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Practicality in POCUS: Benefits of Ultrasound Training in Medical Education

Robert Martin
Rowan University

Ho An Lau
Philadelphia College of Osteopathic Medicine

Ryan Morrison
Rowan University

Kate Deiling
Rowan University

ROWAN-VIRTUA
School of Osteopathic Medicine

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Robert Martin[1], Ho An Lau[2], Ryan Morrison[1], Kate Deiling[1]

1 Rowan-Virtua School of Osteopathic Medicine - Simulation Center, **2** Philadelphia College of Osteopathic Medicine

Introduction:

The utilization of point-of-care ultrasound (POCUS) is rapidly increasing throughout the medical community as recognition of and access to the benefits of bedside ultrasound becomes more readily available. The vast advantages of POCUS include: Focused Assessment with Sonography in Trauma (FAST) exam, central and peripheral intravenous cannulation, and ultrasound-guided injections and biopsies. As POCUS becomes an integral component of healthcare, both undergraduate and graduate medical POCUS education is urgently necessary in curricula. Despite the apparent need of POCUS curricula, there is still a lingering question: **Are there evidence-based benefits to POCUS training in undergraduate and/or graduate medical education settings?**

Methods:

Systematic review involving PubMed, Google Scholar, and Scopus.

Results/Discussion:

Pre-Clinical

Research demonstrates the utilization of POCUS education improves anatomy education and physical examination skills for sonographic assessment of *abdominal, reproductive, cardiovascular, and renal structures.* [1-4] Simulation enhanced POCUS education demonstrated that self-guided simulation learning alongside traditional instructor-led lectures resulted in a greater competency for ultrasonographic evaluation of basic cardiac anatomy and physiology.[5] Another simulator for transabdominal ultrasound noted the potential of simulation to improve ultrasound skills, master basics, and improve confidence of users in the evaluation of abdominal organs.[6] A low-cost femoral triangle model for the first year medical student allowed for practice of ultrasound-guided procedures and reinforcement of anatomical knowledge of the femoral triangle.[7]

Clinical

One study found that **students** who completed a emergency medicine clerkship with integrated POCUS training (including FAST and ultrasound-guided vascular access training*) performed significantly better on testing as compared to emergency medicine* ***residents*** that did not complete the additional training.[11] Another emergency medicine POCUS enhanced clerkship for medical students demonstrated an improvement in fund of knowledge and reinforced skills such as extended-FAST (eFAST) or Rapid Ultrasound for Shock and Hypotension (RUSH).[12] In a similar notion, a simple one-hour eFAST training session during a surgical clerkship exhibited the potential for improved competency for medical students performing and interpreting the eFAST examination.[13]

Graduate Medical Education (GME)

A study investigating the integration of a POCUS curriculum in a military internal medicine residency demonstrated improved sonography skills corresponded with a greater retention of knowledge, improved confidence in performing ultrasound guided invasive procedures, and a 37% increased interest in the use of POCUS in future clinical practice.[15] In an alternative setting, a large academic internal medicine residency program implemented a POCUS curriculum and noted that the residents who completed the entire curriculum had a substantial long-term gain in knowledge for all major ultrasound applications, with a notable increase in confidence for cardiac and pulmonary applications.[16]

Guest anesthesiologists lecturer educating Rowan-Virtua SOM POCUS Elective students - *Image courtesy of Rowan-Virtua SOM Simulation Center*

Standardization

In 2022, an international consensus conference proposed recommendations for undergraduate medical student ultrasound education. These recommendations alongside a Canadian consensus for ultrasound education proposed an agreement on a basic preclinical and clinical ultrasound curricular domains for medical POCUS.[18,19] These will be explored further in a future study.

Structured, small group teaching sessions with didactics, clear learning objectives, and mandatory hands-on learning are all characteristics of POCUS education that can yield greater POCUS skills, confidence, and understanding for students.[20]

Conclusion

POCUS education has been shown to be effectively implemented in undergraduate through graduate medical education settings. The inclusion of a properly integrated POCUS curriculum can result in greater confidence in ultrasound use, increased knowledge of anatomy and basic sciences for various organ systems, improved ultrasound knowledge and performance in clinical clerkships, and offers improved confidence and knowledge in ultrasound during residency. In order for POCUS to be effectively taught, various domains should be addressed as outlined by the international consensus on ultrasound education. Specifically, structured, small group teaching sessions with didactics, clear learning objectives, and mandatory hands-on learning are characteristics of POCUS education that can yield greater POCUS skills, confidence, and understanding.

Ryan Morrison (OMS-IV) utilizing simulation mannequin with augmented reality accessories - *Image courtesy of Rowan-Virtua SOM Simulation Center*

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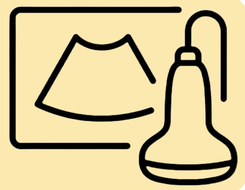

Abstract:

As point-of-care ultrasound (POCUS) becomes an integral component of healthcare, both undergraduate and graduate medical POCUS education is urgently necessary in curricula. Despite the apparent need of POCUS curricula, there remains a lingering question: Are there evidence-based benefits to POCUS training in undergraduate and/or graduate medical education settings? This systematic review utilized PubMed, Google Scholar, and Scopus to identify articles of interest that met the inclusion criteria and relevance to undergraduate and/or graduate medical education. Qualitative evaluation of research was conducted to identify common themes for benefits of POCUS and the requirements or characteristics for effective POCUS educational curricula. Results for undergraduate medical education were separated into pre-clinical and clinical education. In pre-clinical POCUS education, POCUS education improves anatomy education and physical examination skills for sonographic assessment of abdominal, reproductive, cardiovascular, and renal structures. Further enhancement can be achieved via simulation devices that are generalized ultrasound simulation mannequins, one defined body region such as the abdomen, or local regions of interest such as the femoral triangle. In clinical undergraduate POCUS education, benefits involved greater performance on knowledge tests and general ultrasound competency in emergency medicine, surgical, family medicine, and physical medicine and rehabilitation clerkships. These studies also found improved comprehension of specific POCUS examinations such as those for ultrasound-guided injections, FAST, eFAST, and RUSH. Further integration of POCUS education into graduate medical education was found to successfully improve ultrasound knowledge and competency in both academic and military internal medicine residencies. One limitation of this study is that this article is a review resulting in no specific intervention being introduced. The resultant hypothesis of this systematic review cannot be tested; rather evidence-based recommendations are restricted to the currently available literature within the searched databases. From this review, it was found that the inclusion of a properly integrated POCUS curriculum can result in greater confidence in ultrasound use, increased knowledge of anatomy and basic sciences for various organ systems, improved ultrasound knowledge and performance in clinical clerkships, and offers improved confidence and knowledge in ultrasound during residency.