, conferences papers and books / book chapters.

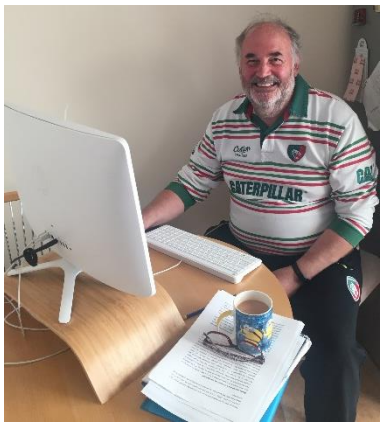
External to the University of Salford I have held many roles nationally and internationally, including nuclear medicine and radiography committee and conference work. I am Fellow and Gold Medal holder of the UK Society of Radiographers. I have been advisor to many societies, for example Consultant Advisor to the American Society of Radiologic Technologists (USA) in

the early 2000s regarding the introduction of Advanced Radiographic Practice across America. I was Honorary Consultant in Nuclear Medicine for several years at a local hospital. I have 12 years' experience of being a journal editor for 2 journals and 35 years' experience as journal article reviewer for 14 journals.

ResearchGate: (11) Peter Hogg (researchgate.net)

Google Scholar: Peter Hogg - Google Scholar

Ken Holmes (Retired)



Last job: Senior Lecturer Medical Sciences in the Institute of Health, University of Cumbria, UK.

Area(s) of professional and research expertise - nuclear medicine and Diagnostic Radiography. Research interests - practical aspect of radiography.

I was born and trained as a Radiographer in Birmingham (UK). I qualified in 1976, gained my radionuclide imaging diploma in 1989 and was awarded a fellowship of the UK Society and College of Radiographers in 2017. I have published physics, imaging procedures and positioning books for Radiographers.

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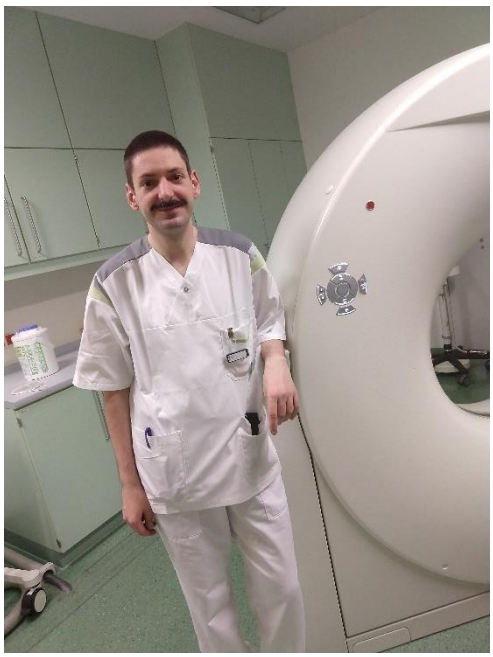
Wilfried Hunziger



Medical Technologist in Radiology

I worked a couple of years as a freelancer for a wide variety of Hospitals and private clinics in Berlin, Germany and its surroundings as a Medical Technologist. In this role I have done thousands of X-rays and hundreds of CT and MRI scans, sometimes on infectious patients as well. But as it comes to the times of the COCIV-19 pandemic it was a completely new situation we were faced with. That´s the reason why I was writing the chapter in this book - to be a little bit better prepared for the next pandemic. I work for the 'Diakonissenhaus' - a German, Lutheran company engaged in public healthcare, services for the elderly and education. Here I serve as a Radiologic Technologist in the Hospital of Luckau and do mainly X-rays and CT-scans.

Dr Mable Kekana

Bachelor's degree and Honours in Diagnostic Radiography; Diploma in Tertiary Education; Bachelor of Administration; Masters and Doctorate in Education.

I am a Senior Lecturer and Head of Radiography Department at the University of Pretoria. I am also the chairperson of the School of Healthcare Sciences. I am passionate about teaching and learning in Radiography and Healthcare Sciences in general. My areas of expertise, in addition to Radiography core modules, are ethics, human rights and professional practice, research and community engagement. The onset of the COVID-19 pandemic posed some challenges in all these areas. Amendments to both theory and practice had to effected in a short space of time. Greatest challenges related to clinical training and assessment as well as collection of data for research purposes. At the University of Pretoria, we were somehow ready to move to full virtual teaching because we have been in a hybrid teaching mode since 2016.

I appreciate the opportunity to share my experiences with the global community of radiographers and imaging technologists. I also regard this as an opportunity to share experiences as I will also be learning from experiences that are shared by other colleagues globally.

Dr Merlisa Claudia Kemp

PhD (Doctor of Philosophy)

I am the head of the Department of Medical Imaging and Therapeutic Sciences at the Cape Peninsula University of Technology in the Western Cape, South Africa. I teach on the BSc Diagnostic Ultrasound programme and supervise/co-supervise Master of Science and Doctor of Radiography students. I have 20 years of Diagnostic ultrasound experience and specialise in vascular ultrasound imaging.

I wanted to contribute to the e-book to share the experiences by academics and students during the pandemic and illustrate how the pandemic exacerbated the already challenging circumstances faced by the students from disadvantaged socio-economic backgrounds whilst being students at a historically disadvantaged institution of higher education, namely CPUT.

Raymond Roneel Keshwan

Master of Science (Medical Radiation Physics) with Distinction; Bachelor of Medical Radiation Science (Medical Imaging); Graduate Certificate in Tertiary Teaching; Diploma in Diagnostic Radiography.

I am the Head of School of Health Sciences at the Fiji National University. I teach in the Medical Imaging Science programme, mainly in the radiation physics and safety domain. I have a Master of Science (Medical Radiation Physics) with Distinction from the University of Wollongong, Postgraduate qualification in tertiary teaching, and a Bachelor of Medical Radiation Science (Medical Imaging) qualification from Charles Sturt University Australia. I regularly present at national and international conferences and meetings. I have a passion for medical education, particularly in medical physics and imaging in resource and opportunity-stricken Pacific Island countries. I hope that my contribution to this e-book will be helpful in improving the working practices of academic radiographers and appreciating that there is value in sharing ideas.

Anas Khateeb

MSc in Medical Imaging

I work as a radiographer the United Nations Relief and Works Agency for Palestine Refugees Hospital, Qalqilya, Palestine. I wanted to contribute to this eBook because it is important to show psychologic impacts of COVID-19 on Palestinian frontline healthcare workers and radiographers during stressful events.

Kleanthis Konstantinidis

Bachelor of Science in Radiography; Master of Science in Healthcare Administration.

I graduated from Technological Educational Institute of Athens in 2006 with bachelor's degree in Radiographic Science. In 2019 I received my master's degree in Healthcare Services Administration from Public Health School of University of West Attica.

Experience and employment: I have 13 years of clinical experience as Radiographer in Diagnostic Imaging, both in private and public sector. I am currently employed in Diagnostic Imaging Department of KAT General Hospital of Attica since 2017.

I started my research work in 2020, counting two publications and four conference presentations until now. My clinical practice focuses on CT and MRI. My research interests focus on web-based tools for e-learning, continuing education and training of healthcare professionals. My contribution to this e-book is an opportunity to submit personal experience and help colleagues cope with barriers and difficulties emerged during COVID-19 outbreak.

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Alfred Lam

Bachelors of Science Biology; Bachelors of Medical Radiation Sciences; Masters of Arts in Education; Medical Radiation Technologist – Radiation Therapist (Ontario)

Currently: Professor at The Michener Institute at UHN. I have been at the Institute for the last 12 years and have always been passionate about higher education. I wanted to contribute to the e-Book as I feel like there is much knowledge to be shared in how the education sector pivoted and navigated through the Covid-19 Pandemic. I am an avid artist and pianist.

Kathryn Malherbe

Bachelor of Radiography in Diagnostics; Bachelor of Science, Honours in Neuroanatomy; Certificate in Mammography; Masters of Radiography in Diagnostics; Have just submitted my PhD in Clinical Anatomy.

I have an absolute passion for teaching and learning radiography students. When COVID-19 hit our country April 2020, there were many challenges for me, as one of the lecturers to move from lecture halls to fully online teaching. I did however get into the change over a few months and are now well versed in this manner.

I am currently a lecturer at the University of Pretoria in South Africa. I have 15 years clinical experience as a radiographer and mammographer. I am pleased for the opportunity to contribute and to share the views from a South African perspective. I believe we had a unique outlook during the COVID-19 pandemic.

Rahul Mohla

Bachelors of Science Biology and Chemistry, Minor in Physics; Bachelors of Medical Radiation Sciences; Medical Radiation Technologist – Radiation Therapist (Ontario); CDC (Cand.) with the CAMRT.

Currently: Faculty at The Michener Institute of Education at UHN

I have worked as a Radiation Therapist at the wonderful Cancer Centre of Southeastern Ontario. After gaining valuable experience, I have now been at the Institute for the past three years, looking to contribute to the next wave of radiation therapists. I was looking to provide insight to this e-book and help both educators and students alike in this new world the pandemic has created in the realm of education. I hope the innovative ideas my amazing colleagues and I have shared here will aid in moving forward in educating our future health care workers.

Hafsa Tareq Momoniat

Postgraduate Certificate in Medical Imaging (Medical Image Reporting); Bachelor of Science with Honours Diagnostic Radiography

I am the Clinical Tutor at the Radiology department, Manchester Royal Infirmary (MRI), which is a part of the Division of Imaging at the Manchester University Hospitals NHS Foundation Trust. MRI is a large teaching hospital situated in the city of Manchester.

After my maternity leave ended, I returned to work full-time. I spend 1.5 days a week working clinically in the plain x-ray department. I spend half a day reporting musculoskeletal plain X-rays, and the remaining 3 days managing students and focusing on the department's Continued Professional Development activity.

I wanted to contribute to this e-book to provide my personal perspective on the pandemic. I was pregnant when the pandemic began. Life at home was very different to life as a Radiographer on the frontline. We have often forgotten the struggles of the individuals who were moved away from the frontline and those who are isolating. I have recently become the Health and Wellbeing Champion for my work area, and I aim to deliver on new wellbeing initiatives. My children remain at the center of my world.

ResearchGate: https://www.researchgate.net/profile/Hafsa-Momoniat

Dr Kathleen Naidoo

Doctor of Technology in Radiography; Master of Health Sciences in Radiography

I have been a diagnostic radiography educator since 2013 and have worked at three different universities within South Africa, during this time. I am currently employed at the Cape Peninsula University of Technology. I am involved in undergraduate teaching and postgraduate supervision for both Masters and Doctorate candidates in Radiography. To me being an educator is such a fulfilling role and I am constantly learning from those around me. I am passionate about radiography education and I consider myself an advocate for patient centered caring. Based on this, my doctoral research study focused on understanding the concept of caring from the perspective of students with the aim of providing them with the support needed to cope in the clinical environment. The outcome was a new theory in the form of a model

which provides a framework of reference for diagnostic radiography educators and students to begin a learning journey that will enable the development of a culture of caring in radiography. I chose to write a collaborative piece for this eBook because I felt there was a need to share our experience with the larger radiography community. We often work in isolation and forget there are others out there like us, experiencing similar challenges and going through shared emotions. This eBook to me is a unification of the radiography population.

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Niusha Nowbahari

Master of Science; Bachelor of Science; Bachelor of Science in Medical Radiation Sciences; Medical Radiation Technologist - Radiation Therapy (Ontario).

I am an instructor in the Radiation Therapy Program at the Michener Institute of Education at UHN in Toronto, Canada.

Working in education during the pandemic has been a new experience with its own benefits, challenges, and lessons learned. This is why the idea of contributing to this e-book was very appealing to me - because the e-book allows professionals from around the world to share their experiences of adapting to and working within a pandemic, so that we can learn from each other.

I am grateful to work with amazing, dedicated colleagues, and hope that the experiences we've shared in this e-book can be helpful to our colleagues around the world.

Alexandra Partner

Masters of Science; Postgraduate Certificate in Higher Education; Bachelors of Science with Honours; Senior Fellow of Higher Education Academy.

I am a Health and Care Professions Council registered Diagnostic Radiographer. Having been a Senior Lecturer, I am currently the Assistant Discipline Lead for Diagnostic Imaging, Operating Department Practice and Osteopathy at the University of Derby, UK. I was programme leader for Diagnostic Radiography for seven years, and now support strategic leadership and management of the discipline. I am research active, my current interests are simulation, student experience, placement, quality, and patient care. My passion for improving care is demonstrated in my work as a board member for Healthwatch

Leicestershire. I review for Radiography Journal and sit on Insight editorial advisory board. I work with our professional body, as part of the Diagnostic Imaging Advisory Group, Deputy Chair of Heads of Radiography Education and being a College of Radiographers assessor. I hold external roles as a HCPC Fitness to Practice panel member and as an assessor for Quality Standard for Imaging. I am an experienced external examiner.

I wanted to contribute towards this book as I am passionate about education and development of our profession. Having presented at ISRRT conferences, I would like to promote research and evidence-based practice globally.

ResearchGate: https://www.researchgate.net/profile/Alex-Partner-2

Dr Aarthi Ramlaul

Doctor of Education; Master of Arts in Learning and Teaching in Higher Education; Bachelors Degree of Technology in Diagnostic Radiography; National Diploma in Diagnostic Radiography.

I am a diagnostic radiographer and currently a principal lecturer and programme leader of the undergraduate diagnostic radiography and imaging programme at the University of Hertfordshire, UK. As a programme leader I experienced first-hand the challenges of changing a face-face- taught course to online learning methods in order to stay safe during the Covid-19 lockdown where it was also important to ensure that teaching, learning and student support remained optimum throughout. A lot has been learned during the pandemic period and I was keen to share hence my contribution to this excellent resource.

I am committed to the upliftment of the profession and have edited and authored numerous publications, including four textbooks aimed at supporting student and qualified radiographers. It has been a pleasure to work and learn alongside my friend and collaborator, Prof Hesta Friedrich-Nel to share our experience of supporting our students during the pandemic.

Dr Omar Rimawi

PhD (Doctor of Philosophy)
I work as the head of psychology department, Faculty of Educational Sciences, Al-Quds University, Palestine.

I wanted to contribute to this eBook because it is important to show psychologic impacts of COVID-19 on Palestinian frontline healthcare workers; radiographers, during stressful events.

ResearchGate: https://www.researchgate.net/profile/Omar-Rimawi

Dr Leslie Robinson

Diploma of the College of Radiographers; Masters Degree in Magnetic Resonance Imaging; Doctorate of Education; Fellow of the College of Radiographers.

I am a retired Diagnostic Radiographer and now an artist. I still hold honorary academic contracts with the University of Swansea Medical School, for whom I am an external advisor for a professional doctorate student, and the University of Salford.

My specialist interests in clinical practice were MRI and CT. As an academic I was interested in teaching and learning and gained a doctorate in education. I was also interested in researching the experiences of students, patients and practitioners and led the development of a set of patient and practitioners partnership guidelines for the UK Society of Radiographers. I have also been involved in exploring and promoting the use of social media to support patients and students.

All of these experiences and interests can now be seen reflected in my artwork.

https://blithedotart.wordpress.com/about/
https://www.instagram.com/leslierob10/
https://www.facebook.com/leslierob10

I agreed to write this article as I think it's important to share alternative views of lockdown and to encourage others to think about a life beyond lockdown and radiography.

Dr Belinda van der Merwe

PhD (Doctor of Philosophy) in Health Professions Education; Masters in diagnostic radiography and a tertiary education diploma.

I am a senior lecturer in the radiography programme at the Central University of Technology in South Africa. I am privileged to manage the first-year radiography students and I am lecturing modules for the third and final year students. During the pandemic, with limited the face-to-face lecture time on campus, it was imperative to adopt various strategies to adequately prepare the students. Through the practice of the scholarship of teaching and learning, I have reflected on the possibilities to engage the students in the virtual environment.

I have served as a previous president of the Society of Radiographers of South Africa. My research interest is focused on radiation protection training and assessment.

Mr Gareth Thomas

FCR (Fellow of the College of Radiographers), MSc. (Master of Science (Radiography), BSc. (Bachelors in Science with Honours) PgCUTL (Post Graduate Certificate in University Teaching and Learning), FHEA (Fellow of the Higher Education Academy)

I qualified as a Radiographer in 2000 and in 2005 to date I held the role as a Clinical Lecturer and Academic Lecturer at Cardiff University, U. K. In addition to Radiography education, I was President of the College of Radiographers (2017-18) - global leading organisation for Imaging and Oncology where I was fortunate to gain extensive knowledge of clinical radiography and professional policy.

Past President of the Society & College of Radiographers and currently the organisation's International Representative. I'm currently a Lecturer at the School of Healthcare Sciences at Cardiff University teaching on both undergraduate and postgraduate programmes within Diagnostic Radiography. With a unique role as an Academic and Clinical lecturer I have been witness to the role Diagnostic Radiographers on the front line during the COVID-19 pandemic from both a clinical and educational perspective.

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ResearchGate: https://www.researchgate.net/profile/Gareth-Thomas-11

Dr Riaan van de Venter

PhD (Doctor of Radiography); Master of Technology: Radiography (research); Postgraduate Diploma in Tertiary Education

I am a lecturer and research associate in the Department of Radiography at the Nelson Mandela University in South Africa. My main research interests pertain to professional development and education, gender studies (LGBTQIA+ related), trauma, death, role extension and advanced practice, as well as affective learning. I was motivated to contribute to this e-book to share the lessons I have learnt during the coronavirus pandemic so that others can have some practical examples to enhance student engagement in the digital teaching and learning space.

Gerhardus George Visser Koch

Degree of Master in Health Sciences: Radiography (Diagnostic); Postgraduate Diploma in Tertiary Education; Professional Certificate in Computerised Tomography.

I am a full-time Diagnostic Radiography lecturer at the Cape Peninsula University of Technology, located in the Western Cape Province of South Africa. I am involved at the undergraduate and postgraduate levels, supervising Master's Degree research projects within Radiography. I am also involved in curriculum development with the notion of professional role extension. I have a keen interest in artificial intelligence and radiation dose tracking. This has led me to enrol for a Doctor of Radiography qualification. Needless to say, the coronavirus pandemic greatly impacted all of our lives, but with all the challenges, I feel that I have grown substantially, in both my personal and professional life. I chose to partner up and share my experiences from an educator's perspective for the eBook, with the intention that it could provide a little bit of hope and motivation for my peers around the world. I would like to leave you with the following quote, authored by Nelson Mandela: "*Education is the most powerful weapon which you can use to change the world*". I live by this quotation, and I have incorporated this belief into my daily practice, using the student-centred, teaching and learning approach.

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Beth L. Weber

Masters in Public Health; Registered Radiologic Technologist from American Registry of Radiologic Technologist / ARRT; Registered Diagnostic Medical Sonographer; Certified Radiology Administrator from American Healthcare Radiology Administrators / AHRA; Fellow of American Society of Radiologic Technologist.

I have been the Director of Imaging Services and Privacy Officer for the Avera Heart Hospital in Sioux Falls, South Dakota since 2000. I am involved in the Avera Health Systems Radiology Service Line, serving as chair of the Quality and Safety Committee. I received a Master's in Public Health with a certificate in Healthcare Executive studies from the University of Minnesota in 2007. My progressive professional experience includes being a staff Diagnostic Radiologic Technologist, Sonographer, Chief Technologist, and Director of Imaging Services. I have 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. I am currently serves on the American Registry of Radiologic Technologists / ARRT Board of Trustees. Beth is part of the ARRT legislative committee.

Dr. Bimali Sanjeevani Weerakoon,

PhD (Doctor of Philosophy); Bachelor of Science Honours in Radiography.

I work at the Department of Radiography/Radiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Peradeniya, 20400, Sri Lanka

I received BSc (Hons) in Radiography degree from the Department of Radiography/Radiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka, in 2011, and the PhD from Chiba University, Japan, in 2017. I began my career in 2012 as a temporary demonstrator in the Department of Radiography/Radiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka and am now a senior lecturer. In addition, in 2012, following my graduation, I was licensed to practice as a diagnostic radiographer in Sri Lanka. Apart from them, I have produced or co-authored several scientific peer-reviewed articles in the field of medical imaging.

I am now engaged in several research projects and supervising a number of MSc and MPhil students in the field of medical imaging. Plain radiography, computed tomography, magnetic resonance imaging, mammography, and dental radiography are some of the areas in which I

am interested in conducting research. This book provides me with the opportunity to share my experiences during the pandemic with other radiography communities throughout the world.

Google Scholar: https://scholar.google.com/citations?user=vNX52igAAAAJ&hl=en
ResearchGate: https://www.researchgate.net/profile/Bimali-Weerakoon)

Deborah. A.L. Whiteside

I am an experienced Clinical Lead Diagnostic Radiographer working within a small team at a regional static PET/CT unit in Preston, North West England. We undertake a wide variety of scans, the majority being Oncology referrals, but also many patients attend with suspected infection, inflammatory conditions together with a growing number of dementia patients undergoing Brain Imaging.

I wanted to contribute to the eBook to share and provide an insight of my personal experiences and fears as a patient throughout my own COVID-19 journey. I found the actual documenting of my thoughts and emotions quite cathartic.

I qualified as a Diagnostic Radiographer in 1987 and completed my Radionuclide Imaging Diploma in 1992 before moving to PET/CT in 2012. I am a member of the UK Society and College of Radiographers.

Dr Julie Woodley

PhD (Doctor of Philosophy); Master of Science); Diploma of the College of Radiographers; Higher diploma of the college of Radiographers; Teachers Diploma of the College of Radiographers; Further Education Teaching Certificate; ARRT (R) (American Registry of Radiologic Technologists- Radiography).

I qualified as a diagnostic radiographer in 1985 before obtaining my master's degree in medical ethics and law from the University of Liverpool. After a period of clinical practice in both the UK and USA I moved into education and am now a senior lecturer at UWE (University of the West of England-Bristol). My doctoral studies focused upon ethical decision making within disciplinary teams and I have a keen interest in all ethical issues in healthcare especially those related to transplantation and the impact of new technologies. I am also heavily involved with research governance and am chair of my faculty's research ethics committee along with being appointed as Chair of the Central Bristol NHS Research ethics committee. I am also a specialist advisor to the Care Quality Commission

and am interested in investigating the applicability of ethical issues within a wider interdisciplinary research arena and conducts collaborative research in this area.

The College of Radiographers nominated me for the 'Research Excellence Framework Main Panel A' (subcommittee 3) and this is the first time I have also been involved in the REF in this way. Finally, I am now Chair of the College of Radiographers Research Interest Group.

ResearchGate: https://www.researchgate.net/profile/Julie-Woodley/publications

Tay Yi Xiang

Master of Science; Bachelor of Science with Honours; Postgraduate Certificate in Medical Education; Member of the Academy of Medical Educators.

I am Principal Radiographer (Education) in the Radiography Department, Singapore General Hospital where I also coordinate education activities and oversee training and education in General Radiography as the Education Lead. As a department appointed clinical educator, I also hold responsibility for faculty development related to teaching and assessment. In tandem to my above roles, I am a Singapore Institute of Technology appointed clinical educator, involved in clinical supervision of undergraduate student radiographers. At present, I am a member of the Radiography Education Sub-Committee in SingHealth Duke-NUS Radiological Sciences Academic Clinical Programme and CPD Committee Member of the Association for Medical Education in Europe. In recognition of my commitment to medical education, I have been admitted as a Member of the Academy of Medical Educators. My research interests include healthcare education, health services research and image interpretation. Writing the history of the present in education has always been worth attempting and is even more so now because of the way history is made. Hence, it is my honor to be able to contribute a chapter in this e-book as the imaging and therapy radiography profession worldwide gather to write the history of the present. Now, Let the work speak for itself.

This free to access book was written by an international group of practising, retired, student and university radiographers. This book, published by ISRRT, focuses on radiographer reflections of the COVID-19 pandemic. It explores a range of perspectives about the pandemic, including personal and professional experiences.

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