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ORIGINAL RESEARCH

Experiences of Medical Imaging Students and Clinical Learning in a Limited Resource Setting - A Qualitative Study in Rwanda

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Abstract

Purpose: This qualitative research aimed to explore the experiences of University of Rwanda medical imaging students during their clinical practice in the country.

Methods and Materials: Focus Group Discussions (FGDs) with open-ended questions were held with twenty five medical imaging sciences students who were enrolled in their second and final year respectively of the bachelors with honors and national diploma programs.

Results: Qualitative exploratory descriptive research was conducted in March 2017 through FGDs. The recorded data was transcribed, anonymized, coded, categorized and conceptualized into four themes: theory-practice gap, teaching and learning support, occupational health and safety, resources and infrastructure. Data was analyzed using content analysis. The findings indicate that there were aspects which negatively impacted clinical experiences of medical imaging students. This valuable information is important to create awareness among medical imaging academia and practicing professionals about the challenges faced by medical imaging students in clinical practice.

Conclusion: Medical imaging students experienced a number of challenges during their clinical training in Rwanda. Based on these findings, specific recommendations are suggested with an aim to enhance the clinical training process of medical imaging students.

Introduction

Two important aspects of medical imaging education are theory and practice. Clinical practice is an integral part of medical imaging students' education. It allows students to have direct experience with the real world of medical imaging, practice skills, and learn about general medical imaging protocols and the responsibility of the medical imaging technologist (MIT). The clinical practice aims to prepare medical imaging students to apply the classroom-based theoretical knowledge and skills to real patient situations. According to Mathews (1), clinical placements allow students to have the opportunities to observe preceptors, bridging the gap between theory and practice.

In nursing, the importance of clinical learning has been clearly acknowledged. Clinical learning experience has been described as the 'heart' of professional education as it provides the nursing students with an opportunity for consolidating knowledge, socializing into the professional role, and acquiring professional values (2). Similarly, both theoretical and clinical components of education are included in health science educational programs such as medical imaging technology.

Background

The shortage of health workers that Rwanda has faced in the last two to three decades is largely traced back to the 1994 genocide. Many health professionals were killed, while others fled the country (21 and 22). It was against this background that government sought to transform the health sector by developing human resources professionals in the field of health and research which led to the birth of Kigali Health Institute (presently the College of Medicine and Health Sciences University of Rwanda) in 1996. In its early foundation, the institution offered advanced diplomas, and was the only institution to offer a three-year training program in radiography in the country. The University has made significant achievements in upgrading some of the advanced diploma programs to full bachelor's degree levels including medical imaging sciences.

The University of Rwanda medical imaging students begin their clinical placement training during the second semester of their first year which runs in a block system. Within the clinical placement, student radiographers work directly with patients and competent professional radiographers in particular areas of expertise. The University relies upon a close working relationship with each of the clinical facility, and trusts that the clinical staff supervising the students will provide a suitable environment to maximize learning (18).

Problem Statement

Despite many studies about the importance of student learning during clinical practice, many researchers report on the negative experiences of students from other health care professions such as nursing during clinical placement (3, 4). Some of the experiences may relate to medical imaging.

However, there are important differences between the clinical experiences of medical imaging students and other health care students. For example, a significant feature of medical imaging practice includes the highly hazardous nature of practice due to the use of ionizing radiation. Similarly, undergraduate student radiographers in developing countries such as Ghana and Nigeria face numerous challenges at the site during clinical training which have not been well documented. These challenges may hamper the progress and quality of students in clinical training (5). In Rwanda, the development of entry-level clinical skills in medical imaging is largely a shared responsibility between academic instructors and practitioner MITs. Nonetheless, there are many MITs who lack fundamental skills in health research, academic training, and experiences in preceptorship and supervision.

The lead author, in his capacity as an educator, often observed medical imaging students expressing concern and dissatisfaction with their clinical learning experiences, but did not have objective data to substantiate these claims. Furthermore, there is a lack of data studying these issues which might shed light on the experiences of medical imaging students while in clinical placement. These factors generated an interest to formally investigate the experiences of medical imaging students during their clinical training. In addition to the need for research and data, there is a deeper theoretical need to understand how learning takes place in clinical practice. There is a specific need to explore the consequences of inadequate or poorly administered clinical placement, consider the barriers to the effective clinical placement, and provide practical guidelines for providing effective clinical placement. To date, no studies exist which would provide insight into the experiences of students undertaking medical imaging practice in Rwanda; hence, conducting this study is timely and relevant. Therefore, the aim of this qualitative study was to assess the student learning experiences during the clinical placement training block.

Materials and Methods

Study design and setting

A qualitative exploratory descriptive study and contextual research design was applied and focus group discussions (FDGs) were used to collect data. The study was conducted in the Medical Imaging Department at the College of Medicine and Health Sciences at the University of Rwanda.

Study population and sample

All second and third year medical imaging students were chosen to participate in this study since they had already been exposed to different clinical settings in their training at the University of Rwanda. They would therefore be able to reflect on their various experiences during clinical practicum.

Convenience sampling method was utilized to recruit thirteen (13) students from the second year of their bachelor's degree program and twelve (12) from the third year of diploma program which was phasing out.

Data collection and instrument

FGDs were conducted using an interview guide developed based on the literature and research objectives (17). Each FGD had six to eight students, the duration of interviews lasted between 45 and 90 minutes, and it was conducted in a quiet room. Since the principal investigator was a lecturer in the Radiology department, a moderator who had experience in qualitative research assisted in conducting the FGDs. All the interviews were tape recorded and notes were taken by the research team.

Data analysis

The data were analyzed by qualitative content analysis following the guidelines given by Stewart, Shamdasani and Rook (6). After each FGD, the research team carried out debriefing sessions. Sessions were transcribed verbatim. Three levels of coding were selected to coding the data as follows:

Level One coding: The researcher and the other team members examined the data line by line and assigned codes by the language of the participants who attended FGD.

Level Two coding: The researchers compared the coded data, and categories were created after clustering the coded data resulting from the Level One coding.

Level Three coding: A central theme was derived from the categories that emerged during coding.

Ethical considerations

Prior to the study, an ethical approval was obtained from the Institutional Review Board (IRB) of the College of Medicine and Health Sciences, University of Rwanda. All participants were informed about the design and objectives of the study and informed consent was obtained from each participant. All the participants were given code numbers to maintain anonymity. Confidentiality was ensured by guarding against unauthorized access to the data. Participants were assured that information provided would not be used against them and were informed of their rights to withdraw from the study at any stage.

Establishment of rigor

Characteristics of qualitative research identified by Lincoln and Guba (7), which include credibility, dependability, conformability and transferability, were met in the following ways:

Credibility: All participants were taken through the same main questions and were interviewed to the point of data saturation. After a transcription was made, the researchers went back to some of the participants, to ascertain whether the transcribed data was a truthful version of their experiences. All the participants could not be reached since some had departed for recess. Dependability was achieved through a dense description of the methodology and description of data which was organized in categories and subcategories. To maintain Conformability all the research activities were carried out per the research objectives. Member check was obtained by replaying the voice recordings immediately after the interviews to confirm the comments that had been made during the FGDs. The experienced qualitative researcher assisted in the process of peer debriefing.

Results

Twenty-five students from level three (48%) and level two (52%) participated in this study. Seven were females and eighteen were males.

The qualitative analysis of the FGDs revealed the emergence of four main themes:

1. Theory practice gap
2. Teaching and learning support
3. Occupational health and safety
4. Resources and infrastructure

Theory-practise gap

Theory-practice gap has been described as the disparity between what has been learned in the classroom setting and what is practiced in the clinical environment (8). In this study, most of the students expressed concern that since academic staff were not accompanying them into the clinical setting to reinforce what they were teaching, students felt the need to conform to the varying practices of the clinical staff. The following verbatim statements were expressed by the students.

"We start clinical practices with already set objectives, however when we go we do what is given by the hospital's departments without considering the objectives of clinical placement e.g. If I go with the aim of mammography and the hospitals do not have this service, I do other things not included in my objectives so I ask myself what will happen if I go abroad after graduation. Since I will be having a theory only I will fail practice and employment of course due to poor or incomplete practice"

"We study the theory of radiographic pathology-however on site no radiologists to help in interpretation"

"As lecturers are together with students in class, the same should also happen in the hospital. Lecturers know more what the student should learn at the right level."

"In class things are ok however the practice requires a lot of work. Why plain x-ray practice is only evaluated alone at the clinical training? Why do we learn CT scan, MRI in class? If lecturers could come to sites, they can help to practice that and more"

The students in this study felt that there was lack of faculty support to reinforce the theory in the clinical area. Clinical settings were rich in learning experiences, but lacked a supportive environment. The disparity between what is being taught and what is being practiced discourages the learners in seeking experience and results in the loss of learning and growth opportunities (4).

Teaching and learning support

This theme emerged from all FGDs where 85% of the students expressed inadequate support from the lecturers and preceptors during their practicum.

"Lecturers coming to evaluate you at the end are not helping because they do not know if objectives were obtained. Little knowledge gained will affect one even for further studies."

"If lecturers taught theory they should be the ones to help supervise to achieve the objectives. Lecturers consider us as if we are staff while sending us to hospitals. School should select somebody with ability to help even from the hospital. Lecturers should explain goals and objectives to those in hospital in order to give them responsibility."

"Being alone in clinical department especially during emergencies can be risky, you can try to perform, but if an incidence happens, it will not be easy to handle ...so someone may be taken to prison."

"Lack of proper supervision from my lecturers makes me feel ashamed of the kind of knowledge I will get. The hospital staff do not like to train us they say, "I am not your teacher call your teacher."

"My worst experience is that am supervised by staff with less qualification of staff especially in hospital (A1-diploma) while we are doing BSc."

The findings of the study concur with studies conducted in other disciplines where the students felt that clinical educators did not enhance learning through provision of opportunities, and instead took on a role more focused on evaluation than supervision (16). The lecturers and clinical instructors should incorporate theory into practice and facilitate the process of professionalism for their students.

Occupational health and safety

Protection of health care workers, including preventing student exposure to unnecessary ionizing radiation when caring for patients, is a major concern to all promoting occupational health (9). It is well-established that radiation exposure can give rise to both deterministic and stochastic side effects, and both categories can be seen in the clinical setting (23). Almost 80% of students raised concerns regarding occupational hazards during their clinical rotation.

"Safety issues-no protective measures given to students especially the monitoring badges."

"Radiations is my first worry as there are some hospitals that do not have good protection."

"We try to help patients and hospitals staff during clinical training; however we do not get any feedbacks with regard exposure from the radiation monitoring devices."

"Some hospitals/staff do not care about infections control and our teaching institution do not provide material for protecting us."

"I have worries about going to clinical placement without being vaccinated e.g. Hepatitis."

Occupational health care promotes a healthy workplace environment and safe working conditions (19). According to the Center for Disease Control, maintenance of immunity is an essential part of prevention and control programs for health care workers from risk of exposure to and possible transmission of vaccine –preventable diseases. In this study, students felt that the university should provide mandatory vaccination and protective devices for them before embarking on clinical practicum. In addition, the radiation regulatory agency should require the university and clinical sites to periodically monitor their students and staff for radiation exposures.

Resources and infrastructure

Organizational support and infrastructure are important to develop competent professional radiographers. Nearly 90% of students expressed concern regarding resources and infrastructure.

"Lecturers should organize how to provide materials at the beginning of the clinical placement training. They can also help us to find gloves or mask."

"Lecturers can place students where they are sure that students will get required skills as per set objectives. For example some district hospitals do not have ultrasound, MRI, mammography technology."

"Financial challenges results to lack of personal security especially when clinical placement is done far away from Kigali. No accommodation and we do not know behaviors of people well in the new community."

"In this case of shortage of finances need to look for other people in hospitals to deal with students as a way of reducing the cost."

In this research, 90% of students indicated they face financial challenges and are unable to reach the clinical area on time, which affects their clinical learning.

Financial challenges have been reported as a driving factor for poor wellbeing, lower academic performance and retention (20). Future research on factors related to financial stress among students and the associated implications should be considered to enable monitoring of the quality of student life and to plan for appropriate interventions

Discussion

Our FGDs on clinical experiences of medical imaging students found there were challenges faced during clinical placement. Students also clearly conveyed that they felt there was a theory-practice gap, lack of teaching learning support, and health and safety issues in the clinical area.

This study reported a dichotomy between theory taught at the University and the actual practices in the clinical setting. This created a confusing environment for students, who had concerns about their own competency, and even their safety while training.

Furthermore, the students also highlighted that on most occasions, the lecturers were not accompanying students to reinforce what they had taught. In actual practical settings, students were left with no option but to obey what the clinical staff were telling them to do, or face exclusion. This hindered integration of theory and practice. According to a study (10), student nurses experience a “theory-practice gap” when they find themselves caught between the demands of their tutors to implement what they have learned in theory, and pressure from practicing nurses to conform to the constraints of the real clinical environment.

Students’ level of training or scope of practice was not considered when tasks were delegated. For instance, they reported that they had been left to manage departments alone without any supervision which compromised the integration of theory and practice, and even raised concerns about patient safety. According to Kyei (11), the difference in theory and practice becomes evident during clinical practice examinations where a student handles a case alone unaided because the student is accustomed to supervision by an additional staff member. Students wanted faculty to accompany them in real patient situations where students cover for staff shortages. These shortages could be the result of staff taking time off to conduct private work and earn extra money due to the economic situation (12).

The lack of learning materials and specialist physicians including radiologists was reported by participants, and implies that what is taught and learned in the classroom may be what is occurring in practice and thereby resulting in a theory-practice gap. Furthermore, participants voiced

that without academic staff participating in clinical learning at the hospitals, skills in advanced procedures in ultrasound, computed tomography, and contrasted studies simply remain as theoretical concepts that will never be attained (13). In addition, the report pointed out there is currently insufficient staff time or investment in interventional materials to provide interventional radiology service Rwanda (13). The authors further highlight that despite the availability of state of the art imaging equipment interventional and advanced imaging procedures, including MRI arthrography, have not yet been utilized or performed to the best of our knowledge.

Teaching, learning support

The majority of students felt that they needed to rely on clinical radiographers who also could not offer the necessary guidance, clinical teaching and supervision due to heavy workloads, inadequate clinical education skill and a shortage of equipment.

Some participants pointed that they were being supervised by radiographers who had lower level qualifications which may have negatively impacted their learning experiences in the clinical area. Trained health personnel can teach students how to carry out procedures, and then supervise them as they practice the same. Competency should be part of the learning contract with students so that they attend their clinical placements with a constructive attitude (4, 12).

Occupational health and safety

In this study participants expressed concerns that inadequate radiation protection measures and lack of radiation monitoring badges created anxiety during their clinical placements. These findings are similar to those reported by Kyei (11) that a majority of the respondents believed that no radiation monitoring devices were available for the students. Additionally, crowded rooms without adequate protected areas discouraged students to attend training in duty rooms out of fear of exposure. The students in this study also expressed concerns that the lack of hepatitis vaccination, personal protective equipments and inadequate clinical guidelines generated anxieties and fears of being infected, particularly when interacting with high risk patients. It has been found in nursing research that limited availability and accessibility of protective equipment and non-adherence to standard guidelines may be due to lack resources and training (14).

Resources and infrastructure

The resource-constrained environment in most clinical placements posed a huge challenge to the students who participated in this study due to the inadequacy of specialized imaging modalities. The majority of the students reported that they had never received actual clinical experience in modalities like ultrasound, mammogram and dental imaging. The current study findings are also supported by a Rwanda radiology country report (13), stating that the public hospitals were not equipped with sufficient materials such as

rectal catheters, contrast bags, and tubing to perform adult enemas

Participants in this study expressed concerns about lack of access to specific clinical materials such as masks, gloves, and radiation protective and monitoring devices in some hospitals during placements. Additionally, participants expressed financial challenges with respect to securing safe accommodations and sustenance needs during clinical placements. The resource-constrained learning environment is a challenge in many disciplines like physiotherapy and nursing (15), particularly in the developing countries.

Conclusion and recommendations.

Lecturers and clinical preceptors should strive to create a comprehensive curriculum that is taught in the classroom and translates with continuity into the clinical experience. They should create a conducive environment that can enhance the learning experiences of the medical imaging students. The following recommendations are based on the findings from our study and would enhance student learning in the clinical experience if implemented:

- Lecturers and clinical preceptors should work collaboratively to meet the learning objectives and implement those objectives in practice.
- Teaching sites should strive to provide necessary environment and resources for student learning.
- Clinical sites should provide adequate protective measures against radiation, training in radiation safety and offer periodical medical checkup for students to decrease anxiety about personal health and safety while learning.
- The university's college of medicine and health sciences should formulate a comprehensive immunization policy for all students and university faculty involved in clinical supervision of students.
- Periodic debriefing and counseling sessions could assist to allay student anxiety levels during clinical learning.
- Pre-clinical conferences and establishing expectations of the clinical learning experience would better prepare the students psychologically to handle challenges they are likely to experience during their clinical practice.

Limitations and suggestions

- In this study the FGDs was conducted in English although participants were not native English speakers. This may have affected their ability to express their thoughts fluently to some extent.
- In the Medical Imaging field, qualitative research is still not

a common research method. Qualitative research approaches should be promoted in our discipline.

- The results of this qualitative research study cannot be generalized because of the small sample size. Therefore, future research should be considered with a larger sample size.
- A very limited number of studies have been done in Africa on this topic in the medical imaging field. Consequently the literature is scarce on this topic.
- The focus of this study was medical imaging students which may restrict the findings. The study might be extended to other medical professions of the University for gathering rich information about the experiences of Students and Clinical Learning.

Conflict of interest

The authors declare that there are no conflicts of interest.

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References

1. St John-Matthews J, Pace K, Vogan C. Supporting radiography learners with dyslexia during clinical placement. *Imaging & Therapy Practice*. 2016.
2. Khoza LB. Nursing students' perception of clinical learning experiences. *Journal of Human Ecology*. 2015 Jul 1;51(1-2):103-10.
3. Rajeswaran L. Clinical Experiences of Nursing Students at a Selected Institute of Health Sciences in Botswana. *Health Science Journal*. 2016 Nov 15;10(6).
4. Mabuda BT, Potgieter E, Alberts UU. Student nurses' experiences during clinical practice in the Limpopo Province. *Curationis*. 2008;31(1):19-27.
5. Kyei KA, Antwi WK. Effect of clinical placement; the radiography student in Ghana.
6. Stewart DW, Shamdasani PN. *Focus groups: Theory and practice*. Sage publications; 2006
7. Guba EG, Lincoln YS. *Naturalistic inquiry*.
8. Kaphagawani NC, Useh U. *Analysis of nursing*

9. Maja TM, Motshudi MJ. Precautions used by occupational health nursing students during clinical placements. *Curationis*. 2009;32(1):14-9.
10. Tiwaken SU, Caranto LC, David JJ. The real world: Lived experiences of student nurses during clinical practice. *International Journal of Nursing Science*. 2015;5(2):66-75. DOI: 10.5923/j.nursing.20150502.05
11. Kyei K.A., Antwi W.K., Bamfo-Quaicoe K., Offei R.O. Challenges faced by radiography students during clinical training, *Clinical Medicine Research*. Special issue: Radiographic Practise Situation in a Developing Country. Vol. 4, No. 3-1, 2015, pp. 36-41. <https://doi.org/10.11648/j.cmr.s.2015040301.18>.
12. Kaseke F, Mutsambi M. Experiences of health science students during clinical placements at the University of Zimbabwe. *Cent Afr J Med*. 2014 May-Aug;50(5-8):45-52.
13. Rosman DA, Nshizirungu JJ, Rudakemwa E, Moshi C, Tuyisenge JD, Uwimana E, Kalisa L. Imaging in the land of 1000 hills: Rwanda radiology country report. *Journal of Global Radiology*. 2015;1(1):5.. 1. 10.7191/jgr.2015.1004.
14. Foluso O, Makuochi IS. Nurses and midwives compliance with standard precautions in olabisi onabanjo university teaching hospital, sagamu ogun state. *International Journal of Preventive Medicine Research*. 2015;1(4):193-200.
15. Ernstzen DV, Statham SB, Hanekom SD. Learning experiences of physiotherapy students during primary healthcare clinical placements. *African Journal of Health Professions Education*. 2014;6(2):211-6., 6(2):211-216, doi:10.7196/ajhpe.530
16. Rafiee G, Moattari M, Nikbakht AN, Kojuri J, Mousavinasab M. Problems and challenges of nursing students' clinical evaluation: A qualitative study. *Iranian journal of nursing and midwifery research*. 2014 Jan;19(1):41.
17. O Nyumba T, Wilson K, Derrick CJ, Mukherjee N. The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution*. 2018 Jan 1;9(1):20-32. <https://doi.org/10.1111/2041-210X.12860>
18. Medical Imaging sciences Curriculum. University of Rwanda [MIS-UR], 2012.
19. Immunization of Health-Care Workers: Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory committee (HICPAC) *MMWR*. 2011; 60 (RR07)1-45. Available from: <https://www.cdc.gov/mmwr/preview/mmwrhtml/000505577.htm>
20. Jeff Grabmeier (2015). 70 percent of college students stressed about finances. Available online, <https://news.osu.edu/news/2015/07/01/financial-wellness/>
21. Katia Savchuk (2014). How Rwanda went from genocide to global health model. *Globalpost*. Available online, <https://www.pri.org/stories/2014-04-08/how-rwanda-went-genocide-global-health-model>
22. Binagwaho A, Kyamanywa P, Farmer PE, Nuthulaganti T, Umubyeyi B, Nyemazi JP, Mugeni SD, Asiimwe A, Ndagijimana U, Lamphere McPherson H, Ngirabega JD. The human resources for health program in Rwanda—a new partnership. *New England Journal of Medicine*. 2013 Nov 21;369(21):2054-9.
23. Goodman, T.R. (2010). Ionizing Radiation Effects and their Risks to Humans. *American College of Radiology*. Available online, <https://.imagewisely.org/Imaging->