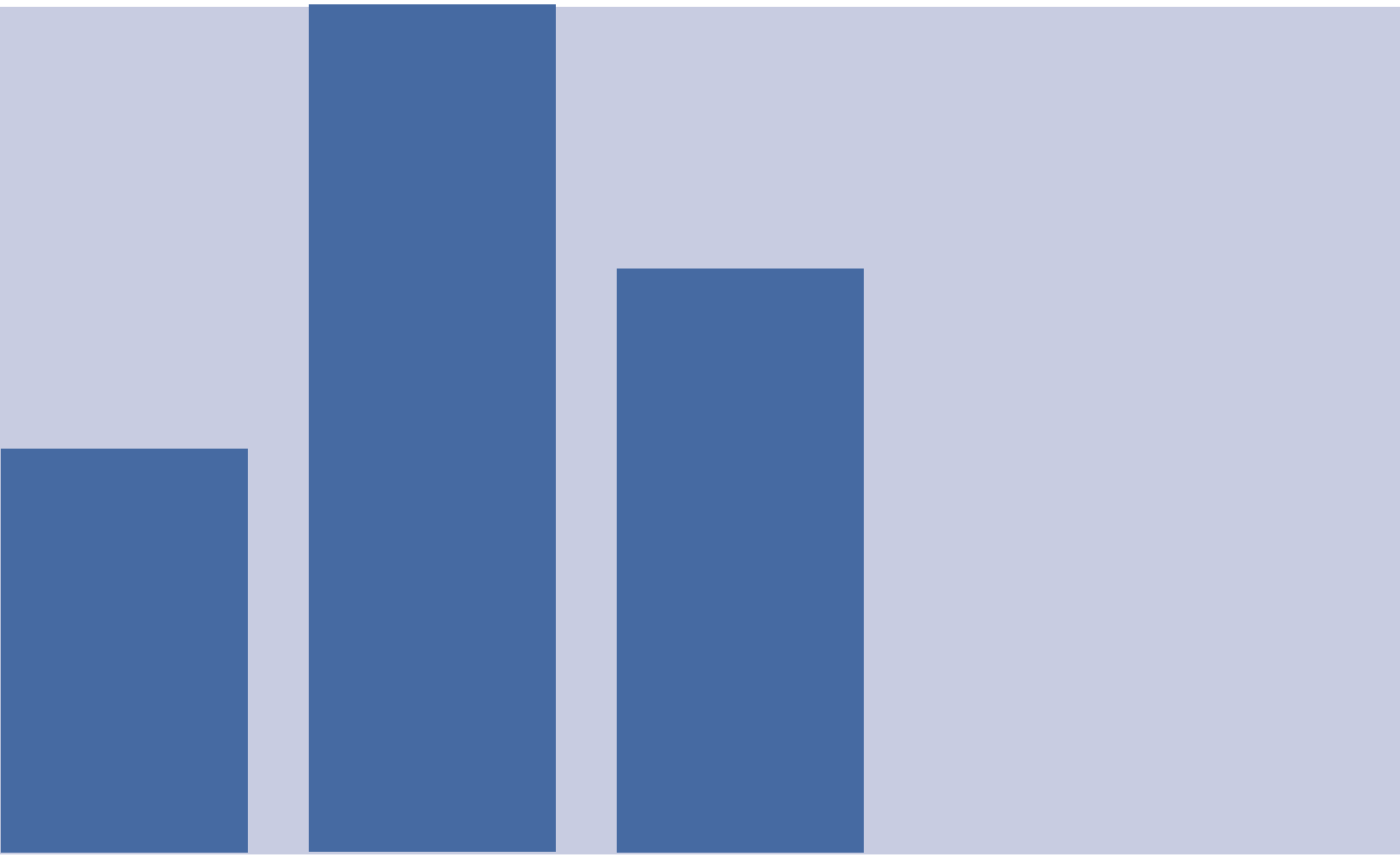
The Academy
The Health Management Academy

CASE STUDY SERIES:

A FOUNDATION FOR INNOVATION

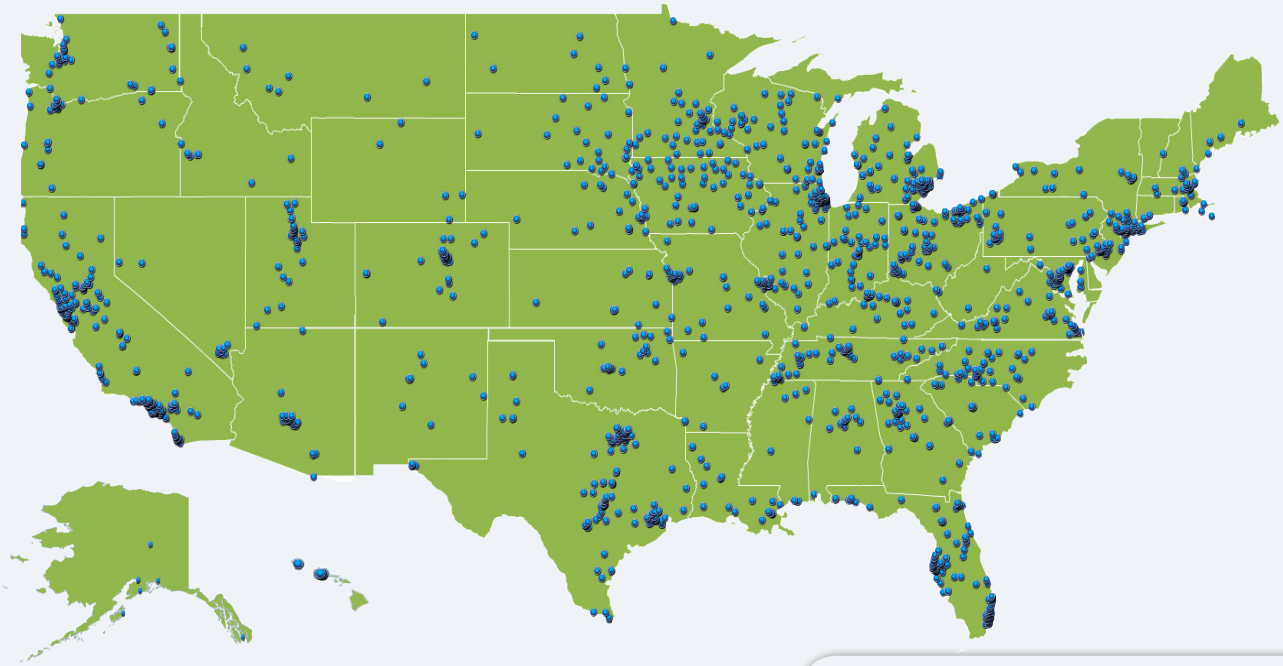
The Continuous Training Model for Point-of-Care Ultrasound



Impact & Reach of The Academy Members

The Academy member health systems have evolved through consolidation and organic growth during the lifespan of The Academy. In most cases, they are the private sector leaders in their communities by developing fully integrated, population-based services. We have taken seriously our mission of assisting executives to build successful enterprises, which has led to the variety of services that now comprise The Academy.

1600+ Hospitals and Counting



Did You Know?

The Academy Top-100 Health Systems Represent:

- 65% Net Patient Revenue
- 67% Inpatient Visits
- 40% ER Encounters
- 46% Outpatient Visits
- 44% Healthcare Employees
- 44% Employed Physicians
- 4% GDP

> "As pace of change in the healthcare industry increases, the value of learning from the best educators and your peers becomes more critical."
>
> – James H. Skogsbergh
> President & CEO, Advocate Health Care

Contents

The Academy Case Study Series

The Academy Case Study Series is designed to highlight the challenges and opportunities of Leading Health Systems. The cases, developed by The Academy researchers, present actual activities and events from Leading Health Systems that assist in The Academy's peer learning programs, including Executive Forums, Collaboratives, Fellowship Programs, and the Physician Leadership Program.

Authors

Sanjula Jain
Project Director
The Health Management Academy

James (Jay) Flounlacker, M.B.A.
Senior Vice President
The Health Management Academy

Charles M. Watts, M.D.
Former SVP of Medical Affairs & Chief Medical Officer
Northwestern Memorial Healthcare
Executive-in-Residence, The Health Management Academy

Acknowledgments

The Health Management Academy extends its appreciation to FUJIFILM SonoSite for providing the funding for this Case Study.

The Innovation Case Study Series

Accelerating the adoption of innovative technologies in today's multi-hospital health systems has become a greater priority as technology advancements, regulatory changes, payment transitions and clinical restructuring transform healthcare in increasingly rapid cycles. Through a five-part case study series, we use the example of point-of-care ultrasound, a potentially disruptive, yet adaptable imaging technology, to explore the stages of adoption from organic growth through facilitating innovation. Point-of-care ultrasound has been documented to improve quality, patient benefit, and cost efficiency which make it an ideal technology from which to study and learn.

Introduction

Case Study Overview: Training As a Foundation For Innovation

Point-of-care ultrasound is a novel clinical diagnostic and treatment tool with rapidly growing acceptance. Practicing physicians, whether in the clinic or hospital, may not have had training opportunities sufficient to be fully proficient with the technology and gain maximal value from its potential. Given the clinical and cost benefits, a robust ultrasound training curriculum covering medical school, residency, fellowship and practice is indicated. By providing point-of-care ultrasound education as part of its adoption strategy, health systems can effectively accelerate adoption, overcome potential disruption, and reduce the lag time between initial pilots and widespread diffusion.

Study Purpose

The purpose of this case study is to offer a strategy for more rapid adoption of ultrasound technology through an education and training program beginning in medical school and extending through current clinical practice, with implications for other medical innovations.

Study Approach

The educational framework outlined in this case study was developed through interviews with practicing physicians and medical school faculty on the adoption of point-of-care ultrasound technology. A comparative analysis of clinician and health system bedside ultrasound training programs was conducted at Allina Health, Banner Health, Cedars-Sinai Medical Center, University of California Irvine School of Medicine, University of California Los Angeles, and University of Southern California-Los Angeles County.

Innovation in Healthcare – An Emerging Essential

The Transforming Environment

Multi-hospital integrated health systems are facing an evolving set of opportunities and challenges as the healthcare industry undergoes substantial transformation. Major transitions include:[1] providing more services for less reimbursement, decreasing the variation of care and increasing efficiency, and transitioning from a volume to value-based payment system.

> "Development of continuously learning health systems in which science, informatics, incentives, and culture are aligned for continuous improvement and innovation … with best practices seamlessly embedded in the care process and new knowledge captured is an integral by-product of the care experience."
> – Institute of Medicine, 2012 Report

As care delivery continues to transform, health systems are challenged to ensure that innovation is continuously identified, adopted and reinvented.[2,3]

The Innovation Learning Curve

An innovation can be an idea, a practice or an object (e.g., technology, device, or drug) that is perceived as new by an individual or group, in this case practicing clinicians and health systems. Incorporation of new innovation into practice

currently averages 17 years.[2] However, the pace of technological advancements in today's dynamic healthcare environment requires a more rapid approach to adoption and diffusion of innovations.

The potential for a health system to accelerate adoption is contingent on its capability to embrace innovation and move as quickly as possible to facilitation.[4] Knowledge dissemination lies at the core of any innovation adoption process. Using PoCUS as an example, by providing high-quality, targeted education during the implementation process, health systems can effectively overcome disruption and reduce the lag time between the identification of PoCUS' potential and its implementation.

Growth of Point-Of-Care Ultrasound

Point-of-care ultrasound (PoCUS) technology is a safe and effective form of mobile imaging defined as "ultrasonography brought to the patient and performed by the provider in real time."[5] The time to action is immediate, with improved early diagnosis and treatment, fewer complications when used for procedure guidance, decreased length of stay, substitution of ultrasound for other imaging forms, and reduced cost of care.[6-9]

The use of ultrasound has grown considerably in recent years, complementing clinical care in specialties beyond emergency medicine and cardiology. The introduction and initial growth of portable ultrasound in a health system frequently is organic, person to person, limited to a single or narrow application beginning in a hospital unit.[4] Although slow and deliberate, this early organic growth and diffusion results in validation of the use of PoCUS, creates local champions, and sets the stage for more rapid spread of use and divergence of the settings in which it is useful.

Our research shows that PoCUS can disrupt existing business models and clinical processes although a centralized approach, including an organized training program, from the health system corporate office has been found to be effective in balancing disruption.[4,10] Our analysis highlights a substantial opportunity for health systems to invest in organized multi-tiered training and education programs to support sustainable innovation adoption.[12-14]

The Continuous Training Model

As PoCUS increasingly penetrates clinical practice, there is an unmet need for high-quality education that integrates skill sets in both image acquisition and interpretation.[11] The positive effect that ultrasound technology has on care delivery emphasizes the need for early and continuous education for clinicians to gain the most value from the technology and to minimize the innovation learning curve.

The rate at which PoCUS is proliferating will likely outpace training of adequate numbers of qualified users if clinical education does not evolve fast enough.[12] Through a comparative analysis, this case study provides health systems with development strategies for customizable training programs. Health systems which support training from medical school to residency and fellowship through current practice, will be better positioned for its clinicians to gain the most value from PoCUS technology, while simultaneously reducing the lag time between adoption and implementation.

> "The ultimate disruptive change is that currently many medical student graduates will begin residencies with a skillset in PoCUS, but will be practicing in hospitals where they are more experienced than the faculty. We desperately need to evolve the clinical education model to incorporate ultrasound training starting from medical school through continuing education as practicing clinicians if we want to ensure the highest quality patient care."
>
> – Dr. Chris Fox, Director of Ultrasound in Medical Education, UC Irvine School of Medicine

I. UC Irvine – the Medical School "Jump Start"

The University of California Irvine School of Medicine (UCI) is one of the first medical schools[15] to develop a teaching approach for early integration of ultrasonography within the traditional, 4-year medical school curriculum.

UCI's program, led by Dr. Chris Fox, Director of Ultrasound in Medical Education, creatively fosters active, continuous learning of the technology throughout all four years of medical school. Year one provides exposure to the basics,

understanding the physics, depth, frequency and operation of the device in parallel to the clinical introduction to anatomy and physiology.

Concurrent with exposure to organ visualization and technical familiarity, second year students are presented with a series of pathological cases, such as gallstones and ectopic pregnancies, requiring hands-on application with PoCUS to gain familiarity with the range of pathology presentations. In years three and four, students have the opportunity to use ultrasound during clinicals and enroll in an optional elective course for more focused training in a specialty of their choice.

As medical schools strive to keep pace with the transforming demands of clinical practice, PoCUS training is an opportunity for them to incorporate new, relevant experiences into the undergraduate curriculum. UCI's commitment to ultrasound education through its formal, rigorous curriculum (Appendix A) provides students an upper hand as they transition to residency.

Strategies for Medical School Integration

From the first 4-year program, spearheaded by the University of South Carolina School Of Medicine in 2006 to 2014, 11 medical schools (Appendix B) are offering ultrasound training. Establishment of PoCUS training in medical school requires "training the trainers" and wedging additional topics into the existing tightly-scheduled curriculum. Three guidelines have emerged from existing medical school programs:

- **Start small** – Successful programs have initially considered PoCUS an adjunct to the traditional teaching of existing courses such as human anatomy and medical physiology. Once training is established, the program will expand as faculty assess the benefits.
- **Faculty champions** – A core group of PoCUS faculty champions with requisite experience are needed to provide students real-time training. This may require recruiting clinicians (e.g., radiologists and obstetricians) outside of the medical school.
- **Experiential learning** – Ultrasound is a spatial medium that requires hands-on learning and practice to grasp. Supplementary to didactic lectures, the more successful programs include a variety of scanning opportunities for students on mock and live patients in both formal and informal settings.

UCI Champions Experiential Learning

In addition to receiving regular instruction on PoCUS and having access to ultrasound machines to work through the curriculum, UCI medical students can also practice scanning with systems in workshops and informally in the student lounges. The pillar of the program is in its active training pioneered by Dr. Fox that generates enthusiasm and fosters peer-to-peer instruction.

Ultrafest: A music-filled, outdoor symposium for medical students throughout California that provides hands-on workshops and interactive "sonogames". Students practice scanning each other while competing for time and accuracy.

The medical school "jump start" generates greater knowledge and comfort with PoCUS, reducing "the intimidation factor" that first year residents may experience, according to Dr. Liz Turner, Director of Bedside Ultrasound in Pulmonary and Critical Care at University of California-Los Angeles (UCLA).

II. Allina Health and LAC+USC – Specialty Training in Graduate Education

Allina Health – Industry-Leading IMBUS Residency Program

PoCUS, as a procedural and diagnostic tool, is rapidly expanding from early-use medical specialties (e.g., anesthesia, obstetrics, critical care, emergency medicine, and cardiology) to broader specialties such as primary care. This expansion echoes the American Medical Association's decision that "ultrasonography should be integrated into the practice of well-trained non-radiologist physicians."[16]

As of yet, there is no standardization of ultrasound training among specialties. However, an ideal foundation for residents will have been provided in medical school which bridges the anatomy visualization basics learned in medical school with clinical case management in residency. The current "see one, do one, teach one" educational model falls short of preparing residents for complete and confident use of PoCUS in their practice.[17]

> "Completing PoCUS bootcamp is the equivalent of getting your learners permit. To become fully proficient, it requires proctored practice to develop the skill."
> – Dr. Terry Rosborough, Director of Medical Education, Abbott Northwestern Hospital, Allina Health

As one of the only internal medicine residencies in the nation to integrate ultrasound education into its training program, Allina Health's Internal Medicine Bedside Ultrasound (IMBUS) Program equips residents with a comprehensive PoCUS skillset through its 3-year curriculum (Appendix C). Residents begin with an intensive 1-week bootcamp with a 50-50 split of didactic and hands-on instruction. Students engage in weekly CODE simulations to run through 30 different clinical scenarios. A 4-week procedure rotation is built in for residents to learn how to perform focused procedures (e.g. central lines) often requiring the use of bedside ultrasound as part of Abbott Northwestern Hospital's procedure team.

As a result of the structured training facilitated through IMBUS, faculty leaders believe that outcomes have improved and the number of proficient faculty and residents has grown.[17] The IMBUS framework, initially intended only for internal medicine residents, is being introduced health system-wide and to a broad range of specialty residents. Based in part on the growing pool of trained residents and faculty, Allina is expanding PoCUS to new clinical departments and applications, such as telehealth outreach sites.[10]

LAC+USC – Advanced Specialization in Fellowship

Appendix D lists select residency and fellowship programs that require ultrasound education. The variation in residency requirements and training programs has contributed to a gap in resident PoCUS proficiency[18] that is being closed by University of Southern California-Los Angeles County (LAC+USC).

LAC+USC offers a 1-year PoCUS fellowship program (Appendix E) focused on scanning technique and clinical integration of the technology. Under the mentorship of Dr. Dina Seif, Emergency Medicine Fellows participate in "scan shifts" each month in which they perform multiple ultrasound scans in a number of applications. The collected videos provide the basis for weekly ultrasound review sessions integrated with journal article discussions.

Fellows integrate clinical cases with evidence-based practices to discuss the pros and cons of scanning protocols for specific pathologies, common pitfalls in less common conditions, clinical indicators and patient engagement strategies enhancing patient workups.

Strategies for Residency and Fellowship Integration

As PoCUS usage continues to expand across specialties, health systems that currently offer bedside ultrasound training will increasingly adapt their educational approach to keep pace with evolving expected competencies. To prepare for the influx of first year residents with prior exposure to PoCUS from medical school, health systems should consider:

> "We need to have a system in place to support PoCUS learners with more faculty, archiving infrastructure, equipment, clinical protocols, and everything in between."
> – Dr. Liz Turner, Director of Bedside Ultrasound in Pulmonary and Critical Care, UCLA

- **Leveraging trained residents & fellows** – The success of a training program relies on the competencies of its trainers. Given the shortage of PoCUS trainers, organizations will have the opportunity to leverage trained residents and fellows for peer-based instruction using communication tools such as on-call systems.
- **Supporting infrastructure –** To augment a program's faculty core and educators, health systems will need supporting infrastructure such as clinical simulation laboratories, patient "phantoms" for scanning practice, a formal curriculum, basic equipment needs, and a picture archiving and communication system.
- **Departmental curriculum** – The corporate level of a health system can provide support to clinical departments, such as a simulation laboratory, which will encourage the clinical departments to develop specialty protocols and requirements.

III. Banner Health and Cedars-Sinai – Training for Practicing Clinicians

Increasing PoCUS utilization highlights the need to ensure that practicing clinicians are properly trained in ultrasound for effective incorporation into patient care. Practicing physicians, nurses, or other health care providers not previously exposed to or trained in ultrasonography can easily acquire the training and education needed for very focused and limited uses. Probably the most common application is ultrasound procedure guidance such as vascular access for central line insertion or other needle-based intervention.

Training for a limited or focused use can generally be accomplished with a 1-3 day course which could be provided internally by hands-on mentoring in a hospital-based simulation center, or through external accredited courses. Clinical simulation training has become very sophisticated, with a large number of physical models and computer-based simulators that allow the trainee to experience and master image capture and interpretation before advancing to directly supervised use with patients. Often experienced clinicians are reluctant to acquire a new technical skill or approach, so the training should be convenient, thorough, and provide the necessary education to allow for immediate skillful application.[13,19]

Banner Health – Simulation-Based Model for Practitioners

Banner Health takes advantage of extensive simulation training facilities to provide the necessary education for providers performing vascular access, and for residents and attending physicians for image capture and interpretation regarding specific diagnostic and treatment protocols. Banner Health recognized early on that "when something is new and innovative, by definition there is nothing else out there like it. Therefore, you have to account for skill transference and behavioral changes" particularly amongst seasoned clinicians according to Dr. Mark Smith, System Director of Simulation and Innovation.

> "If something is truly innovative, you have to address building education for it."
> – Dr. Mark Smith, Director of Simulation and Innovation, Banner Health

Presented with the challenge of rapidly creating ultrasound competency and overcoming potential clinician resistance in its system-wide adoption of PoCUS,[4] Banner Health co-developed a training program with its internal physician-led Simulation Center and PoCUS supplier's technical curriculum. Through a combination of prescriptive training videos and physician-proctored scanning practice, Banner Health has built an expert training force of educators and service-line specific curriculum.

Cedars-Sinai – Vascular Access Training for Nurses

At Cedars-Sinai Medical Center, the Emergency Department has significantly improved throughput and patient outcomes with the addition of an ultrasound training program specific to the nursing staff. [20] "Teaching our nurses how to use PoCUS for vascular access in high acuity and "difficult stick" patients, has significantly cut our costs from reduced length of stay to fewer instances of infection," according to Cedars-Sinai RN Clinical Educator, Phil Booth.

> "Teaching our nurses how to use PoCUS for vascular access in high acuity and "difficult stick" patients, has significantly cut our costs from reduced length of stay to fewer instances of infection."
> – Phil Booth, RN Clinical Educator, Cedars-Sinai

The Cedars-Sinai training program is a short four-hour course with hands-on simulated practice designed exclusively for the nursing department. The curriculum developers factored in functionality needs resulting in the selection of PoCUS machines with probes for vascular access, which are different than the machines used by Cedars-Sinai physicians. After five proctored sticks nurses are certified, making it convenient for rapid ultrasound skill set diffusion. Cedars-Sinai continues to track its outcomes to better adapt and develop training programs for other focused applications throughout the medical center.

Strategies for Clinical Practice Integration

Training of practicing clinicians with the pressure of a busy practice is inherently more challenging than resident education,

according to physicians who we interviewed. Training clinicians is becoming less time consuming and more intuitive with the accelerating miniaturization and digitization of PoCUS technology.[13,14,17,18] Educational best practices for practicing clinicians include:

- **Value proposition** – The value to the provider in terms of time savings and quality of care should be clearly and regularly communicated. Evidentiary support from internal studies (e.g. IMBUS-PCI Study at Allina Health) can be an asset to gain support.
- **Expand protocols** – Clinical protocols that are adapted to include PoCUS use will accelerate interest of practitioners in training.
- **Health system engagement –** Designation of a Chief Ultrasound Officer as in the case of UC Irvine, or development of a novel "Pump and Tank" sepsis protocol by Banner Health's Care Management Council[4] show the practitioner that the health system is fully supportive of training.

Health System Training Integration

The continuous training framework presented for ultrasound technology is a complement to the current clinical educational model. PoCUS has been shown to have rapid uptake in basic skills and understanding with proper training, making the integration of this technology into a health system more feasible than other innovations that require entirely new training infrastructure.

Health systems can look to their ultrasound manufacturer as a starting point for suggested curricula and infrastructure guidance for entry-level training, and options for specialized training (e.g., central line insertion).

Coordination

As PoCUS education programs gradually proliferate through the health system, logistics between departments such as equipment acquisition and shared use will need to be addressed. Beyond clinical integration, decisions such as whether physicians should be allowed to bill for these procedures involves coordination between the organization's finance, operations and clinical leadership.

Credentialing and Privileging

Health systems should guide each clinical department to determine its own privileging criteria in consultation with corresponding professional society guidelines, particularly for procedure-specific requirements, as a template.

Often, credentialing and privileging is specific to each health system, and the challenge is transferability between institutions. At the residency and fellowship levels, PoCUS training certification grants a practicing physician privileging rights at all institutions as the skills are integrated within a resident or fellow's overall clinical training. For current practice, privileging is local to the health system (e.g., Banner Simulation Center PoCUS course only grants permission to perform ultrasound-guided lines within the Banner Health System Network).

As PoCUS training and curricula continue to mature, health systems will have increased options to provide education across the learning continuum from medical school, residency, and fellowship through clinical practice.

Lessons Learned

- As the value of PoCUS becomes increasingly known, a comprehensive training model is indicated.
- Training for PoCUS is evolving to include medical school, residency, fellowship and clinical practice.
- Medical school ultrasound training provides a lifelong "jump start" for clinicians.
- Health systems can increase patient care benefits by providing infrastructure such as PoCUS-specific training curricula, protocols and developing faculty champions.
- Continuous training offers health systems a strategy to overcome barriers to innovation adoption.

Discussion Questions

How can health systems encourage medical schools to include PoCUS training in the curriculum?

What is the best way to encourage graduate education courses to include PoCUS training in residency and fellowship?

How can a health system most efficiently develop a core group of PoCUS trainers?

Does your health system have a process that will expand clinical protocols to include PoCUS use?

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Suggested Reading

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Appendix A: UC Irvine Medical Education Curriculum

YEAR 1	YEAR 2	YEAR 3	YEAR 4
CLINICAL FOUNDATIONS I	**CLINICAL FOUNDATIONS II**	**CLERKSHIP-FOCUSED TRAINING**	**SPECIALTY-SPECIFIC ELECTIVE**
■ KNOBOLOGY ■ CARDIOVASCULAR ■ GI PHYSIOLOGY ■ RESPIRATORY ■ MUSCULOSKELETAL ■ GENITOURINARY ■ HEAD & NECK	■ SCANATHON PRACTICE ■ USING ULTRASOUND IN FEVER EVALUATION ■ FOCUSED ASSESSMENT OF THORACIC EXAM ■ LUNG ULTRASOUND ■ GASTROINTESTINAL & GENITOURINARY ULTRASOUND ■ CUMULATIVE SKILLS	■ GENERAL SURGERY ■ UROLOGY ■ VASCULAR SURGERY ■ ENT ■ INTERNAL MEDICINE WARD ■ MICU ■ GERIATRIC MEDICINE ■ FAMILY MEDICINE ■ PEDIATRICS ■ OBSTETRICS/GYNECOLOGY	

Visit http://www.ultrasound.uci.edu/curriculum.asp for curriculum details.
Source: UC Irvine Ultrasound in Medical Education Curriculum. 2014.

Appendix B: Medical Schools with 4-Year Ultrasound Curricula

- Eastern Virginia Medical School
- Hofstra North Shore-LIJ School of Medicine – Hofstra University
- Mount Sinai School of Medicine
- Loma Linda University School of Medicine
- Ohio State University College of Medicine
- Texas Tech University Health Sciences Center School of Medicine
- Uniformed Services University of the Health Sciences F. Edward Hébert School of Medicine
- University of California Irvine School of Medicine
- University of South Carolina School of Medicine
- Wayne State University School of Medicine
- West Virginia University School of Medicine

Source: American Institute of Ultrasound in Medicine & Dr. Richard Hoppmann, Founder of Society of Ultrasound in Medical Education. 2014.

Appendix C: Abbott Northwestern IMBUS Program Curriculum

Basics of Ultrasound

- Physics, Artifacts, Bioeffects
- Machine mechanics and knobology
- Bedside ultrasound mechanics in a patient room
- Patient discussion & consent
- Draping of male/female patients
- Image annotation
- Integrative approach to clinical decision making at the bedside

Pulmonary Ultrasound

- Pleural ultrasound: A-lines, lung sliding, pneumothorax, pleural effusion
- Interstitial syndromes: B-lines

Cardiovascular Ultrasound

- Windows: Parasternal long/short axis, Apical 4/5, LA & 2 chamber, Subxyphoid 4-chamber & short axis
- Pericardial assessment
- LV/RV function assessment
- Semi-quantitative assessment of clinically significant valvular dysfunction
- Assessment of diastology & dysfunction*
- Qualitative assessment of chamber size & overload
- Semi-quantitative assessment of volume status & fluid responsiveness
- Assessment of aorta for aneurysm*
- Vascular 2-point DVT screening*

Abdominal Ultrasound

- Urinary
- Renal evaluation for hydronephrosis
- Kidney findings in chronic kidney disease
- Bladder assessment
- Hepatobiliary
- Hepatomegaly assessment
- Findings in cirrhosis
- Gallbladder & CBD assessment*
- Assessment for splenomegaly
- Peritoneal free fluid evaluation
- Bowel
- Ileus & small bowel obstruction assessment
- Inflammatory bowel states assessment*

Soft Tissue Ultrasound

- Lymphadenopathy
- Cellulitis & abscess

HEENT Ultrasound

- Thyroid*
- Ocular*
- Sinus*
- ICP assessment with optic nerve sheath measurements*
- Real-time intubation guidance & confirmation

Musculoskeletal Ultrasound

- Assessment of the symptomatic joint, bursa, tendon/ligament*

Procedural Ultrasound

- Central & peripheral venous/arterial line placement
- Thoracentesis
- Lumbar puncture
- Paracentesis
- Abscess I&D
- Endotracheal tube placement verification
- Central venous line placement verification
- Joint, soft tissue, and bursa injections

*advanced topic

Source: Dr. David Tierney, Director of IMBUS – Internal Medicine Residency Program & Center for Clinical Simulation, Abbott Northwestern Hospital

Appendix D: Select Graduate Education Programs Featuring Ultrasound

SPECIALTY	TRAINING		ACGME GUIDELINES
	REQUIRED	EMERGING	
ANESTHESIOLOGY			Recommended assessment of skills in ultrasound-guided regional anesthesia; use of ultrasound for placement of invasive catheters, and general use of ultrasound in case management.
CARDIOLOGY			Fellows must demonstrate competence in intravascular ultrasound.
EMERGENCY MEDICINE			Residents must use ultrasound for the bedside diagnostic evaluation of emergency medical conditions and diagnoses, resuscitation of the acutely ill or injured patient, and procedural guidance.
INTERNAL MEDICINE			Residency training institutions must ensure availability of services such as ultrasound for case management. Internal medicine is the precursor to specialties such as cardiology that require specialized ultrasound training.
PHYSICAL MEDICINE/ REHABILITATION			Residents must have progressive responsibility in managing patients with competency in use of musculoskeletal ultrasound.
PULMONARY AND CRITICAL CARE			Fellows must demonstrate knowledge of imaging techniques employed in evaluation of patients with pulmonary disease or critical illness, including use of ultrasound; use of ultrasound techniques to perform thoracentesis and place intravascular and intracavitary tubes and catheters.
THORACIC SURGERY			Residents must be able to interpret appropriate imaging studies (e.g., ultrasound, etc.); have minimum operative experience in endoscopic ultrasound.
UROLOGY			Recommended assessment of ultrasound-guided interventions (e.g., biopsy, prostatic nerve block), interpretation of organ ultrasounds (e.g., kidney, bladder).

*ACGME: Accreditation Council for Graduate Medical Education
Source: ACGME Program Requirements; The Health Management Academy 2014.

Appendix E: LAC+USC Emergency Ultrasound Residency & Fellowship

Emergency Ultrasound Residency Curriculum:

Residents will become experts in the following emergency ultrasound applications through the experience of performing multiple exams under direct supervision.

Topics Covered:

- Trauma Ultrasound
- OB/GYN
- Emergency Echocardiography
- Abdominal Aortic Aneurysms
- Hepatobiliary
- Genitourinary
- Vascular Ultrasound
- Thoracentesis, Paracentesis and Lumbar Puncture
- Foreign Body Detection
- Cellulitis and Abscess
- Deep Venous Thrombosis
- Musculoskeletal
- Ocular Ultrasound
- Rapid Ultrasound in Shock (RUSH Exam)
- Pediatric Applications
- Other Advanced Applications

Emergency Ultrasound Fellowship:

Fellows receive intensive advanced instruction in emergency ultrasound over the one-year program. The fellow has specialized scan shifts each month in which they perform multiple ultrasound scans in a number of applications, together with the ultrasound faculty. The collected videos then provide the basis for weekly Thursday ultrasound review sessions. Fellows have multiple opportunities for advanced work in many areas of ultrasound; teaching, research, learning how to coordinate local and national conferences, mastering the many facets of running an ultrasound program and achievement of the RDMS (registered diagnostic medical sonographer) degree.

Visit http://keck.usc.edu/Education/Academic_Department_and_Divisions/Department_of_Emergency_Medicine/Ultrasound.aspx for curriculum details.

Source: Keck School of Medicine of USC, Department of Emergency Medicine, Ultrasound Education. 2014.

About The Academy

The Academy provides unique, executive peer learning, complemented with rigorous and highly targeted research and advisory services to executives of Top-100 health systems. These services enable health system and industry members to cultivate the relationships, perspective, and knowledge not found anywhere else.

The Academy has created the first and only knowledge network exclusively focused on Top-100 health systems. This learning model is based on a proven approach refined over 16 years working side-by-side with members.

The Academy Member Health Systems

Company	CEO Forum	CFO Forum	CHRO Forum	CIO Forum	CMIO Forum	CMO Forum	CNIO Forum	CNO Forum	CSO Forum	GRO Forum	ONC Forum	PHIL Forum	SRE Forum	TRS Forum	CFO Fellowhsip	CMO Fellowship	CNO Fellowship	SRE Fellowhsip	Institute
Grand Total	**24**	**56**	**29**	**24**	**33**	**36**	**29**	**36**	**20**	**37**	**28**	**23**	**31**	**37**	**22**	**54**	**11**	**22**	**95**
Adventist Health (CA)			1			1			1					1					
Adventist Health System (FL)	1	1	1	1	1	1	1	1		2	1	1	1	1		2			2
Advocate Health Care	1	1	1		1	1		1	1	1	1	1	1		1	2	1	2	1
Allina Health	1																		
Ascension		2								1				1					
Atlantic Health System			1	1				2			1		1			3			1
Aurora Health Care	1	1	1	1		1		1		1	1	1		1	1	3		2	
Avera Health													1						
BJC HealthCare		1		1											1				
Banner Health	1	1	1		1	1	1	2	1	1	2	1	2	1	1	3		2	5
Barnabas Health								1											
BayCare Health System	1												1						7
Baylor Health Care System		1	1				1	1		1	2			1					
Beaumont Health System	1											1							
Bon Secours Health System	1	1	1	1	1	1	1	1					1	1		2	1	1	1
CHRISTUS Health		1												1					
Carilion Clinic		1																	
Carolinas HealthCare System		1	1	1				1			1			1					
Catholic Health Initiatives								1			1		1	1		1			
Catholic Health Partners		1			1					1				1					
Cedars-Sinai						1							1						
Christiana Care Health System	1	1	1			1		1	1	2		2		1		3			6
Cleveland Clinic		1	1						1	2				1	2				
Cone Health		1	1	1	1	1	1	1			1		1	1		2			
Dignity Health		1										1		1	1				
DoD/VA Interagency Program Office					1														
Duke University Health System				1		2	1	1		1	1					2	1		
Einstein Healthcare Network		1																	
Elliot Health System					1														
Fairview Health Services		1							1	1			1	1				2	
Florida Hospital System								1											
HCA Healthcare					2	1	1	1					1			3			
Hackensack University Medical Center						1													
Hawai'i Pacific Health		1	1	1						1		1			2				
Hoag	1	1	1	1		1			1				1	1		1			3
Hospital Sisters Health System		1	1																
Indiana University Health										1									
Inova Health System					1					1									
Integris Health	1											1							
Intermountain Healthcare	1	1	1	1	1	1	1	1	1	1	1	1	1		2	4	1	1	5
Johns Hopkins Health System						1	1	1									1		1
Kaiser Permanente		1																	
Legacy Health System														1		1			
Lehigh Valley Health Network	1	1	1	1	1	1		1		1	1	1	1				1		
Mayo Clinic										1									
McLaren Health Care	1																		
MedStar Health		1			1		1						1	1		1			
Memorial Healthcare System (FL)						1													
Memorial Hermann		1				1				1				1					
MemorialCare Health System (CA)		1								1			1						

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Methodist Le Bonheur Healthcare										1									
Montefiore Medical Center	1	1	1	1	1		1		1	1	1	1		1	1	2			7
Mount Sinai Medical Center										1									
MultiCare Health System			1					1						1	1				
NYU Langone Medical Center																			
NewYork-Presbyterian Hospital	1	1				1		1	1	1	1		2				1	2	8
North Shore-LIJ Health System		1	1	1	1		1	1		1	1	1	1	1		2	1	2	8
Northwestern Memorial HealthCare		1	1	1	1				1			1	1	1	1				3
Norton Healthcare		1	1	1	1	1	1	1		1		1	1	1		2	1		
Novant Health		1							1										4
OSF HealthCare							1	1											
Oakwood Healthcare System						1													
Ochsner Health System	1	1		1	1	1	1		1	1	1		1	1	1	3		2	
OhioHealth		1				1					1					2			6
Palmetto Health						1		1											
Partners HealthCare							2		1	1	2			1					
Penn Medicine		1						1											
Piedmont HealthCare		1						1	1		1				1				
Presbyterian Healthcare Services		1											1	1					
Presence Health					1											1			
Providence Health & Services	1	1	1		2	1	1	1	1	1	1	1	1		1	4		2	5
Regional Medical Center at Memphis (The MED)		1										1							4
SCL Health System		1												1					
SSM Health Care		1				1	1												
Scott & White Healthcare														1					
Scripps Health		1	1							1				1					
Sentara Healthcare		1	1											1	1				
Sharp HealthCare	1	1		1	1	1	1			1	1	1	1		1	1		1	
Spectrum Health			1		1														
St. Joseph Health												1							
Stanford Hospital & Clinics		1			1			1					1						
Summa Health System							2												
Swedish Medical Center												1							
Tenet Healthcare Corporation						1	1	1											
Texas Health Resources		1					1							1					
The University of Chicago Medical Center		1																	
Trinity Health						1													
UCLA Health System					1		1	1											
UF Health Shands		1		1		1													
UMass Memorial Medical Center					1	1					1								
UPMC		1							1										
UnityPoint Health	1	1	1	1	1	1			1	1			1	1					
University Hospitals					1	1		1		1				1			1		
University of Maryland Medical System					1														
University of Michigan Health System		1																	
Vanderbilt University Medical Center	1			1			1	1			1				1				
Vanguard Health Systems	1	1	1	1	2	1	1									1			4
Veterans Health Administration							1												
Virtua	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3		2	9
Yale New Haven Health System	1	1		1				1	1	1	1	1	1	1	1		1	1	5

515 Wythe Street Alexandria, VA 22314

(703) 548-1022

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