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## Reform of a Senior Medical Student Radiology Elective Using a Needs Assessment

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Designing electives for medical students in diagnostic radiology is challenging due to the lack of available patient care responsibilities as a basis for structure [1]. Compared with other clinical rotations, there are limited opportunities to assess and review patients, write clinical notes, or perform procedures. Rather, students often spend their elective “looking over the shoulders” of residents or attending physicians, which is not a well-received educational activity [2]. In fact, the passive nature of some radiology electives has led students to pursue an elective in the field simply because they believe it is low stress and time could be used for other purposes [3].

A few authors have provided suggestions on how to structure diagnostic radiology electives for senior medical students [1,2,4–6]. For example, Naeger et al [4] recommended providing goals and objectives on the first day of the elective, implementing a reliable attendance record, using mid- and end-of-elective evaluations, and having an attending radiologist assigned to the student with regular face-to-face meetings. Supplemental educational activities include gathering case histories, reviewing online teaching modules or articles, giving a presentation, or preparing a case report [4]. Reported benefits of elective restructuring include increased comfort with ordering radiologic imaging [1], increased elective enrolment [5], and higher test scores [6].

Nevertheless, a limitation of the current literature is the absence of student input as a basis for elective reform. According to Kern et al’s [7] approach to curriculum development in medical education, the first step in planning a successful curricular intervention is performing a needs assessment. A needs assessment is a systemic evaluation of the learner’s needs to identify educational gaps and obtain suggestions for improvement. The results of a needs assessment can then help set priorities for future curricular interventions.

Student evaluations following the completion of a radiology elective is a practical tool that medical educators can use to obtain feedback regarding a student’s elective experience. Items assessed in these evaluations, the format of which is typically determined by the undergraduate medical program, are variable and can include: effectiveness of structured and unstructured teaching sessions, opportunity to perform procedures, and overall satisfaction with elective experience. Although there has been extensive research and debate on the validity of student evaluations of teaching and its correlation with learning [8–10], student evaluations are usually the only data medical educators have available to assess teaching effectiveness.

At McMaster University, medical students can complete electives at 1 of 4 university teaching hospitals. Our department offers electives to students from McMaster University, other Canadian universities, as well as medical students studying abroad. Radiology rotations are not a mandatory component of the undergraduate medical curriculum at McMaster University. While on elective, students are encouraged to rotate through the various imaging

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modalities, observe staff and residents in image interpretation, and attend resident teaching rounds. Specific sites have implemented their own unique educational activities for students; for example, giving a 10-15-minute presentation, or working through learning modules. Based on personal observations and informal feedback, we suspected that improvements could be made to our medical student radiology electives.

In this paper, we describe 2 studies undertaken to restructure our senior medical student radiology elective. First, we conducted a formal needs assessment to identify current educational gaps. Based on these results, we established student-driven educational priorities, developed 3 curricular interventions, and restructured our elective at a single site, which was studied prospectively. A single site was chosen to pilot the new elective to allow for comparison of student scores postintervention across the different elective sites.

### Study 1: Needs Assessment

#### *Aim*

We sought to conduct a needs assessment of senior medical student radiology electives to identify current educational gaps, identify suggestions for improvement, and set priorities for future elective structure. The educational experience of the elective was evaluated via the following outcome measures: achievement of educational goals, student satisfaction with elective experience, perceived knowledge gained, and impact on career choice.

#### *Materials and Methods*

The study protocol was reviewed by the McMaster Research Ethics Board and requirement for ethics approval was waived as this was deemed an audit project. Informed consent was obtained electronically from all participants.

#### *Data collection*

A retrospective survey using LimeSurvey [11] as an online platform was used. All senior medical students who completed a diagnostic radiology elective at McMaster University during the 2015 calendar year were invited to complete the survey. Senior medical students were defined as students in the clerkship phase of their training (third- or fourth-year students in 4-year programs, or second- or third-year students in 3-year programs). A pilot survey was administered to 3 senior medical students and 2 radiology residents before implementation to promote the survey's face validity. All respondents agreed the survey's design was adequate. Respondents did suggest rewording 2 questions for improved clarity, which was performed. The Salant-Dillman protocol was used to maximize response rate [12]. First, an e-mail was sent 1 week in advance to notify all eligible participants of their

upcoming invitation to participate in the study. Next, an e-mail containing the survey link was sent to all participants. Three weeks was allotted for survey completion with a final reminder e-mail sent 1 week before closing the survey [12].

Survey items assessed the following: reasons for pursuing a diagnostic radiology elective, student educational objectives, elective satisfaction, perceived knowledge gained, the value of various current and potential educational activities, how our elective compared with electives in other disciplines, and impact on career choice. Survey items included dichotomous, ranking, 5-point Likert-type scale questions with responses ranging from 1 (poor) to 5 (excellent), as well as a few open-ended questions (Supplemental Appendix S1). A 5-point Likert-type scale using the above anchors was used in the survey to be consistent with the evaluations used by our institution's undergraduate medical program.

#### *Data analysis*

Data were analysed using Microsoft Excel 2010 (Microsoft Corp, Redmond, WA) and SPSS version 24 (IBM Corp, Armonk, NY).

Proportions, *t* tests, and univariate analyses of variance (ANOVAs) were used to describe and analyse responses from the quantitative and Likert-type scale questions.

Our survey included 6 open-ended questions to capture data that could have been missed with the quantitative questions. Five of these questions yielded very few responses and were not incorporated into our analysis. One open-ended question, which proved fruitful, was, "What were your top 3 educational objectives for your elective?" This question was analysed by one of the study authors (N.L.) and a first-year radiology resident using quantitative content analysis [13]. First, all responses were read and a coding framework was developed by the 2 assessors. Both assessors then coded the data into the predetermined framework using words as units of analysis. Proportions were used to describe these results.

To assess our survey's construct validity, we first generated 2 hypotheses derived from our data. The first hypothesis was that students who were more interested in radiology would be more satisfied with the elective. The second hypothesis was that students who were more satisfied with their elective would rate their knowledge gained higher. These 2 hypotheses were assessed using a univariate ANOVA and Pearson's correlation coefficient.

With regards to our survey's reliability, we analysed the questions involving student ratings of educational activities. Given that we expected each activity to have its own educational value, we first performed a principal component analysis (PCA) to determine which activities were related. Related groupings were then analysed using Cronbach's alpha. In cases where there was missing data (ie, students were not exposed to a particular educational activity), we substituted the grand mean of the items to preserve the power of the data [14].

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