

Milestones on a Shoestring:

A Cost-Effective, Semi-automated Implementation of the New ACGME Requirements for Radiology

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Rationale and Objectives: The advent of the ACGME's Next Accreditation System represents a significant new challenge for residencies and fellowships, owing to its requirements for more complex and detailed information.

Material and Methods: We developed a system of online assessment tools to provide comprehensive coverage of the twelve ACGME Milestones and digitized them using freely available cloud-based productivity tools. These tools include a combination of point-of-care procedural assessments, electronic quizzes, online modules, and other data entry forms. Using free statistical analytic tools, we also developed an automated system for management, processing, and data reporting.

Results: After one year of use, our Milestones project has resulted in the submission of over 20,000 individual data points. The use of automated statistical methods to generate resident-specific profiles has allowed for dynamic reports of individual residents' progress. These profiles both summarize data and also allow program directors access to more granular information as needed.

Conclusion: Informatics-driven strategies for data assessment and processing represent feasible solutions to Milestones assessment and analysis, reducing the potential administrative burden for program directors, residents, and staff.

Key Words: ACGME; informatics; Milestones.

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Medical educators have witnessed a sea change in resident assessment over the past 30 years. For most of the history of academic medicine, the determination of resident competency for independent practice was based on the subjective assessment of the academic faculty who trained them. Since the founding of the Accreditation Council for Graduate Medical Education (ACGME) in 1981, resident education has experienced increasing structure, standardization, and accountability requirements with the goal to provide a more consistent level of quality in post-graduate training (1). Most recently, the ACGME has unveiled its Next Accreditation System (NAS) for resident education and introduced the concept of ACGME Milestones (2). Citing a public demand for greater accountability in medical education, these new standards strive to focus on outcomes, be learner centered, and prepare trainees for the

evolving complexities of 21st century medicine (3). To accomplish these goals, the NAS and Milestones increase the granularity of information gathered on individual residents; the new standards require both frequent reporting of resident progress over time (every 6 months) and more detailed information about resident performance in the specific domains deemed critical to the practice of their chosen specialty.

In 2013, in collaboration with the American Board of Radiology, the ACGME established specialty-specific Milestones for Radiology (4), summarized in Table 1. Starting in July 2013, radiology residency programs have been required to gather data and provide summary reports for individual residents to the ACGME (5). In 2013–2014, approximately 64% of residency programs provided some form of feedback to their residents about their Milestones progress (6).

Although the new requirements are intended to minimize bureaucracy, the practical implementation of an increasingly complex data collection system poses numerous challenges for individual residency programs. Many residents perceive the NAS to be an annoyance unlikely to impact quality of radiology training (6). The need for finer measurement detail results in greater administrative burdens for program faculty and staff. Additionally, successful implementation of the NAS requires overcoming several hurdles in psychometrics, data management, and reporting.

In this work, we describe an inexpensive, informatics-driven solution to track and report ACGME milestones for

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TABLE 1. The 12 Radiology Milestones

Abbreviation	Full Name
PCTS1	Patient Care and Technical Skills 1: Consultant
PCTS2	Patient Care and Technical Skills 2: Competence in Procedures
MK1	Medical Knowledge 1: Protocol Selection and Optimization of Images
MK2	Medical Knowledge 2: Interpretation of Images
PROF1	Professionalism 1: Professional Values and Ethics
ICS1	Interpersonal and Communication Skills 1: Effective communication with patients, families, and caregivers.
ICS2	Interpersonal and Communication Skills 2: Effective communication with members of the health care team
SBP1	Systems Based Practice 1: Quality Improvement (QI)
SBP2	Systems Based Practice 2: Healthcare Economics
PBL1	Practice Based Learning and Improvement 1: Contrast Agents, Radiation Safety, MR Safety, Sedation
PBL2	Practice Based Learning and Improvement 2: Self-Directed Learning
PBL3	Practice Based Learning and Improvement 3: Scholarly Activity

From Vydareny et al. (4).

radiology developed at our institution, a large academic center with approximately 40 radiology residents. We also report preliminary findings during the first year of NAS data gathering.

ASSESSMENT OF THE PROBLEM

Before implementation, our Residency Education Subcommittee (composed of faculty, residents, chief residents, and the residency program director) spent several sessions determining how best to achieve NAS compliance. We elected to design a series of short online point-of-care evaluations to be performed immediately after a procedure, examination, or consent. Each division within our department was provided a template assessment tool that contained questions evaluating multiple Milestones; this template was based on the original language described by Vydareny et al. (4). Subspecialties then modified these templates to their specific practices. Each question was assigned to one or more of the 12 radiology Milestones by the program director.

We also identified other commonly used educational resources and existing program requirements that could be integrated into the system. For example, our residents frequently use several popular online resources (RadPrimer, Radiological Society of North America (RSNA)/AAPM Online Phys-

ics Modules, Cleveland Clinic Pediatric modules, and Institute for Healthcare Improvement (IHI) Quality and Safety modules). By assigning an appropriate Milestone to each module, residents can receive credit for their independent study. If, for example, a resident documents completion of the RSNA/AAPM “Radiation Dose and Risk” module, credit will automatically be assigned to PBL1 (Patient Safety). Procedural logs for interventional radiology and cardiovascular imaging, two other programmatic requirements, could be combined with the Milestones system. Finally, the potential for electronically graded online quizzes and self-assessment modules (SAMs) allows for some evaluations to be performed without direct faculty involvement. The use of quizzes can be used to target Milestones that are less commonly evaluated during daily clinical training, such as Healthcare Economics (SBP2) or Radiation Safety (PBL1). As has been described previously, SAMs from external sources (eg, the American Journal of Roentgenology) can be quite useful for evaluating resident Milestones, particularly those in systems-based practice and practice-based learning (7). Table 2 summarizes our assessment strategy.

IMPLEMENTATION AND TECHNICAL DETAILS

The core of our system uses a series of online forms built in Google Drive (Mountain View, CA), an online productivity suite with several attractive features (Table 3). A major advantage of Drive is its seamless integration between data collection, storage, e-mail, and publication services (8). Online evaluations are constructed via a graphical user interface with drag-and-drop features. Nine different categories of user input (eg, multiple-choice questions, picklists, scales, and free text) are available. Images and video are also easily embedded into each form, a particularly useful feature for building quizzes and SAMs. After the submission of each evaluation, users receive a confirmation e-mail. The process of digitizing a typical paper evaluation takes approximately 10–30 minutes, depending on its complexity and its similarity to other preexisting forms, which can be used as templates. Our current library of assessment tools is available online and can easily be shared with other institutions on request.

Individual Resident Profiles/Postprocessing

A major advantage of standardized digital form-based assessment tools is the ability to automatically generate dynamic, individualized summary information for each resident (eg, resident profiles). Indeed, a complex, data-driven system necessitates subsequent thoughtful organization of the large amounts of acquired information into meaningful summaries, while simultaneously retaining the ability to explore the data at its most granular level if necessary. Cloud-based tools do exist that could potentially be used to summarize and collect data.

Our current system generates report cards using R, a free statistical programming language (9). R has the advantage of

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