Needs Assessment for a Radiology Elective: Residents' Practical Perspective

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Abstract:

Purpose: Medical student radiology electives remain a challenge from a medical education standpoint, and research into the area has been popular recently. Assessment of radiology topics used in the clinical practice of a junior resident, and what radiology skills they find useful, is largely absent from the literature. As such, with the aim to improve our local elective program, we sought to survey first-year residents on what imaging topics they use and recommend for inclusion in a radiology elective.

Methods: An anonymous survey was distributed to all first-year residents at our institution to determine their knowledge of specific radiology topics relative to their needs in residency, the prevalence of these topics in their program, and their perspectives on what is needed for a radiology elective.

Results: 19 (28%) of our first-year residents completed the survey, most of whom (59%) were family medicine residents. Of those who had completed an elective in radiology prior, 42% felt having a staff mentor is useful during such a rotation. While 47% agreed or strongly agreed that their knowledge of diagnostic imaging was adequate for their needs, this number dropped to 5% for interventional radiology. Topics most frequently identified as needing to be emphasized in electives included chest radiography, abdominal radiography, and imaging appropriateness.

Conclusions: We have identified a potential structure and key topics which should be emphasized in a radiology elective to provide trainees with information relevant to their future training, regardless of their specialty of choice.

Introduction:

Radiology rotations during medical school are useful regardless of the student's intended specialty. At Memorial University, up to 59% of students complete a radiology elective in their fourth year according to Undergraduate Medical Education, despite being an optional rotation and with only 4% of the class applying to radiology as their first choice in residency program (Canadian Residency Matching Service, 2019). Students understand the importance of radiology experience for their training, knowing they will be expected to interpret common abnormalities during their clinical education (Kondo & Swerdlow, 2013). Radiology electives, however, are unique in that they are typically observerships, as there are no patient care responsibilities which can be assigned to the student. This poses a challenge for the teacher of these adult learners, ensuring structured learning, guidance on learning objectives, consistent preceptorship, and student autonomy (Darras *et al.*, 2019).

For decades, radiology groups have been undertaking scholarly methods to address these issues within their respective elective curricula. These methods frequently involve implementing new features and comparing student performance on a pre- and post-test (Blaine *et al.*, 1985; Sider & Rogers, 1989; Hilmes *et al.*, 2016; Hartman *et al.*, 2018). More recently, a needs assessment was used to identify features to include: from a student survey, Larocque, Lee, Monteiro, and Finlay (2018) identified that chest X-ray and computed tomography (CT) interpretation were the students' main goals of the rotation, and that students felt an assigned faculty mentor and hands-on experience reviewing cases would be helpful improvements.

The current radiology elective at Memorial University is a two- or four-week rotation in which students are given a schedule of which hospital they will spend each day in. Students are not assigned designated times on a modality or with a specific radiologist or resident. For the

purposes of institutionally required in-training evaluation reports, daily paper-based cards are completed by the resident or staff member the student had the most interaction with that day; there is no other assessment.

This study identifies first-year residents' perspectives on ideas to rework the Memorial University radiology elective to embody these aspects from literature. Literature review reveals a handful of studies analysing medical student perspectives on their radiology elective, their satisfaction with the elective, and tracking their learning by radiologist-created pre- and post-tests. The utility of these rotations as the student progresses through residency has not yet been assessed. As students may not know which areas within radiology would be most useful, given the variety of modalities used depending on the specialty (Kondo & Swerdlow, 2013), students may have unperceived needs which differ from their expectations. Assessment of radiology topics used in the clinical practice of a junior resident, and what radiology skills they find useful, is currently absent from the literature. These results would provide more practical needs for an effective radiology elective and would address medical students' unperceived learning needs. This paper describes a needs assessment survey distributed to first-year residents of Memorial University inquiring about their experience in and knowledge of radiology topics and their opinions on what topics should be taught during medical school radiology electives.

Methods:

Upon review by the institutional health research ethics board, this study was waived as a program evaluation. Consent was obtained electronically from all participants.

Data Collection:

An anonymous survey was sent via institutional email to all 78 first-year residents of Memorial University's Faculty of Medicine. The survey was hosted with the data-encrypted online survey tool, Qualtrics. A pilot survey was first completed by three fourth-year medical students and one staff radiologist whose suggestions for rewording and reformatting were accepted. The survey was distributed via mass email forwarded by the Postgraduate Medical Education secretary to all first-year residents, at this point approximately five months into their program. Two weeks later, it was distributed via Facebook message to the same individuals. A final second email request was sent four weeks after the first. The survey was open for a total of six weeks.

The survey (see Appendix) requested demographic information limited to the respondents' medical school, their residency program, and any previous experience with radiology outside of medical school. If respondents had any experience with radiology rotations, they were asked about the distribution of time between residents and staff, and if this was advantageous to them. Finally, respondents were asked to describe their knowledge of specific radiology topics compared to their needs during their first year of residency (Postgraduate Year 1, PGY1), and their perceptions of which radiology topics should be emphasized in medical school radiology rotations.

Data Analysis:

Microsoft Excel for Office 365 was used to analyse the data. Numerical data including demographics and Likert scale responses were analysed with proportions and an exemplary Chi-

square analysis, while the written comments were assigned a theme by the author. Thematic analysis could not be completed due to the few responses to the open-ended questions.

Results:

Demographics:

The first-year residency class at Memorial University consists of 78 trainees. While 22 respondents initiated the survey and provided demographic and radiology elective details (28% response rate), only 19 surveys were completed.

Table 1: Respondent demographics

		Number of respondents	Percentage of total respondents (22, %)
Prior medical school	MUN	13	59
	Other	9	41
Residency program	Family Medicine	13	59
	Pediatrics	2	9
	Neurology	2	9
	Anesthesiology	1	5
	Radiology	1	5
	Orthopedic Surgery	1	5
	Psychiatry	1	5
	Obstetrics & Gynecology	1	5
Completed a radiology elective	In medical school (2 weeks)	11	50
	In residency (4 weeks)	3	14
	In either	13	59

Most respondents were family medicine residents (13, 59%). None had experience with medical imaging prior to medical school. Half of all respondents had completed a two-week rotation in radiology during medical school; 3 respondents (14%) had completed a four-week rotation during residency. Accounting for overlap, 13 respondents (59%) had done a rotation in radiology at some point, one of whom did not complete the questions regarding their elective experience (Table 1).

Of the 12 respondents who shared their experience with radiology rotations, there was overall satisfaction with the proportion of time spent with residents and staff, with 83% and 75% reporting their amount of time spent with residents and staff, respectively, was what they had expected entering the elective. Two individuals reported they spent "much more time" with residents than they wanted: one of these respondents answered that they spent "most of the time" with residents, while the other only spent "a bit of the time" with residents. Conversely, two individuals reported spending "much less time" with staff than they wanted: these responses corresponded with the two individuals who spent "none of the time" with staff. One individual who spent "about half of the time" with staff felt this was "much more time" than they wanted. A total of 50% had a staff mentor during their rotation: of these, a third (2, 17% of all respondents) felt having a staff mentor facilitated learning, while two-thirds (4, 33% of all respondents) felt it was not helpful. Of the remaining 50% who did not have an assigned staff mentor, half felt it would have benefited them, while half did not (Table 2).

Table 2: Perceptions and preferences of time spent with residents on staff on elective

		Number of respondents	Percentage of total respondents (12, %)
Elective time spent with residents	Most of the time	8	67
	About half of the time	2	17
	A bit of the time	1	8
	None of the time	1	8
How did this compare with your expectations?	Much more time than I wanted	2	17
	About as much time as I wanted	10	83
	Much less time than I wanted	0	0
Elective time spent with staff	Most of the time	1	8
	About half of the time	4	33
	A bit of the time	5	42
	None of the time	2	17
How did this compare with your expectations?	Much more time than I wanted	1	8
	About as much time as I wanted	9	75
	Much less time than I wanted	2	17
Did you have a staff mentor?	Yes, and it facilitated learning	2	17
	No, but I would have liked to	3	25
	No, but it wasn't needed	3	25
	Yes, but it wasn't helpful	4	33

Perceived knowledge level:

Regarding perceived knowledge level, most respondents agreed that they felt their knowledge of diagnostic radiology was adequate for their needs in their first year of residency (8, 42%); however, 58% (11) disagreed that their knowledge of interventional radiology was adequate (Figure 1). Respectively, 5% (1) and 0% (0) strongly agreed while 5% (1) and 11% (2) strongly disagreed that their knowledge of diagnostic and interventional radiology was adequate for their first year of residency (Figure 1). Comparing these results for those who did complete a radiology rotation in medical school with those who did not reveals no significant difference in perceived knowledge for either diagnostic ($p = 0.2$) or interventional radiology ($p = 0.8$) (Table 3).

Figure 1: Knowledge level of radiology relative to PGY1 needs

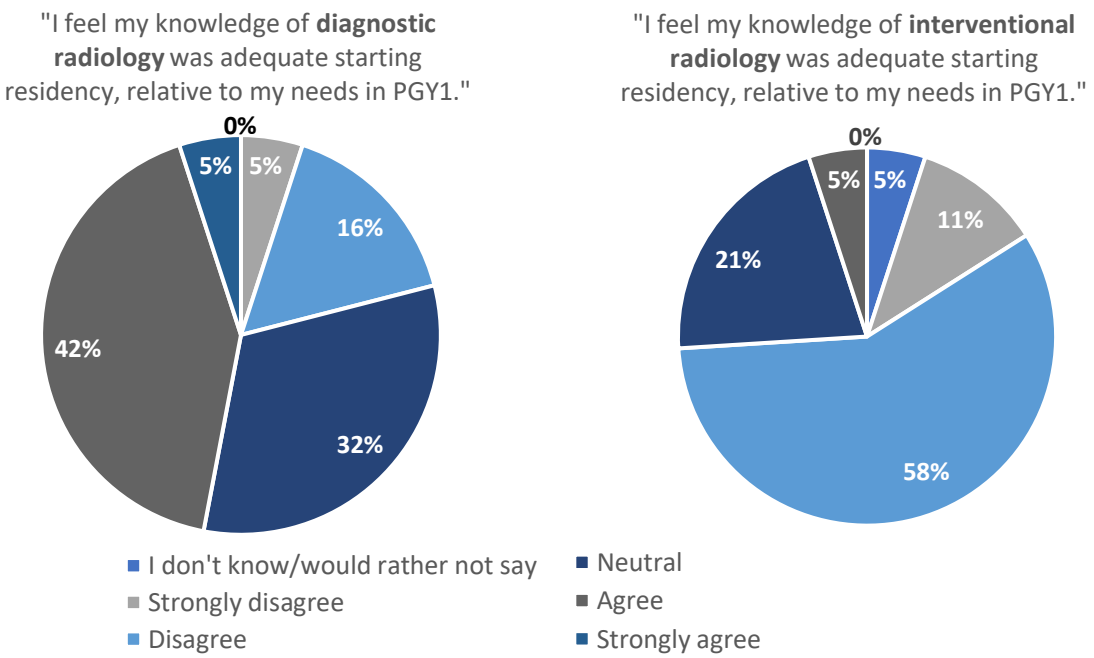


Table 3: Knowledge level of radiology relative to PGY1 needs based on completion of a medical school radiology elective

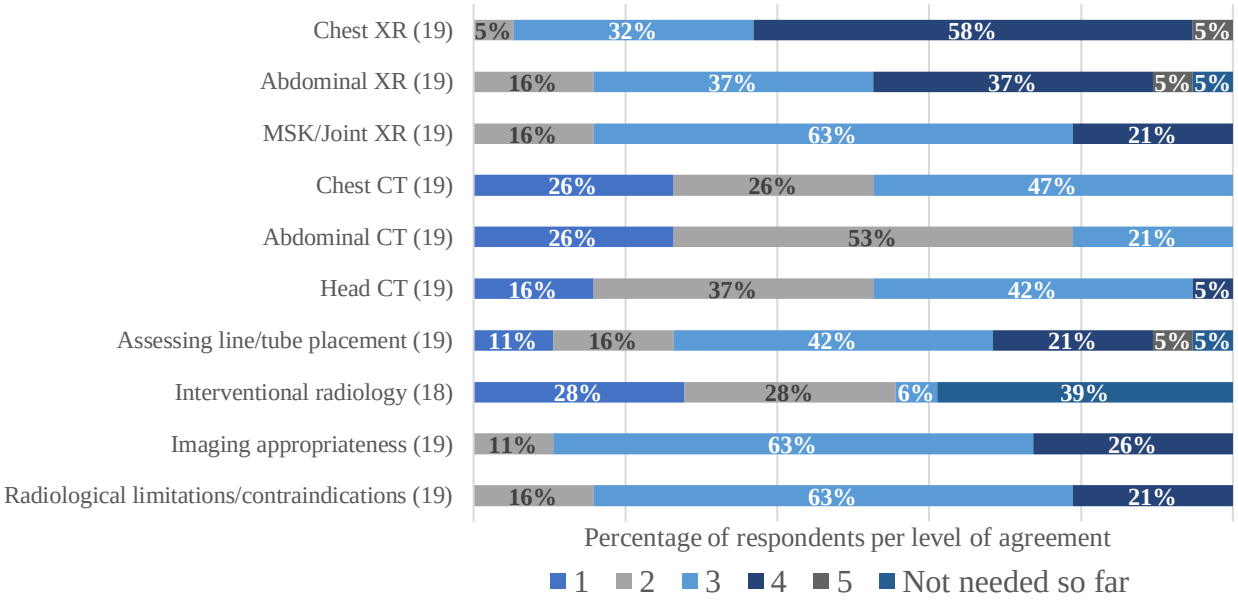
"I feel my knowledge of diagnostic radiology was adequate starting residency, relative to my needs in PGY1."				
	Completed an elective in medical school		Did not complete an elective in medical school	
	Number of respondents	Percentage of total respondents (9, %)	Number of respondents	Percentage of total respondents (10, %)
Strongly disagree	0	0	1	10
Disagree	0	0	3	30
Neutral	4	44	2	20
Agree	4	44	4	40
Strongly agree	1	11	0	0
I don't know/prefer not to answer.	0	0	0	0
"I feel my knowledge of interventional radiology was adequate starting residency, relative to my needs in PGY1."				
	Completed an elective in medical school		Did not complete an elective in medical school	
	Number of respondents	Percentage of total respondents (9, %)	Number of respondents	Percentage of total respondents (10, %)
Strongly disagree	1	11	1	10
Disagree	6	67	5	50
Neutral	1	11	3	30
Agree	0	0	1	10
Strongly agree	0	0	0	0
I don't know/prefer not to answer.*	1	11	0	0

**Chi Square analysis was performed, excluding the non-response option, comparing the two groups for both questions, at the 95% confidence level. No statistically significant difference was found between responses to either the diagnostic (p = 0.2) or interventional (p = 0.8) radiology questions.*

Most respondents agree that the modalities questioned (Figure 2) were needed at some point during their first year of residency. Knowledge of interventional radiology was an exception, with 39% (7) of respondents stating it had not been needed thus far. One individual (5%) reported not needing knowledge of abdominal X-ray, and one (5%) reported not needing to assess line and tube placement thus far during their first year of residency. Overall, few respondents rated their comfort level in any of the modalities as a five on the five-point scale relative to their needs in their first year of residency: each of chest X-ray, abdominal X-ray, and

assessing line and tube placement had one respondent (5%) report full comfort with the modality relative to their needs thus far. Respondents were most comfortable with chest X-ray, with 58% (11) reporting a score of 4/5; this was followed by abdominal imaging (7, 37%) and imaging appropriateness (5, 26%). Respondents were least comfortable with their knowledge of interventional radiology, with 28% (5) respondents ranking their comfort at 1/5. Abdominal and chest CT were other areas in which respondents ranked low 1/5 comfort with their knowledge relative to their needs thus far in residency: both modalities had 26% (5) of respondents rating their comfort at 1/5, while 53% (10) and 26% (5) rated their comfort with abdominal CT and chest CT at 2/5, respectively. The predominant response for other modalities was a comfort level of 3/5 relative to their needs thus far in their first year (Figure 2).

*Figure 2: Respondents' comfort level with a specific topic relative to their needs in PGY1, on a five-point scale**

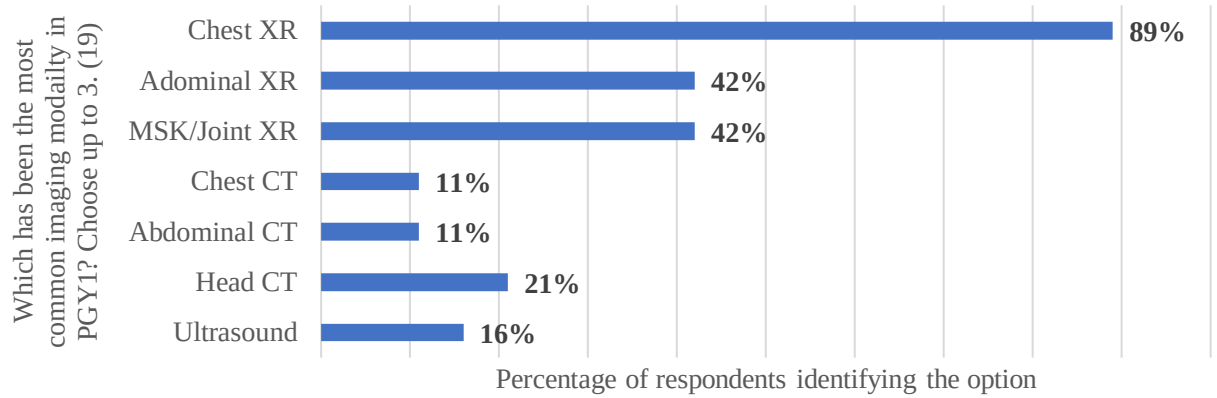


**The number of responses for each question is shown in parentheses next to the modality questioned.*

Implications for radiology electives:

The most common imaging modality during the first year of residency was chest X-ray, with 89% (17) of respondents ranking it among the top three modalities to which they have had the most exposure (Figure 3). Abdominal and joint X-ray were the next most common, each with 42% (8) of respondents ranking it within their three most prominent modalities. Chest and abdominal CT were the least reported (2, 11% each). One respondent used the write-in "Other" option to include "malfunctioning PACS and other programs." No option received no responses.

Figure 3: Imaging modality exposure in PGY1



Respondents felt that chest X-ray (9, 50%), abdominal X-ray (8, 44%), and imaging appropriateness (8, 44%) should be emphasized more strongly in medical school radiology electives (Figure 4). Abdominal CT (1, 6%) and chest CT (2, 11%) were identified by the fewest respondents. There were no write-in responses, and no option received no responses.

Responses to the two freeform questions included in the survey are shown in Table 4. One respondent identified that inadequate technology in the form of poor IT support for non-radiologists hampers their learning of image interpretation: "the IT priority has clearly been to get imaging working for radiologists…." Three respondents identified that increased experience with imaging has been most helpful for their learning: this came in the form of an emergency

department rotation for one respondent, interpreting several chest X-rays at once for another, and with hands-on point-of-care ultrasound.

Figure 4: PGY1 perspective on which topics should be emphasized more strongly in medical school electives

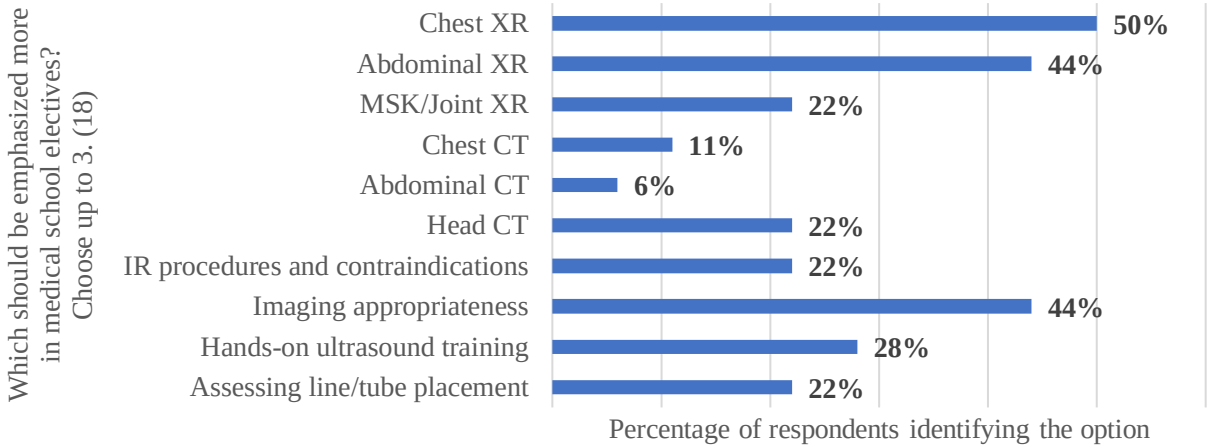


Table 4: Freeform comments

	Responses:	Theme:
Are there any other imaging-related educational needs you felt were not discussed above?	The disappointing reality on the ground in some outlying hospitals, where the IT priority has clearly been to get imaging working for radiologists, but the ability to usefully look at and compare imaging for other MDs is vestigial at best. This is not helping me improve my experience with basic image interpretation.	Inadequate technology hampers learning
Are there any radiology learning experiences you felt significantly contributed to your knowledge? Please briefly describe what these were and their format.	Emerg rotations were very helpful with improving radiology related knowledge necessary for a family medicine resident.	Experience/exposure
	Repeated exposure to image interpretation. This is so important and I felt the more I did, the more comfortable I got. Having 1 drawn-out lecture on CXR interpretation is not very helpful. Going through 20 CXRs though rapid fire for key findings and clinical relevance is.	Experience/exposure
	Not necessarily radiology-specific but completing PoCUS training has been helpful	Experience, hands-on

Discussion:

Adult learning theory makes it clear why the identifying the ideal structure and content of a medical school elective requires insight into why learners opt to enrol in the rotation. One of Knowles' assumptions of andragogy is that one's readiness to learn depends on the perceived need to learn the material. Ensuring that medical learners receive an orientation to learning—that is, that they understand why their current learning objectives will be important for their future—allows them to incorporate their previous experience to their new learning (Taylor & Hamdy, 2013). This also necessitates that teachers understand their learners' future needs. Medical students themselves may not yet understand how some radiology topics will become relevant in their specialty (Kondo & Swerdlow, 2013). As adult learners, however, having this understanding is key to their learning, making it useful to have a framework: as first-year residents often complete varied off-service rotations, knowing their practical needs with regards to radiology topics will help prepare incoming medical students by offering a more tailored learning environment as they complete their radiology electives.

Of the 22 respondents to this survey, 59% had completed a rotation in radiology at some point, either in medical school or during their residency. Most elective learners reported spending either "about half" or "most" of their time with residents and felt this was in line with their expectations. Meanwhile, respondents stating they spent "none" of their elective time with staff felt this was "much less time" than they expected, while those who spend "about half" of the time with staff felt this was "much more time" than they expected. This speaks to the importance of ensuring learners have opportunity with both staff and residents. Learners thus generally appreciate having significant time with residents during elective—perhaps a result of perceptions that residents have more time to teach, teach at a more appropriate level, or are more

able to spend time answering questions—provided they do have some time with a staff radiologist.

Half of those respondents who completed an elective reported having a designated staff mentor. Interesting, learner preferences in this respect varied widely, differing from literature: two-thirds of those who had a staff mentor felt it was not helpful, while those who did not have a staff mentor are split evenly on whether or not they feel it may have been useful. Other radiology groups who have implemented mentorship programs have found it successful and appreciated (Kasch *et al.*, 2016), and a needs assessment of medical students revealed that an assigned staff mentor was one of the most requested changes to their radiology rotation (Larocque, Lee, Monteiro & Finlay, 2018). Varying mentor styles such as the degree of presence of the staff mentor may be an area worth investigating to understand this difference.

There was no statistically significant difference in respondents' comfort level with diagnostic and interventional radiology between those who had completed an elective during medical school and those who had not. Overall, most agreed that their knowledge of diagnostic radiology was adequate for their needs thus far in their first year of residency, while most disagreed with the same for interventional radiology. It would be expected that those who had completed an elective prior to starting residency may be more knowledgeable about radiology: scholarly work with goals to restructure and improve radiology electives have shown that strategies such as implementing specific learning objectives, student schedules, and additional learning modalities improve student outcomes on researcher-designed assessments (Blaine *et al.*, 1985; Sider & Rogers, 1989; Hilmes *et al.*, 2016; Hartman *et al.*, 2018). That these residents were only five months into their residency, and small sample size of the two groups, may account for these results.

There is little published on which topics are emphasized during radiology electives, hence the value of investigating which topics are most useful for residents early in their careers. The most common modality to which residents are exposed in their first year is plain radiographs, with chest, abdominal, and joint X-ray being the top listed modalities. Chest and abdominal X-ray were two of the topics which most respondents felt should be emphasized more strongly during medical school electives, likely due to their high frequency of appearance in the resident workload. Imaging appropriateness was another topic which respondents felt deserved more emphasis during radiology rotations, with almost half of all respondents identifying it in their top three topics and over half feeling only neutral about their knowledge level. Medical students also recognize the importance of learning imaging appropriateness before residency (Larocque, Lee, Monteiro & Finlay, 2018). This is useful to know as both internal medicine and general surgery residency program directors agree that the skill of selecting the best imaging modality to order is crucial for new residents (Kondo & Swerdlow, 2013). It is thus an important generalizable skill which is relevant to any student completing a radiology elective (Hartman, Thomas, & Ayoob, 2018), and care should be taken to discuss it during the rotation. While respondents were least comfortable with their knowledge of interventional radiology, 39% felt it was not needed thus far during their residency. Interventional radiology procedures may be a topic more useful for some physicians further in their career. Due to small sample size for statistical analysis, comparison of these responses between groups was not performed. Finally, freeform comments include a call for improved information technology staff assistance due to difficulty comparing scans, which may suggest a need for picture archiving and communications software (PACS) training for all first-year residents, so they can learn how to retrieve old scans, set up single-screen comparisons, and adjust window and level values.

Comparison between demographic groups (for example, between residency programs which require more significant volumes of imaging interpretation and those which require less) could not be completed due to the low 28% response rate and the uneven distribution of programs the respondents are in (Table 1). As such, the Chi square analysis (Table 3) comparing respondents' comfort level with diagnostic and interventional radiology between those who had and had not completed a radiology elective during medical school is an approximate result and not necessarily applicable to a larger scale. A thematic analysis of written comments to open-ended questions could not be completed as intended, due to the low number of responses (4 responses). Future work includes a larger scale survey of junior residents' imaging needs, perhaps with emphasis on non-radiology programs, and implementing reflective changes during the medical school radiology elective to be assessed with resident comfort or skill level at the completion of the first year of their program.

Conclusion:

A needs assessment survey of first-year residents at Memorial University regarding medical student radiology rotations was completed to gauge their perspective on potentially relevant topics for inclusion in a restructured rotation. Learners expect to spend some time with staff radiologists while most of the rotation may be with the guidance of residents. Chest X-ray, abdominal X-ray, and imaging appropriateness were identified as key topics to emphasize during radiology rotations. This information can be incorporated into planning radiology electives.

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Appendix:

Needs Assessment Survey

Radiology Electives: The Resident Perspective

Thank you for participating in this survey.

The aim of this survey is to complete explore the needs of PGY1 residents for use in an undergraduate elective in radiology. We are asking for you to share your experience through this survey, which will gauge your comfort level with and use of radiology topics thus far during your residency.

This survey takes approximately 5 minutes to complete. It is anonymous and voluntary. While we value your responses to each question, you may skip any questions you wish, and you may leave the survey at any time. This project will contribute to the overall goal of improving the radiology elective at Memorial University, and we would greatly appreciate your insight.

Your Training Background:

1. In which residency program are you currently enrolled?
    a. Anesthesiology
    b. Family Medicine
    c. General Surgery
    d. Internal Medicine
    e. Neurology
    f. Obstetrics/Gynecology
    g. Orthopedic Surgery
    h. Pathology
    i. Pediatrics
    j. Psychiatry
    k. Radiology
    l. Other: [text box]
2. Please indicate your year of residency.
    a. PGY1
    b. Other: [text box]
3. Have you ever been enrolled in a different residency program than you are currently in?
    a. No
    b. Yes
4. At which medical school did you complete your MD?
    a. Memorial University
    b. Dalhousie University
    c. Université Laval
    d. Université de Sherbrooke
    e. Université de Montréal
    f. McGill University

g. University of Ottawa
h. Queen's University
i. Northern Ontario School of Medicine
j. University of Toronto
k. McMaster University
l. Western University
m. University of Manitoba
n. University of Saskatchewan
o. University of Alberta
p. University of Calgary
q. University of British Columbia
r. Other: [text box]

5. Do you have a background in medical imaging (e.g. radiographer, sonographer, medical or veterinary professional with experience in interpreting images)? If yes, please indicate how many years.
    a. No
    b. Yes. Number of years: [text box]
6. Did you complete an elective in radiology during your undergraduate training? If yes, how many weeks in total?
    a. No
    b. Yes. Number of weeks: [text box]
7. Have you completed a rotation in radiology during your postgraduate training? If yes, how many weeks in total?
    a. No
    b. Yes. Number of weeks: [text box]

Questions 8 through 11 are shown only if respondents answered "Yes" to either Questions 6 or 7.

8. Please reflect on your radiology elective(s). How much time did you spend with staff?
    a. Most of my time
    b. About half of my time
    c. A bit of my time
    d. None of my time
9. How did this compare with your expectations?
    a. Much more time than I wanted
    b. About as much time as I wanted
    c. Much less time than I wanted
10. Please reflect on your radiology elective(s). How much time did you spend with residents?
    a. Much more time than I wanted
    b. About as much time as I wanted
    c. Much less time than I wanted
11. Please reflect on your radiology elective(s). How much time did you spend with staff?
    a. Yes, and it facilitated learning

b. Yes, but it wasn't helpful
c. No, but it wasn't needed
d. No, and I would have liked to
e. I don't know/I prefer not to answer

Your Perceived Needs:

12. I feel my knowledge of diagnostic radiology was adequate starting residency, relative to my needs in PGY1.
    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree
    f. I don't know/I prefer not to answer
13. I feel my knowledge of interventional radiology was adequate starting residency, relative to my needs in PGY1.
    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree
    f. I don't know/I prefer not to answer
14. Please rate your comfort level with the following upon starting residency, relative to your current needs in PGY1. (Options: 1 not comfortable at all, 2, 3, 4, 5 extremely comfortable, I don't know or prefer not to answer, Not needed at all so far during PGY1)
    a. Chest X-ray interpretation
    b. Abdominal X-ray interpretation
    c. MSK/Joint X-ray interpretation
    d. Chest CT interpretation
    e. Abdominal CT interpretation
    f. Head CT interpretation
    g. Assessing line/tube placement
15. Please rate your comfort level with your knowledge of interventional radiology upon starting residency, relative to your current needs in PGY1.
    a. 1 – Not comfortable at all
    b. 2
    c. 3
    d. 4
    e. 5 – Extremely comfortable
    f. I don't know/I prefer not to answer
    g. Not needed at all so far during PGY1
16. Please rate your comfort level with your knowledge of imaging appropriateness upon starting residency, relative to your current needs in PGY1.

a. 1 – Not comfortable at all
b. 2
c. 3
d. 4
e. 5 – Extremely comfortable
f. I don't know/I prefer not to answer
g. Not needed at all so far during PGY1

17. Please rate your comfort level with your knowledge of radiological limitations/contraindications upon starting residency, relative to your current needs in PGY1.
    a. 1 – Not comfortable at all
    b. 2
    c. 3
    d. 4
    e. 5 – Extremely comfortable
    f. I don't know/I prefer not to answer
    g. Not needed at all so far during PGY1
18. What is the most common imaging modality you have needed to assess so far in residency? Indicate up to 3.
    a. Chest X-ray
    b. Abdominal X-ray
    c. MSK/Joint X-ray
    d. Chest CT
    e. Abdominal CT
    f. Head CT
    g. Ultrasound
    h. Other: [text box]
19. Which of the following do you feel should be more strongly emphasized in radiology teaching during undergraduate medical school electives? Indicate up to 3.
    a. Chest X-ray interpretation
    b. Abdominal X-ray interpretation
    c. MSK/Joint X-ray interpretation
    d. Chest CT interpretation
    e. Abdominal CT interpretation
    f. Head CT interpretation
    g. Interventional radiology procedures, indications, contraindications, and risks or side effects
    h. Imaging appropriateness
    i. Hands-on ultrasound training
    j. Assessing line/tube placement
    k. Other: [text box]
20. Are there any other imaging-related educational needs you felt were not discussed above?
    a. [text box]

21. Are there any radiology learning experiences you felt significantly contributed to your knowledge? Please briefly describe what these were and their format.
    a. [text box]
22. Do you have any other comments about this survey or radiology education?
    a. [text box]