

Rapid Web-Based Platform for Assessment of Orthopedic Surgery Patient Care Milestones: A 2-Year Validation

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OBJECTIVE: To determine the validity, feasibility, and responsiveness of a new web-based platform for rapid milestone-based evaluations of orthopedic surgery residents.

SETTING: Single academic medical center, including a trauma center and pediatrics tertiary hospital.

PARTICIPANTS: Forty residents (PG1-5) in an orthopedic residency program and their faculty evaluators.

METHODS: Residents and faculty were trained and supported in the use of a novel trainee-initiated web-based evaluation system. Residents were encouraged to use the system to track progress on patient care subcompetencies. Two years of prospectively collected data were reviewed from residents at an academic program. The primary outcome was Spearman's rank correlation between post-graduate year (PGY) and competency level achieved as a measure of validity. Secondary outcomes assessed feasibility, resident self-evaluation versus faculty evaluation, the distributions among subcompetencies, and responsiveness over time.

RESULTS: Between February 2014 and February 2016, 856 orthopedic surgery patient care subcompetency evaluations were completed (1.2 evaluations per day). Residents promptly requested feedback after a procedure (median = 0 days, interquartile range: 0-2), and faculty responded within 2 days in 51% (median = 2 days, interquartile range: 0-13). Primary outcome showed a correlation between PGY and competency level ($r = 0.78$, $p < 0.001$), with

significant differences in competency among PGYs ($p < 0.001$ by Kruskal-Wallis rank sum test). Self-evaluations by residents substantially agreed with faculty-assigned competency level (weighted Cohen's $\kappa = 0.72$, $p < 0.001$). Resident classes beginning the study as PGY1, 2, and 3 separately demonstrated gains in competency over time (Spearman's rank correlation 0.39, 0.60, 0.59, respectively, each $p < 0.001$). There was significant variance in the number of evaluations submitted per subcompetency (median = 43, range: 6-113) and competency level assigned ($p < 0.01$).

CONCLUSIONS: Rapid tracking of trainee competency with milestone-based evaluations in a learner-centered mobile platform demonstrated validity, feasibility, and responsiveness. Next Accreditation System-mandated data may be efficiently collected and used for trainee and program self-study. (J Surg Ed ■■■■-■■■. Published by Elsevier Inc on behalf of the Association of Program Directors in Surgery)

KEY WORDS: competency, feedback, next accreditation system, validation, web-based

COMPETENCIES: Patient Care and Procedural Skills, Practice-Based Learning and Improvement

INTRODUCTION

US residency and fellowship training programs have transitioned to an accreditation system based on objective education outcomes. This Next Accreditation System (NAS), as developed by the Accreditation Council for Graduate Medical Education (ACGME), necessitates continuous data collection and program self-study.¹ Central to

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the NAS are training milestones, with each specialty dividing the 6 domains of clinical competency into discrete knowledge, abilities, and attributes. These subcompetencies are composed of 5 levels of milestones, representing a trajectory of professional development during training.^{2,3} Residents are expected to advance from novice (level 1) to proficient (level 4) competency by graduation, with level 5 set as an aspirational target few will reach.

Orthopedic surgery was one of seven specialties chosen for the first wave of NAS implementation beginning July 2013.¹ Its milestones were developed by a workgroup in 2011.^{2,4} Of 41 subcompetencies, the workgroup selected 16 areas to sample the spectrum of patient care ranging from ankle fractures and rotator cuff disease to tumor and metastatic bone disease.⁵

Outcomes-based education in the NAS presents challenges to residency programs. Biannual submission of resident-level competency requires significant data tracking and review. The NAS also requires biannual meetings of a clinical competency committee (CCC) that reviews performance data and makes final determinations before submission to the ACGME.⁵ A review of program director surveys found that administrative workload and insufficient monetary support were principal barriers to implementing the ACGME Outcome Project.⁴ During a symposium on the NAS at the 2013 annual meeting of the American Orthopedic Association, 91% of participants felt that the NAS would increase the burden of accreditation, with 73% believing it would be a large increase.⁶

The ACGME did not provide a platform for efficient data collection and reporting. Rather, it hoped to foster innovation and experimentation among programs for how to best implement outcomes-based GME.¹ Simply modifying end-of-rotation evaluations to a milestone-friendly format is of questionable value for assessing procedural or patient care skills, for which rapid assessments may be more appropriate.⁵

To comply with NAS requirements, we developed a web-based platform for rapid collection of milestone-based evaluations. The purpose of this study is to report on its initial 2 years of use in an orthopedic surgery residency program. In addition to assessing validity, feasibility, and responsiveness, this platform allows for novel analysis of a residency program within the NAS paradigm. Ongoing study of milestone-based assessments is critical, as this model is now fundamental to trainee evaluation and program accreditation.^{6,7}

MATERIALS AND METHODS

Platform Rationale

The goal of the electronic Milestone Tracking and Competency System (eMTRCS) is to facilitate ACGME milestone-based evaluations via an automated collection and reporting platform. A preimplementation survey of orthopedic surgery residents found a desire for rapid assessment and more feedback.⁸ The local GME office also

advises programs to regularly complete and track direct-observation assessments.⁹ Therefore, the system was designed to allow specific evaluation of subcompetencies whenever observed, and it was made web-based and accessible to all types of mobile phones, tablets, laptops, and desktop computers.

In accordance with a learner-centered model,¹⁰ residents initiate an evaluation after a subcompetency-related event. Trainees complete a self-assessment along with subjective comments, and assign it to the supervising faculty member. An automated e-mail or text message is then delivered to that faculty member. Upon login, the evaluator assigns a competency level and provides subjective comments. The evaluator can view a trainee's comments but is blinded to the trainee-assessed milestone level. This information is then relayed to the resident and available for review throughout training.

In initial testing, faculty members were concerned about assigning competency level 1 or 2 to junior residents without being able to assure them of appropriate progress. Therefore, a global rating measure was added, allowing faculty to comment on whether a trainee is progressing above, at, or below expectations.

Platform Design

The main technical requirement was a database that allowed for input and recovery via the Internet. eMTRCS was built as a Linux, Apache, MySQL, and PHP stack. Database administration uses phpMyAdmin, an open source tool. Users login via university credentials, and the system maintains the same standards as clinical data. The interface was built in HTML, CSS, PHP, and JavaScript including the C3.js chart library. Although the core functions of trainee-driven evaluations remained, iterative updates and feature additions have continued; eMTRCS is currently on version 2.6.2. Program directors and administrators can access usage statistics, view dashboards, edit user profiles, create custom evaluations, manage rotations, and export reports for CCC meetings and ACGME submission.

Data Collection

Beginning in February 2014, the 40 residents in an orthopedic residency program were encouraged to use eMTRCS for milestone-based evaluations. Training on the platform and the NAS was provided in-person to faculty and residents, and both groups also received user guides. Departmental technology and systems management specialists provided support. All data through February 2016 was de-identified before analysis and was determined exempt from review and informed consent by institutional review board human research criteria.

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