

Medical Radiologic Technology Education in Ethiopia: Implications for the Development of Postgraduate Programs

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Abstract: Radiological imaging has become an essential tool in disease diagnosis, treatment and management. Medical imaging professionals were crucial in providing radiological imaging services in healthcare facilities. Training these professionals requires a rigorous program at both the undergraduate and postgraduate levels. Radiologic technology education has progressed to the level of doctoral philosophy (PhD) in many countries. Despite the fact that the number of universities offering undergraduate radiology technology programs in Ethiopia has increased in the last five years, there is currently no recognized institution offering a well-established postgraduate radiology technology program. Due to the lack of established postgraduate training opportunities, graduates were forced to leave the profession, which posed problems for the health care system. The purpose of this study was to explore medical radiology technology education in Ethiopia and the challenges and future prospects of postgraduate education in the field. A descriptive qualitative research method was used in the study. Secondary document reviews and semi-structured interviews with five key informants were conducted. The interviews were held between February 16 and February 22, 2022. The study identified the historical foundations of Ethiopian radiology technology education, the quest for graduate programs and the role of radiology technologists in healthcare services. There is a great need for postgraduate education in radiology technology in Ethiopia. Graduates must continue to enjoy their professional development while remaining in the sector and providing quality health care services in medical imaging. Collaboration between stakeholders and higher education institutions is necessary to meet the continuing education needs of health professionals.

Keywords: Education, Professional Development, Ethiopia, Radiographer, Radiologic technology, postgraduate studies

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Introduction

Following the x-rays discovery in November 1895 by Wilhelm Conrad Roentgen, a German Physicist (Riesz, 1995), radiological imaging became a discipline that progressed from x-ray technicians trained in hospitals to professionals trained at the higher education institutions (HEIs) levels (Cowling, 2008). The discovery of X-rays was followed by rapidly developing X-ray technology and new imaging modalities in medical imaging: mammography, ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), interventional cardiac radiography, interventional vascular radiography, bone densitometry, nuclear medicine (NM) and other branches of medicine. Further, radiological sciences and radiation therapy emerged (Fridell et al., 2009). Therefore, radiology technology, as a profession, is evolving and changing dramatically as new imaging modalities emerge (Fridell et al., 2009).

All professions build on the foundations of education and training, and education and training in radiology technology is no exception, as it is continually being improved through a growing body of research (Cowling, 2008). Consequently, various countries introduced radiography education at various times (McGrigor, 1945). The Educational Branch of the European Federation of Radiography Societies (EFRS) aims to advance radiography research and education at all levels of the continent and supports institutions wishing to expand or improve their radiography education programs (McNulty et al., 2016). Furthermore, the Australian Institute of Radiography is in charge of evaluating diagnostic radiography qualifications (Australian Institute of Radiography, 2010).

The discovery of X-rays by William Roentgen in 1895 has been highlighted as influencing modern medical technology immediately after the First World War (Reeves, 2002). Radiography education has gone through various extensive reforms in different countries (Ahonen & Liikanen, 2009; Doi, 2006; McNulty et al., 2016). A study that was

conducted in the UK on “Diploma to degree, 1976 to 1993” identified a narrative account of steps taken towards establishing radiography as a graduate profession (Price, 2009). The International Society of Radiographers and Radiological Technologists (ISRRT) provides a forum for information and discussion on developments and changes in the radiographic profession globally (Cowling, 2008). Advances in the area show that postgraduate programs opened in most developed countries during the end of the 20th century. In the UK, the program was launched in 1993 (Price, 2009) while the master’s program started in Finland in 1999(Ahonen & Liikanen, 2009).

Educational standards and scope of practice for radiology technologists vary widely around the world. The changes and new developments in medical imaging-initiated countries to extend the role of radiographers and radiologic technologists to support the emerging medical imaging need in the health care services(Cowling, 2006). These changes were initiated either by advances in technologies or through the demand for change driven by personnel shortages within the health care system (Williams I, 2006. Studies show that radiographers held career aspirations that included greater recognition, clinical involvement, autonomy, and challenging work (Ferris, 2009). Another study shows that the better practice and role extension of radiography professionals’ education played a key role (Cowling, 2006).

There is no extensive study undertaken across the world regarding the history of radiography education but one done in Sri Lanka and the other in Australia could be cited as examples (Madushanka et al., 2015; Smith, 2009). Another study conducted in Ethiopia showed that the attrition rate of radiologic technologists is alarmingly high and attributed mainly to a lack of access to professional development due to lack of postgraduate programs in the field (Berihun, 2020).

Since the discovery of x-ray, medical imaging has played an exceptional role in the optimization of patient care. It is very clear that medical imaging has become established as having an important role in patient

management, and especially in diagnosis, intervention, and surgical guide (Doi, 2006b). As more and more imaging modalities emerged in the field, the use of radiographic imaging evolved over time from simple image production to image processing, image display, image recording and storage, and image transmission, most of which are included in picture archiving and communication system (PACS)(Doi, 2006; Fridell et al., 2009). Considering its importance, countries invest huge money in owning these modern machines in their health care system. Ethiopia is also one of the countries that invest huge capital in buying modern medical imaging equipment. Considering the crucial importance of medical imaging in health care; qualified imaging professionals are looked-for both in quantity and quality. These professionals are graduates of higher education as radiographers (diploma holders), radiologic technologists (degree holders), medical physicists, and radiologists (specialists). For the same reason, the radiographers and radiologic technologists have been trained in Addis Ababa University (AAU) for a long time and contributed remarkably to health care services. Currently, AAU owns the Department of Medical Radiologic Technology and trains students at the undergraduate level. However, it has not started training at a postgraduate level yet. Bule Hora University has launched an MSc program in medical radiologic technology in 2020. However, the program failed to be effective due to lack of professionals as those expatriates who agreed to come to run the program did not do so raising security issues in addition to COVID-19.

Statement of the Problem

Since the discovery of X-rays, medical imaging has been vital in-patient care. It is undeniable that medical imaging plays a significant role in patient management, especially in diagnosis, intervention and surgical guidance(Doi, 2006). As new imaging modalities emerged, the use of X-ray imaging changed over time, from simple image production to image processing, image display, image recording and storage, and image transmission, most of which are now included in image archiving and communication systems (PACS) (Doi, 2006; Fridell et al., 2009). Given

their importance, countries spend a lot of money to have these advanced radiological imaging machines in their healthcare systems.

Ethiopia has spent a lot of money to get modern medical imaging equipment. Given the critical role of medical imaging in health care, qualified radiological imaging professionals are wanted in both quantity and quality. These professionals are radiographers, radiology technologists, medical physicists and radiologists.

As stated above, Addis Ababa University has a long history of training radiographers, radiology technologists and radiologists and currently owns the Department of Medical Radiology Technology that trains undergraduate students. However, the university has not yet started offering postgraduate training in radiology technology. According to a study, medical radiologic technologists in Ethiopia have a high attrition rate due to a lack of postgraduate training programs in the field (Eyuel et al, 2020). Both the national healthcare system and the economy of the nation are thought to be significantly impacted by this. In order to better understand how medical radiology technology education has evolved, the opportunities and challenges it has experienced along the way, and to capture the experiences of others, this study is necessary.

Objectives

General objective

The main objective of this study is to explore radiologic technology education and existing opportunities and challenges for professional development through postgraduate educational programs in Ethiopia.

Specific objectives

This study aims to:

- Explore the historical background of radiologic technology education in Ethiopia.
- Identify the existing opportunities and challenges in advancing radiology technology education.
- Study the experiences of other countries with training in radiological technology.
- Make recommendations for the future development of postgraduate programs in radiological technology

Research Questions

The research questions to be addressed in this study are:

- What progress has been made in medical radiologic technology education in Ethiopia?
- What are the challenges in developing and running effective postgraduate programs in radiology technology education in Ethiopia?
- Is there a lesson to be learned by Ethiopia from the experiences of other countries in postgraduate radiologic education?

Definition of terms

Radiography: An imaging modality that uses x-ray to image body system.

Radiographer: A person who is trained and deals with x-ray imaging.

Radiologic Technologist: A person who trained in medical imaging with the use of x-rays, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI).

Methodology

Study area

This research was conducted at Addis Ababa University, College of Health Sciences (AAU, CHS). In this college, there are four schools: School of Medicine, School of Allied Health Sciences, School of Public Health, and School of Pharmacy. The Department of Medical Radiologic Technology has been owned by AAU since 1998 and is currently under the School of Medicine

Research design

To gather information on the topic under study, a descriptive qualitative approach was used, which included document reviews and semi-structured interviews with purposively recruited participants for their rich information.

Study population

The Departments of Medical Radiology Technology in the Ethiopian higher education institutions served as the study's population. Seven public universities and four private colleges offered bachelor's degree in Medical Radiology Technology. A Master's program in the field was introduced by Bule Hora University in 2020.

Target population

The current Departments of Medical Radiology Technology at Bule Hora University, AAU and CHS were the study targets.

Sampling technique

Data were collected to answer the research questions using the maximum variation sampling technique. In order to obtain the necessary

information, all available documents in the Medical Radiology Technology (MRT) Department of the AAU were viewed. The interview was conducted with two senior staff members who previously served as department heads, the President of the Ethiopian Radiographers and Radiologic Technologist Association (ERRTA), who is also responsible for organizing the Master's program in Medical Radiology Technology at Bule Hora University, and two master's candidates at Bule Hora University.

Data collection instruments

Document reviews and semi-structured interviews were used to gather data.

Data collection techniques

Data were collected by reviewing letters, logbooks, rosters and graduate profiles. Two former department heads were interviewed to triangulate the file data. In addition, the current President of the Ethiopian Radiographers and Radiologic Technologist Association (ERRTA) and the coordinator of the master's program at Bule Hora University was interviewed. The students' representative and master's students and one student from Bule Hora University were also interviewed. All interviews were conducted in Amharic.

Data Analysis

Data from the documents were analyzed, and student statistics, management issues, and postgraduate program proposals were identified. A qualitative content analysis method (Creswell, 2012; Ritchie et al., 2003; Sandelowski, 2010) was used to analyze the data. The information collected from the documents was organized carefully and used to triangulate the data obtained from the interview. The interviews were transcribed and translated by the author who coded, classified, and

manually grouped related topics into one theme. Three major themes emerged from the data.

Findings

Three thematic areas have been identified using a content thematic qualitative data analysis method. The emerging themes were the historical foundation of radiography education in Ethiopia, the quest for career development, and the health care role of radiography professionals. Sub-themes emerged under each major theme and were thoroughly discussed. Table 1 displays the major themes and sub-themes.

Table 1 Themes, sub-themes, major events, year and associated major activities

Major theme	Sub-theme	Year	Major activities	Opportunities/challenge
Historical development radiologic Technology y education in Ethiopia	Brief historical introduction of radiography education in Ethiopia	1963	Introducing radiography education in Ethiopia	Expatriate instructor (Mr. Webb)
		1970	Moved from Menelik II hospital to Tikur Anbessa (Black Lion) Hospital	Support of WHO reduced to one and a half year from two years
		1990	One-year senior course training introduced after advanced diploma program	Discontinued after one year
		1996	The program adopted the 1994 new health education and training policy	The two-year diploma program resumed
		1998	Owned by AAU	Used the opportunity of AAU policy to upgrade all diploma programs into degree program
	Launch of Baccalaureate degree program in Radiologic Technology	2004/20 05	BSc program launched	

		Current status of Radiologic Technology at AAU	
	Launch of MSc program at Bule Hora University	2020 A long-awaited master's program launched	Program opened at Bule Hora University but challenged by lack of human resource to run the program The imaging service is run by the graduates and remote parts of the country get service
Health care role of radiologic technology professionals in Ethiopia	Demands among professionals		Lack of career development contributed to increased attrition of professionals.
The quest for postgraduate trainings	Human resource		Lack of qualified academic personnel in the field remains obstacle to launching the postgraduate program
	Misunderstanding of the role of extension of medical radiologic technologists		The role extension of radiography professionals misunderstood among radiologists

Theme 1: Historical Development of Radiologic Technology Education in Ethiopia

This theme emerged from a review of documents and interviews with key informants and was further subdivided into three sub-themes. The first sub-topic focuses on a brief history of radiography education in Ethiopia while the second one deals with the development of the diploma program into a bachelor's degree. The last one is concerned with the newly opened master's program at Bule Hora University. The opportunities and challenges of the program are dealt with in all the sub-themes.

Sub-theme 1: Brief historical introduction of radiography education in Ethiopia

According to unpublished documents in the current Department of Medical Radiology Technology, Mr. Webb, the British expatriate radiographer, introduced radiography as a profession in Ethiopia in 1955 E.C/1963 G.C with the support of the World Health Organization and UNICEF under the ownership of the Ministry of Health. Similar to the evidence from the documentary review, senior staff interviews also backed the establishment of radiography training in Ethiopia. Accordingly, one of the current senior staff (the first diploma holder in radiography) and former department head of MRT in his interview said, "The radiography profession is among the pioneer health professions in Ethiopia; radiography education started in Ethiopia in 1963 according to the Gregorian calendar. It was first introduced by an English radiography professional called Mr. Webb. During that time the program was led by the Ministry of Health."

According to the documents and interview, Radiography School was first established at Menelik II Hospital. Another senior staff member who got a diploma from this school, later earned his first degree after enrolling in the first batch of the program, and then became head of the department mentioned, "The radiography education started before I joined the

program and it has a long history. It began in 1955 E.C. at the Menelik II Hospital. At the time, the school accepted only a few students and trained them." Documents reviewed indicate that the School of X-ray Technicians trained students at the diploma level. In 1970, the school was relocated to Tikur Anbessa Hospital under the Ministry of Health. One of the former department heads described the situation as follows: "...after some time the school moved to Tikur Anbessa Hospital under the leadership of the Ministry of Health." The school continued training students at the diploma level. According to the documents reviewed, the duration of training was reduced from two years to one and a half years in 1970 and continued until 1990.

After the diploma program, a one-year senior training program was introduced in 1990 and graduates received an advanced diploma. In an interview, a senior staff from the Radiologic Technology Department described the scenario as follows: "There had not been any improvement in the radiography education...but in 1990 G.C. a program called Post-basic Senior Course was launched for one year. The program enrolled those who graduated as x-ray technicians; it was called an Advanced Diploma." The program was discontinued after a year and replaced with a two-year diploma program that functioned from 1990 to 2004. Generally, for more than 40 years, the School of X-ray Technicians provided a diploma-level training.

The president of ERRTA also substantiated the above version saying, "...for approximately 40 years the school remained at diploma level..." graduating x-ray technicians and radiographers. Due to lack of human and other resources the school enrolled students every two years, i.e., a new batch was admitted only after the existing batch graduated and enrollment was very little.

The second senior academic staff and former department head said the following when asked about x-ray technicians' training. "The school was training only one batch in two-year period and the number of students enrolled was very small; it ranged from 10 to 20." When it comes to

manpower, the document review showed that the school had very few staff, both academic and supportive. In general, in four decades, the school has produced about 462 graduates of X-ray technicians. The table below was compiled from documents found in the Department of Medical Radiologic Technology.

Table 2 Number of diploma graduates from the School of X-Ray Technicians and the School of Radiography from 1965E.C-2004 E.C

Year of graduation	Number of graduates
1957	10
1959	14
1961	13
1964	15
1966	7
1969	12
1972	13 (Transferred from Menelik II Hospital)
	26
1973	28
1974	27
1976	32
1978	30
1980	25
1982	19
1984	23
1985	14
1987	15
1990	15
1992	17
1993	19
1995	28
1996	30
1997	30
Total	462

Source: Documents including rosters from the Department of Radiologic Technology

In addition to regular students, the school enrolled special students who essentially came on scholarships. Until 1980 E.C (1988 G.C), six police officers, three air force officers, nine army officers, one prison officer, and one Navy officer graduated from the X-ray Technician Training School.

Sub-theme 2: The launching of Baccalaureate degree program

The event of AAU taking over the Radiography School from the Ministry of Health in 1998 marked a new beginning. The second senior academic staff and former head of the department has the following to say. "AAU took over the school in 1998 (G.C.) and launched a three-year degree program in 2004.... In the early phase the university enrolled a significant number of students - 60, 70 and the like. Then the program was changed into a four-year program in 2007."

The need for a degree in the field triggered a debate in the School of Medicine. According to our interview with a senior staff member involved in the initiation of the course, there were lots of supporters but a few opponents to the introduction of a degree program in radiology. The Department made a remarkable achievement in 2004/2005 when it launched a bachelor's degree program with the full support of the school. This was in line with the policy of the Federal Government of Ethiopia, which strongly believes in nurturing professionals from all disciplines with the sole aim of improving the nation's healthcare system. The first academic staff and former head of the Department told us that "...there were professionals who supported the launching of a degree program in radiography; and others who strongly opposed and wanted to suppress the profession during that time. However, we strongly fought and finally won."

The degree program accepted both upgrading professionals from diploma and students coming directly from preparatory schools. The Department is located in Tikur Anbessa Hospital, sharing a building with the Nursing School. In 1999 E.C. 39 students (34 males and 5 females)

received the country's first radiography degree. For four years in a row, a three-year program was in place, but beginning from 2007 it became a four-year degree program. The number of graduates until 2013 E.C. was 476 (336 males and 140 females) (see Table 3).

Table 3 Number of graduates in Medical Radiologic Technology by Year of graduation

Year of graduation in E.C	Number of Graduates	Sex		Remark
		M	F	
1999	39	34	5	
2000	61	37	24	
2001	45	32	13	
2003	No graduates	-	-	Due to the four-year program
2004	26	25	1	
2005	57	43	14	
2006	47	38	9	
2007	42	31	11	
2008	20	15	5	
2009	25	18	7	
2010	22	11	11	
2011	22	11	11	
2012	35	16	19	
2013	35	25	10	
Total	476	336	140	

Sub-category: Current status of the Department of Medical Radiologic Technology at CHS, AAU

The Department shares five small rooms in the building of the Nursing School. One room serves as a meeting hall for the department head, one as a room for the secretary, and the remaining three rooms shared by 20 instructors. There is no enough space for both a store and a library. Classes are conducted in the College of Health Sciences at Sefere

Selam while two rooms for ultrasound simulation were recently made available in Tikur Anbessa Hospital.

Despite the fact that the Department sends students to various hospitals for clinical practices, it has no vehicles; students and instructors face serious transportation challenges as seen in the minutes of the Department and students' complaints documented. The intake capacity of the Department is 20-25 students.

Currently, the Department is working intensively with AAU and CHS to launch postgraduate programs. A memorandum of understanding with RAD-AID International was signed on its behalf by the College of Health Sciences, AAU.

Sub-theme 3: The launching of an MSc program at Bule Hora University

Bule Hora University launched a master's program in Medical Radiologic Technology in 2020. This came due to the resistance of CHS, AAU, to open the program. Originally Bule Hora University planned to launch a degree program, but needs assessment revealed that professionals had a strong interest in the master's program. After discussions with the ERRTA President, the university has amended a plan to introduce a master's degree instead of a bachelor program.

Unfortunately, the emergence of COVID-19 and the start of the northern war in Ethiopia shortly after the program was launched significantly impacted the initiative. For example, expatriates who promised to come and teach in the program declined for the reasons stated.

The MSc program coordinator of Bule Hora University described the issue as follows:

.... Radiography education has been offered at a diploma level for over 40 years. When a bachelor's degree program was launched, there were hopes among professionals...but after that,

for 13 years a master's degree program did not start, which directly affected the profession. ... it was not only the absence of a master's degree program that affected the profession but also that no parallel programs such as short courses or continuing professional development courses were available. ...We cannot say the professionals are familiar with modern imaging machines. Ethiopia owned modern imaging machines that are of European standard. ... Through lots of ups and downs, the master's program started at one university. Due to security issues, COVID-19, and its distance from the center, it is a struggle to bring foreign instructors. So, we are running the program as blended. We bring students here to Addis sometimes...that is so challenging. For a lasting solution, we are thinking of passing the ownership of the program over to Addis Ababa University (AAU): it is pioneer in beginning the training program and has the necessary manpower and resources for practical sessions.

A student interviewee currently pursuing a master's program at Bule Hora University described the program's current state as follows:

I joined the MSc program because I used to struggle for its launching, but here at Bule Hora University the program has a lot of challenges, lack of instructors being the main one. For the teaching-learning to be ineffective, situations in our country also played a detrimental role. That the program started in a rush was also a challenge but we are adults and we managed to continue. The support of the Association and RAD-AID International was also great. However, the university is remote and there is no access to many things. There was nothing special prepared for the program. I think the AAU should own the program.

From this, it follows that a facility assessment by higher education institutions, partners, and the environment is required before beginning a new program. According to an MSc student, the implementation of a

new program at Bule Hora University has been challenged by the country's lack of stability.

Theme 2: The role of medical imaging professionals in Ethiopia's health care services

X-ray service is thought to have begun in Ethiopia by the Italians and was practiced in large urban hospitals. The technicians in 1957 were foreigners and their major duties were to provide x-ray services to employees in order to prevent TB expansion. X-ray technicians worked whenever an X-ray machine was installed, including in public hospitals, embassies, police hospitals, army hospitals, and war zones. They played an important role in radiological imaging services across the country.

The introduction of modern imaging techniques such as CT scan, MRI, ultrasound and mammography along with the needs of the communities increased the demand for medical imaging personnel. Moreover, the introduction of degree programs and the expanding needs for medical radiology technologists have significantly increased the use of medical imaging in the community. Currently, medical radiology technologists in Ethiopia cover radiology services across the country as part of a role expansion provided by the Ministry of Health. This role expansion allows radiology technologists to perform some medical imaging that was once thought to be the responsibility of radiologists. They interpret some conventional X-rays and perform abdominal, obstetric and pelvic ultrasounds. The Ministry of Health conducted needs assessment for the services but was unable to provide all corners of the country with specialist radiologists. As a result, it decided to expand the role of radiology technologists based on their training in higher education. The role of medical imaging in the Ethiopian health care system was described by a senior academic staff member as, "Surprisingly, the development of medical imaging technology is among the main pillars in advancing the health service system. In laboratories and other health fields, medical imaging is prominent, and in the future, it may even be

more advanced to diagnose diseases. Thus, it has a great benefit to health care.”

The President of the ERRT Association described the role of medical imaging professionals as crucial in assisting with disease diagnosis, whether using x-rays, ultrasounds, CT scans, or MRI; “.... health care medical imaging serves as a backbone... At a diploma level, professionals play an irreplaceable role in x-ray services and at degree level, they support the health care in CT-scan, ultrasound, MRI ...”

The radiology technologist profession has evolved beyond providing X-ray services to include more advanced imaging modalities such as CT scan, MRI, and ultrasound. Postgraduate programs should therefore encourage and support increased professional activities.

Theme 3: The quest for postgraduate trainings

A review of departmental documents, such as meeting minutes revealed that the launching of a master's program in Medical Radiology Technology was an important issue and that curriculums proposing master's programs were sent to the School of Medicine every year. In addition, it has been shown that students are interested in seeing the development of the profession. Because the program had been postponed for so long, academic staff became hesitant to respond when asked to explain the situation to students and other professionals about the possibility of opening a postgraduate program. Three major sub-themes emerged from the reviewed documents and interviews. These include high professional career development demands, lack of trained human resources to run the field's postgraduate program, and a misunderstanding of a radiologic technology role extension.

The president of the ERRTA mentioned the issues raised by the members as:

I served as the president of ERRTA for the last four years. During this time the main question of the professionals was education. They asked why there was no postgraduate program and training. They blamed the Association for not doing its job. Based on this we had to press stakeholders and now some questions seem to have been addressed. The start of the MSc program at Bule Hora University, with all its problems, is taken as a step forward. In addition, we collaborated with the Ministry of Health to continue professional development...We started the program even though it is not all-inclusive at this time.... There is a good start.

It is clear from this that professional associations exist to fight for the professional development of their members. In this case, ERRTA has played an irreplaceable role in pressuring stakeholders to start a postgraduate program in Medical Radiology Technology.

Sub-theme 1: High demands for career development among professionals

There has been a high demand for medical imaging professionals to advance their career. The questions come from both academicians and clinicians. Students, as well as graduates, were interested in furthering their career. In the meeting on the master's degree issue, according to the document reviewed, one member of the academic staff mentioned: "...The Senate Legislation states that one has the right to learn and develop his/her career...and it is mandatory to have at least a master's degree to teach in the undergraduate program...therefore, I think the university failed us..."

During the interview, the need for professional development was discussed in terms of the necessity to develop skills in the new and emerging imaging technologies, in addition to the question from the professionals. It was discussed by the participants that if manpower is not trained in alignment with the emerging technologies; the service

provider will not be as effective as expected. The first academic staff described the situation as;

“...as new and advanced equipment is continuously introduced into the health service in Medical Imaging, there is a need for professionals to equally develop their skills ...If the service provider is not competitive enough and cannot fulfill the demand of service-seekers, the professionals seek better education to be competent in their career and feel more confident...”

Sub-theme 2: Lack manpower trained at postgraduate level in Medical Imaging in the country

The primary reason behind the failure of the School of Medicine to proceed with developed curriculum was a lack of qualified instructors to deliver the master's program. After reviewing the documents, the school sent a letter to the Department asking them to meet the minimum requirements of the curriculum; including human resources. However, believing that the issue of manpower was the colleges' mandate, the department urged the school to bring the curriculum up to the college level. Unfortunately, things turned out differently than the department had hoped.

Sub-theme 3: Misunderstanding on the role extension of medical radiologic technologists

As evidenced by documents and interviews in the Department, one of the obstacles was a misunderstanding on the part of the Ministry of Health regarding the role extension for medical radiologic technologists. The Ministry added a role extension or additional role to the job profile of medical radiologic technologists. These roles take into account the education and training received by radiologic technologists during their undergraduate studies.

The second academic staff and former head of the department described the scenario as:

...the profession is not as such developed in our country due to various reasons. In addition, recently after the program developed into a bachelor's degree, there seems to exist a competition among Radiology and Radiologic Technology professionals. Radiologists perceived the role extension of the Radiologic Technologists as taking their job and they were always reserved and strongly opposed when the issue of a master's degree in MRT was raised in the School's Academic Committee Meeting. They also indirectly put pressure on and objected to the master's program in Medical Radiologic Technology. I believe this misunderstanding should be solved and hope that the university will do it easily.

The misunderstood role extensions of health professionals sparked a debate on the profession and particularly that of Medical Radiological Technologists was not welcomed by few radiologists.

Discussion

From 1957 to the present, Addis Ababa University's Radiography Department has been known by various names (School of X-ray Technician, School of Radiography, and now a Department of Medical Radiologic Technology). This study explored the historical background of Medical Radiologic Technology Education in Ethiopia starting from its conception to the current status. From the collected data, three thematic areas emerged: the historical foundation of medical radiology technology education in Ethiopia, the quest for career development, and the quest for postgraduate trainings.

Radiology Education in Ethiopia, as in other countries (Madushanka et al., 2015; Smith, 2009), went through several phases. When it was

established, it was at a diploma level, which was very similar to that in other countries (Madushanka et al., 2015; Price, 2009).

Its advancement from diploma to degree program had not been as smooth as expected and the process was difficult as in other countries (Price, 2009). In the UK the degree program was launched in 1987 (Price, 2009) after much opposition and was such good progress that Ethiopia launched the degree program in radiography eleven years after the start. In the UK, Radiography moved to an all-graduate entry profession by 1993 (Price, 2009). Some countries open postgraduate programs in radiography education within a few years from the start of the degree program (Ahonen & Liikanen, 2009; Price et al., 2000). In Sweden, radiography education has progressed into a doctoral degree (PhD). According to (Elshami et al., 2021), radiographers can pursue their PhD in Arab countries. In Ghana there is a masters and PhD in radiography profession (Ba-etilayoo, 2022). In Uganda, Ernest Cook Ultrasound Research and Education Institute (ECUREI) offers Masters of Medicine in Radiology, Masters of Diagnostic Ultrasound, and Masters of Medical Imaging (Ernest Cook Ultrasound Research and Education Institute, 2023). A study found that establishing new programs is usually challenged by internal and external criticism and competition (Ahonen & Liikanen, 2009) and the current study found similar challenges faced in Ethiopian radiography educational development. There were challenges in the development of radiology professionals and the reasons seem to be due to misunderstood role extension.

Radiography as a profession is developing and changing dramatically. These changes are initiated either by advanced technologies or through the demand for change-driven personnel shortages within the health care system. Internationally, radiographers are taking responsibilities that were previously within the domain of radiologists and these additional responsibilities have been termed skill-mixing or role extension (Irving, 1996). Role extension of radiographers has taken place in the United Kingdom (Williams I., 2006) which developed expanded roles in radiography, with the consultant radiographer defined

as the most advanced practitioner (Cowling, 2008). Radiographers in the country extended their role by reporting on plain film radiographs, mammography, CT and MRI images (Woznitza et al., 2021). On the other hand, graduates in radiologic technology in America, South Africa, and in Europe are entitled to do different jobs; and the role differs from country to country (Cowling, 2013; McNulty et al., 2016) indicated that the shortage of radiologists would not easily be overcome and that the role extension would be a valuable asset to the health service, particularly in remote areas. In Uganda, there was an agreement between universities, radiographers, radiologists, and the health ministry to promote the inclusion of image interpretation into their radiography undergraduate degree programs (Cowling, 2013). Similarly, a study done in South Africa shows that formal image interpretation by radiographers can significantly contribute to clinical practice regarding patient management with special consideration in education and training (van de Venter & ten Ham-Baloyi, 2019). It is believed that education is often the key to any role progression (Cowling, 2006). A study conducted in Ethiopia identified that there is a high demand for professional developments through postgraduate studies among radiologic technology professionals (Kumsa et al., 2022). The role extension and educational development of radiologic technologists in Ethiopia were not welcomed by radiologists (Berihun, 2020). The study discovered that few radiologists do not support the extension of the role of medical radiological technologists just because of a misunderstood role extension. This misunderstanding endangers the program's possibility to progress into postgraduate programs. Similar to other studies (Andersson et al., 2020; Cowling, 2008; Madushanka et al., 2015), Ethiopian radiological imaging professionals hope to advance their careers through advanced education.

Conclusion and recommendations

Radiologic technology education in Ethiopia has advanced significantly over the past two decades. The program has been upgraded from diploma to a graduate level and is offered in public and private

universities, in addition to Addis Ababa University, and services have been expanded. The graduates make a significant contribution to the health care system in the country. At the same time, there is a high demand for postgraduate studies in Radiology Technology among professionals in the country.

This study suggests that higher education institutions should evaluate their program and the needs of their graduates and strive to support their continued professional growth. It should also be remembered that quality health care can be achieved through continuous and advanced education. Higher education institutions should seriously consider requests for new programs. Stakeholders should also bring their needs to higher education and show interest in the postgraduate profession.

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