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A national radiation oncology medical student clerkship survey: Didactic curricular components increase confidence in clinical competency

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Abstract

Purpose/Objectives—Students applying to radiation oncology residency programs complete one or more radiation oncology clerkships. This study assesses student experiences and perspectives during radiation oncology clerkships. The impact of didactic components and number of clerkship experiences in relation to confidence in clinical competency and preparation to function as a first year radiation oncology resident are evaluated.

Methods and Materials—An anonymous, internet-based survey was sent via direct e-mail to all applicants to a single radiation oncology residency program during the 2012–2013 academic year. The survey was composed of three main sections including questions regarding baseline demographic information and prior radiation oncology experience, rotation experiences, and ideal clerkship curriculum content.

Results—The survey response rate was 37% (70/188). Respondents reported 191 unique clerkship experiences. 27% of respondents (19/70) completed at least one clerkship with a didactic component geared towards their level of training. Completing a clerkship with a didactic component was significantly associated with a respondent's confidence to function as a first-year radiation oncology resident (Wilcoxon rank-sum $p = 0.03$). However, the total number of clerkships completed did not correlate with confidence to pursue radiation oncology as a specialty (Spearman's rho $p = 0.48$) or confidence to function as a first year resident (Spearman's rho $p = 0.43$).

Conclusions—Based on responses to this survey, rotating students perceive that the majority of radiation oncology clerkships do not have formal didactic curricula. Survey respondents who completed a clerkship with a didactic curriculum reported feeling more prepared to function as a radiation oncology resident. However, completing an increasing number of clerkships does not

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appear to improve confidence in the decision to pursue radiation oncology as a career or to function as a radiation oncology resident. These results support further development of structured didactic curricula for the radiation oncology clerkship.

Introduction

The fourth year of medical school is important for the continuing development of the aspiring physician. Fourth-year medical students (MS4's) must complete multiple elective and required clerkships, make a final decision regarding which medical specialty to pursue, and apply to their selected specialty's residency programs. MS4 clerkship experiences therefore have immediate implications for career trajectory. The fourth-year medical school curriculum is being scrutinized to ensure that curricular components provide strong educational value (1). Multiple studies, including our pilot study in 2012, demonstrate curricular variability in clerkship experiences in radiation oncology and other specialties (2–9).

For a medical student considering radiation oncology as a career, the clerkship experience is crucial since this is frequently the student's first formal exposure to the field. Some institutions make an effort to expose students within the second-year curriculum and third-year clerkships to radiation oncology (3, 4), but often students must independently seek opportunities to gain exposure to radiation oncology before the fourth year. As a result, students must simultaneously become familiar with and evaluate their fit within radiation oncology while auditioning for residency. Therefore, MS4 experiences on radiation oncology clerkships play a pivotal role in helping the MS4 decide whether to pursue the field while developing a solid clinical foundation that facilitates the transition to a first year radiation oncology resident.

This report addresses step two of Kern's six-step approach to curriculum development (10), a targeted needs assessment of learners. This involves identifying the learners, establishing proficiencies at baseline, and identifying gaps in information, training, and knowledge. Our 2012 brief report of a pilot radiation oncology clerkship targeted needs assessment revealed that less than half of clerkship experiences included didactic lectures, case discussions, or hands-on sessions at the MS4 level even though MS4's consider these components important for a formal curriculum (2). Here we report an expanded, formalized national survey to summarize MS4 clerkship experiences nationwide. We hypothesized that the presence of a structured didactic clerkship curriculum would correlate with MS4 confidence to function as a first year radiation oncology resident. Secondly, we hypothesized that completing multiple radiation oncology clerkships, independent of the presence or absence of a formal didactic curriculum, would correlate with MS4 confidence in radiation oncology clinical competency. Lastly, we report feedback on the ideal structure of a radiation oncology clerkship curriculum.

Methods and Materials

An anonymous, internet-based survey was developed from input by radiation oncology faculty, a senior radiation oncology resident, and a MS4 applying in radiation oncology.

Study data were collected and managed using Research Electronic Data Capture (REDCap). These electronic data capture tools are hosted at the University of Chicago (11). REDCap is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.

To ensure validity, the survey was developed with input from multiple radiation oncology faculty members, a radiation oncology resident, and a MS4 student applying for radiation oncology. The survey was divided into three main sections with nine subsections (Appendix e1 can be found at www.redjournal.org). Branching logic was used in the survey to elaborate on specific responses. Therefore, the total number of questions varied depending on individual responses. The first survey section consisted of general questions to obtain baseline demographic information and characterize respondents' radiation oncology experiences prior to beginning radiation oncology clerkships. Examples of previous experience included conducting radiation oncology research, shadowing radiation oncologists, or a lecture on radiation oncology during the first two years of medical school. The second section was a standard set of clerkship questions for each rotation completed. These questions characterized each department's demographics, presence or absence of curricular components, and the respondent's confidence in clinical competency at the end of the clerkship. To maintain anonymity, respondents were not asked to identify institutions by name. The third section characterized what respondents desire in an optimal radiation oncology clerkship curriculum. The question response format included multiple-item Likert scale (5 = "Extremely," 4 = "Quite," 3 = "Moderately," 2 = "Somewhat," and 1 = "Not at all"), with additional Yes/No and free-response questions. Likert results are reported as median [interquartile range]. The survey was estimated to take 15–20 minutes to complete. Respondents were permitted to save their responses and return at a later date to complete the survey. Only fully completed surveys were used in the data analysis since confidence in clinical skills, decision to pursue the specialty, and other factors were compared between pre- and post-clerkships.

Internal reliability of the survey was high. Cronbach's alpha for "Rating of components desired in an ideal rotation," "Prior confidence in clinical competency," and "Post-confidence in clinical competency" was 0.90, 0.86, and 0.88, respectively. Internal reliability of objective questions (e.g. "Number of lectures during the rotation") was not analyzed, as these types of questions do not represent cognitive constructs.

Survey invitations were sent after the 2013 rank-list deadline via direct e-mail February 22, 2013, to all applicants to a single radiation oncology residency program. Participants had 16 days to complete the survey. Three reminder e-mails were sent to invited participants who had not completed the survey. The survey was closed March 8, 2013, one week prior to the United States National Residency Match Program (NRMP) Match Day to avoid any impact of match results on survey responses.

All survey data was compiled and organized in the REDCap secure web database. Statistical analysis was performed using Stata v12.0 (StataCorp LP, College Station, Texas). Descriptive statistics are used to report general clerkship experience. The Wilcoxon rank-sum test was used to test the hypothesis that a didactic curriculum would significantly affect confidence and to analyze the interaction of other variables (e.g. prior radiation oncology experience) on ordinal scales. The Spearman's rank correlation coefficient was used to test the hypothesis that number of rotations correlate with increasing clinical confidence. The University of Chicago Institutional Review Board and the NRMP approved this project.

Results

Of 188 surveyed applicants to a single radiation oncology residency program, 70 completed the survey in its entirety giving a response rate of 37%. Overall, 171 (91%) of applicants were from a United States allopathic medical school, 5 (3%) were from United States osteopathic medical schools, and 12 (9%) were from foreign medical schools. Only responses from allopathic trainees were received. Due to privacy concerns, respondents were not asked to identify if they were domestic or foreign. Baseline characteristics of the 70 respondents included a median age of 27 (range 24–35), 77% male, and 14% MD/PhD's (Table 1). A majority of respondents had conducted radiation oncology research or shadowed a radiation oncologist prior to beginning radiation oncology clerkships. 26% of respondents had no prior radiation oncology clinical or research experience. There was an even split between respondents who had previously decided to apply for radiation oncology residency or not prior to beginning their first radiation oncology clerkship ($n = 35$ in both groups).

Data for 191 unique clerkship experiences (individual student rotations) were obtained from the 70 respondents, with a median number of three rotations completed per respondent and median rotation length of four weeks (Table 2). 91% of clerkships were completed at an academic medical center affiliated with a medical school. 52% of clerkships were at residency programs with 5–11 residents with 14% having 16 residents. Respondents recalled being provided with clear goals and objectives on 66% of clerkship experiences. However, 42% of rotations did not have any formal curricular components specifically for MS4's (i.e. lectures, case discussions, hands-on sessions, etc.). Regarding lectures for MS4's, 72% of clerkship experiences had no lectures specifically covering material at the MS4 expertise level given only to medical students and not to residents. 19 Respondents (27%) reported that at least one of their radiation oncology clerkships included a formal lecture series (i.e. a set of lectures geared specifically for medical students). Respondents reported giving a departmental lecture on 85% of their clerkships. Sixty-five percent of these lectures were on a clinical topic of the respondent's choosing.

Regarding clinical experiences on the clerkships, survey respondents reported opportunities to perform history and physicals without supervision (90%), contouring (78%), and writing/dictating a consult (73%). Opportunities to participate in specific cases such as brachytherapy, stereotactic radiosurgery, and stereotactic body radiation therapy/stereotactic ablative therapy and to review port films were less frequent (Table 3). 27% of respondents

reported initiating clinical research during their clerkship with 45% of those projects leading to a publication or abstract presentation (Table 4).

Associations between clinical experiences and residency program size were evaluated to determine whether training program size correlated with the MS4 educational experience. A higher number of residents at a particular program correlated with a higher number of dedicated MS4 lectures ($p<0.01$) but a lower likelihood for a MS4 to perform a history and physical independently ($p<0.01$) and dictate/write a consult note ($p<0.05$). With each subsequent clerkship, respondents reported increasing confidence in clinical competency areas except knowledge of radiation biology ($p=0.07$) and evaluation of dose-volume histograms ($p=0.07$).

When evaluating the importance of certain curricular components in a theoretical, ideal four-week clerkship as envisioned by the respondents, lectures and hands-on sessions covering the basics of radiation treatment planning and contouring were rated highly (Figure 1). When respondents were asked about their medical school colleagues not pursuing radiation oncology, 41% of survey respondents felt lectures on radiation oncology could be given during another mandatory clerkship (e.g. medicine, radiology, etc.) and 34% of recommended that a mandatory clinical experience be integrated within a general oncology rotation (Table 5). The median Likert score was 4[3–5] when respondents were asked about the importance of lectures covering radiation oncology in the preclinical years of medical school. However, the presence of a preclinical curriculum lecture on radiation oncology had no bearing on confidence to pursue the field (4[3–5] vs. 3[2–4], $p=0.2$).

Survey respondent confidence regarding their decision to pursue radiation oncology based on perceived fit with the specialty prior to any clinical clerkship had a median Likert score of 3.5[2–4]. Respondents were more likely to be confident in their specialty decision if they had done prior work (4[3–5] vs. 2[1–3], $p<0.01$) or shadowing (4[3–5] vs. 2[1.25–3], $p<0.01$) in radiation oncology. Respondents with prior experience in radiation oncology had higher confidence in their knowledge of physics (2[1–2] vs. 1[1–2], $p<0.05$) and their ability to evaluate a dose-volume histogram prior to beginning their clerkships (2[1–3] vs. 1[1–1], $p<0.01$).

Completing at least one clerkship with a formal lecture curriculum (defined as a scheduled series of MS4-tailored lectures throughout the clerkship) was significantly associated with respondents' confidence to function as first-year (PGY-2) radiation oncology residents (3[3–4] vs. 3[2–3], $p=0.03$). In addition, previous experience with radiation oncology significantly increased confidence to function as a first year radiation oncology resident ($p<0.01$). Subset analysis was attempted on the respondents who did or did not have prior exposure to radiation. Due to the small number of respondents in each subset, statistical significance was lost, although a trend remained for increased confidence in the group that had prior exposure to radiation oncology and received a formal curriculum ($p=0.15$).

The total number of clerkships completed by a respondent did not correlate with confidence to pursue radiation oncology as a specialty (Spearman's $\rho=0.48$) or confidence to function as a first year resident (Spearman's $\rho=0.43$). Clerkships that provided goals and

objectives were reported to have a greater number of dedicated MS4 lectures ($p<0.01$), but goals and objectives did not increase a respondent's overall confidence to pursue radiation oncology as a specialty ($p=0.38$). Being an MD or MD/PhD had no effect on confidence to function as a first-year radiation oncology resident ($p=0.87$).

Discussion

There are multiple reports of targeted needs assessments for MS4 clerkships and sub-internships reported. For example, in a targeted needs assessment of MS4's completing surgical sub-internships in preparation for general surgery residency, over 95% report achieving the objective of deciding whether or not to pursue the specialty. However, only 49% received formal objectives and 10% received a detailed reading schedule. 88% of students who did receive objectives/reading schedules felt this was beneficial to their education. The conclusion of this study was that a unifying, central curriculum would be effective in creating more competent and confident MS4's (5). Similar structured curricular inconsistencies have been reported from junior residents' reflections (6), in fourth-year emergency medicine clerkships (7), and in internal medicine sub-internships (8, 9).

Little is known regarding the implementation of structured curricula in radiation oncology clerkships in the United States. A literature review from 1998 to 2009 of undergraduate medical education in radiation oncology identified seven reports of methods of undergraduate exposure to the field including integration of didactics and reading into a radiology rotation, anatomy-based courses, clinical reasoning within radiation oncology cases, and web-based modules (12). Hirsch *et al.* established the Oncology Education Initiative in an effort to advance oncology and radiation oncology education at the medical school level (3). This group demonstrated that even a single didactic lecture within the radiology clerkship was sufficient to improve knowledge of radiation oncology (13). Over 80% of students expressed motivation to learn more about the subject or take oncology electives, and 32% of students pursued further training in radiation oncology. Zaorsky *et al.* has also shown excellent results integrating an optional radiation oncology clerkship experience into the third-year core surgery clerkship (4). However, there is a paucity of literature on structured curricula for clinical the MS4 radiation oncology clerkship.

To our knowledge, our previous brief report (2) and this report are the only targeted needs assessments of the MS4 radiation oncology clerkship. Here we report the results of an expanded, more comprehensive web-based survey of 188 radiation oncology applicants during the 2012–2013 academic year. This report reveals perceived curricular inconsistencies across radiation oncology clerkships. A minority of clerkships provide structured formal didactic curricular components to complement the clinical experience.

As respondents completed more clerkships confidence increased in the overall knowledge base. This supports the idea that more experience yields better clinical performance. However, our analysis also found that respondents who complete a radiation oncology clerkship with a formal curriculum feel more prepared to function as a first year radiation oncology resident. This does not hold true for completing more clerkships. In other words, a structured student experience seems to have greater impact on student comfort with their

eventual transition to radiation oncology residency than the number of rotations completed. Therefore, further development of formal curricula for radiation oncology clerkships should be pursued.

Approximately two-thirds of clerkship experiences were reported to provide clear goals and objectives. This survey did not ask whether respondents felt that these objectives were being met. However, in clerkships where no MS4 curricular components are included (e.g. case discussions, lectures), the educational plan is presumably that MS4's complete all learning goals and objectives via self-directed learning and clinical experience. This is a large responsibility placed on the MS4 already preoccupied with career exploration and uncertainty, the residency application process, and "auditioning" for residency programs during clinical clerkships. The expectation that the MS4 completes all learning objectives independently may be somewhat unrealistic. The majority of clerkship experiences (72%) had no lectures geared specifically for the MS4, yet a majority of MS4's (85%) delivered a formal lecture to the department by the end of their clerkship.

This study has some limitations. First, survey respondents were not able to enter data if they had completed five or more clerkships. The structure of the survey allowed for a maximum of four clerkship experiences to be reported. However, this is unlikely to have significantly impacted our findings as only 2 out of 70 respondents completed greater than 4 clerkships. Additionally, this survey was conducted from February 22nd to March 8th, 2013. This is approximately 6–9 months after the majority of clerkships were completed. There is a possibility of recall bias with respondents either over- or under-reporting clerkship experiences. However, if students do not recall structured didactics or clinical experiences, this suggests that these educational experiences may be of low impact and require modification and improvement. There is also potential for social desirability bias, with respondents providing answers that are "socially desirable." We attempted to reduce this bias by releasing the survey after the rank list deadline. Lastly, with a response rate of 37%, the 16-day time period given to complete the survey may have been prohibitive. There is a possibility that the invited participants that did not respond had significantly different clerkship experiences. Also, students completing radiation oncology clerkships that either did not apply to radiation oncology or did not apply to our residency program may have had different clerkship experiences. However, this survey was sent to the majority of 2013 applicants given that in 2012 there were 258 applicants for a radiation oncology residency position in the United States (14).

As most medical students have minimal mandatory experience with the field of radiation oncology prior to the final year of medical school, MS4 radiation oncology clerkship experiences play an important role in exposure to the field and ultimately, career decisions. The task before the MS4 is stressful and challenging. Within a 3–4 month window, the MS4 must evaluate whether radiation oncology is the appropriate career choice while simultaneously making an effort to perform well clinically to be favorably looked upon by institutions during the residency application process. MS4's completing radiation oncology clerkships are at a crucial point in their career. One clerkship experience has the ability to affect a career choice. Therefore, clinical educators are responsible for providing the most enriching, high quality clerkship experience geared for the MS4 level of expertise. With

students completing a median of three clerkships, this comprises approximately 25% of their fourth year of medical school and is equivalent to 1/16 of a radiation oncology residency. Returning to Kern's Six Steps (10), the next priority is to establish clear learning objectives and develop and implement a radiation oncology clerkship curriculum based on the results of the targeted needs assessment reported here within. Employing didactic and hands-on/interactive curricular components to achieve pre-established clerkship objectives will help to enhance the MS4 radiation oncology experience. MS4's will be better served through their clerkships by being well informed about the specialty and, as a result, adequately equipped to make important career decisions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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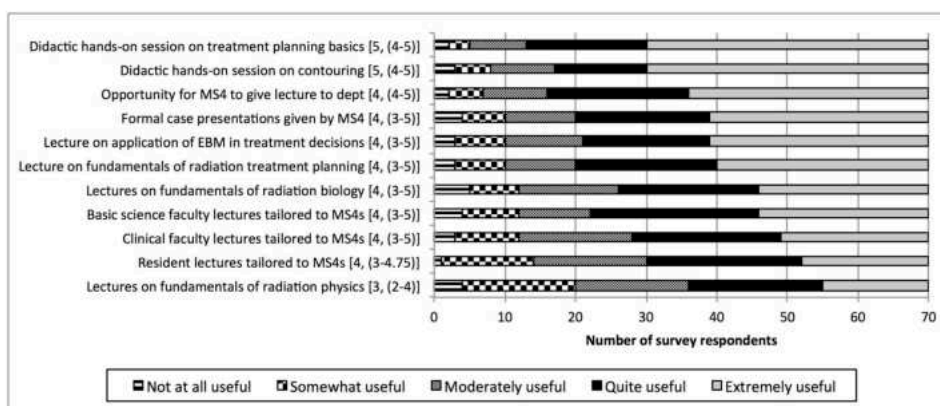


Figure 1. Survey respondent perspectives on the utility of specific curricular components of an ideal radiation oncology clerkship [median Likert score, (Interquartile range)]. (EBM = evidence-based medicine, MS4 = fourth-year medical student)

Table 1

Survey respondent demographics and prior radiation oncology experiences. Reported as [median (range)] or [n (%)].

Number of respondents completing survey (Total surveyed)	70 (188)
Age	27 (24–35)
Gender	
Male	54 (77)
Female	16 (23)
Medical school track	
MD	60 (86)
MD/PhD	10 (14)
Other joint degree	0
Prior to clerkships, the respondent was <u>definitely</u> going to apply for radiation oncology residency position	
Yes	35 (50)
No	35 (50)
Prior to first radiation oncology clerkship the respondent:	
Worked in a radiation oncology department conducting research (clinical, translational or basic science)	42 (60)
Spent time in a radiation oncology department shadowing physicians	48 (69)
Had a lecture on radiation oncology during first or second year of medical school	21 (30)
Prior to first rotation, the respondent had no radiation oncology clinical or research experience	18 (26)
The respondent's medical school has a mandatory clinical radiation oncology experience for all medical students	
Yes	1 (1)
No	69 (99)

Table 2

Radiation oncology clerkship characteristics as reported by survey respondents. Reported as [median (range)] or [n (%)].

Total number of rotations	191
Rotations per survey respondent	3 (1–5)
Rotation length in weeks	4 (1–5)
Location	
University medical center	173 (91)
Academic center not affiliated with University	13 (7)
Community practice	4 (2)
Number of residents	
16 or greater	27 (14)
12 – 15	45 (24)
5 – 11	100 (52)
4 or fewer	11 (6)
No residents	8 (4)
Received clear goals and objectives	
Yes	127 (66)
No	55 (29)
Do not recall	9 (5)
Formal education specifically for medical students	
Hands-on session	48 (25)
Lecture	50 (26)
Prepared case discussion	67 (35)
None of the above	80 (42)
Number of lectures for medical students during each rotation	
0	137 (72)
1	13 (7)
2	10 (5)
3 or greater	31 (16)
“During this rotation, I gave a lecture to the department”	
Yes	162 (85)
No	29 (15)
If yes, the lecture was on:	
A clinical topic of my choice	105 (65)
An assigned clinical topic	9 (6)
Clinical research I have done	37 (23)
Basic science research I have done	7 (4)

Table 3

Survey respondent clinical experiences during radiation oncology clerkships (total rotation experiences = 191).

Clinical experience	Number of Rotations n (%)
Perform an oncologic history and physical independently without resident or faculty supervision	171 (90)
Write or dictate a consult	140 (73)
Contour at a planning station for a clinical case	149 (78)
Participate in a brachytherapy case	114 (60)
Participate in a stereotactic radiosurgery case	109 (57)
Participate in a SBRT/SABR case	93 (49)
Review port films	99 (52)

SBRT = stereotactic body radiation treatment, SABR = stereotactic ablative radiotherapy

Table 4

Research endeavors during radiation oncology clerkships as reported by survey respondents (total rotation experiences = 191).

	Number of Rotations n (%)
Began working on clinical research	
Yes	51 (27)
No	140 (73)
Current status (March after rotation), total responses = 51	
Accepted for publication in a peer-reviewed journal	11 (22)
Accepted or presented as an abstract	12 (23)
Still in progress (no publications yet)	28 (55)
Survey respondent authorship status, total responses = 23	
First author/Co-first author	18 (78)
Co-author (not first author)	5 (22)

Table 5

Survey respondent recommendations for an optimal third- or fourth-year medical school educational experience for medical students NOT planning to pursue radiation oncology as a career (total number of responses = 70).

Educational experience	n (%)
Mandatory clinical experience integrated with a general oncology clinical rotation	24 (34)
Single lecture or series of lectures during another mandatory clerkship (e.g. medicine, radiology, etc.)	30 (43)
Mandatory two week full-time clerkship	3 (4)
Mandatory clinical experience integrated with a mandatory diagnostic radiology rotation	4 (6)
Optional clinical experience during a core clerkship	1 (1)
Nothing	8 (11)