

A Narrative Review on Quality Improvements for Radiology Clerkships from Medical Student

Star Chen,¹  Maruti Kumaran,² 

Abstract

Radiology clerkships have the potential to give medical students a better appreciation of a radiologist's responsibilities toward patient care while raising interest and improving student confidence in diagnostic imaging skills. Unfortunately, many radiology clerkships across the US have developed a reputation for being unorganized and unengaging. This narrative review is focused on summarizing various clerkship practices performed across the US that have been well received by students, as well as specific weaknesses of the traditional clerkship format from the student perspective, with the aim of effective approaches to revamping electives to showcase the realities of the specialty while also attracting bright and motivated students. This narrative review examined 28 studies that gathered survey responses from medical students who completed radiology clerkships to determine their perceptions towards the clerkship. Major findings to be discussed in detail include weaknesses with the traditional format related to passive learning through observing, unclear expectations for medical students, and certain challenges that clerkship directors may face while attempting to implement changes to their clerkship. This narrative review will also discuss specific well-received practices involving more active learning, including interactive workstations, interactive simulators, flipped classrooms, case banks, and online learning modules.

Introduction

Advancements in medical technology have made diagnostic imaging much more widely available than it once was. As a result, clinicians can rely more heavily on diagnostic imaging as compared to previous years to help guide patient management, and the need for radiologists who are both well-trained and dedicated to the field continues to grow. Surprisingly, there is a deficit in the required radiology clerkships across United States (US) medical schools. One study surveying multiple Canadian and US medical schools noted that only about 20% of US medical schools and only 1 of 17 Canadian medical schools require their medical students to take a radiology clerkship, a number which did not change between 2011-2018.¹ This deficit may be further demonstrated by a separate study that found that only 49% of medical schools taught radiology during the 3rd and 4th years. These lessons were often taught by non-radiologists even though 98% of radiology department chairs do not believe these physicians can adequately teach medical students imaging concepts.²

For the medical students who do choose to pursue elective radiology clerkships, they face additional challenges. Radiology clerkships have developed a reputation for being disorganized, having little hands-on learning, and relying mostly on passive shadowing without adequate structured teaching.^{3,4,5} These practices will often fail to keep students engaged,⁴ which could

ultimately lead to decreased long-term learning retention, decreased interest from students that are undecided about which specialty to pursue, and failure to dispel rumors and misconceptions about the specialty.⁶ The effects of this education disparity compared to other clerkships may be seen bleeding into the newer generation of practitioners, as a recent study surveyed 175 post-graduate year-1 (PGY-1) residents across multiple specialties regarding their radiology education and their confidence, and found a concerning mismatch between their radiology-related responsibilities and perceived confidence in their diagnostic imaging skills.⁷ Although 63.7% of the interns were frequently asked to preview radiology studies independently, only 60.2% reported having high confidence in their ability to recognize common/emergent pulmonary findings on chest imaging. Only approximately 33% had high confidence when ordering oral/IV contrast with a computer tomography (CT) study.

With the recent changes to the US medical education and licensing exam practices, it is becoming increasingly difficult to predict how new residency criteria may impact undergraduate radiology education. In one study, the authors suggest that removing a scored Step 1 exam will shift the emphasis toward applicants' numerically scored Step 2CK and likely focus more on other parts of the application, including letters of recommendation, research, and extracurricular achievements.⁸ These authors believe that with fewer schools offering any

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dedicated Step 2CK study time, many medical students may soon flood radiology electives due to the general reputation of them being easier and having decreased time commitments to maximize study time. They also suggest that more students may apply to radiology residencies due to the uncertainty of where they stand in competitiveness without a scored Step 1 score. Both shifts may significantly increase the number of students opting for radiology electives, thus increasing teaching responsibilities for the already busy radiologists. This will require a drastic restructuring of radiology elective curriculums.⁸

The utility of a well-structured and actively engaging radiology elective would be incredibly valuable for the next generation of physicians. To our knowledge, there does not seem to be an existing comprehensive review of medical student perspectives toward the curriculum and structure of radiology electives across the United States. The purpose of this literature review is to summarize certain radiology clerkship practices that have been well-received from the medical student perspective. Specifically, the primary goal of this study is to identify many of the shared limitations of various radiology electives as described by medical students while also identifying certain radiology clerkship practices that were appreciated by the medical students. The secondary goal is to identify certain challenges that clerkship directors may face while attempting to implement favorable changes to the clerkship.

Methods

Search strategy

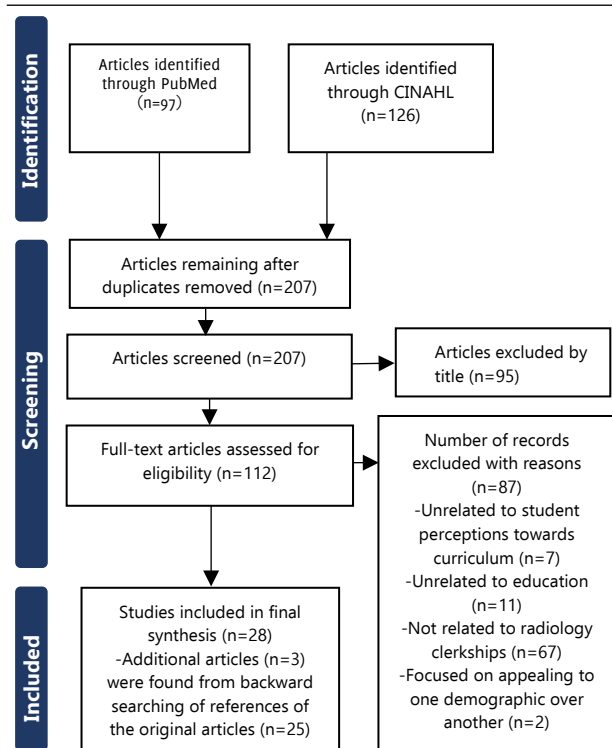
A literature search was conducted within PubMed and CINAHL databases. Search terms used included 'radiology,' 'clerkship,' 'elective,' 'medical student,' 'perception,' and 'preference.' Articles were then obtained from the databases using these search strings: radiology clerkship, radiology clerkship student, radiology elective, medical student preference radiology, and medical student radiology education. Articles were obtained between 1990 to 2023 and included article subtypes such as case reports, commentaries, educational perspectives, randomized clinical trials, meta-analyses, reviews, and systematic reviews.

Inclusion and exclusion criteria

Articles were selected based on their relevance towards formal radiology clerkships as opposed to longitudinal or preclinical radiology education. Articles that specifically discussed student perceptions towards the clerkship were preferentially chosen. In addition, articles that looked at mentorship practices or resident teaching methods during the radiology clerkship were also included if student perceptions to the practices were discussed. Articles that reviewed limitations or challenges that clerkship directors faced when attempting to build or modify their radiology elective courses were also included. To limit the scope of this review, articles that focused on integrated curriculums over four years as opposed to focused electives were excluded. Articles that proposed structural changes to radiology clerkships without data discussing student opinions or perceptions of said changes

were excluded. Studies that looked solely at medical students' radiological competence/knowledge after the elective without considering student attitudes or perceptions towards the elective were excluded to keep the article focused. Any articles that did not pertain to the specific specialty of diagnostic radiology, including solely interventional radiology or radiation oncology clerkships, were excluded. As one of the goals of this study is to examine clerkship practices that medical students viewed favorably or unfavorably, articles that only examined faculty or resident perspectives without discussing medical student perceptions were also excluded. Any articles that focused primarily on professionalism, academic dishonesty, or ethics, as opposed to the educational structure of the elective, were excluded as they did not seem relevant to the goals of this study. Lastly, any articles that primarily focused on evaluating match rates into radiology, applying to radiology residency, appealing to one gender over another to the field, or training medical students in single modalities (e.g., ultrasound) were excluded.

Figure 1. PRISMA Flowchart Demonstrating the Selection Process During the Literature Search.



Data extraction

All articles were independently reviewed by the primary investigator to ensure relevancy. Ninety-seven articles were found on PubMed, and 126 were found on CINAHL. These articles were screened with the inclusion and exclusion criteria and duplicates (Figure 1). Additional articles (n=3) were found from searching through references of the original articles found from the database search that met the selection criteria (n=25), for a total of 28 articles.

Table 1. Primary Literature Sources Included in Review, Detailing the Sample Size, Survey Methodologies, Study Intervention, and Study Type.

Reference	Population	Data collection method	Study intervention	Research design
Belfi et al. (2021)	26 4th year students	5-point Likert test for perception, unpaired t-test for pre-post intervention	Two-week in-person elective converted to virtual elective	case study
Belfi et al. (2015)	101 3rd year students	Post completion ranking survey of preferred learning method	different learning methodologies (traditional, blended, independent)	case study
Belfi et al. (2022)	95 students enrolled in clerkship	5-point Likert scale survey to test student perception	ICARUS interactive gaming modules	case study
Benedetti et al. (2014)	5 medical students	10-point Likert scale and open response	Newly designed radiology elective focused on career development	case study
Darras et al. (2019)	95 medical students and 31 faculty	5-point Likert scale and open response comments	survey assessed student perceptions towards the elective for (1) goal orientation, (2) organization/regulation, and (3) relationships	case study
Desai et al. (2016)	35 medical students	5-point Likert scale survey to test student perception	Integrated website built for elective	case study
Friedman et al. (2017)	40 medical students	5-point Likert scale survey to test student perception	Set up an interactive workstation with anonymized cases for MSK-related pathology	case study
Gomez et al. (2020)	116 medical students enrolled	Likert scale survey and open response feedback	switched to a virtual elective in the setting of COVID-19 pandemic	case study
Huang et al. (2021)	34 medical students	A combination of a 100-point Likert scale and open response	flipped classroom approach	case study
Larocque et al. (2018)	36 surveyed of 58 students who completed elective,	Survey items: dichotomous, ranking, 5-point Likert-type scale questions, as well as open-ended questions	Two studies. The first study is a needs assessment survey, and the second study implements changes to meet those needs.	case study
Mauro et al. (2021)	120 medical students surveyed, 97 were in elective	student satisfaction surveys, including Likert scale and narrative comments	built a cost-effective website	case study
Mullins et al. (2005)	13 medical students surveyed prior to elective start	Open response survey	Survey was conducted to determine the objectives students want met for radiology electives	Observational study
Newbury et al. (2021)	Fourth-year medical students	Entrance and exit surveys given to medical students	Medical students were given PGY-1-level responsibilities	case study
O'Connor et al. (2016)	175 medical students	Likert scale questionnaires evaluating task value, enjoyment, anxiety, boredom, etc.	Alternated flipped learning with didactic lectures	Prospective cohort study
Poot et al. (2012)	Third and fourth-year medical students	questionnaires composed of Likert, free response, and multiple choice	optional survey distributed to third and fourth year medical students	Observational study
Redmond et al. (2020)	91 4th year medical students	Likert scale questionnaires to assess attitudes toward radiology	Active learning (integrated) vs. traditional passive method	Prospective cohort study
Smith et al. (2022)	80 medical students	post-clerkship surveys consisting of multiple choice, ranking, Likert scale, and open response	Surveys were given during COVID-19 pandemic to assess how students perceived radiology virtual training	Observational study
Strickland et al. (2015)	25 medical students who completed the elective	post-clerkship survey of Likert scale questions to assess perceptions	Virtual MSK radiology workstation	Case study
Visccher et al. (2017)	28 medical students across all years	multiple choice, audio recordings, and open-response surveys	Surveyed medical students to assess exposure, perceptions, and suggestions for positive change	Observational study
Webb et al. (2016)	medical students who completed elective	10-point Likert scale and narrative comments questionnaire given to students	new "teaching resident" role developed	Case study
Wu et al. (2021)	23 medical students	post-clerkship survey composed of a 5-point Likert scale	newly added online learning platform and e-book	Case study
Zou et al. (2011)	74 3rd and 4th year medical students	post-conference questionnaire composed of ranking choices	didactic lecture format vs. active participation	case study

Results

Of the 28 articles reviewed, there were 5 review articles, 1 editorial piece, 2 prospective cohort studies, 4 observational studies, and 16 case studies ([Table 1](#)). By far, the most common method used to assess student feedback and perceptions towards the clerkship was a 5- or 10-point Likert scale (e.g., surveyors were asked to rate how much they agree with a statement, 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), which was implemented in 13 of the 28 articles. Nine articles used a mixed-method approach to assess student perspective by including both a Likert scale and other questionnaire methodologies (ranking, open response, multiple choice), and 4 articles used methodologies that did not include the Likert scale. Of the 16 case studies, 14 were conducted while researchers implemented a new intervention to their radiology clerkship, allowing them to collect data on student perspectives toward said changes. Various new teaching methods were implemented, including switching to virtual options considering the COVID-19 pandemic,^{19,20} flipped classroom teaching,^{14,15,16,29,31} interactive workstations,^{18,26} and interactive websites^{17,28} and simulators²⁷.

The two prospective cohort studies compared how students performed and responded to learning from an integrated or flipped classroom modality to the traditional didactic format of radiology learning.^{14,16} All four observational studies did not involve the researchers implementing new interventions to their existing radiology elective. Instead, they focused on assessing students' ongoing perceptions and suggestions for improvement of radiology electives via qualitative surveys.^{2,11,22,30} One editorial was included as it provided additional perspective to some of the challenges and mindsets that students have during a radiology elective.⁴ The 5 reviews provided summaries on various topics, including recommendations on how to structure radiology electives in the context of student values,^{9,13,30} current novel teaching methods that are well received by faculty,³² and various challenges that are experienced by radiology educators.²³

Given the context of this study, the literature search findings were organized into sections: current state of radiology clerkships, the traditional format of many radiology electives, problems with the traditional format, barriers to improvement, and possible solutions to improving clerkships.

Discussion

Current state

In undergraduate medical education, imaging is taught in numerous ways. While many curriculums attempt to integrate diagnostic imaging lessons into preclinical courses, most notably anatomy and other third-year core clerkships, such as internal medicine and surgery, most academic radiologists across the US rely on radiology or fourth-year electives to teach diagnostic imaging concepts to medical students. In a recent survey conducted across US medical schools, approximately 48 of the 54 (89%) radiology department chairs stated they used radiology electives to teach medical imaging, with the second most

common method being integration into other courses such as anatomy (44, 81%).⁹

Many medical students enrolling in radiology electives share specific educational goals they hope to achieve by the end of the elective. In a recent survey, researchers at a single institution conducted a needs assessment of medical students (n=36) who completed the radiology elective to determine students' most common goals for the elective.¹⁰ The top educational goals were to learn about the specialty (n=13, 37%), how to approach various CT scans (n=13, 37%), improve on chest X-ray interpretation (n=10, 29%), and to understand indications for various imaging (n=11, 31%). Researchers also asked students what activities they would like to see incorporated into future electives. The most selected choices were participating in procedures and scanning (96%), interpretation of cases and reviewing with residents or staff (93%), participating in exercises that focused on imaging work-up/appropriate ordering of imaging (91%), and being assigned with a resident mentor during the elective (82%), which was more popularly selected than being assigned with a faculty mentor during the elective (77%). A separate study created a questionnaire for medical students who completed the radiology elective at their institution, and found that these students were motivated to learn about appropriateness criteria for ordering imaging, improve their imaging interpretation skills, increase their confidence, and learn about the science behind technology with regards to protocol, contrast, and techniques.¹¹ These findings demonstrate that many medical students come into radiology electives with specific goals to learn about the field and improve their clinical skills. They are highly motivated to become more involved during the elective.

Traditional format of radiology electives

Across US medical schools, many radiology electives have been structured similarly. Traditionally, radiology electives tend to occur in either 1-week, 2-week, or 4-week blocks during the 3rd or 4th year of medical school.² Prior to starting the rotation, medical students are often given a set of learning objectives, detailing their expectations and roles in the reading room.^{2,12,13} Following this, the traditional radiology elective involves many forms of passive learning by having students observe readouts,^{12,14} attend didactic lectures,^{14,15,16} and have students rotate through different radiology subspecialties.^{17,18} Certain rotation directors have also begun implementing newer practices, such as adding flipped classroom instruction^{15,16} or online learning modules during the pandemic.^{19,20}

Problems with the traditional format

Medical students have reported multiple issues with the traditional structure of radiology electives. Most commonly, the issues seem to relate to the extremely passive observer role students are given, the inaccurate representation of what radiologists do, and unclear communication between students and faculty.

The skillset required to effectively and efficiently interpret and order diagnostic imaging is incredibly high and beyond the skills of medical students.¹³ That, in tandem with the job students are

often given in the reading room of simply observing, results in many medical students feeling unengaged and unsure of their expectations. Researchers in a single institution surveyed 95 medical students who completed their radiology elective and found that the most common themes students had issues with were the lack of autonomy, lack of structured teaching, and lack of preceptor continuity.³ In a different qualitative study at a separate institution, narrative feedback from students centered towards feelings of isolation, feeling like there was no accountability, and feeling of little value, with one student commenting he just felt "like a bother."²¹

Issues with the traditional format of radiology electives can also lead to failures in dissolving misconceptions medical students may have towards radiologist and their field. Currently, many medical students view radiology electives as easy and flexible, which does not accurately represent the daily practice of radiology.¹³ A recent educational perspective helps to further highlight many of the ongoing misconceptions about radiology,⁶ stating that radiologists may be seen as being socially inept, are only interested in financial incentives, that the reading room is a boring place, and that radiologists might soon be replaced by artificial intelligence.⁴ Considering most medical students' passive observer role in the room, sitting silently while watching radiologists dictate studies, it is not far-fetched to understand why several misconceptions are still prevalent across US medical schools.

Problems with communication between students and faculty are also prevalent. Researchers at one institution surveyed thirty-one radiologist faculty. They found that the radiologists lacked clarity regarding learning objectives and what level of knowledge to expect from the medical students.³ Suggestions for improvement have been made in the past, with researchers from one study surveying 28 medical students at their institution and finding proposals that medical students be treated like residents and thus be given responsibilities to review/dictate cases with faculty and have more teaching time with faculty.²¹ So, with these suggestions, why not give medical students more responsibility and have faculty spend more time with them across US medical schools?

Challenges

Many radiology clerkship coordinators will inevitably face similar issues while designing their courses, with most coming from similar themes: (1) faculty don't have time,^{9,13,22} (2) no financial motivation to teach,²² (3) no suitable entry-level tasks for students.¹³ The daily responsibilities of an attending radiologist make it difficult to accommodate extra teaching roles. One review article notes how radiologists often have shift-like rotations and are often at the whims of their scheduling, which ultimately prevents faculty from taking ownership of supervising individual students.¹³ Currently, most US radiologists are compensated on a fee-for-service model, with each study carrying an associated relative value unit (RVU) that determines their reimbursement. Thus, their salaries are heavily reliant on their ability to read high volumes of imaging studies per day. In addition to their ever-increasing clinical responsibilities of interpreting images leading

to their unavailability^{9,22} and little financial incentive to support education as less income is generated due to lower clinical productivity,²² there is decreased motivation for faculty to focus more of their time on teaching medical students.

As one study demonstrates, simply increasing clinical responsibilities for medical students on electives may not address issues of available time for faculty. One institution implemented a novel hands-on elective where fourth-year medical students were given resident-level responsibilities to dictate studies.²³ While this likely led to better learning for the students and was ultimately deemed a success by researchers, they acknowledged that the course was incredibly time-consuming for faculty since each student had to receive individualized education from faculty based on their strengths/weaknesses. So, what are some ways to approach these limitations?

Solutions

Throughout the current literature, numerous teaching modalities were implemented and well-received by medical students. These modalities can be organized into common themes: (1) supplemental online modules and case banks, (2) interactive workstations or simulators, (3) consistent teaching and feedback from residents, and (4) flipped classroom learning.

One well-received modality was with online learning modules, particularly using case banks. In two separate institutions, researchers developed an interactive, electronically available case bank that medical students in the radiology elective could access and use to supplement their learning.^{10,24} At one of the institutions, students responded well to the case bank, giving a median Likert score (5 = excellent, 4 = very good, 3 = good, 2 = fair, 1 = poor) of 4.5.²⁴ At the other institutions, researchers implemented three changes to their clerkship, including the development of resident-led rounds, a new case bank, and a more structured schedule. Satisfaction surveys were then administered to students who had completed the revised radiology clerkship, and those results were compared with surveys from the students who had completed the original elective without the changes.¹⁰ The mean Likert score (ranging between 1=poor and 5=excellent) given by medical students for overall elective experience was significantly higher after implementing the changes compared to before the changes (4.2 ± 0.90 , 3.3 ± 1.28 , $P=0.022$), with the case bank getting a mean score of 4.7 ± 0.49 .

Other institutions employed active learning methods in the form of simulation-based learning. Medical students in radiology electives in two medical schools were allowed to work with a newly implemented interactive workstation simulator.^{18,25} These workstations comprised a desktop computer in the reading room preloaded with anonymized cases and vignettes deemed appropriate for students by faculty. In both studies, medical students were encouraged to use the workstation when faculty and residents were busy dictating. The responses from both groups of students were positive, with one surveyed group reporting that 91% of the medical students believed the station had at least a "moderate" (Likert scale 4/5) positive impact on

their experience, and 35% saying the station was the best experience of the entire elective.¹⁸ For the other group, of the 25 students surveyed, over half described the workstation as the best experience they encountered in radiology education, though the researchers noted that the initial process of exporting anonymized imaging studies for the workstation was time intensive (however, they predict maintenance time requirements to be substantially less), and there were also some hardware troubles.²⁵

In addition, one prospective cohort study by an institution found that employing active learning methods leads to improved student feedback scores and time benefits for faculty.¹⁴ The group created an integrated radiology clerkship, substituting hours of traditional didactics taught by faculty for self-directed simulation sessions where students could interpret cases on image-viewing software. Students (n=91) were assigned to either the traditional clerkship (n=42) or the integrated clerkship (n=49). Researchers found that not only was there a statistically significant improvement in student agreement scores from the integrated clerkship compared to the traditional one as seen with positive statements like "I have a better understanding of the role of the radiologist" (mean Likert score 4.6 vs. 4.3, $P=0.031$) or "my perception of radiology has been improved," (mean Likert score 4.7 vs. 4, $P < 0.001$), a secondary effect they noticed was that the integrated format freed up 7 hours of radiologist time over the week compared to relying on their traditional clerkship.¹⁴ Other methods of interactive learning employed that were ultimately well received by students were the use of the novel open-source ICARUS module,^{19,26} an interactive web-based platform like a game where students are presented with a clinical scenario, and can then simulate ordering studies, interpreting images, and making diagnostic decisions, or incorporating the use of audience response systems on students' smart phones to encourage anonymous interaction during traditional didactics.⁴

Two separate studies investigated developing a new website to help remedy the issue of certain radiology electives being disorganized. One of the research groups claims that students of the technology-driven younger generation prefer self-directed learning and want autonomy. A well-developed website could help accommodate these needs.²⁷ The other researchers built the website, hoping it would help consolidate resources, organize schedules, and improve communication between students and their faculty during the clerkship.¹⁷ In both studies, surveyed students responded overall positively, with the results from one group showing that 82.5% found the website to be either "extremely informative" or "very informative" when asked to rate the website.²⁷ In the other group, survey results showed that 80% of students accessed the website at least once a day, 17% a few times a week, and 90% agreed that having easy access to the schedule positively impacted their experience.¹⁷ Researchers were able to identify pearls and pitfalls that were similar across both studies. Both found that the website helped to promote more autonomy and learner control by easing access to the material.^{17,27} One group found that this increase in autonomy even helped to relieve radiology faculty of time constraints that would otherwise be encountered during traditional teaching.²⁷

Potential pitfalls identified were technical failures,²⁷ and that a poorly designed website would have no benefits to improving student perceptions.¹⁷

Compared to the traditional didactic approach, the flipped classroom method encourages independent self-paced learning, where students often study or perform assignments on their own outside the classroom and return to discuss what they learned and collaborate with faculty. Two studies employed this, with one group having students interpret and dictate an image independently before returning to faculty and helping to generate the final report,²⁸ and the other group completing an interactive workshop where faculty presented a clinical scenario and focused on facilitating discussion and engagement from students as opposed to lecturing.¹⁶ Both studies compared student feedback for the flipped classroom versus the didactic method. However, one prospective cohort study assigned students solely to flipped classroom versus didactic method,¹⁶ while the other students would alternate between both methods.²⁸ Results for both were similar in that students responded significantly more positively to the flipped classroom method, with one group of students stating that they experienced more task value, had less boredom and greater enjoyment,¹⁶ and the other group stating that they felt more engaged and had perceived more educational value.²⁸

Lastly, medical students seem to highly value regular teaching and feedback from residents or faculty. In their review, Visscher and Faden report that medical students interested in radiology highly value longitudinal mentorship and small-group teaching. They often do not perceive a significant difference in teaching quality between residents and attendings.²⁹ One study developed a new "resident liaison for medical student education" role, where the selected resident would focus primarily on actively teaching medical students, recruiting other residents for teaching roles, and serving as course director for their 2-week radiology elective.⁵ Following the program implementation, feedback from the teaching residents and students was excellent, with the 8 medical students surveyed giving an average rating of 9.6 out of 10 and stating that the teaching was excellent. They felt like the resident was invested in their learning. In a separate study, researchers implemented new resident-led rounds where students would be given the chance to take and interpret cases and be given prompt feedback.¹⁰ When surveyed, medical students rated the resident-led rounds very well (Likert score mean 4.9 ± 0.35 out of 5), the highest of all the changes implemented (other changes including a case bank and a more detailed schedule). These findings may suggest that not only are students receptive towards resident teaching, but these residents may also be extremely effective teachers and possibly help alleviate some of the time constraints of teaching from attending radiologists.

Limitations

This article is primarily flawed in that most of the primary literature in this review are case studies and thus did not incorporate control groups for comparison. As a result, there is no specific way to identify if specific interventions were the actual

cause of any improved student feedback and perceptions. In addition, many of the studies included small sample sizes, so the results may not be generalizable across US medical schools. The majority of the studies also relied heavily on the Likert scale to assess students' attitudes, an inherently arbitrary metric that may not always properly represent how students felt.

In addition, this article was written with the purpose of creating an informative narrative literature review. Therefore, it did not follow the stringent guidelines of a true systematic review that followed PRISMA guidelines. This article focused on incorporating a collective of reviews, opinions, and recommendations as opposed to strict data extractions, structured appraisals, and meta-analyses expected of a systematic review. As a result, the article does not specifically examine each primary article to assess whether survey questions were validated, whether a statistician was involved, the response rates for each study, whether surveys were pilot-tested, or whether sample sizes were calculated.

Conclusions

With the current growth of reliance on imaging and projected manpower requirements to meet these demands, it is imperative that teaching institutions across the country look closely at how the specialty is perceived amongst medical students and that radiology electives be revamped to showcase the realities of the specialty and make it attractive. The aim should be to attract bright and motivated students to take up this specialty while also providing a rewarding environment to learn imaging skills for those students who will eventually pursue other fields. Investigators addressed some of the problems of the traditional radiology elective, as well as some of the newly implemented strategies that have been well received by medical students for improving perceived radiology elective quality. The majority of the traditional elective's flaws stem from students' passive observer role in the reading room and unclear expectations as to what medical students should do. Radiology clerkship directors may experience challenges such as time constraints for teaching and not having tasks suitable for the skill level of medical students. Certain novel teaching methods have been implemented, which have been well-received by students and could offer an approach to help alleviate some of these challenges. New active learning methods, such as case banks, interactive simulators, and websites, might help alleviate some of the teaching time constraints experienced by faculty while also keeping students actively engaged. Also, increased resident teaching roles and responsibilities, as well as flipped classroom teaching, can be viewed favorably by medical students while helping to decrease some of the teaching burden from faculty. While this is certainly not a fully comprehensive list of the various novel teaching methods used across clerkships, the positive feedback given by students suggests they may be a step in the right direction towards making radiology clerkships more engaging and valuable for students while also being logistically feasible for faculty.

Summary – Accelerating Translation

Title: A Narrative Literature Review on Quality Improvements for Radiology Clerkships from Medical Student Perspectives

Main problem to solve: Radiology clerkships have the potential to provide medical students with a better appreciation of the responsibilities of radiologists towards patient care while also raising interest and improving student confidence in diagnostic imaging skills. Unfortunately, many radiology clerkships across the US have developed a reputation for being unorganized and unengaging.

Aim of study: This review is focused on summarizing some of the clerkship practices performed across the US that have been well received by students, as well as some weaknesses with the traditional clerkship format from the student perspective, to highlight effective approaches to revamping electives to showcase the realities of the specialty while also attracting bright and motivated students.

Methodology: The investigators performed a literature search on the PubMed and CINAHL databases using specific search terms deemed relevant to the topic of this review. From the results of the initial research, investigators proceeded by individually selecting articles to be reviewed more in depth and for final analysis based on specific inclusion and exclusion criteria listed in the review. The result was 28 studies that gathered survey responses from medical students that completed radiology clerkships to determine their perceptions towards the clerkship.

Results: Major findings discussed included weaknesses with the traditional format related to passive learning through observing, and unclear expectations for medical students, as well as certain challenges that clerkship directors may face while attempting to implement changes to their clerkship. This review also discussed specific well-received practices involving more active learning, including interactive workstations, simulators, flipped classrooms, case banks, and online learning modules.

Conclusions: With the growing demands towards diagnostic imaging, it is imperative that teaching institutions across the country look closely at how the specialty is perceived amongst medical students and that radiology electives be revamped to showcase the realities of the specialty and make it attractive to bright and motivated students to take up this specialty. Investigators addressed some of the problems of the traditional radiology elective, as well as some of the newly implemented strategies that have been well received by medical students for improving perceived radiology elective quality. The majority of the traditional elective's flaws stem from students' passive observer role in the reading room and unclear expectations for what medical students should do. Radiology clerkship directors may experience challenges with time constraints for faculty to teach and not having tasks suitable for the skill level of medical students. Certain novel teaching methods have been implemented, which have been well-received by students and could offer an approach to help alleviate some of these challenges. New active learning methods, such as case banks, interactive simulators, and websites, might help alleviate some of the teaching time constraints experienced by faculty while also keeping students actively engaged. In addition, increased resident teaching roles and responsibilities and flipped classroom teaching can also be viewed favorably by medical students while helping to decrease some of the teaching burden from faculty. While this is certainly not a fully comprehensive list of the various novel teaching methods used across clerkships, the positive feedback given by students suggests they may be a step in the right direction towards making radiology clerkships more engaging and valuable for students while also being logistically feasible for faculty.

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