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Factors Influencing Radiological Students and Technologists in Choosing Subspecialty Different from General X-Ray in Saudi Arabia:

(Review Artical)

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Abstract

Background: Radiological students face a complex decision-making process, with four years of study and one year of internship before graduation. After graduation, they apply for a career in their chosen specialty, depending on available positions. Some radiologic technology subspecialties in Saudi Arabia face workforce shortages. Graduates from radiologic sciences programs have the opportunity to choose from six subspecialties during their internship year. Motivations, perceptions, and expectations for their future influence their selection of subspecialties.

Aim of Study: This study discovers the most influential factors affecting Saudi radiological students and technologist choice of subspecialty in radiology field at the Kingdom of Saudi Arabia.

Methods: A comprehensive search was conducted across multiple databases including Medline, Embase, CINAHL, Scopus, Web of Science, IEEE Xplore Digital Library, CADTH, and WorldCat. All English-language papers documenting the factors influencing the choice of students and radiologic technologist in Saudi Arabia.

Results: Researches state that MRI modality was the most preferred specialty for the participants. The most important factor which has the direct effect on the choice of internship subspecialty was future job opportunities and personal interest. No promising advance or gain (limited career) rose to be the most important factor affecting the technologist to avoid X-ray specialty.

Conclusion: Saudi radiological technologist and students were influenced mostly by future job opportunities in that field and personal interest, when they considered their future subspecialty. MRI modality was the most preferred specialty in the internship rotation, while interventional radiology was the least modality chosen in the internship.

Key Words: *Radiological Students – Saudi Arabia – Technologists – X-ray.*

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Introduction

THE choice of a future career in radiological department can be a confusing experience for radiological student, as there are many factors to consider. Radiological students spend four years of study and one year in an internship before graduation. In the last year of the collage, students begin their internship rotations, where they are exposed to patients and specialties for a month in each rotation depending on the specialty they are assigned, except General X-ray they spend two months. For last four months they must choose their favourite subspecialty or as needed. After graduation, each student applies for a career on the specialty that he likes but it depends on the availability of vacant position in each section **[1]**.

A further training program to become a full specialist in that field. For example, in National Guard Hospital there is a program in the first year of a career called Saudi career and development program SCDP. There is a Persistent workforce shortages exist in some radiologic technology subspecialties in Saudi Arabia. Unlike other fields in medical applied sciences graduates from radiologic sciences programs have the chance to choose one of six subspecialty during the internship year. Students tend to choose subspecialist like commuted tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), nuclear medicine (NM) and Interventional radiology (IR) and General X-ray. Students' motivations, perceptions as well as expectation for the future of their career have direct impact to guide the student for selecting particular subspecialty **[2]**.

Radiology is a technologically advanced field that interacts with almost all surgical and medical areas [1]. In recent years, official reports from the United States (US) and United Kingdom (UK) have revealed a growing disparity between the number of applicants and the available residency positions in radiology, despite it being a highly competitive medical specialty for a long time [2,3]. Less than 2% of medical students in Saudi Arabia choose for a career in radiography, while general surgery, pediatrics, and internal medicine are the most popular specializations [4]. The decrease in desire for radiography is likely a complex issue that encompasses aspects such as knowledge, economic considerations, and lifestyle choices [5-7]. In addition, several aspects are exclusive to gender, further contributing to the intricacy of the issue [8]. The decrease in the choice for radiography might result in a reduction in the number of workers and ultimately, a severe shortage of radiologists [2,9].

Ensuring an adequate number of well-qualified radiologists in various healthcare settings relies heavily on comprehending the factors that impact medical students' decision to pursue a radiology residency, as well as the factors that influence radiology residents' choice to specialize in a particular radiology subspecialty [10-14]. Prior studies have shown that the selective preference of radiology trainees for certain subspecialties, such as pediatric radiology, women's imaging, and nuclear medicine, has resulted in or is expected to result in shortages in these particular areas of radiology [12-13,15-16]. The selection of radiology subspecialties is influenced by several criteria, including both professional and personal considerations [11-14]. There is little data in Saudi Arabia that investigates the variables that influence the selection of radiology subspecialties.

Aim of work:

This study aims to measure the factors that influencing the radiological technologists and students in choosing their subspecialty in the internship rotation and decide to enter the radiology.

Literature Review:

Hin et al., [15] found that Personal interests and previous positive internship experience were the two most important factors for the students, residents, and physicians when selecting their specialty. According to Burack [16] reported that clinical role models as being important influences on students' subspecialty choice. In this regard researchers expect to find differences between male and female student. Female students tend to avoid working in subspecialties involving the use of X-ray. Therefore they choose ultrasound and MRI as subspecialties. This was also found in similar fields like surgery. Carolyn and others [17] confirmed this assumption when they compared male and female selection for residency subspecialties.

Medical students are the source of a country's physicians. Determining how medical students select their areas of specialization is the key to achieve a balanced distribution of doctors among all specialties [18]. The choice of a medical specialty by a medical student is a complex process in which several factors play a contributory role, making the decision process an evolving one as the medical student undergoes different experiences in his/her professional journey [19].

The progress of diagnostic imaging techniques in Saudi Arabia:

The progress of diagnostic imaging techniques relies on the use of evidence-based practice (EBP) and active engagement in research [20-26]. To make a sustainable progress in the area of health research, it is essential to enhance research skills at both the individual and organizational levels [27]. Various strategies are being employed by educational and health institutions to encourage individuals to pursue careers in research. These include mandatory and optional research assignments, dedicated student sections in well-known journals, the creation of student-led scientific conferences, and integration of research capacity building into applied health sciences' curriculum, and the organization of workshops on different aspects of research methodology [28].

Radiologists and physicists have a lengthy track record of doing research in the field of radiation science. Although radiographers are still in the early phases of their research in radiology, they are making progress in their academic development by undertaking research studies alongside their teaching duties at universities [20,29-31]. Nevertheless, it is important to differentiate between medically educated professionals, such as Radiologists and physicists, and radiographers, since their unique educational programs might influence their drive to do research. The factors that facilitate undergraduate research are similar to those that limit it [32]. These strategies include teaching research methodology, offering early research experiences, and providing elective research activities [33-35]. They also involve ensuring sufficient resources and formal support [34-39], improving supervision capacity and support [38-40], conducting research in groups [33-41], and promoting research opportunities while fostering a sense of community by recognizing students' research achievements [34-36,39,40,42].

Scientists in the area of radiography have explored several subjects, such as the progress in medical imaging technology and its influence on patient welfare and the standard of healthcare [43,44]. There are many strong reasons to investigate the motives of clinical radiographers for doing radiologic research. Primarily, radiographers have a substantial obligation and possess unrivaled proficiency in delivering patient care in the domain of diagnostic

imaging [20]. Another factor is the rapid and continuous progress of diagnostic imaging technologies. The field of digital medical imaging and patient administration systems has made significant progress, with the introduction of hybrid imaging and the increasing prevalence of artificial intelligence [45-48]. Furthermore, it is crucial to highlight the essential role that radiology specialists have in guaranteeing patient radiation safety throughout medical imaging operations. Radiology specialists are required to follow the "as low as reasonably achievable" (ALARA) concept, which means they must minimize occupational radiation dosage and patient exposure while ensuring high picture quality during radiologic examinations [49].

Given the current advancements in technology and the important role that radiographers play in connecting technology with patients, it is imperative for clinical radiographers to actively engage in the growth of radiologic research. Radiographers are now expected to do more than just stay up with technological advancements. They must also actively participate in patient-centered advancements and contribute to research in healthcare and technology. This indicates a shift in position from being a clinical radiographer to being a researcher [20].

There is an increasing trend among radiology practitioners in several countries, such as Portugal, Denmark, Norway, Sweden, Singapore, and Finland, to actively engage in research and make use of research findings [20,21,50-53]. Over the last decade, there has been a substantial rise in the number of publications in the field of radiography [21,54]. However, the level of research involvement among radiographers has remained relatively low. Furthermore, individuals who have engaged in research have gained valuable research experience throughout their academic pursuits [21,50-53].

Physicians, residents, and senior medical students in the Kingdom of Saudi Arabia (KSA) have documented their perspectives, impediments, and attitudes towards research [54-57]. Nevertheless, there is a lack of empirical studies that have explored the attitudes and conduct of radiology practitioners and interns in Saudi Arabia towards research, leaving this area of knowledge unexplored. In order to address this disparity, our study aims to ascertain the perspectives of radiology professionals and trainees on radiologic research, as well as examine their involvement in research endeavors.

In Saudi Arabia, a Radiology Technologist or Specialist is a highly skilled professional who has obtained a bachelor's degree after completing four years of undergraduate studies and one year of internship. On the other hand, a Radiology Technician is a professional who has obtained a diploma certificate after completing two years of undergraduate studies. Successfully navigating the dynamic healthcare setting in the diagnostic imaging area and generating significant contributions to radiologic research may seem challenging, but it is definitely attainable [58,59]. It is important to have a positive perspective towards evidence-based practice (EBP) in order to acknowledge that research is not only vital for delivering healthcare of high quality, but also for enhancing workflow [20,51]. In order to cultivate a research-oriented environment in the field of radiography, it is crucial to provide education to radiology practitioners on the importance of evidence-based practice (EBP) and motivate them to adopt this change in mentality [60]. This method is anticipated to improve the general research culture in the area of radiology [20,60].

Discussion

The radiological specialties chosen by radiology student and technologist as their careers is an important issue of the future supply of technologist in different specialties, and it is important for the planning of the workforce of health-care services. In addition, selection and professional training for a student in a specific radiological specialty requires much investment of time, training effort and money.

The study focuses on the selection of subspecialty and the significant relation of different factors with the selection of specialties, any factors influence the subspecialty choices of radiology students and technologist. These factors range from individual characteristics such as gender and education, occupation, year of experience. These factors also include the influence from a mentor/tutor/adviser, personal reasons (e.g. family, friends, etc), previous positive clinical experience during your rotation, personal interest, future job opportunities in that field. This project revealed that the most influential factor was guidance from a mentor, tutor, or advisor, as their substantial impact on the students enabled them to receive excellent training and guidance in choosing their subspecialties.

Also our findings describes that Magnetic Resonance Imaging was the most decided subspecialties by the respondents since its considered as one of the highly advance modalities and prestigious for some of the respondents. In the current scenario radiological students thinking about availability of job, the good financial rewards, the work flow and environment in the section.

We are presenting the choice rate of several radiology subspecialties and the variables that influence this preference among a sample of radiology trainees selected from 18 institutions in three areas of Saudi Arabia. The primary personal influencing variables among our trainees were a profound personal interest, a rewarding and satisfying rotation experience throughout training, and a stimulating intellectual challenge. Likewise, these three criteria were the primary personal influencing factors among UK radiology trainees who responded to the same survey

method [11]. Furthermore, a study conducted among US radiology trainees revealed that great personal interest and intellectual challenge were the primary characteristics that influenced them the most. Conversely, the primary elements that influenced the work of our trainees were the direct effect on patient care and the presence of modern or diverse imaging techniques. Similarly, UK radiology trainees identified these two variables as the most influential work-related elements [11], but US radiology trainees ranked the availability of sophisticated or diverse imaging modalities as the primary work-related factor [61]. Curiously, Canadian radiology residents who were going to pursue fellowship training indicated personal interest as the primary personal reason, whereas better employability was identified as the primary work-related factor, when a different method was used [12].

Our trainees predominantly choose interventional radiology and neuroradiology as their preferred subspecialties. Similar findings were reported in the US, UK, and Canada, where both specialty were among the top four choices [11,13,62,63]. Nevertheless, the selection of these subspecialties has seen some variations in the last decade or two, perhaps indicating changes in the employment landscape. For instance, there has been a gradual decline in the popularity of interventional radiology in the United States over time [63]. Furthermore, the preference for neuroradiology in Canada has declined in recent years [12]. In addition, it is worth noting that not all individuals who first express an interest in interventional radiology throughout their training ultimately pursue this specialty at the conclusion of their residency study [63]. The waning interest in interventional radiology has been ascribed to the demanding work environment characterized by heightened radiation exposure and an unappealing lifestyle [13]. However, our trainees mostly choose interventional radiology due to the opportunity to acquire actual "interventional" skills, which directly affect patient care, and their great personal interest in the field. The selection of neuroradiology as a specialization for our trainees was primarily driven by the presence of innovative and diverse imaging techniques, the direct effect on patient treatment, and a strong personal interest.

Our trainees showed the least preference for subspecialties such as pediatric radiology, women's imaging, and nuclear medicine. Furthermore, these three subspecialties have continuously ranked at the bottom of the preference list in Western nations [12-13,61,62]. The restricted employment market for pediatric radiography, mostly performed in big academic facilities, has been proposed as a possible reason for the reluctance to choose this field. This limits the availability of private work and potentially higher salaries for candidates [13,61]. Furthermore, nuclear medicine is often seen as a very demanding specialization, while mammography is often seen as lacking in excitement or interest [13]. The selection of pediatric radiology, women's imaging, and nuclear medicine as specialties for our trainees was primarily influenced by their direct impact on patient care, the presence of advanced or diverse imaging techniques, positive and satisfying experiences during training rotations, and the favorable flexibility of working hours and on-call duties.

Approximately one-third of the radiology trainees in our sample were female. The underrepresentation of women in the field of radiography is well acknowledged. For instance, while comprising almost half of the medical school graduates, barely a quarter of radiology residents in the US and Canada are female [8,64]. Although there is no definitive reason for this lack of representation [65], it might be associated with the apprehension of radiation hazards. Remarkably, the latest discovery revealed distinct gender-based disparities in the selection of radiology subspecialties, with a higher representation of males in interventional radiology and an entirely female presence in the gynecological/breast subspecialty. According to reports, female radiologists tend to concentrate on certain areas of expertise, such as mammography and sonography, while avoiding interventional and vascular radiology [65]. The hesitancy of our male trainees to go into gynecological/breast radiography may be attributed to the very traditional culture in Saudi Arabia, where female patients generally prefer to be treated by female physicians.

Conclusion:

Saudi radiological technologist and students were influenced mostly by future job opportunities when they considered their future subspecialty. MRI modality was the preferred specialties in the internship, while interventional radiology was the least modality chosen in the internship. This research is the inaugural investigation to analyze the elements that impact the selection of various radiology subspecialties among radiology trainees in Saudi Arabia. The trainees were selected from three locations in Saudi Arabia, and the list of characteristics considered comprised 16 distinct personal and professional aspects. In addition, the discussion included gender-specific variations in preference. Nevertheless, due to the use of a convenience sample, it is important to exercise care when attempting to apply the present results to a larger population. In addition, the limited sample size may have obscured some connections between the parameters examined and the selection of subspecialties. However, this discovery is seen as a distinctive contribution to the profession that has the potential to assist radiology training directors in making evidence-based adjustments to residency programs, thereby ensuring the continued availability of an adequate radiography workforce.

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العوامل التى تؤثر على طلاب وتقنيى الأشعة فى اختيار تخصص فرعى مختلف عن الأشعة العامة فى المملكة العربية السعودية: مراجعة

الخلفية: يواجه طلاب الأشعة عملية اتخاذ القرار المعقدة، مع أربع سنوات من الدراسة وسنة واحدة من التدريب العملى قبل التخرج. بعد التخرج، يقدمون طلبًا للحصول على وظيفة فى التخصص الذى اختاروه، اعتمادًا على الوظائف المتاحة. يواجه بعض تخصصات تقنية الأشعة فى المملكة العربية السعودية نقصًا فى القوى العاملة. يتاح لخريجى برامج العلوم الأشعة اختيار واحد من ستة تخصصات فرعية خلال سنة التدريب العملى. تؤثر الدوافع والتصورات والتوقعات لمستقبلهم على اختيارهم للتخصصات الفرعية.

هدف العمل: يكتشف هذا البحث العوامل الأكثر تأثيرًا على اختيار طلاب الأشعة وتقنييهم فى المملكة العربية السعودية للتخصص الفرعى في مجال الأشعة.

الطرق: تم إجراء بحث شامل عبر قواعد بيانات متعددة بما فى ذلك: Medline, Embase, CINAHL, Scopus, Web of Science, IEEE Xplore Digital Library, CADTH, and WorldCat. تمت مراجعة جميع الأوراق باللغة الإنجليزية التى توثق العوامل التى تؤثر على اختيار الطلاب وتقنيى الأشعة فى المملكة العربية السعودية.

النتائج: تشير الأبحاث إلى أن تخصص الرنين المغناطيسى كان التخصص الأكثر تفضيلًا للمشاركين. العامل الأهم الذى يؤثر مباشرة على اختيار التخصص الفرعى فى سنة التدريب هو الفرص الوظيفية المستقبلية والاهتمام الشخصى. لم يظهر وجود تقدم واعد أو ربح (مهنة محدودة) كعامل الأكثر أهمية يؤثر على تجنب التخصص فى تقنية الأشعة.

الاستنتاج: تأثر تقنيى الأشعة والطلاب السعوديين فى الغالب بالفرص الوظيفية المستقبلية فى ذلك المجال والاهتمام الشخصى، عندما نظروا إلى تخصصاتهم المستقبلية. كان تخصص الرنين المغناطيسى هو التخصص الأكثر تفضيلًا فى دورة التدريب العملى، بينما كانت تخصصات الأشعة التداخلية هى الأقل تفضيلًا فى التدريب العملى.