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Research article

Career in radiology; the ghanaian clinical medical Student's perception

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ABSTRACT

Background: The importance of radiology in this era of evidence-based medicine cannot be disputed. This has resulted in the increase in demand for radiologists. Thus, the issue of whether there would be sufficient numbers of medical students to meet this growing demand needs further probing.
Purpose: To assess Ghanaian clinical medical students' perceptions about a career in radiology.
Materials and methods: This was an online questionnaire-based survey of 575 clinical medical students in five public medical schools in Ghana from September 2020 to February 2021. Student's t-test and one way analysis of variance was used to compare means. For the Likert scale questions, differences in the mean Likert scale responses were assessed among various clinical year groups and across gender using Kruskal-Wallis test and Mann–Whitney U tests. A logistic regression was used to determine the significant predictors of the choice of radiology as a career.
Results: Most 340 (59.1%) of the participants were males. The average age of participants was 24.64 ± 3.084 years. Students agreed that, radiology is relevant in this era of evidence-based medicine (mean Likert score = 4.62, SD = 0.819), which yielded significant responses in the third clinical year (p = 0.004). Nearly 30% of respondents stated they did not receive enough didactic lectures or tutorials in radiology, citing insufficient lectures (89.9%), a lack of lecturers (9.5%), and trouble grasping ideas (0.7%) as their main concerns. 133 (23.1%) stated they would choose radiology as a specialty, with flexible working schedule (61.9%) and high income (68.3%) as their topmost reasons. Less patient contact (8.0%) was the least observed reason. A flexible working schedule increased the choice of radiology as a specialty by 2.319 folds (95% CI: 1.413–3.805, P = 0.001). Teleradiology significantly contributed to the choice of radiology as a career (p = 0.001).
Conclusion: Generally, the clinical students had varied but positive perceptions on radiology as a specialty.

1. Introduction

In recent years, medical staffing has dramatically shifted from huge demand for primary care physicians in the twentieth century to demand for medical specialists [1]. During the end of the nineteenth century, medical science developed to the point where it was impossible to master all areas but to choose one or two among several specialties. Therefore, specialization became indispensable in contemporary medicine [2]. There is an extensive variety of medical specialties which may challenge medical students, owing to the numerous factors that must be accounted

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for in selecting a profession or area of specialization. Understanding the factors that lead to the choice of a specialty is important to address the job market requirements [3].

Radiology as an area of specialization has received attention globally with many promising prospects [4]. The economic value of radiology reduced owing to a robust supply of residents entering the specialty and payment slashes for imaging services in the past, but with an improving economy and an aging population using more medical services, radiology is on the rise again [5]. It will interest you to know that, hospital-based physicians like radiologists and anesthesiologists, who for a period past, experienced a higher level of job insecurity than perhaps any other medical specialists, have now become physicians who are in great demand today [1].

Radiologists' roles have in recent times widened to encompass aspects of economic gatekeeping, political advocacy, public health provision, patient well-being, and information technology. It is through these roles that radiologists keep on making significant impact in the health care system [4]. If medical students are allowed the opportunity of doing clinical rotations in radiology, they may end up showing keen interest in the field. Decisions about careers are dependent on students' perceptions and knowledge. Therefore, accurate information is needed for such decisions to be made in order to benefit the students and the field of radiology [6]. In Ghana, the medical field is a highly evolving sector with many specialties and a growing number of specialists even though their numbers are relatively inadequate in servicing the population especially in radiology which is relatively a young specialty. Radiologists have proven to provide effective services through patient health care delivery even though they are few in number and their distribution skewed towards the urban centers. The issue of whether there would be a sufficient number of medical students who will opt for a career in radiology to meet the growing demand for radiologists in this era of evidenced-based medicine calls for a critical inquiry. It is in this light that this study examined the Ghanaian clinical medical students' perceptions about a career in radiology with the following objectives.

- To determine the knowledge, thoughts/opinions and practices in radiology as a specialty.
- To examine possible associations between the demographics, the influence of teleradiology, the availability of radiology rotations and the presence of adequate lectures on the choice of radiology as a specialty.
- To find out the main factors influencing the choice of radiology as a specialty.

2. Materials and Methods

2.1. Study design and study site

This was a cross-sectional questionnaire-based survey of clinical medical students in five public medical schools in Ghana, namely Institution 1, Institution 2, Institution 3, Institution 4, and Institution 5 from September 2020 to February 2021. The students included in this study were medical students currently in their clinical years of study (Level 400-Level 600) since they are likely to be more exposed to radiology, which is a clinical discipline.

2.2. Questionnaire

The self-administered questionnaire used for this study consisted of both open and closed ended questions. This questionnaire was developed after a thorough review of literature and information relating to the research topic. The questionnaire comprised five sections: Socio-demographic characteristics of the students; Questions assessing the knowledge, thought/opinion and practices concerning radiology as a career; Knowledge on the influence of teleradiology and the types of radiation used in radiology; Information concerning when students were first exposed to radiology and whether they would choose radiology as a career; and questions ascertaining the main factors that will influence their decisions to choose radiology as a career. A five point Likert-scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree) was employed in assessing the knowledge, thought/opinion and practices concerning radiology as a career. To ensure an easy administration of the questionnaire at the convenience of the participants, the questionnaire was transformed into an online-based survey using Google Forms. The objectives of the research were clearly explained to the participants at the beginning of the

Table 1. Characteristics of participants.

Item	Count (%)	P-value
Age		
Minimum	19	-
Maximum	44	-
Mean (Standard Deviation)	24.64 (3.08)	-
Gender		
Male	340 (59.1%)	-
Female	235 (40.9%)	-
Average Age for Males	25.05 (3.33)	**<0.001***
Average Age for Females	24.04 (2.59)	
Name of Medical School		
Institution 3	117 (20.3%)	-
Institution 5	79 (13.7%)	-
Institution 2	189 (32.9%)	-
Institution 4	179 (31.1%)	-
Institution 1	11 (1.9%)	-
Average Age of Students per Institution (Standard Deviation)		
Institution 3	24.55 (3.16)	**<0.001***
Institution 5	24.92 (1.62)	
Institution 2	23.90 (2.59)	
Institution 4	25.39 (3.83)	
Institution 1	24.00 (1.34)	
Which Level are You in?		
Level 400(First Clinical Year)	127 (22.1%)	-
Level 500(Second Clinical Year)	132 (23.0%)	-
Level 600(Third Clinical Year)	316 (55.0%)	-
Nationality		
Ghanaian	558 (97.0%)	-
Non-Ghanaian	17 (3.0%)	-
Do you have any physicians in your family?		
Yes	189 (32.9%)	-
No	386 (67.1%)	-

* Statistically significant.

questionnaire, after which participants were required to indicate as to whether they would like to participate in the survey, before moving onto the main sections of the questionnaire. The questionnaire was pretested on 15 medical officers and 15 clinical medical students to remove ambiguity in the questions and appropriate revisions were made where necessary. This was done to ensure clarity, validity and reliability of the questionnaire.

2.3. Sampling and data collection

From the primary records of the various institutions; Institution 5, Institution 3, Institution 4, Institution 2 and Institution 1 had 668, 633, 492, 209 and 167 clinical students respectively, giving a total population of 2169 as at September 2020. Mugenda & Mugenda (2003) indicates that whenever an accessible population is below 10, 000, a sample size of

Table 2. Likert scale means comparisons of items by gender and clinical year.

Item		Level (Clinical Year)				Gender		
	Total	**400**	**500**	**600**	**P-value**	**Male**	**Female**	**P-value**
Knowledge on Radiology as a Specialty	Mean (SD)					Mean (SD)		
Radiology is relevant in this era of evidence-based medical treatment.	4.62 (0.819)	4.54 (0.853)	4.57 (0.783)	4.68 (0.818)	**0.004***	4.67 (0.755)	4.55 (0.901)	0.090
Radiology is a high technology driven profession.	4.31 (0.756)	4.22 (0.776)	4.29 (0.757)	4.36 (0.745)	0.107	4.34 (0.726)	4.27 (0.796)	0.351
Plain X-ray, CT Scan, Mammography, Fluoroscopy, PET Scan and SPECT Scan are radiation-based imaging modalities used in radiology.	4.96 (0.250)	4.92 (0.410)	4.99 (0.087)	4.96 (0.206)	0.096	4.93 (0.322)	5.00 (0.000)	**<0.001***
MRI and Ultrasound Imaging are non-radiation-based modalities used in radiology.	5.00 (0.059)	5.00 (0.000)	5.00 (0.000)	4.99 (0.079)	0.440	4.99 (0.077)	5.00 (0.000)	0.239
Thoughts and Opinions on Radiology as a Specialty								
Radiologists are crucial in the hospital health care team.	3.50 (1.141)	3.17 (1.024)	3.54 (1.149)	3.62 (1.161)	**0.001***	3.52 (1.168)	3.47 (1.103)	0.511
I will choose radiology because of manageable life style conditions. (e.g., hours worked, flexible schedule)	3.64 (1.089)	3.67 (1.047)	3.64 (1.079)	3.63 (1.112)	0.976	3.72 (1.070)	3.52 (1.107)	0.021
Radiology has a higher income potential over other medical specialty/career.	3.42 (0.987)	3.72 (0.999)	3.52 (1.052)	3.25 (0.921)	**<0.001***	3.38 (1.036)	3.47 (0.912)	0.213
The lifespan of radiology workers is reduced when compared with other health workers.	2.87 (1.088)	3.09 (0.960)	2.75 (0.960)	2.83 (1.175)	**0.003***	2.76 (1.167)	3.02 (0.945)	**0.001***
Practises in Radiology as a Specialty								
Radiologists do not have direct contact with patients in most instances.	2.75 (1.293)	2.95 (1.221)	2.65 (1.266)	2.71 (1.327)	0.115	2.83 (1.324)	2.64 (1.241)	0.090
Many physicians can read their own images and do not need radiologists.	2.32 (1.001)	2.57 (1.124)	2.31 (0.958)	2.23 (0.952)	**0.016***	2.44 (1.025)	2.15 (0.942)	**0.001***
Appropriate radiological practices do not pose any significant threat/harm to your health.	3.14 (1.176)	3.16 (1.144)	3.24 (1.099)	3.08 (1.219)	0.425	3.25 (1.193)	2.97 (1.132)	**0.004***
Radiology staffs are regularly monitored for exposure to radiation in order to regulate over exposure to radiation for safety reasons.	3.80 (1.300)	3.76 (0.988)	3.89 (0.930)	3.78 (1.526)	0.588	3.71 (1.072)	3.93 (1.567)	0.090
Protective equipment are regularly used by radiologists to help reduce direct exposure to radiation.	3.85 (1.112)	3.83 (1.067)	3.81 (1.071)	3.86 (1.148)	0.631	3.83 (1.138)	3.87 (1.075)	0.851
***Statistically significant.**								

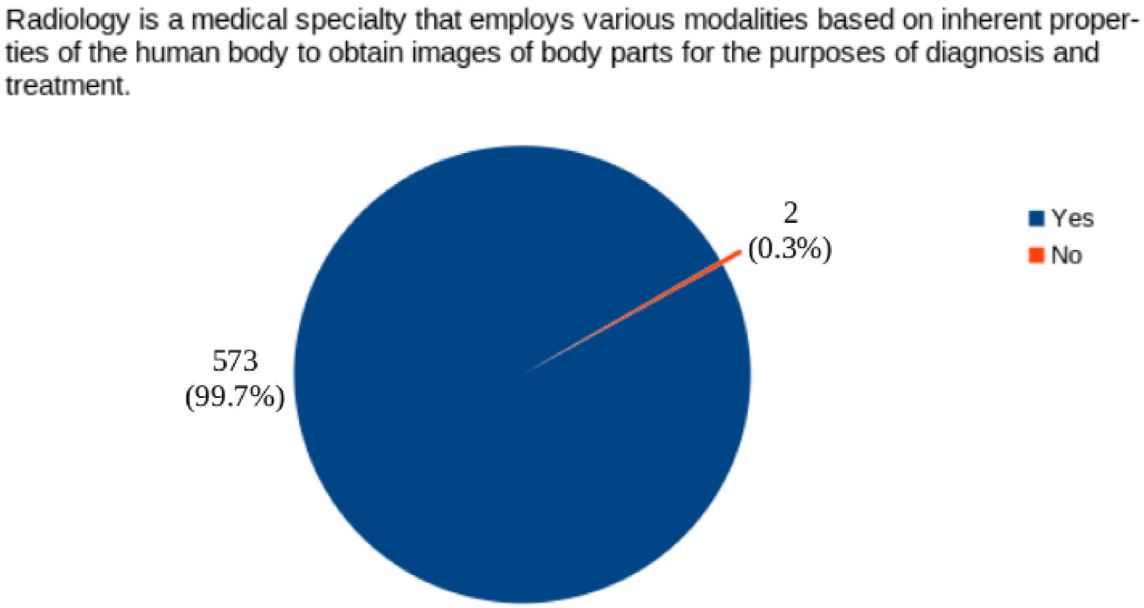

Figure 1. A pie chart assessing the students' knowledge about the definition of radiology as a specialty.

between 10% and 30% is a good representation of the target population and hence 25.0 % was adequate for analysis [7]. A sample size of 542 was estimated for this survey. This figure was adjusted to 6.0% non-response rate and the new sample size was estimated at 575. After permission was sought from the school authorities, the link for the questionnaire was shared with the students through their class representatives via their class Whatsapp platforms. Responses obtained were monitored by the lead researcher until the required sample size was attained, after this, the questionnaire was then closed to the students.

2.4. Statistical analysis

Data obtained from the completed questionnaires were collated, organized, coded and analyzed using SPSS version 23 and Microsoft Excel. The results were then presented in appropriate tables and charts. Student's t-test was employed to determine differences in means between two continuous variables and one way analysis of variance (ANOVA) was used for three means. For the Likert scale questions, differences in the mean Likert scale responses were assessed among the various clinical year groups as well as across gender using Kruskal-Wallis test and Mann–Whitney U tests. An average Likert scale score of 3.00 was taken as neutrality, a score greater than 3.00 was taken as an agreement and a score less than 3.00 was taken as a disagreement. Furthermore, the greater an average Likert scale score above 3.00, the stronger the level of agreement and vice versa. Also, a Chi-squared test was used to determine the association between the socio-demographics, influence of tele-radiology, the presence of radiology rotations in the various institutions, availability of adequate didactic lectures/tutorials in radiology and the choice radiology as a career. A binary logistic regression was used to determine the significant predictors of the choice of radiology as a career.

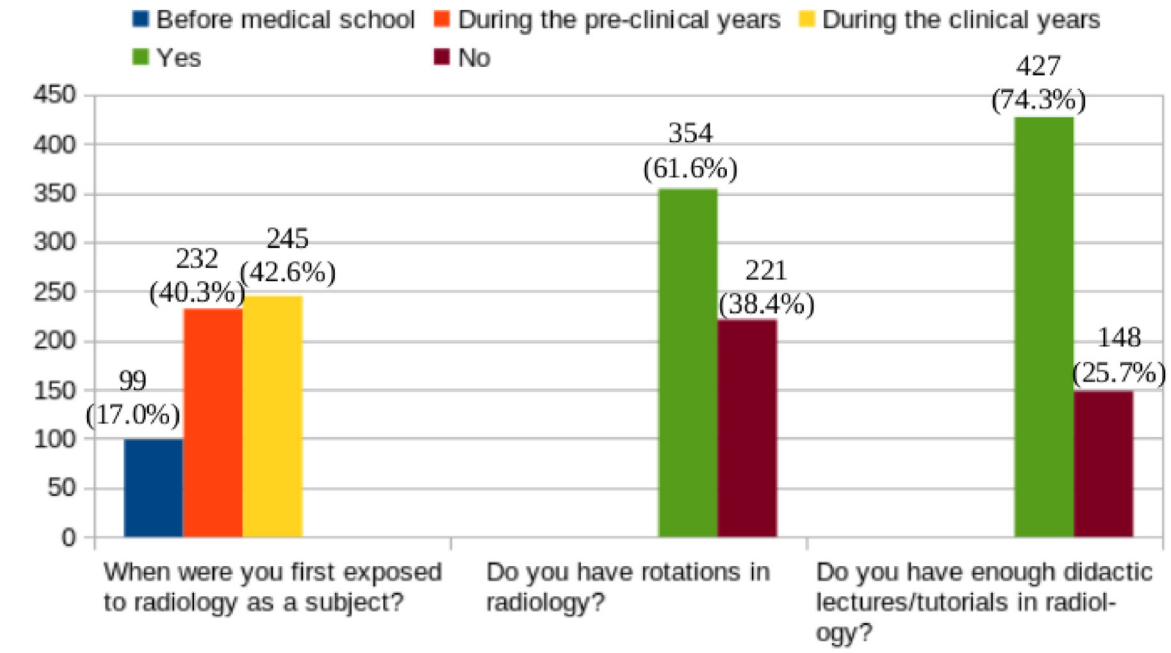

Figure 2. Distribution showing students' first exposure to radiology as a subject, the availability of radiology rotations and the presence of didactic lectures/tutorials in radiology.

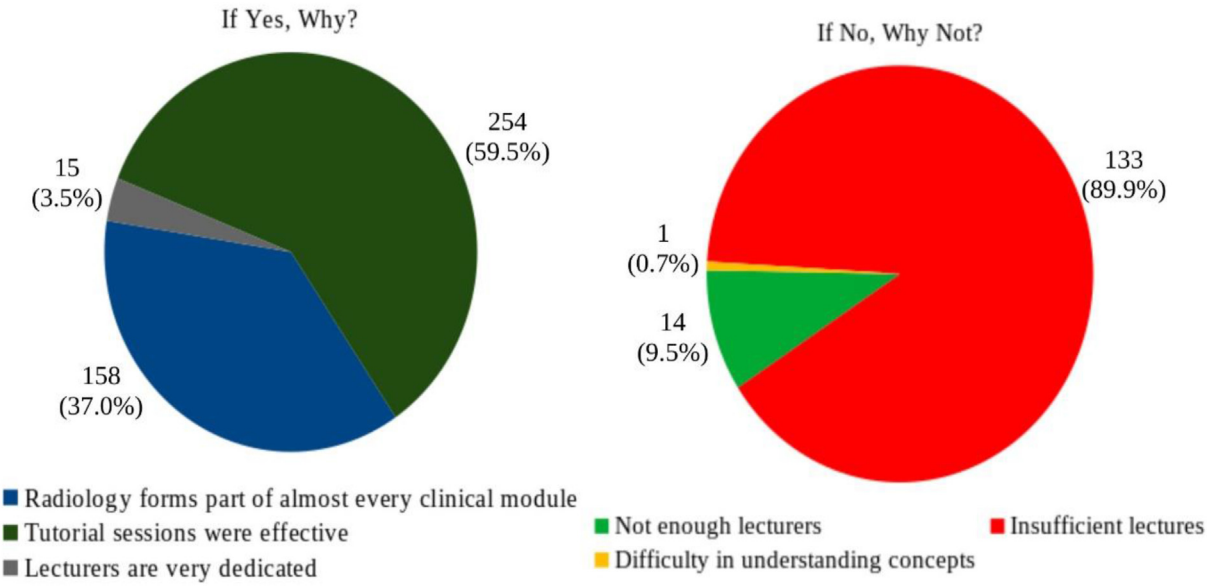

Figure 3. Pie charts showing the reasons why there is adequate or inadequate didactic lectures/tutorials in radiology.

3. Ethical issues

Ethical approval for this study was obtained from the institutional review boards with clearance numbers CCTHERC/EC/2020/083 and KBTH-ADM/00224/2021 respectively. Confidentiality and anonymity were maintained throughout the entire work.

4. Results

A total of five hundred and seventy-five students participated in this survey, of which majority 340 (59.1%) were males. The average age of participants was 24.64 ± 3.084 years. The average age of the females was significantly lower than that of the males (24.04 ± 2.585 years vs 25.05 ± 3.328, $p < 0.001$). Students belonging to Institution 2 and Institution 4 medical schools constituted the majority (64.0%) of the studied population, Table1.

The knowledge, thoughts/opinions and practices on radiology as a specialty were assessed according to gender and clinical year. This comparative analysis revealed differences in certain responses. The students agreed on the relevance of radiology in this era of evidence-based medical treatment (mean Likert score = 4.62, SD = 0.819). This response was more significant for the students in their third clinical year ($p = 0.004$), as shown on Table 2.

Only 2 (0.3%) had the response to the definition of radiology wrong (Figure 1).

The majority of the students, 427 (74.3%) indicated they had adequate didactic lectures/tutorials in radiology and stated the tutorial sessions were effective as their main reason for the response (Figures 2 and 3).

Teleradiology and its ability to influence the choice of radiology as a career are presented in Figure 4.

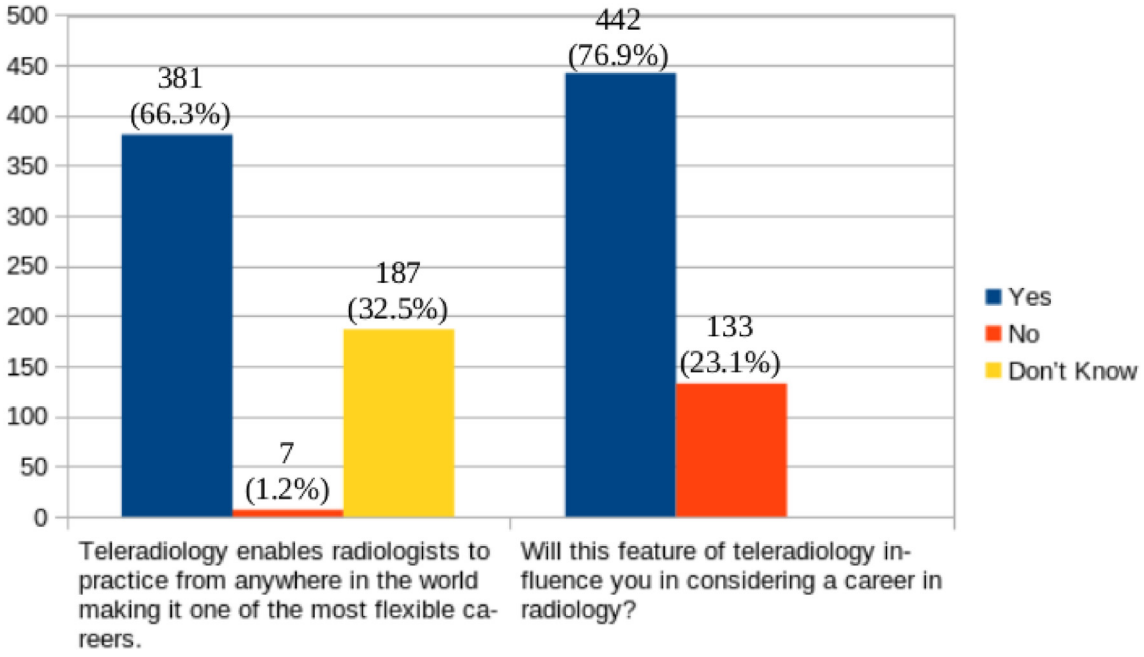

Figure 4. Distribution showing how teleradiology influences the decision to choose a career in radiology.

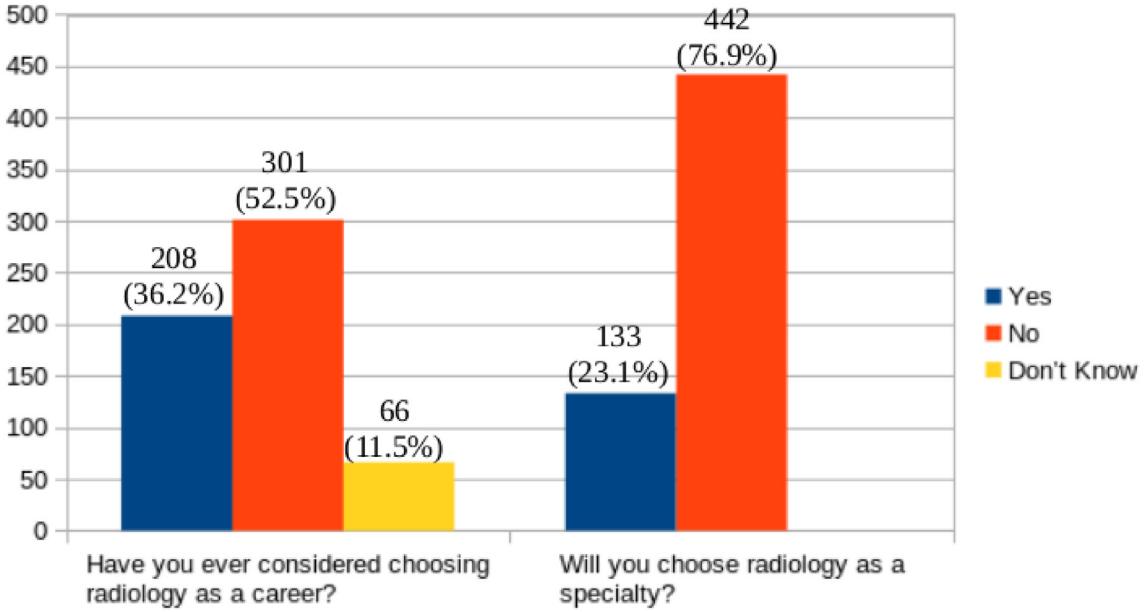

Figure 5. Students' consideration of radiology as a specialty versus whether they will choose radiology as a career.

Out of the 208 (36.2%) of the students that indicated they would consider choosing radiology as a career, 133 stated they would in effect choose radiology as a specialty (Figure 5).

The two topmost reasons for choosing radiology as a specialty were flexible working schedule (68.3%) and high income (61.9%). Other reasons that influenced the choice of radiology as a career can be seen in Figure 6.

Analysis of the factors influencing the choice of radiology as a specialty found that, flexible working schedule was the only significant factor influencing the choice of radiology as a specialty (OR: 2.319, 95% CI: 1.413–3.805, P = 0.001), seen in Table 3.

Responses indicated that, a significant proportion of the students who wanted to pursue radiology as a specialty were males (72.2%, $p < 0.001$). The feature of teleradiology was seen to also significantly contribute to the choice of radiology as a career ($p = 0.001$). No significant associations were noted among the other variables and the choice of radiology as a specialty, Table 4.

5. Discussion

The result of our study showed that, 52.5% of the total population considered radiology as a career, but just 23.1% would choose it as a specialty (Figure 5). Compared to a study in Morocco, none of the medical students considered choosing a career in radiology but the majority of them considered a career in cardiology and general surgery [8]. We found that, Ghanaian clinical medical students would choose radiology as a career largely because of its scheduling flexibility (Figure 6). This was consistent with a study conducted in Sydney [9]. The value medical students place on a favorable lifestyle has previously been identified as a significant factor in specialty selection. This was strongly corroborated in our study, by the binary logistic regression performed (OR: 2.319, 95% CI: 1.413–3.805, P = 0.001). This scheduling flexibility presumes a lot of women pursuing radiology, yet only 35% female representation has been reported in Ghana [10]. We observed that, significantly more males than females were willing to choose radiology as a specialty ($p < 0.001$, Table 4). Whereas in Canada and Switzerland, studies have shown that job flexibility attracted more women than men to radiology [11, 12]. Minimal administrative responsibilities and good work-family balance have been reported as more influential to practicing female radiologists compared with male radiologists in Australia and Switzerland [13, 14].

Most of the respondents disagreed that radiologists do not have direct contact with patients and only 8.0% of them considered this notion to choose a career in radiology (Table 2 and Figure 6). This current finding is encouraging as other studies have reported that, lack of direct patient contact discourages medical students from pursuing radiology as a specialty [15, 16]. It is important to point out that many radiological disciplines such as such as mammography and interventional radiology involve a high level of patient interaction [17]. Advanced imaging and technology have elevated the radiologist's importance not only by increasing diagnostic imaging use, but also by placing the radiologist in a more central position in integrated patient care [18, 19]. We found that, the majority of the students were exposed to radiology before their clinical years (Figure 2). Early exposure to certain specialties during the preclinical years has been shown to increase interest in those fields [20].

We found in this current study that, 25.7% of the students were not satisfied with the didactic lectures and tutorials they received and 38.4% of them did not have rotations in radiology (Figure 2). Rather than being a separate course, radiology is typically spread in medical school as an adjunct subject to other courses [21]. Bransletter et al. looked at first-year students who were exposed to an integrated radiology program for an entire year and discovered that, they were more interested in

Table 3. Binary logistic regression assessing the factors that influence the choice of radiology as a specialty.

Factors	Odds Ratio (OR)	95% Confidence Interval (CI)		P-value
		Lower	Upper	
High Income	1.128	0.731	1.739	0.587
Flexible Working Schedule	2.319	1.413	3.805	**0.001***
Interest in the field	0.706	0.406	1.227	0.217
Improved Health Facilities	1.230	0.793	1.909	0.356
Less Patient Contact	1.148	0.564	2.337	0.704
Lesser duration of Specialization	0.443	0.168	1.169	0.100

* Statistically significant. Hosmer and Lemeshow: Chi square = 1.054, P = 0.994.

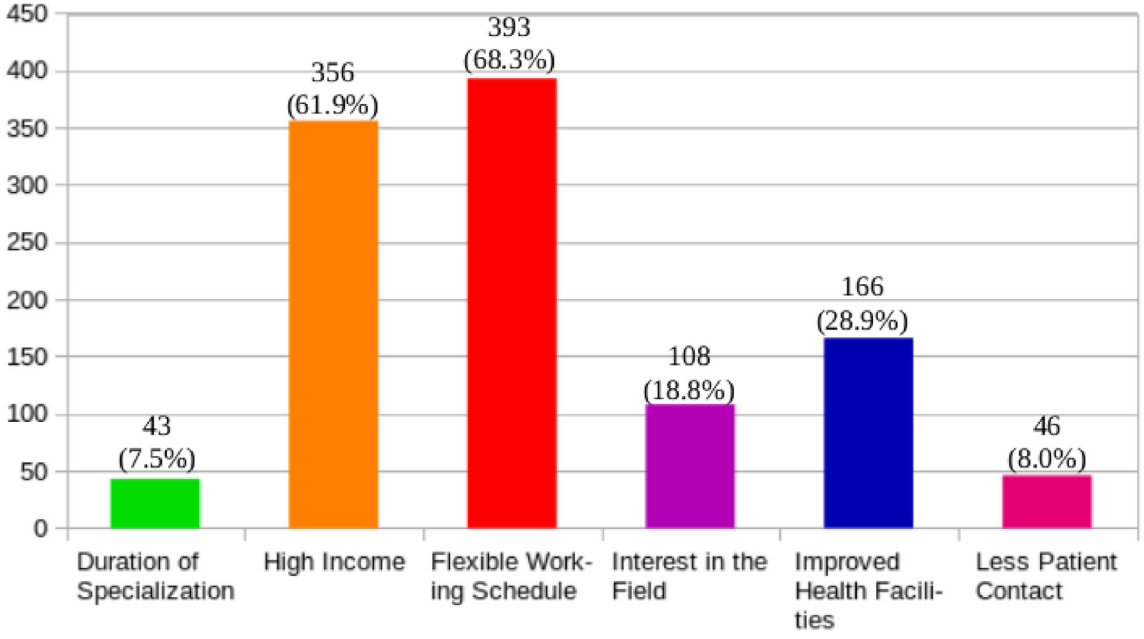

Figure 6. Distribution of the factors influencing the choice of radiology as a specialty.

Table 4. Assessing the effect of demographics, the influence of teleradiology, the availability of radiology rotations and the presence of adequate lectures on the choice of radiology as a specialty.

Variable	Will you choose radiology as a Specialty?		P-value
	Yes	No	
Gender			
Male	96 (72.2%)	244 (55.2%)	**<0.001***
Female	37 (27.8%)	198 (44.8%)	
Which Level are You in?			
Level 400	25 (18.8%)	102 (23.1%)	0.569
Level 500	31 (23.3%)	101 (22.9%)	
Level 600	77 (57.9%)	239 (54.1%)	
Do you have any physicians in your family?			
Yes	47 (35.3%)	142 (32.1%)	0.489
No	86 (64.7%)	300 (67.9%)	
Will this feature of teleradiology influence you in considering a career in radiology?			
Yes	117 (88.0%)	325 (73.5%)	**0.001***
No	16 (12.0%)	117 (26.5%)	
Do you have rotation in radiology?			
Yes	84 (63.2%)	270 (61.1%)	0.667
No	49 (36.8%)	172 (38.9%)	
Do you have enough didactic lectures/ tutorials in radiology?			
Yes	104 (78.2%)	323 (73.1%)	0.236
No	29 (21.8%)	119 (26.9%)	

* Statistically significant.

radiology careers afterwards [22]. The combination of technology and medicine and the wide range of clinical work have been cited as some of the reasons for interest in radiology in other studies [23]. In our study, we had positive feedback from the majority of the students on teleradiology influencing their decision to choose radiology as a career (Figure 4 and Table 4). Rapid innovation in radiology has led to continual advances in subspecialty knowledge, with significant implications for radiology teaching [24].

One limitation for this study was potentially skewed responses towards certain medical schools. The determination of the number of medical students who will potentially pursue a career in radiology based on their perception maybe an overestimation.

The authors recommend that, clinical radiology rotations must, be included in the medical school clinical training curriculum and given a higher priority, which should help improve students' perceptions regarding radiology as a specialty. Mentorship sessions, and elective training internships are also recommended.

6. Conclusion

The clinical students had varied but positive perceptions on radiology as a specialty, and as many as 23.1% of them are willing to pursue a career in radiology.

Key Results:

- The commonest reason for the choice of radiology as a specialty was flexible working schedule (68.3%) followed by high income (61.9%). However, a logistic regression revealed that, flexible working schedule was the only significant factor influencing the choice of radiology as a specialty and increases the choice by 2.319 folds (95% CI: 1.413–3.805, P = 0.001).
- Teleradiology was also seen to significantly contribute to the choice of radiology as a career (p = 0.001).

Declarations

Author contribution statement

Klenam Dzefi-Tettey, Emmanuel Kobina Mesi Edzie, Philip Narteh Gorleku, Edmund Kwakye Brakohiapa, Adu Tutu Amankwa, Abubakari Bawah Abdulai, Iddrisu Baba Yabasin: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Kafui Kossi Kekessie, Ewurama Andam Idun, Caroline Emmanuella Ntiamoah-Koufie, Franklin Acheampong, Bright Oppong, Frank Quarshie, Henry Kusodzi, Abdul Raman Asemah: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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