EDUCATIONAL ADVANCE

Ultrasound Competency Assessment in Emergency Medicine Residency Programs

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Abstract

Objectives: In the Model of the Clinical Practice of Emergency Medicine (EM), bedside ultrasound (US) is listed as one of the essential procedural skills. EM milestones released by Accreditation Council for Graduate Medical Education and American Board of Emergency Medicine require residents to demonstrate competency in bedside US. The purpose of this study was to assess the current methods used by EM residency training programs to evaluate resident competency in bedside US.

Methods: This was a cross-sectional survey study. A questionnaire on US education and competency assessment was electronically sent to all EM residency program directors and emergency US directors. The survey consisted of questions regarding the US rotation, structure of US curriculum, presence of US fellowship, image archiving, quality assurance methods, feedback, competency assessment tools, and frequency of assessment. The survey responses are reported as the percentages of total respondents along with 95% confidence intervals (CIs).

Results: A total of 124 of 161 EM residency programs participated in this study, representing a 77% response rate. Twenty-six percent (95% CI = 18% to 34%) of programs assess competency only at the end of the US rotation. Eight percent (95% CI = 3% to 13%) assess competency only every 6 months, and 13% (95% CI = 7% to 19%) assess competency only annually. Eight percent (95% CI = 3% to 13%) assess competency only during the final year of training. Thirty percent (95% CI = 22% to 38%) of programs assess competency with a combination of the above intervals, and 16% (95% CI = 10% to 22%) do not assess US competency. Fourteen percent (95% CI = 8% to 20%) use objective structured clinical examinations (OSCEs), and 21% (95% CI = 14% to 28%) use standardized direct observation tools (SDOTs) to assess resident competency in US. Approximately one-third (33%, 95% CI = 24% to 41%) of standardized testing for US competency is conducted with multiple-choice questions. Thirty percent (95% CI = 21% to 38%) administer practical examinations to assess US skills.

Conclusions: Currently, a majority of EM residency programs assess resident competency in bedside US. However, there is significant variation in the methods of competency assessment.

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Bedside ultrasonography (US) is listed as one of the skills essential to the practice of emergency medicine (EM) in the 2011 Model of the Clinical Practice of EM.[1] The American College of Emergency Physicians (ACEP) recommends integration of US education into the core curriculum of all EM residency programs, and the currently suggested curriculum is based on consensus recommendations from the 2008 Council of Emergency Medicine Residency Directors (CORD) conference.[2,3]

The Accreditation Council for Graduate Medical Education (ACGME) recently introduced the concept of educational milestones for resident assessment, and subsequently the EM Milestones Working Group developed specialty-specific milestones.[4] In October 2012, the ACGME and the American Board of Emergency Medicine (ABEM) finalized 23 milestones, and US was designated patient care skill number 12.[4] This patient care skill requires EM residents to demonstrate competency in performing bedside US.[5–7] To successfully implement

US milestones, it is crucial to understand the current competency assessment methods used among EM programs including their content, frequency, and specific assessment tools. The objective of this study was to assess the current methods used by EM residency training programs to evaluate resident competency in bedside US.

METHODS

Study Design and Population
This was a cross-sectional survey study conducted electronically using a questionnaire developed by the investigators. The approval of the University of Arizona Medical Center Institutional Review Board was obtained.

Survey Content and Administration
A 20-item questionnaire on US education and competency assessment practices was developed based on existing literature and knowledge of current emergency US training as derived from discussions with experts in the field. To ensure content validity, four emergency physicians with expertise in emergency US and resident education reviewed each survey question for relevance and clarity. The survey consisted of multiple-choice and free-text response questions regarding the US rotation, structure of US curriculum, presence of US fellowship, image archiving, quality assurance methods, feedback, assessment tools, and frequency of assessment.

All EM residency program directors and emergency US directors were included in the study. The questionnaire was distributed via e-mail with an introduction regarding our project and goals. The e-mail message contained a link to the survey (SurveyMonkey.com) as well as an opt-out option. When the available e-mail address did not lead to a response from a particular program, the principal investigator e-mailed the department coordinator asking for the contact information for the appropriate faculty member who was actively involved in the program's US education. This faculty member was then e-mailed a link to our survey. If there was no response by the conclusion of our study, the program was deemed a nonresponder. Data were manually evaluated to assure one response per program. The e-mail was sent a total of five times and the survey was closed in November 2012.

Data Analysis
Descriptive statistics were used to summarize the data using SAS version 9.3. The responses were reported in terms of the percentage of total respondents along with 95% confidence intervals (CI).

RESULTS

A total of 124 of the 161 (77%) EM residency programs responded, and 120 (74%) completed the entire questionnaire. Fifty-two percent of these programs offer US fellowships. Eighty-eight percent (95% CI = 82% to 94%) offer mandatory US rotations. During the mandatory or optional US rotations, only 23% (95% CI = 15% to 31%) of programs administer pretests, 45% (95%

CI = 36% to 54%) administer posttests, and 22% (95% CI = 15% to 30%) administer both.

With regard to assessing US skills, 26% (95% CI = 18% to 34%) of programs assess competency only at the end of the US rotation. Eight percent (95% CI = 3% to 13%) assess competency only every 6 months, and 13% (95% CI = 7% to 19%) assess competency only annually. Eight percent (95% CI = 3% to 13%) assess competency only during the final year of training. Thirty percent (95% CI = 22% to 38%) of programs assess competency with a combination of the above intervals, and 16% (95% CI = 10% to 22%) do not assess US competency. The core US examinations assessed during competency testing included focused assessment with sonography in trauma, 97.5%; aorta, 95%; cardiac, 85.0%; gallbladder, 77.5%; renal, 75.0%; pelvic, 72.5%; procedure guidance, 62.5%; thoracic, 60.0%; deep vein thrombosis, 42.5%; superficial, 40.0%; and ocular, 27.5%. The methods used to assess US competency assessment are summarized in Table 1. Regardless of their methods for assessment, 88% (95% CI = 82% to 94%) of responders require a specific number of US examinations to achieve competency for graduation.

Image review and quality assessment are performed at 82% (95% CI = 75% to 89%) of programs. Of these, 65% (95% CI = 57% to 73%) review still images. Twenty-eight percent (95% CI = 20% to 36%) of programs use US workflow solutions. Only 31% (95% CI = 23% to 39%) of programs transmit images wirelessly, and only 22% (95% CI = 15% to 29%) transfer to picture archiving and communication systems. Fifty-one percent (95% CI = 42% to 60%) of programs provide e-mail feedback to residents regarding their US examinations. Approximately 24% (95% CI = 16% to 31%) use workflow solutions to provide feedback. Fifty-six percent (95% CI = 47% to 65%) provide feedback through individual sessions.

DISCUSSION

Our data demonstrate that there is significant variation in US competency assessment among EM residency

Table 1
Ultrasound Competency Assessment Methods Used by Different EM Residency Programs

US Competency Assessment Method	Frequency, n (%) 95% CI
OSCEs	16 (14) 8–20
SDOTs	25 (21) 14–28
Multiple-choice test questions	39 (33) 24–41
ACEP online interactive examinations	39 (32) 24–41
Practical examinations	37 (30) 21–38
Direct observation	24 (20) 13–27
Simulation	10 (8) 1–17
Human models	27 (22) 9–35
Combination (real patients, simulation, and models)	32 (27) 13–41

ACEP = American College of Emergency Physicians; OSCEs = Objective structured clinical examinations; SDOTs = standardized direct observation tools.

programs. Most striking is that 18% of programs do not perform image review regularly to assess resident imaging skills and that 16% of programs never evaluate US competence. Only 35% of programs use standardized tools (objective structured clinical examination [OSCE] or standardized direct observation tool [SDOT]) to assess US competency, and only 30% of programs administer practical examinations to assess US skills. A majority of EM programs (88%) require a specific number of US examinations to achieve competency for graduation. Some results reported in the CORD-AEUS consensus survey differ from those of our study. The consensus survey reported that 6% of programs do not assess resident US competency.[7] Fifty-three percent use SDOT or nonstandardized evaluations, and 8.1% use OSCE or other simulated encounter. Only 73% of programs require a specific number of US examinations for graduation.[7] The discrepancies noted between our survey and the CORD-AEUS survey may be related to differences in response rates. The CORD-AEUS survey reported a response rate of 68% (108 of 159 programs), whereas we included two new programs and received a response rate of 77% (124 of 161 programs).

Our study revealed that 88% of programs offer mandatory US rotation, which is an increase from 72% in 2008.[8] In addition, in 2008, 21% of EM residency programs reported that US training is primarily self-directed by residents, whereas in our study none of our responders reported the same. Our survey also revealed that 52% of EM programs offer US fellowships, which demonstrates an increase from 40% in 2008.[8]

With regard to resident feedback, we have identified two areas for improvement: the use of video instead of still images and the need for direct observation while scanning. The use of video for quality assurance is superior in that it provides a better understanding of the operator's technique and thus improves the quality of feedback. Real-time observation and resident feedback, whether in a standardized format or in patient care settings, will increase the quality of US education. Use of Web-based workflow systems along with wireless image transfer can facilitate quality assurance assessment and provide a platform to give feedback to residents. Adoption of these suggested improvements has the potential to significantly improve resident education by way of specific and timely feedback.

By describing core and advanced US skills, the consensus paper makes clear recommendations for US educational tracks.[5] It also outlines different methods of bedside US competency assessments. How the emergency US milestones affect US rotations remains unknown, and the best way to standardize US competency assessment remains unanswered. Additional research beyond expert opinion is needed to identify effective and objective US competency assessment tools.

LIMITATIONS

This survey-based study was limited in that not all EM residency programs responded. Although there was a response rate of 77%, responder bias may have resulted in an overrepresentation of programs with greater interest in US education or programs with US fellowships. Our survey instrument was not pilot tested and validated prior to implementation. Questions provided through survey methods are limited by interpretation of questions and by the variable response rate to questions that are marked as "if you answered no to this question skip to next question." We did not collect specific information regarding the SDOT assessments, specific number of US examinations required for graduation, and barriers to implementing the CORD-AEUS consensus guidelines at each program. The differences in responses between EM programs that offer US fellowships and rotations and EM programs that do not were not included in our data analyses. While this survey answers questions regarding what current US education formats exist, as well as what competency assessment tools and quality assurance feedback formats are being used for US assessment, it does not address what components are best, nor is it fully encompassing of all assessment tools.

CONCLUSIONS

Currently, a majority of emergency medicine residency programs assess resident competency in bedside ultrasound. However, there is significant variation in the methods of competency assessment.

References

1. 2011 EM Model Review Task Force, Perina DG, Brunett CP, et al. Model of the clinical practice of emergency medicine. Acad Emerg Med 2012;19:e19–40.
2. American College of Emergency Physicians. Emergency ultrasound guidelines. Ann Emerg Med 2009; 53:550–70.
3. Akhtar S, Theodoro D, Gaspari R, et al. Resident training in emergency ultrasound: consensus recommendations from the 2008 Council of Emergency Medicine Residency Directors conference. Acad Emerg Med 2009;16(Suppl 2):S32–6.
4. Beeson MS, Carter WA, Christopher TA, et al. The development of the emergency medicine milestones. Acad Emerg Med 2013;20:724–9.
5. Kessler CS, Leone KA. The current state of core competency assessment in emergency medicine and a future research agenda: recommendations of the working group on assessment of observable learner performance. Acad Emerg Med 2012;19:1354–9.
6. Jones MD Jr, Rosenberg AA, Gilhooly JT, Carraccio CL. Perspective: competencies, outcomes, and controversy–linking professional activities to competencies to improve resident education and practice. Ann Emerg Med 2011;86:161–5.
7. Lewiss RE, Pearl M, Nomura JT, et al. CORD-AEUS: consensus document for the emergency ultrasound milestone project. Acad Emerg Med 2013;20:740–5.
8. Ahern M, Mallin MP, Weitzel S, Madsen T, Hunt P. Variability in ultrasound education among emergency medicine residencies. West J Emerg Med 2010;11:314–8.