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Research Article

Transforming Magnetic Resonance Imaging Education through Simulation-Based Training

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ABSTRACT

Introduction: Clinical instructors are facing the challenge of limited clinical training sites as the opportunities to train on actual patients become less available. In addition, work regulations, productivity requirements, and patients' awareness of trainees "practicing" on them has led to a decline in training opportunities. These factors reduced training experience into fewer direct patient encounters, and fewer opportunities to perform procedures. This study assesses the perception of students on the MRI simulation training for undergraduate medical imaging students.

Methods: This action research study used a triangulation method to integrate quantitative and qualitative data. After participation in six simulated MRI training sessions, students completed a questionnaire and focus group discussion to assess their perceptions. Percentage distributions were calculated for the questionnare and qualitative comments were summarized using thematic content analysis to identify recurrent themes.

Results: The MRI simulation program was well received by students. Simulation proved to be an effective educational method, providing a comfortable learning environment for learning.The study confirmed the constructive role of simulation in MRI education and preparation for clinical practice as 69% endorsed using the learned skills during simulation in clinical practice. Simulation training also helped to identify areas for improvement in practice and learning from mistakes (60%).

Conclusions: The results of this study support the use of simulation in MRI education and demonstrate that MRI-simulated training sessions were well received by radiography students. Students perceived both educational and clinical benefits from this simulation training session.

RÉSUMÉ

Introduction : Les instructeurs cliniciens sont confrontés au défi du nombre limité de sites de formation clinique et les occasions de formation sur des patients se font plus rares. D'autre part, les exigences de productivité, les pressions et la sensibilisation des patients à ce que des apprentis pratiquent sur eux ont mené à une baisse des occasions de formation. Ces facteurs réduisent l'expérience de formation à un plus petit nombre de rencontres directes avec des patients et d'occasions d'effectuer les procédures. Cette étude mesure les perceptions des étudiants face à la formation en simulation d'IRM pour les étudiants de premier cycle en imagerie médicale.

Méthodologie : Cette étude de recherche action a fait appel à la méthode de la triangulation pour intégrer les données quantitatives et qualitatives. Après avoir participé à six séances de formation en simulation d'IRM, les étudiants ont rempli un questionnaire et participé à des groupes de discussion pour évaluer leurs perceptions. Des distributions en pourcentage ont été calculées pour les questionnaires alors que les commentaires qualitatifs ont été résumés à l'aide de l'analyse du contenu thématique afin de déterminer les thèmes récurrents.

Résultats : Le programme de simulation en IRM a été bien reçu par les étudiants. La simulation s'est avérée être une méthode éducative efficace offrant un environnement confortable pour l'apprentissage (83%). L'étude a confirmé le rôle constructif de la simulation dans la formation en IRM et la préparation à la pratique clinique, alors que 69% des participants ont indiqué avoir utilisé les compétences acquises durant la simulation en pratique clinique. La formation par simulation a aussi contribué à recenser les domaines d'amélioration dans la pratique et aidé à l'apprentissage à partir des erreurs (60%).

Conclusion : Les résultats de cette étude appuient le recours à la simulation dans l'enseignement de l'IRM et ont démontré que les séances de formation par simulation en IRM étaient bien accueillies par les étudiants en radiographie. Les étudiants perçoivent des avantages au double plan éducatif et clinique dans ces séances de formation par simulation.

Keywords: Simulation; radiology education; medical imaging

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Introduction

A challenge in medical imaging undergraduate education is to apply theoretical knowledge in clinical settings utilizing different types of equipment. It is a necessity for students to integrate the theoretical knowledge into skills and competencies to solve problems and develop the capability appropriate to working with a clinical team [1, 2]. However, chances to develop these qualities are inadequate in undergraduate clinical practice. Simulation can help to achieve these goals since clinical instructors are facing the challenge of limited clinical training sites as the numbers of students entering medical schools increase, and the opportunities to train on actual patients become less available [3].

In addition, work regulations, productivity requirements, pressures, and patients' awareness of trainees practicing on them have led to a decline in training opportunities [4]. These factors reduced training experience into fewer direct patient encounters and fewer opportunities to perform procedures [5]. Magnetic resonance imaging (MRI) is a lengthy procedure [6], which limits the number of patients a trainee can observe in a clinical day. Patient safety is a critical component of MRI training [7] and fear of making mistakes and feeling unprepared are the two primary stressors of a trainee during clinical placement [8].

The Association for Medical Education in Europe Guide no. 82 recommends new simulated training models and practices in a controlled environment to promote patient safety and quality [9] as a supplement to traditional training methods in medical education, including radiography [5].

Simulation is a teaching strategy that utilizes an artificial representation of a clinical setting and provides students with skills practice without compromising medical ethics or the legal rights of patients [10, 11]. The simulated practice can be described as techniques designed to demonstrate the procedure, decision making, and critical thinking in a simulated clinical environment [12]. Simulation training includes manikins, computer-enhanced manikins, part-task trainers, computer-based virtual reality simulation, simulated patients, and procedural skills [3].

Most of the available literature [13, 14] connects simulation to experiential learning and learning styles [15], and some studies [16, 17] link simulation to the adult learning theory [18]. Likewise, researchers [19] contend that simulation based on the constructivist learning approach [15, 20] aims to develop critical thinking and problem-solving skills through collaborative learning [21]. However, simulation can be also grounded on the complexity theory where learning is described as emergent, and students develop many competences to take appropriate action in a comprehensive situation [22]. Simulation is a blended approach to learning that is informed by the key pedagogical theories of social learning [23], constructivism [20], and experiential learning [15]. Simulation can enhance higher order thinking, critical problem solving, and reflection [24]. Multiple feedback mechanisms and actions allow better achievement of learning outcomes, and both instructor and student can learn during the simulation experience [22].

Simulation represents an opportunity for medical imaging and diagnostic radiography students to support technical skills development [25]. Virtual simulations are used successfully in radiation therapy programs [26]. However, it is not widely adopted in radiography [27], and there are few published articles about its implementation in radiography [28]. In MRI, most of the simulations used were a numerical simulation for the MR signal [29, 30].

There is rich literature in nursing and medicine reporting that simulation promotes the development of skills and competence, improves learning, and maximizes students' confidence; further, students consider it to be an enjoyable experience [31]. Simulation activities improve performance, increase patient safety, and prevent errors [5, 32]. Virtual simulation allows the trainee to develop their understanding and practice their skills in a safe learning environment [28]. In radiography, Kong finds that simulation-based learning can enhance students' radiographic knowledge and improve their confidence in practicing clinical skills and making decisions [32]. Additionally, simulation used to assess trainee's performance to identify strengths and areas for improvement [33]. However, lack of evidence for the transfer of skills from simulation to clinical practice is a common limitation identified in the literature [31].

The aim of this study was to assess the perception of undergraduate medical imaging students on MRI simulation training as a component of their medical imaging training program in a structured and systematic manner.

Methods

The study was conducted by the Medical Diagnostic Imaging (MDI) Department at the College of Health Science. It is a 4-year undergraduate diagnostic radiography Bachelor of Science (Honors). The MDI program spreads over eight semesters. Course sequence ensures construction and acquisition of knowledge from basic to more advanced levels to adequately prepare MDI students for clinical practice.

The current study is a mixed method study conducted during the 2015–2016 academic year in the MRI module, which is offered in the fourth year of the study plan. The module provides the theoretical base knowledge for equipment, patient care and safety, and contrast media in MRI. It provides systematic instruction for examining each anatomic area, including indications, patient positioning, equipment, artifacts, and tips on optimizing image quality for each anatomic area. The module has a clinical practical component as corequisite (advance imaging clinical practice) to underpin the practical experience.