Sonographer Educator in the Emergency Department to Prevent POCUS Skills Attrition: A Novel Education Intervention

ANITA KNOPOV, MD; STEPHANIE HESS, MD; ANDREW MUSITS, MD, MS; GIANNA PETRONE, DO; BRIAN CLYNE, MD, MHL; JANETTE BAIRD, PhD; RUBY MERAN, RDMS; KRISTIN DWYER, MD, MPH

ABSTRACT

BACKGROUND: Point-of-care ultrasound (POCUS) is a pivotal diagnostic tool for emergent conditions, yet the variable proficiency of emergency physicians (EPs) poses challenges. Inadequate skills may lead to care delays and suboptimal patient evaluation. This manuscript explores an innovative educational intervention deploying a Registered Diagnostic Medical Sonographer (RDMS) credentialed sonographer educator (SE) in a large academic Emergency Department (ED). We sought to evaluate the feasibility of using a SE to address POCUS skills deficiencies and attrition.

METHODS: The study involved 26 EPs voluntarily participating in hands-on training with the SE between July 2021–June 2022. The educational sessions addressed machine operation, image acquisition, image interpretation, and electronic medical record documentation of POCUS results. Subjects who consented completed a survey on their comfort level with POCUS before and after the intervention.

RESULTS: Survey data indicated increased comfort and competence among participants with basic machine operation, resident POCUS supervision, and ordering and documenting POCUS exams. Post-training, 44% of providers reported performing more POCUS exams, 44% reported documenting their POCUS in the EMR more often clinically, 57% were more likely to encourage residents to perform scans, and 14% were more likely to perform a POCUS before ordering a comprehensive ultrasound. The study also observed an increase in the number of scans performed post-intervention (more than double). The SE intervention addressed challenges such as resource limitations, and feedback from participants highlighted the program's positive impact, particularly in reducing intimidation and fostering a desire for further training. While self-reported data and limited survey completion pose limitations, the increase in POCUS scans and positive feedback underscore the intervention's potential.

CONCLUSIONS: This pilot study demonstrates the feasibility and initial impact of integrating a SE into an academic ED setting. Further research is warranted to assess the specific effects on provider comfort and clinical decision-making with POCUS. The findings support the value of a dedicated SE in enhancing EPs' POCUS proficiency, promoting ongoing education, and ultimately improving patient care.

KEYWORDS: skill retention, medical education, sonographer educator, ultrasound

INTRODUCTION

Need for Innovation

Point-of-care ultrasound (POCUS) has become the standard of care diagnostic tool for the evaluation of many emergent conditions.[1] However, provider comfort and skill with POCUS varies. Many emergency physicians (EPs) did not receive comprehensive POCUS training and EPs who were fully trained in POCUS find their proficiency declining, as skill attrition is a well-recognized phenomenon.[2] While all EPs should be comfortable with image acquisition, interpretation, and the use of POCUS for real-time clinical decisions, academic EPs have the added responsibility of teaching POCUS and modeling the integration of POCUS into clinical care. Inadequate POCUS skills, or failure to perform a clinically indicated POCUS leads to care delays or suboptimal evaluation of unstable patients.[3] An innovative approach is needed to support EPs in developing and maintaining POCUS proficiency.

BACKGROUND

Ultrasound has played a role in clinical medicine since the 1960s. Advances in technology lead to expanded use of bedside ultrasound for rapid and non-invasive patient diagnosis.[4] The FAST exam is now part of the Advanced Trauma Life Support (ATLS) algorithm and has become the standard of care. POCUS is highly sensitive and specific for AAA and pneumothorax, can accurately identify the etiology of undifferentiated shock and ectopic pregnancy, and can decrease time to surgery by 90 minutes and time in the ED by 48 minutes.[5-9] In 2012, the Accreditation Council for Graduate Medical Education designated POCUS as one of the milestone competencies for EM residents.[10,11] The American College of Emergency Physicians specifies that EPs should demonstrate proficiency in 12 POCUS applications.[1]

Objective of Innovation

This pilot study aims to: (1) assess the feasibility of introducing a RDMS credentialed sonographer educator (SE) into a large academic ED and (2) evaluate if hands-on training sessions with the SE increase self-reported competence and confidence with POCUS. Few training programs have a dedicated SE and the feasibility and impact has not been previously described.

Development Process

This educational innovation was designed to enhance POCUS training for attendings at a single, Level 1 trauma center with the support of a dedicated SE. The SE is RDMS trained ultrasound technologist, who was hired by our ultrasound division to help educate providers on ultrasound image acquisition. The long-term goals were to improve the quality of POCUS for patient care and resident education.

Our SE provides hands-on instruction to medical students, residents, fellows, APPs and attending physicians in the ED. All learners can schedule sessions with or obtain help from the SE on shift.

Participants were surveyed to understand the demographics of those who opted in for scanning shifts. Relevant survey information included time in practice, POCUS training in residency, POCUS credentialing status, POCUS attitudes, and self-perceptions of competency in performing, teaching, and making clinical decisions using POCUS. We surveyed participants on how many sessions and hours per session they spent with the SE and the strengths and weaknesses of the sessions. A Likert scale was used to answer questions such as, "It is important as an emergency provider to have competency in POCUS," "I feel comfortable with basic operation of the ultrasound machine," "I am comfortable supervising residents on the most common POCUS exams," and "I know how to place an order for a POCUS in EPIC and document my findings." Lastly, participants rated their perceived level of competence in performing and making clinical decisions for specific types of ultrasound scans (e.g., FAST, Echo, Renal) on a Likert scale from very incompetent to very competent.

The survey was created by faculty with education research expertise and piloted on non-study-participant volunteers. Multiple iterations of the survey were developed using a Delphi method until a final questionnaire was achieved for administration.

In addition, we evaluated the number of scans performed and saved in our image storage solution, QPath-e (Telexy Healthcare, Maple Ridge, British Columbia, CA), during the 12 months prior to and 12 months after the SE education intervention. This study was IRB exempt.

Implementation Phase

All EM faculty were notified of the opportunity to train with the SE in voluntary scan sessions. Faculty were reminded regularly about the availability of the SE and could sign up for an unlimited number of sessions. Prior to their first session, participants were sent an email invitation to participate in the survey, including informed consent. Participants received the same survey again one week and 30 days after their session.

During the intervention, participants worked one-on-one with the SE performing POCUS exams on ED patients. Participants received real-time feedback and teaching on machine operation, image acquisition and interpretation, sonographic anatomy, and how to order and document POCUS in the electronic medical record. Some participants used the opportunity to train with the SE to obtain POCUS credentials for the first time through the "practice-based pathway."[1]

Early implementation challenges to this innovation included resource limitations (i.e., machines) when multiple learners were scanning simultaneously. Two additional machines were acquired during this timeframe, and learner schedules were adjusted to maximize the efficiency of the SE.

OUTCOMES

For the survey, descriptive statistical analysis was conducted using SAS (Version 9.4, Carey, NC). A total of 26 attending physicians completed POCUS training with the SE out of 114 faculty (between July 2021–June 2022).

Of those who participated in SE scan sessions, 23 participants completed at least one survey following the training. Participants attended between one and 10 SE sessions, with a majority (n = 18, 78.6%) attending <three sessions. Participants' sessions each lasted an estimated median of two hours per session (IQR: 1.5, 4), with a range of 1 to 18. The most frequently performed POCUS exams were ECHO (n = 17, 74%), Gallbladder (n = 13, 56.5%), and FAST (n = 10, 44.7%). The median number of exams completed per session was 3 (IQR: 2,5), ranging from 1–8 exams.

The median number of years post-residency for participants was 22 (IQR: 12, 28) with a range of 2 to >30. A majority (n = 14, 60.9%) reported that POCUS was not part of their residency training. While many participants (n = 14, 60.9%) were already POCUS credentialed, this was low compared to our provider group's overall >90% POCUS credentialing rate.

On the post-training survey all participants agreed/strongly agreed that it was important for EPs to be competent in POCUS. Over half agreed/strongly agreed that they felt comfortable with basic operation of the ultrasound machine (65%); were comfortable supervising residents on most common POCUS exams (74%); and were comfortable ordering a POCUS procedure in the electronic medical record (65%).

When comparing the surveys completed prior to the intervention to the surveys completed after the intervention, we found increase in agreement with the following statements: "It is important as an emergency medicine provider to have competency in POCUS," "I feel comfortable with basic operation of the ultrasound machine," "I am comfortable

supervising residents on the most common POCUS exams," and "I know how to place an order for a POCUS in EPIC and document a procedure note with my findings." (**Table 1**)

After working with the educator, 44% agreed/strongly agreed that they performed more POCUS exams; 14% agreed/strongly agreed they were more likely to attempt a POCUS before ordering a comprehensive ultrasound; 44% agreed/strongly agreed that they are documenting more POCUS exams in the patient chart; 57% agreed/strongly agreed that they encourage residents to perform more POCUS exams; and 100% agreed/strongly agreed they would sign up for further sessions with the sonographer educator.

For a subsample (n = 10), survey data was available for self-reported POCUS competency both before they engaged in a SE session and after. Post-training these participants reported increased competence using POCUS for clinical decision making, but no change in self-perceived competence using POCUS for procedures (**Table 2**).

Table 1. Average Agreement Pre- and Post-Training Survey

	Average Agreement with Statement		
	Pre (n=9)	Post (n=9)	Percent Change
It is important as an EP to have competency in POCUS	4.6	4.7	2.4%
I feel comfortable with basic operation of the US machine	3.4	4.0	16.1%
I am comfortable supervising residents on the most common POCUS exams	3.2	3.4	6.9%
I know how to place an order for a POCUS in EPIC and document my findings	3.2	3.6	10.3%

Legend: (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Table 2. Participant self-assessment of POCUS competence

Skills	Pre-training % Competent/very competent (n = 10)	Post-training 1 % Competent/very competent (n = 10)
Clinical decisions for POCUS exams		
FAST/Trauma	60%	70%
ECHO/Cardiac	40%	50%
Gallbladder/biliary	30%	40%
Renal	30%	50%
Obstetrics/gynecology	30%	40%
Airways/thoracic	30%	30%
DVT	10%	0%
Bowel	0%	0%
Ocular	30%	30%
MSK	10%	10%

In total 413 scans were recorded during the 12 months prior to the SE intervention (an average of 16/physician) and a total of 888 scans during the 12 months after the intervention (an average of 34/physician).

DISCUSSION

This study describes the feasibility and initial assessment of the impact of introducing a SE as a novel education intervention for attendings hoping to obtain, maintain or improve their POCUS skills.

In this study, 26 providers, out of a group with 114 providers, attended at least one POCUS scan shift with the SE. Participation was uncompensated and voluntary, and most participants attended multiple sessions, with some attending as many as 10 sessions. This suggests that obtaining and maintaining POCUS skills is of significant interest to our EPs. This was further validated as 100% of providers surveyed stated that it was important to be competent in POCUS.

Providers received qualitative feedback on topics ranging from machine basics and POCUS workflow to assistance with more advanced skills such as image acquisition. Multiple attendings commented on being intimidated by POCUS. One participant commented: *"I no longer fear learning this skill."* Another stated: *"I would love more time with the SE."* When asked what aspects of the session were most useful, comments included *"All of it!" "Everything!"* and *"So many."* In the open-ended portion of the survey, providers documented that they valued the tips and tricks from the SE when struggling to obtain optimal views and real-time individualized feedback.

The education sessions were learner-driven and tailored to self-identified needs, which adheres to adult learning principles, specifically with the concept of andragogy. Our learners, which are attending physicians, are fundamentally different from many other learners in medical education due to their knowledge why they need to learn the skill of POCUS (i.e., it is standard of care). In addition, attending physicians are motivated and can use the time with the SE to tailor to their own needs. Additionally, one-on-one sessions allowed for psychological safety. EP physicians that do not feel their POCUS skills are adequate may feel intimidated to learn a new skill, so provider comfort was a priority. Additionally, this program facilitated several of our uncredentialed faculty to become POCUS credentialed.

The providers who opted to participate tended to be further out from residency, less likely to have trained with POCUS and were overrepresented by the minority of uncredentialed providers in our group. Only 65% identified as being comfortable with basic machine operation (e.g., switching probes, choosing a preset, entering patient information, adjusting depth) pre-intervention.

With minimal training, providers self-report performing more POCUS, documenting more POCUS clinically,

encouraging residents to incorporate POCUS more often and ordering fewer comprehensive studies.

While hiring a SE does come with a cost, we believe that having an SE in the department is important in terms of maintaining skills, building up physician confidence and self-perceived competence, increases their comfort in ability to supervise residents, while generating billing and helping to avoid malpractice.

Limitations

Data was self-reported and not all of providers completed a survey after the educational intervention. While we did not adjust for confounders (e.g., number of clinical shifts worked), the group who participated in the intervention more than doubled the number of POCUS scans performed the year after the intervention. One must consider that providers may have increased the number of scans performed, but also that they may have been saving and documenting the scans more appropriately after the SE intervention.

CONCLUSION

This preliminary evaluation of a SE in the ED demonstrates feasibility. Additional studies need to be performed to better understand the specific impact of a SE on provider's comfort with POCUS and increase use of POCUS to make clinical decisions. However, universally, our surveyed providers described their sessions with our SE useful and continue to sign up with her to work on their POCUS skills.

References

1. Ultrasound Guidelines: Emergency, Point-of-care, and Clinical Ultrasound Guidelines in Medicine. ACEP Policy Statement. June 2016 https://www.acep.org/siteassets/new-pdfs/policy-statements/ultrasound-guidelines-emergency-point-of-care-and-clinical-ultrasound-guidelines-in-medicine.pdf
2. Clyne B, Barber Doucet H, Brown L, Musits A, Jacobs E, Merritt C, Merritt R, Allister L, Petrone G, Musisca N, Smith JL, Baird J, Mello MJ. Maintaining procedural skills for academic emergency medicine faculty: A needs assessment. AEM Educ Train. 2021 Aug 1;5(4):e10648. doi: 10.1002/aet2.10648. PMID: 34853821; PMCID: PMC8609535.
3. Emergency Department Ultrasound Privilege and Practice. ACEP Policy Statement. April 2023. https://www.acep.org/patient-care/policy-statements/emergency-department-ultrasound-privilege-and-practice
4. "Evolution of Point-of-Care Ultrasound." 20 May 2019, radiologykey.com/evolution-of-point-of-care-ultrasound/.
5. Jeanmonod D, Yelamanchili VS, Jeanmonod R. Abdominal Aortic Aneurysm Rupture. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459176/
6. Stone BS, Muruganandan KM, Tonelli MM, Dugas JN, Verriet IE, Pare JP. Impact of point-of-care ultrasound on treatment time for ectopic pregnancy, The American Journal of Emergency Medicine. 2021;49:226-232, ISSN 0735-6757, https://doi.org/10.1016/j.ajem.2021.05.071.
7. Szabó GV, Szigetváry C, Szabó L, Dembrovszky F, Rottler M, Ocskay K, Madzsar S, Hegyi P, Molnár Z. Point-of-care ultrasound improves clinical outcomes in patients with acute onset dyspnea: a systematic review and meta-analysis. Intern Emerg Med. 2023 Mar;18(2):639-653. doi: 10.1007/s11739-022-03126-2. Epub 2022 Oct 31. PMID: 36310302; PMCID: PMC10017566.
8. Yoshida T, Yoshida T, Noma H, Nomura T, Suzuki A, Mihara T. Diagnostic accuracy of point-of-care ultrasound for shock: a systematic review and meta-analysis. Crit Care. 2023 May 25;27(1):200. doi: 10.1186/s13054-023-04495-6. PMID: 37231510; PMCID: PMC10214599.
9. Pare JR, Liu R, Moore CL, Sherban T, Kelleher MS Jr, Thomas S, Taylor RA. Emergency physician focused cardiac ultrasound improves diagnosis of ascending aortic dissection. Am J Emerg Med. 2016 Mar;34(3):486-92. doi: 10.1016/j.ajem.2015.12.005. Epub 2015 Dec 12. PMID: 26782795.
10. ACGME Program Requirements for Graduate Medical Education in Emergency Medicine. June 2020. www.acgme.org/Portals/0/PFAssets/ProgramRequirements/110_EmergencyMedicine_2020.pdf?ver=2020-06-26-125701-320
11. Lewiss RE, Pearl M, Nomura JT, Baty G, Bengiamin R, Duprey K, Stone M, Theodoro D, Akhtar S. CORD-AEUS: consensus document for the emergency ultrasound milestone project. Acad Emerg Med. 2013 Jul;20(7):740-5. doi: 10.1111/acem.12164. PMID: 23859589.

Authors

Anita Knopov, MD, Brown Emergency Medicine, Providence, RI

Stephanie Hess, MD, Lehigh Valley Health Network, Allentown, PA

Andrew Musits, MD, MS, Brown Emergency Medicine, Providence, RI

Gianna Petrone, DO, Brown Emergency Medicine, Providence, RI

Brian Clyne, MD, MHL, Brown Emergency Medicine, Providence, RI

Janette Baird, PhD, Brown Emergency Medicine, Providence, RI

Ruby Meran, RDMS, Brown Emergency Medicine, Providence, RI

Kristin Dwyer, MD, MPH, Brown Emergency Medicine, Providence, RI

Disclosures

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This study was deemed IRB Exempt. This is included in the Development Process. None of the authors have any conflicts of interest to disclose.

Correspondence

Anita Knopov, MD
Brown Emergency Medicine
55 Claverick Street
Providence, RI 02903
anita_knopov@brown.edu