


Innovation Through Collaboration


Creation of a Combined Emergency and Internal Medicine Point-of-Care Ultrasound Fellowship

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Abbreviations

ACGME, Accreditation Council for Graduate Medical Education; CPUS, clinician-performed ultrasound; ED, emergency department; EDOU, emergency department observation unit; EM, emergency medicine; IM, internal medicine; US, ultrasound

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For more than 2 decades, clinician-performed ultrasound (CPUS) examinations have been a required component of emergency medicine (EM) residency training programs.^{1,2} Due to the need for leaders in the field to develop advanced techniques, perform scientific investigations, and manage ultrasound (US) programs in both academic and clinical settings, more than 100 EM US fellowships have been established nationally since 1997.³ Many graduates of these fellowships are involved in teaching at medical school, residency, and fellowship levels, resulting in a high proportion working in academic settings, with high rates of job satisfaction.⁴ As the utility of CPUS has become more widely recognized, more than 50 US medical schools have integrated US into their preclinical and clinical curricula.⁵ This has resulted in many medical school graduates entering residency programs with a substantial degree of US exposure and the expectation that US will be an integral part of their residency training and clinical practice. Beyond this, a recently published expert consensus described a model for the development of system-wide clinical US programs, which will require substantial collaboration across specialties and departments.⁶

In internal medicine (IM) practice, however, CPUS (also frequently referred to as point-of-care US) is less widely established. This potentially results in the undesirable situation in which trainees have greater specific knowledge and experience than their supervising residents and faculty. This discrepancy is not due to a lack of awareness of the utility of CPUS in IM, as its applications are well described, with multiple subspecialties releasing consensus guidelines.^{7–11} A needs assessment and national guideline for IM CPUS training have been published in Canada, and the American College of Physicians has recently released a statement on the importance of CPUS in IM, but the development of expertise within IM practice environments and subspecialties remains a

considerable challenge.^{8,12–15} There are more than 400 IM residency programs in the United States, each with a need for education on CPUS in the inpatient, outpatient, and critical care settings. Although several specialties (most notably critical care, rheumatology, cardiology, and nephrology) are integrating US into their fellowship training, there is a concern that subspecialty interest will exacerbate the dearth of skilled users in general IM training by recruitment of US-competent IM resident graduates into their fellowship programs. At the time of this publication, there are only 2 IM CPUS fellowships currently available in the US, which clearly provides inadequate throughput for future needs.¹⁶

A Proposed Solution

The wealth of CPUS expertise in EM makes it a natural resource to tap for the initial period of developing IM experts. Emergency medicine is responsible for treating diseases from every single specialty and has historically collaborated in developing specific CPUS capacity for surgery, trauma, family medicine, pediatrics, and IM subspecialties. The cross-specialty nature of EM practice means that it has evolved a multisystem approach to US that is applicable for almost any patient condition. Regardless of the clinical setting, there will be conditions better diagnosed and managed with CPUS, so many of the lessons learned from the emergency department (ED) will be applicable.

There are, however, contrasts between the ED and the practice settings of IM and IM subspecialties, with differences in the patient populations, existing infrastructure, specific clinical questions, and work flow. The future leaders in and practitioners of IM CPUS will require training that is tailored to the practice of IM. We describe below our experience in creating a combined EM/IM US fellowship in an EM setting that has experience in developing combined specialty training programs with the medical school, pediatrics, critical care medicine, hospitalist medicine, and nephrology.

Our Experience

Our US fellowship is not Accreditation Council for Graduate Medical Education (ACGME) accredited,

and certification of the fellow is provided by the individual institution. In 2016 we recruited our first IM trained fellow (C.M.B.) to an EM US fellowship that has been in continuous existence since 2003. The applicant was already enrolled in a pulmonary critical care medicine fellowship and was able to modify his pulmonary critical care medicine fellowship training schedule to meet the 12 months of training required for the EM fellowship. His specific goals were to develop the clinical, academic, administrative, and pedagogic skills needed for critical care practice and leadership of a system-wide IM and critical care US program. His curriculum included the elements outlined in the EM core content of clinical US training, with deemphasis of certain applications (eg, musculoskeletal, nerve blocks, and female pelvic) and commensurate increased emphasis on others (eg, cardiac, lung, and evaluation of shock).¹⁷ Research, administration, quality assurance, teaching, and academic research were heavily emphasized. The curriculum was customized to include rotations with supervised scanning time in the intensive care unit, as well as a large amount of time in hands-on scanning in the echocardiography suite and image interpretation under the supervision of cardiac sonographers. A relationship was also developed with the Division of Cardiac Anesthesia for training in transesophageal echocardiography. Reflecting CPUS educational needs at every level, the fellow developed teaching materials and skills in a wide variety of settings, including bedside proctoring, small-group teaching, and formal presentations, as well as undergraduate medical education and nontraditional training formats such as simulation and inverted classroom sessions. At the completion of the CPUS training program, the fellow was invited to take on the role of director of clinical ultrasound for the Department of Medicine and has completed an initial CPUS training program for the entire pulmonary and critical care faculty at his institution, as well as a program of introductory CPUS for the IM residents. Funding for the fellow during this pilot EM/IM US training stemmed from the institutional National Institutes of Health T32 training grant in cardiopulmonary epidemiology research, which aligned with his CPUS fellowship activities.

In 2017, the second EM/IM fellow began a CPUS US fellowship after completion of a nephrology fellowship. His specific goal was to develop skills that would allow him to become expert in the CPUS

applications relevant to nephrology, particularly cardiac and lung US assessments of the volume status. The curriculum was developed with his clinical service time taking place in the emergency department observation unit (EDOU), with a high degree of exposure to patients receiving dialysis. His clinical activities in the EDOU funded the fellowship training using the same model as traditional EM US fellows. He benefited from the high prevalence of renal disease among the general ED population and developed a research project that focused on patients with end-stage renal disease visiting the ED, who represent an enormous burden of care nationally.¹⁸ The use of lung US for assessment of fluid overload in this group is currently entirely the domain of the bedside clinician, making this fellowship the best path to studying its efficacy in his population of interest. The fellow received special education in large-group presentations, billing mechanisms, and volume assessment techniques. The research project has resulted in a number of regional and national presentations, as well as consulting relationships with industry and policy groups. The most updated version of the educational curriculum provided to that fellow and current fellows is available as supplemental content online, which was developed in collaboration with the department of IM and the first IM US fellow graduate of our program.

Recognizing the need to expand capacity and develop a comprehensive, sustainable program tailored to the needs of IM career physicians, a formal partnership has been established between the Division of Emergency Ultrasound in the ED and the Section of Hospital Medicine. Through this collaboration, a clinical service line at 1 full-time equivalent has been created that employs IM US fellows as hospitalists at the academic level of instructor working 50% clinical hours. The remaining nonclinical time is protected for didactic, hands-on, academic, and administrative training under the supervision of IM and EM faculty. This allows for continued growth of IM clinical skills in the vital first year after residency while allowing for the development of practice patterns that integrate the use of CPUS in an IM clinical environment. A portion of the revenue generated by the fellow's clinical time is transferred to the ED as an educational stipend to support the EM US faculty and ED CPUS educational programs. The increased demand for the time of the EM US faculty has thus

been balanced by increased financial support for the ED US division and increased research collaboration opportunities.

For the Section of Hospital Medicine, the fellows' clinical service assists in staffing night and weekend shifts that are traditionally difficult to staff. These shifts have increased weight in accounting of clinical hours, allowing the fellows' clinical time to remain at less than 800 hours per year. Additionally, it has allowed for professional development among members of their faculty and introduced novel clinical practices that improve the quality and efficiency of patient care. The active engagement of IM CPUS fellows and faculty in research and curricular development has increased the academic output of the Section of Hospital Medicine. Although IM billing for CPUS is an area of continued exploration nationally, EM has had continually updated specialty coding and reimbursements in place since 2001.¹⁹ This allows a range of reimbursement options to be proactively considered by the Department of Internal Medicine and presents another potential avenue to justify administrative investment in US training. In addition, improvement of interdepartmental relationships, channels of communication, and collaboration are intrinsically beneficial and enhance professional relationships and morale within the institution as a whole. The combined IM/EM fellowship has accepted 3 IM fellows in 2018. One fellow will work clinically in the EDOU, whereas the other 2 will enter the hospitalist pathway outlined above.

Beyond addressing the need for CPUS training and capacity building within IM, the arrangement has had a variety of other beneficial effects. For the ED, the unique skill sets and interests of the IM fellows provide new depth and expertise to the clinical, academic, and research missions of the department. The ED Division of Ultrasound has also benefited by access to a large pool of potential fellowship applicants at a time when many ED US fellowships are struggling to fill positions. This program has provided an opportunity for multidisciplinary collaboration that extends the scope of CPUS research to practice settings outside the ED while increasing available providers for undergraduate medical education, resident teaching, international and global health US projects, development of a transesophageal US program, quality assurance, and increased involvement in professional societies. This program has

also benefitted the ED by raising its profile among other specialties and the sense of recognition in a field for which it has advocated for many years.

One of the most common concerns in discussions about creating a US fellowship track to address the needs of IM is ensuring a funding stream to support the fellows' salaries and educational costs. At this point, we have identified and used 3 pathways, although there are probably many more:

1. A US training program integrated into an existing ACGME-accredited IM fellowship. Although the fellow can partially offset the costs of the EM CPUS training by contributing to the ED in the form of work in departmental quality assurance, residency teaching, and research, these do not fully offset the costs of training and supervision, so a system to transfer funds from the fellow's primary department to the ED may be needed.
2. Use of the EDOU as a clinical environment in which reimbursements for the fellow's clinical service cover his or her salary and educational costs. As noted above, this provides a setting for the practice of hospital medicine in a location close to the ED that facilitates direct proctoring by the ED faculty. The funding mechanism for this position is identical to the funding model of the EM US fellows.
3. Working as a hospitalist in the Department of Medicine, where revenues generated by clinical service are used to support the fellow's salary and a stipend directly to the ED Division of CPUS (or whatever group is providing the resources and teaching for the fellowship curriculum).

As interest in advanced CPUS training grows among other specialties and subspecialties, these arrangements could serve as models in institutions where there is a well-established and vigorous EM US fellowship program. The EM training site should have experience in the practice and teaching of a wide spectrum of US applications, thereby being able to offer training for a range of more focused specialties. It should have a track record of autonomy in its use of US in the clinical setting as well as experience in administration, reimbursement, quality assurance, education, research, and both intra- and extra-institutional CPUS leadership. Table 1 summarizes several of the more commonly identified barriers and how they are addressed by our proposed solution.

Effectiveness

Although our EM/IM CPUS fellowship is still young, there have already been measurable successes. The IM subspecialty fellows have made numerous research presentations in national and international IM, nephrology, pulmonary, and critical care conferences.²⁰⁻²⁶ In our institution, the partnership has resulted in novel collaborations with hospital medicine, cardiology, radiology, and anesthesia. Faculty development for other divisions now has an increased pool of instructors, and the work of image review and quality assurance is divided among a larger pool. As noted, graduates have already found leadership positions in the field of IM US, and the current class is being recruited. With increasing use of US in every clinical practice domain

Table 1. Potential Barriers and Possible Solutions to a Combined EM/IM Collaborative CPUS Training Program

Barrier	Proposed Solution
Insufficient expert faculty for non-EM US	Formal partnership with existing emergency US fellowships for educational resources, clinical experience, infrastructure, and expert faculty
Imperfect overlap between emergency US techniques and applications and those of other specialties	Collaborative fellowship curriculum development with experienced EM faculty and non-EM faculty to tailor skill development and education to IM needs
Funding for non-ACGME fellows wishing to pursue a yearlong US fellowship	Creation of service lines to staff IM shifts (eg, difficult-to-fill hospitalist shifts and EDOU) with US fellows
Funding for US fellowship faculty to mentor an increased number of fellows	Financial transfer from service lines employing US fellows to support protected time for faculty of the US fellowship.
Limited CPUS research in many IM settings.	EM CPUS faculty and other specialties collaborate in designing and implementing CPUS research in IM
Lack of infrastructure for CPUS examinations outside the ED	Expertise in machine purchasing and management, quality assurance solutions, reimbursement, administrative issues, and educational resources shared as a part of a formal partnership

and the likelihood of widespread use of US at the bedside and point of care in the near future, the need for advanced CPUS training for general internists and IM subspecialties is likely to grow.

Costs

The primary costs of training are described above and are dominated by the educational and administrative time of the program leadership. Additional costs relating to equipment purchases will be site specific, although our experience is that US machines are increasingly common in both inpatient and outpatient units. During the development of this pathway, there was concern that formalizing this advanced training would be used as a barrier to CPUS use by non-fellowship-trained IM clinicians. In our experience, however, the opposite effect is observed, as the fellows serve as ambassadors and demonstrate the clinical utility of CPUS to faculty within their subspecialties. The incorporation of this CPUS into IM programs actually has the potential for hidden savings, as application of CPUS has been shown to decrease unnecessary imaging and complication rates from invasive procedures.^{27,28}

Alternatives

The collaborative arrangement described in this article is not possible in every institution, so it is important to explore other possible paths. One possibility is to incorporate CPUS into preexisting graduate medical education curricula instead of developing a separate fellowship. This potentially allows a more focused and specialized skill set to be developed, without requiring exposure to examinations and skills that might be outside the traditional scope of practice for a given specialty. For many programs, however, the primary barrier to this method is identifying a champion with the expertise required and protected time to develop that curriculum and monitor its implementation. Our experience is that this is the ideal role for a graduate of a CPUS fellowship, which imparts ability in educational methods and curricular development in addition to clinical US skill.

Another possibility is to adopt a watchful waiting strategy, as graduates from medical school enter residency with increasing levels of competence in CPUS.

Ultimately, this may lead to a generational shift as these trainees incorporate US into medical practice during residency. Although this default strategy is effectively being used across the country, it conflicts with most accepted tenets of postgraduate medical education by effectively abdicating the role of faculty in teaching optimal clinical practice. Most importantly, during the transitional generations, there is insufficient expert oversight for trainees making clinical decisions, resulting in vulnerability to misapplication or misinterpretation of US, which could cause clinical harm. Even after this vulnerable transition time, the experience in EM suggests that there will be a continued need for those with more advanced training in CPUS to be educators, administrators, scientists, and leaders within IM.

Two other IM CPUS fellowships exist and have already begun to produce leaders in the field.¹⁶ The University of South Carolina started their primary care ultrasound fellowship in 2011, with the stated aim of stimulating incorporation of point-of-care US across primary care specialty training. The second IM CPUS program started in 2016 at the Oregon Health and Science University. Following the EM CPUS fellowship model, these programs use a combination of didactics and hands-on scanning, including opportunities for supervised scanning with EM faculty. The Oregon Health and Science University and University of South Carolina fellowships, however, are independent entities from the EM US fellowships in their respective institutions, in contrast to the combined fellowship described here. The relative advantages to an independent fellowship include the opportunity to more directly focus on the needs of primary care physicians and hospitalists. The drawback, as previously noted, is the requirement of the availability of sufficient CPUS faculty within the specialty. This was one of the original drivers for the combined EM/IM fellowship within our institution. Furthermore, the established research and educational infrastructure of the EM US fellowship became immediately incorporated into the new IM fellowship without the time required to build local IM expertise.

Conclusions

There is a clear need to train the next generation of practitioners and leaders in CPUS for IM and the

medicine subspecialties. Although not currently a required part of the ACGME competency guidelines for IM residency, CPUS is clearly becoming more heavily integrated into IM clinical practice globally. The American Board of Medical Specialties has announced that CPUS will likely be granted status as a designated focused practice, which will likely require experts to provide assessments and education for trainees from multiple specialties seeking that designated focused practice. Starting in 2018, most of the EM CPUS fellowships are enrolled in the national residency match program, which provides a mechanism for matching IM applicants to available positions. Underlying the formation of the program described in this article is the belief that the expertise and mechanisms that have been developed in the specialty of EM will be broadly applicable in the training of future leaders of CPUS in other specialties. Although only in its third year, it appears that this model can provide an educational pathway that is of the highest standards while providing a flexible, personalized, and rewarding experience. Three possible funding pathways for IM fellows have been identified. There may be other alternative methods to deliver training for IM and other specialties. It is to be seen whether this model will be feasible and effective in other institutions.

References

- Mateer J, Plummer D, Heller M, et al. Model curriculum for physician training in emergency ultrasonography. *Ann Emerg Med* 1994; 23:95–102.
- 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–S36.
- Emergency Ultrasound Fellowships. EUS fellowship programs. Emergency Ultrasound Fellowships website. <http://www.eusfellowships.com/programs.php>. Accessed April 14, 2018.
- Moak JH, Gaspari RJ, Raio CC, Hart KW, Lindsell CJ. Motivations, job procurement, and job satisfaction among current and former ultrasound fellows. *Acad Emerg Med* 2010; 17:644–648.
- Bahner DP, Goldman E, Way D, Royall NA, Liu YT. The state of ultrasound education in US medical schools: results of a national survey. *Acad Med* 2014; 89:1681–1686.
- Strony R, Marin JR, Bailitz J, et al. Systemwide clinical ultrasound program development: an expert consensus model. *West J Emerg Med* 2018; 19:649–653.
- Brown SM, Sekiguchi H, Pinsky MR. A new era in critical care ultrasound: professionalization. *Ann Am Thorac Soc* 2017; 14:1747–1749.
- Ma IW, Arishenkoff S, Wiseman J, et al. Internal medicine point-of-care ultrasound curriculum: consensus recommendations from the Canadian Internal Medicine Ultrasound (CIMUS) Group. *J Gen Intern Med* 2017; 32:1052–1057.
- Soni NJ, Tiemey DM, Jensen TP, Lucas BP. Certification of point-of-care ultrasound competency. *J Hosp Med* 2017; 12:775–776.
- Niyyar VD, O'Neill WC. Point-of-care ultrasound in the practice of nephrology. *Kidney Int* 2018; 93:1052–1059.
- Möller I, Janta I, Backhaus M, et al. The 2017 EULAR standardised procedures for ultrasound imaging in rheumatology. *Ann Rheum Dis* 2017; 76:1974–1979.
- Lewis K, McConnell M, Azzam K. A systematic needs assessment for point of care ultrasound in internal medicine residency training programs. *Can J Gen Intern Med* 2017; 12. <https://doi.org/10.22374/cjgim.v12i2.178>.
- Maw A, Jalali C, Jannat-Khah D, et al. Faculty development in point of care ultrasound for internists. *Med Educ Online* 2016; 21:33287.
- Eisen LA, Leung S, Gallagher AE, Kvetan V. Barriers to ultrasound training in critical care medicine fellowships: a survey of program directors. *Crit Care Med* 2010; 38:1978–1983.
- American College of Physicians. ACP statement on point-of-care ultrasound in internal medicine. American College of Physicians website. <https://www.acponline.org/meetings-courses/focused-topics/point-of-care-ultrasound-pocus-for-internal-medicine/acp-statement-in-support-of-point-of-care-ultrasound-in-internal-medicine>. Accessed October 1, 2018.
- Barron KR, Wagner MS, Hunt PS, et al. A primary care ultrasound fellowship: training for clinical practice and future educators [published online ahead of print September 4, 2018]. *J Ultrasound Med*. doi:<https://doi.org/10.1002/jum.14772>.
- Lewis RE, Tayal VS, Hoffmann B, et al. The core content of clinical ultrasonography fellowship training. *Acad Emerg Med* 2014; 21:456–461.
- Arneson TJ, Liu J, Qiu Y, Gilbertson DT, Foley RN, Collins AJ. Hospital treatment for fluid overload in the Medicare hemodialysis population. *Clin J Am Soc Nephrol* 2010; 5:1054–1063.
- American College of Emergency Physicians. Emergency ultrasound coding and reimbursement. Emergency Ultrasound Teaching website. http://emergencyultrasoundteaching.com/assets/us_coding.pdf. Accessed October 24, 2018.
- Baston C, Anderson B, Reilly J, et al. A retrospective study of the effect of emergency medicine clinician performed ultrasound on

- clinical outcomes in critically ill patients with sepsis [abstract]. In: *D42 Critical Care: Blinded by the Light—Imaging in Critical Care*. New York, NY: American Thoracic Society; 2018:A6814-A.
21. Baston C, Harmon E, Chan W, Panebianco N, Bellini L. A novel clinician-performed ultrasound curriculum for internal medicine residents [abstract]. In: *D41 Critical Care: Learning to Fly—Innovations in Education*. New York, NY: American Thoracic Society; 2018:A6789-A.
 22. Wallace P, Matthias I. General internists in pursuit of diagnostic excellence. *J Gen Intern Med* 2018; 33:2025.
 23. Wallace PJ. What's next for acute heart failure research: a call for multidisciplinary collaborations [published online ahead of print March 5, 2018]. *Acad Emerg Med*. doi:<https://doi.org/10.1111/acem.13402>.
 24. Yarmey E, Brown J, Shofer F, Dean AJ, Panebianco N. Comparison of indicators of fluid overload in hemodialysis patients. Paper presented at: American Society of Nephrology Kidney Week; October 2018; San Diego, CA.
 25. Reisinger NC, Mazumder P, Yarmey E, Shofer F, Dean AJ, Panebianco N. B-line score is predictive of repeat acute care utilization in hemodialysis patients. Paper presented at: American Society of Nephrology Kidney Week; October 2018; San Diego, CA.
 26. Mazumder P, Baston C, Panebianco N, Dean AJ, Reisinger NC. Rapid bedside assessment of diastolic function in hemodialysis patients. Paper presented at: American Society of Nephrology Kidney Week; October 2018; San Diego, CA.
 27. Zieleskiewicz L, Cornesse A, Hammad E, et al. Implementation of lung ultrasound in polyvalent intensive care unit: impact on irradiation and medical cost. *Anaesth Crit Care Pain Med* 2015; 34:41–44.
 28. Mercaldi CJ, Lanes SF. Ultrasound guidance decreases complications and improves the cost of care among patients undergoing thoracentesis and paracentesis. *Chest* 2013; 143:532–538.