Needs Assessment for Standardized Medical Student Imaging Education:

Review of the Literature and a Survey of Deans and Chairs

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Rationale and Objectives: Medical imaging education often has limited representation in formal medical student curricula. Although the need for *greater* inclusion of radiology material is generally agreed on, the exact skillset that should be taught is less clear. The purpose of our study was to perform a needs assessment for a national radiology curriculum for medical students.

Materials and Methods: We analyzed data from previous unpublished portions of the American College of Radiology/Alliance of Medical Student Educators in Radiology survey of Deans and Radiology Chairs regarding prevalence of radiology curricular revisions, assessment tools, use of the American College of Radiology Appropriateness Criteria, and resources used in curriculum revision. We also performed a literature search through both PubMED and a general search engine (Google) to identify available resources for designing and implementing imaging curricula and curricular revisions.

Results: Medical school deans and chairs reported a need for more overall radiology content; one of every six programs (15%) reported they had no recognized imaging curriculum. Of schools currently *with* imaging curricula, 82% have undergone revision in the last 10 years using a variety of different resources, but there is no universally agreed on guide or standard curriculum. The PubMED and Google searches identified only 23 and eight resources, respectively, suggesting a sizable deficit in available guidance; however, a single published medical student radiology curriculum is available through the Alliance of Medical Student Educators in Radiology.

Conclusions: There is a need, but few available resources, to guide educators in adding imaging content to medical school curricula. We postulate that a standardized national curriculum directed by a focused skillset may be useful to educators and could result in greater uniformity of imaging skills among graduating US medical students. A proposed skillset to guide a national curriculum in radiology is described.

Key Words: Medical student; radiology curriculum; medical student education; national curriculum; curricular resources.

Medical imaging has become a critical component of modern medical practice and diagnosis; however, imaging curricula in medical school education have not evolved at an equivalent pace. Medical imaging education, especially that emphasizing appropriate use of examinations has barely penetrated student training, raising the question as to whether US medical schools are adequately preparing students to be safe and efficient practitioners of evidence-based imaging (1). The recent American College of Radiology (ACR)/Alliance of Medical School Educators in Radiology (AMSER) white paper on the status of medical imaging education in the US (1) and numerous prior studies (2–4) have shown the relatively poor penetration and incorporation of imaging instruction into medical school curricula across the country. These studies have suggested that more, and better integrated, imaging education is desired by US medical school leadership.

Although there is some consensus that *more* imaging content is needed, the exact skillset that should be taught is less clear. The *type* of content currently being taught has only been described in a limited fashion in both the radiology and education literature. Of the information available, much of it has been just recently published; the ACR/AMSER survey (1) showed large variability across 4-year medical school curricula in terms of subjects addressed. For example, 20% of Department Chairs stated that radiation safety was not taught in their medical school at any point in the curriculum. Eleven percent stated that diagnostic imaging algorithms (or "what should be ordered when") were not covered. A surprising number of programs taught only about radiographs (21% did not cover computed tomography, 25% taught no ultrasound, 32% did not cover fluoroscopy, and 36% taught no magnetic resonance imaging) (1). Some authors have suggested that teaching medical students how to *interpret*

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advanced imaging modalities is unnecessary; however, students do need to understand when and why these modalities should be ordered to provide appropriate care for their patients as future practitioners (5), and for adequate United States Medical Licensing Examination (USMLE) preparation in the near term.

There are few studies that have directly addressed whether "utilization-oriented" content is taught to students (6). One way to measure if such information is being introduced is to assess if the ACR Appropriateness Criteria (7) are specifically taught. To our knowledge, there are no previous publications assessing whether the ACR Appropriateness Criteria are formally included in medical school curricula. Several recent studies have assessed student awareness of this resource. One found that 96% of senior medical students at one institution were not aware of the ACR Appropriateness Criteria as a resource (8), and another, which surveyed students at multiple US medical schools, found that 77% had never heard of the Appropriateness Criteria (4).

Despite this review of the existing literature, little has been gleaned about what is included in medical student radiology curricula across the US, and whether radiology educators receive sufficient curricular guidance and/or supporting resources to facilitate teaching and curriculum design. To our knowledge no data have been published as to (1) extent of curricular revisions to medical imaging content at programs across the US, (2) the resources schools use when designing or revising their imaging curricula, (3) whether the ACR Appropriateness Criteria are being taught, and (4) whether schools have adequate assessment methods to measure student mastery of pertinent imaging content.

The purpose of our study was to perform a needs assessment for a national radiology curriculum for medical students. We hypothesize that the need is great, and that it is currently largely unmet.

MATERIALS AND METHODS

There were three methods used to collect data: a survey of Deans of US allopathic medical schools and Chairpersons of Academic Radiology Departments, a search of the medical literature, and a general internet search.

Survey

Deans of US allopathic medical schools and Chairpersons of Academic Radiology Departments were both surveyed as part of a national ACR/AMSER survey aimed to establish the current status of medical student education in radiology in the US.

Some of the findings of this national ACR/AMSER survey of Deans and Radiology Chairs have been previously published, and the survey methods are outlined in Ref. (1). In brief, members of the ACR and AMSER conducted a detailed survey that was sent electronically to all US members of the Society of Chairs of Academic Radiology Departments (n = 124) and US allopathic medical school deans (n = 138) with data collected from November 1 to December 18, 2012. Response rates reflected a balanced representation of US allopathic medical schools (see Appendix A). The responses of Deans and Chairs were reported separately.

The questions from this survey regarding the extent or penetration of curricular revisions, course assessment, use of the ACR Appropriateness Criteria, and resources used in curriculum revision have not been previously published. Results are tabulated with the absolute number reporting and as percentages.

Literature Search and Internet Search

A literature search was performed through PubMED using the search term "medical student radiology curriculum" for articles published since 2004. The PubMED search yielded 516 results. Results were reviewed by two authors (E.M.W, D.M.N.) to determine which had applicability to general radiology curricula; specifically articles addressing issues of (1) standardized curriculum, (2) recommended content, (3) curricular guidelines, (4) learning objectives, (5) radiology course structure, (6) radiology educational materials, or (7) radiology course assessment tools were included. As our goal was to identify currently available resources for revising or designing a comprehensive radiology curriculum and minimize results with only tangential applicability to this purpose, articles with a single content focus in which imaging was a method to teach nonradiologic content (such as the use of radiology in teaching anatomy) were excluded. Articles describing a singular teaching method (eg, problem-based learning or e-learning) or single educational activity (eg, a module to teach chest x-ray basics) were also excluded for the same reason.

A Google search was also performed to identify resources outside the literature from PubMED. The search term used was medical student radiology curriculum. Given Google's ability to parse key terms from search strings, thereby resulting in few differences when multiple search strings are used, we limited the search and analysis to this one term, which yielded 269,000 results. Search results are ranked by "relevancy" through Google's "PageRank" algorithm (9). The first 100 search results, presumably the most relevant, were evaluated by two authors (E.M.W., D.M.N.) to determine which links contained information and resources in the same seven categories listed previously. Google links to PubMED articles were excluded. News articles about publications already identified in our literature search were excluded. Multiple links pointing to a single website were assessed as a group as one resource; links pointing to two different resources hosted by the same umbrella website were counted as two different resources. Links to individual university web pages were excluded.