WCUME 2018 Abstract Book

September 14 – 16, 2018

Friday September 14, 2019

Oral Abstract Sessions

Session 1A (1000 – 1130) - Ultrasound Curriculum Development

The "6+" hands-on training scheme is an instructive method to teach abdominal ultrasound to medical students

Fredrik Sævik MD, University of Bergen, Bergen, Norway

The "6+" hands-on training scheme is an instructive method to teach abdominal ultrasound to medical students. Fredrik Sævik2,1, Kim Nylund1,2, Odd Helge Gilja1,21National Centre for Ultrasound in Gastroenterology, Haukeland University Hospital, Bergen, Norway 2Department of Clinical Medicine, University of Bergen, Bergen, Norway

Intro: Ultrasonography has become a useful supplement to clinical examination, increasing the physician's diagnostic accuracy for certain cases. During the recent years, ultrasound equipment has become affordable without compromising image quality. Thus, the modality has every qualification necessary to become an invaluable tool in the hands of a trained clinician. There are currently some well-established abdominal examination protocols available, however, most of them are limited to specific organs and findings in medical emergency settings. Established examination algorithms in comprehensive abdominal sonography are lacking. Here we present a systematic ultrasound examination of the abdomen. **Methods**: The National Center for Ultrasound in Gastroenterology in Norway has provided a systematic examination algorithm called 6+, consisting of six standardized scanning stations accompanied sometimes by scanning of the bowels (fig 1). By using a systematic approach, the risk of missing significant clinical findings is reduced. At Haukeland University Hospital in Norway, medical students as well as residents in gastroenterology have received training in

transabdominal ultrasound for over 20 years, using 6+ as a learning tool in the practical sessions. First, the examination technique at all 6 stations are demonstrated followed by thorough hands-on scanning under close supervision and finally individual training in groups of 2-4 students. Each course participant receives a pocket-sized study card covering 6+ and normal values for gastrointestinal organs, ideal for self-studying. Furthermore, a web presentation with videos is made to facilitate online education.In January 2018 we used 6+ in a one-week elective course in clinical abdominal ultrasound for 20 medical students with the aim to acquire sufficient proficiency in performing abdominal ultrasound. Results: In our experience over many years, the 6+ scheme is easy to communicate to the students and they appreciate a well-structured training program for hands-on ultrasonography. The evaluation of the eligible course had an average score of 4.6/5, and the practical hands-on sessions using 6+ was 4.8/5. **Conclusion**: The relevance of ultrasonography in medical student education is increasing and will be an important part of the examination repertoire of future physicians. Thus, systematical education in ultrasonography should be mandatory for the majority of medical professionals. We conclude that the 6+ scheme for training in abdominal ultrasound is well suited for educational purposes of medical students, is well received and highly rated among students.

Co-Author(s): Kim Nylund, University of Bergen/ Haukeland University Hospital, Bergen, Norway, Odd Helge Gilja, University of Bergen/ Haukeland University Hospital, Bergen, Norway

Penn 5Ps: A Framework for Hands-On Ultrasound Teaching in Undergraduate Medical Education (UME)

Christy Moore B.S., RDMS, RVT, University of Pennsylvania

Title: Penn 5Ps: A Framework for Hands-On Ultrasound Teaching in Undergraduate Medical Education (UME)Introduction:Point of care ultrasound is growing rapidly in UME. In 2015, our institution introduced ultrasound into the pre-clerkship curriculum through didactic and small-group learning. Since then, we have led dozens of hands-on sessions that cumulatively includes over 90 instructors from 9 specialties. Our pool of instructors is represented by clinicians from: radiology, physical medicine & rehabilitation, anesthesia, nephrology, internal medicine, emergency medicine and intensivists, among others. Instructors include senior medical students, sonographers, nurses, residents, fellows and faculty. However, finding skilled instructors remains challenging due to variability of instructors' teaching ability, technical and clinical experience. Students report inconsistent teaching methods despite having shared and explicit hands-on learning objectives. This issue is further exacerbated as learners are expected to emerge with a specific set of technical and cognitive skills that nonetheless, require resource-intensive

teaching. To address this problem, we propose the "Penn 5Ps," a teaching framework for hands-on ultrasound instructors. **Objective/Aim:**To standardize a framework for hands-on ultrasound teaching with the goal of providing a consistent learning experience for students in undergraduate medical education. **Methods/Process**:Participation: instructors should maximize hands-on time for learners; minimize the experience of learners as spectators or instructors as primary scanners. Professionalism: instructors should role model positive patient interactions with clear communication, proper draping and ways to scan in a respectful manner.Preparation: instructors should review the content and objectives of the topic before a hands-on session and gauge his/her own level of knowledge or comfort regarding the topic; clarify inconsistencies prior to instruction.**Perspective:** instructors should teach to the level of the learner (MS1 vs. MS4) because needs and expectations are different; offer a clinical perspective but reframe if the learner is not ready.Protocol: instructors should lead discussions in a predictable and repeatable format to explain clinical presentations, knobs and probes, anatomy and pathology; consider using "5Ps for Learners." **Results:**We expect that the 5Ps for Hands-on Ultrasound Teaching will provide a framework that promotes a consistent, value-rich learning experience for students in UME. This construct provides instructors with a tool for communicating technical and cognitive ultrasound skills regardless of their clinical specialty or experience level. Ultimately, hands-on ultrasound instructors will have a reproducible and objective way to teach ultrasound across multiple topics and settings.**Conclusions:** Our simple instructional mnemonic can serve as the framework for delivering more consistent hands-on teaching from a largely variable group of ultrasound instructors. Further studies will determine if the use of this framework leads to an improved hands-on learning experience from UME students and an improved teaching experience from hands-on ultrasound instructors.

Co-Author(s): Alex Wong, University of Pennsylvania, Anthony Dean, University of Pennsylvania Health System, Nova Panebianco, University of Pennsylvania Health System, Felipe Teran, University Of Pennsylvania, Wilma Chan, Perelman School of Medicine

A 5Ps Framework for Hands-On Ultrasound Learning in Undergraduate Medical Education (UME)

Alex Wong Candidate for Bachelor of Arts, University of Pennsylvania

Introduction: Clinician-performed ultrasound is growing rapidly in UME. Since 2015, our institution has included ultrasound in the pre-clerkship curriculum using small-group hands-on sessions led by preceptors at supervised stations. The goal is for students to emerge with a specific set of technical, cognitive, and psychomotor skills that integrate clinical medicine and ultrasonography. All members of

the group are affected by the skills of the others. To compound this problem, this process depends on a large (and continually increasing) pool of more than 90 instructors who have a broad range of clinical specialties and level of training. As a result, content is presented with different approaches, techniques, clinical priorities, and philosophies; students report inconsistencies in their learning experiences, even with explicit hands-on learning objectives and pre-assigned content to review. To address this problem, we propose the "5Ps for Hands-On Ultrasound Learning," which is a cognitive framework to help medical students organize complex psychomotor and conceptual material that is being presented to them in a small-group format. This framework is designed to complement our methodology used for teaching ("5Ps for Teaching"). **Objective/Aim:** To standardize a cognitive framework for hands-on ultrasound learning with the goal of organizing core concepts and improving hands-on learning experience for UME students. **Methods/Process:** 1.Patient & Problem: learners should list the possible symptoms or chief complaints a patient may present with and the targeted problems an ultrasound study could identify. 2.Probe & Preset: learners should select the appropriate probe and preset for the scan; consider alternatives. 3.Parts & Position: learners should identify the surface anatomy relevant to the scan; orient and position the probe/indicator appropriately. 4.Picture & Pathology: learners should adjust depth, frequency, focus and gain to obtain an image. Know and demonstrate landmarks and anchoring anatomy. Describe the features of an adequate image. Know and identify possible pathology for each view. 5.Pearls & Pitfalls: with a hands-on instructor, learners should review common "pearls" and pitfalls of both technique and clinical practice. Outline an alternative clinical management strategy if the scan is inconclusive. **Results:** We believe that the "5Ps for Learners" will assist learning and provide a more consistent ultrasound experience for students in UME. It will promote universally applicable principles of good ultrasound technique regardless of the learner's training level or future clinical specialty. It will promote reproducible and consistent learning processes across multiple topics and settings. We believe that it will facilitate both understanding and retention of ultrasound skills among future clinicians. **Conclusions:** Our 5P mnemonic can provide a learning framework for the gamut of ultrasound applications even when taught to learners of different levels by diverse preceptors. Further studies will determine if the use of this framework leads to improved information recall, psychomotor skills, and learning experience among UME students.

Co-Author(s): Christy Moore, Perelman School of Medicine, Anthony Dean, University of Pennsylvania Health System, Nova Panebianco, University of Pennsylvania Health System, Felipe Teran-Merino, University of Pennsylvania Health System, Wilma Chan, Perelman School of Medicine

SonOlympics: An Innovative Ultrasound Review for Preclinical Medical Students

Amy Zeidan MD, University of Pennsylvania

Introduction: An increasing number of medical schools are integrating ultrasound training into preclinical curricula, though the standardization for content and competency is still lacking. Prior reports indicate that Gamification and Competition-Based Learning is an effective modality to teach ultrasound. The objective of our report is to evaluate whether SonOlympics-an ultrasound competition between medical students-may serve as a comprehensive course review at the conclusion of medical students' preclinical ultrasound curriculum. **Methods:** Participation was voluntary and medical students were recruited by email. The competition was structured similarly to SonoGames and SonoSlam, which were designed for residents and medical students across multiple institutions. The authors, who were medical students assisted by ultrasound faculty, developed content and cases from the SonoSlam ultrasound curriculum targeted towards preclinical medical students. The event consisted of a quiz bowl, 5 game stations and 5 organ-block stations. All sixteen teams participated in the quiz bowl at the beginning of the session. Each team had 30 seconds to review and document an answer, and the instructor discussed each correct answer and pertinent information prior to moving on to the next question. The 5 organ block stations included heart, FAST, lung, aorta/IVC and US guided IV access. The 5 integrated game stations included blindfolded charades, password, ultrasound of foreign objects, and two clinical case stations. These stations emphasized teamwork, integration of US information to solve complex problems, and clinical management based on US findings. Instructors at each organ block and integrated game stations were either ultrasound trained residents/faculty or medical school faculty who followed scripts designed by the study team. At the end of the event, a voluntary post-session survey was sent to all student participants. **Results:** Sixty-two medical students participated in the competition (40% of the class) and 32% of this group completed the post-session survey. All respondents (100%) recommended the event to a peer and 95% viewed the competition as a sufficient review for the entire course. All respondents (100%) reported learning new material and (100%) felt that the amount of new information was appropriate. Participant recommendations included rotation of team members to the various roles during the game stations and standardization of script execution among judges. **Conclusions:** SonOlympics may be an appropriate alternative tool to review, teach, and assess ultrasound knowledge among medical students in the preclinical setting. Our SonOlympics event could serve as an alternative review and assessment for other medical schools as they begin to develop and implement ultrasound curriculum.

Year two review: student-guided implementation of ultrasound education for pre-clinical medical students at a large medical school

Katelyn Butler MD candidate, University of North Carolina School of Medicine

Introduction: Ultrasound (US) is rapidly expanding across medical and surgical specialties. Prior to the 2016/17 academic year, there was no formal US education for pre-clinical medical students at The University of North Carolina School of Medicine (UNC SOM). Many medical schools have interest in incorporating US education, but barriers exist: limited curricular time, cost of US machines, and instructor time. We aimed to address these barriers and introduce formal US education for pre-clinical students at UNC SOM. A formal ultrasound curriculum at UNC has successfully been implemented and has graduated two cohorts during the 2016/17 and 2017/18 academic years. **Methods:** There are approximately 180 medical students per class at UNC SOM. Two 1st year medical students at UNC SOM formed a Committee on Ultrasound Education and provided organizational support and suggestions to faculty while implementing this program. US education was piloted for MS1s in two separate forms, 1) an US workshop series for a selected cohort of students and 2) integration of ultrasound teaching into UNC's clinical skills and diagnosis course, "Patient Centered Care" (PCC).A total of 40 students participated in the elective workshop series which aimed to reinforce content concurrently being taught in the curriculum. Each student in this elective completed 10 hours of ultrasound training and didactics (split into 2-hour sessions on 5 separate occasions) over the academic year. The final assessment, and a major improvement to the curriculum during the 2017/18 academic year, was an end of the year ultrasound competition. Students competed in teams of 4 for points at various US stations: an online, interactive multiple-choice quiz, an anatomic "scavenger hunt," and a US-based clinical scenario.US education initiatives were simultaneously implemented for all students into UNC's required PCC course to augment acquisition of physical diagnosis and clinical reasoning skills. Each student in PCC completed approximately 3 hours of ultrasound training over the course of the academic year. We recruited faculty teachers (from Emergency Medicine (EM), Anesthesia, Internal Medicine, Pediatrics, and Family Medicine) to obtain a wide variety of US educators. A $50,000 state grant was used to purchase 4 US machines prior to year one of the curriculum. **Results:** Surveys were distributed before and after each elective US session over the last two years. For year one, an average 25.5 students completed each survey with the main aim assessing comfort with ultrasound over the course of the curriculum. Comfort level with ultrasound increased by an average of 37 percent between the first and last ultrasound session. For year two, an average of 30.0 students completed each survey with similar assessment parameters. Comfort level with ultrasound increased by 41.6 percent between the first and last ultrasound session. Additionally, 85% of respondents felt comfortable using ultrasound in the clinical setting. **Conclusion:** Ultrasound education was successfully integrated and sustained in pre-clinical

education at UNC SOM for the past two academic years with data indicating that the elective curriculum increases comfort level with US among MS1 students. Most importantly, the majority of students entering who completed the formal ultrasound curriculum felt comfortable using their ultrasound skills in the clinical setting. Barriers to implementation included limited curriculum time, procuring US machines, finding skilled teachers, and funding for above. US education fit well in students' existing clinical skills and diagnosis course. We have successfully jump-started our program by purchasing machines through a state grant. We plan to utilize "near-peer mentoring" where students who completed the elective curriculum assist with teaching the next cohort.

Co-Author(s): Sasha McEwan, , Apoorva Gupta, , Elizabeth Neylan, , Ashley Beale, , Lacey English, , Stephanie Sun, , Daniel Migliaccio, Department of Emergency Medicine, University of North Carolina School of Medicine, Michael Gilchrist, Department of Internal Medicine, Univeristy of North Carolina School of Medicine


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Session 2A (1300 – 1430) - Ultrasound Curriculum Development

How to Build an Ultrasound Curriculum into Medical Gross Anatomy

Peter Croft MD, FACEP, Maine Medical Center

Introduction: The use of bedside ultrasound (US) has truly blossomed over the last 15 years. It is no longer confined to radiology or imaging departments, but transcends emergency, general surgery, internal medicine, family medicine, pediatric, and orthopedic specialties. As such, it has begun to take a stronghold as a fundamental piece of undergraduate medical education across the country. The literature shows that incorporating US into an anatomy course is a natural fit, however uncertainty still exists regarding the optimal approach to do so. The purpose of this study was to develop an US curriculum within the medical gross anatomy course at Tufts University School of Medicine. **Methods:** US was incorporated into 6 regions throughout the clinical anatomy course. Two to three brief video primers were developed for each region and posted on the course learning management system for students to view prior to attending anatomy lecture and lab. During lab, student groups rotated through the US station to visualize the anatomical structures they were dissecting and gaining hands on experience acquiring US images on their own. Clinical emergency medicine attending physicians and

members of the ultrasound interest group directed the US stations. Students were asked to rate how helpful US integration was as a clinical application of anatomy and how effective the US demonstration and videos were during Clinical Anatomy on a 5 point Likert-Scale. Students were also asked to provide overall comments on the curriculum. **Results:** Of the 203 students who evaluated the US curriculum, 169 (83%) found US as an excellent clinical application of anatomy, gaining a 4.77 mean score (0.56 SD). Students also rated the US demonstrations and video effectiveness highly at 4.60 (0.70 SD), with 147 of 210 students (70%) rating them as very effective. First year medical students found the demonstrations and videos easy to follow, high yield, and integrated well into the anatomy curriculum. **Conclusions:** Lessons learned from the faculty standpoint include keeping a timely rotation schedule in lab and potentially bringing in more experts to keep tables from overcrowding. Overall, the ability to engage students during clinical anatomy and begin to educate them on the utility US early in medical education was successful and will be continued.

Co-Author(s): Linda Afifi, Tufts University School of Medicine, Robert Willson, Tufts University School of Medicine, Rebecca Lufler, Tufts University School of Medicine

First-year Medical Students' Perceptions of Ultrasound-augmented Microbiology Curriculu

Ramon Lee Jr. B.A., University of Pennsylvania Perelman School of Medicine

Introduction: Medical schools face the challenge of increasingly crowded preclinical curricula with growing demand for clinically-relevant teaching methods. Currently, there are no standardized benchmarks for integrating ultrasound into medical school preclinical curricula. The challenges of integrating ultrasound into undergraduate medical education often include lack of resources to support equipment or instructors, but also the limited opportunity to partner with traditional courses outside of anatomy, pathophysiology and physical exam. We investigate the novel use of ultrasound-augmented microbiology curriculum in a case-based decision making process with first-year medical students (MS1s). No previous reports have described how medical students perceive the utility of using ultrasound as a way to learn microbiology. **Methods:** An anonymous 9-item survey was administered to MS1s at the conclusion of an 8-week microbiology course in 12/2017. Study subjects were surveyed after completing their microbiology small-group learning cases. Two of the total 27 interactive microbiology cases were augmented with an ultrasound clip, diagnosis, and teaching points about endocarditis and skin/soft-tissue infections. Prior to the microbiology course, each student also had 4 1-hour hands-on ultrasound sessions covering introductory knobology, cardiac, FAST, and shoulder. The survey consisted of five 6-point Likert scale questions on students' perceived utility of ultrasound in both

cases and a yes/no question on interest in integrating ultrasound into other pre-clinical courses. **Results:** Our survey yielded 132/164 student responses (80%). One-hundred and three (78%) students perceived ultrasound to be useful to their learning of microbiology concepts, and 69 (52%) would like more ultrasound integration into the microbiology curriculum. Students also were interested in integrating ultrasound or microbiology into other preclinical curricula (101 and 125 students, respectively). One-hundred and one students (77%) had some level of agreement that ultrasound was useful to learn about endocarditis; 83 (63%) had some level of agreement that ultrasound was useful to learn about cellulitis. **Conclusions:** The integration of ultrasound into a microbiology course was perceived by first-year medical students to be mostly useful in learning about endocarditis and cellulitis. The majority of students also wished to see more integration of ultrasound and microbiology into other preclinical courses. Ultrasound integration is a novel teaching strategy to address time constraints in an increasingly crowded preclinical curriculum. Further research is needed to investigate the effectiveness of integrated preclinical curricula in knowledge retention and student engagement.

Co-Author(s): Alex Wong, University of Pennsylvania, Robert Doms, Wilma Chan, Christy Moore, Perelman School of Medicine

Simulation Training of Medical Students for Competency in Obtaining Four View Transesophageal Echocardiography: Transesophageal Echocardiography Global Assessment Tool Echocardiography Simulation 2.0 (TEEGATES)

Nathan Nesbitt B.S., The Ohio State College of Medicine

Introduction: Transesophageal echocardiography (TEE) is known to be a valuable tool in cardiac imaging that is superior to transthoracic echocardiography (TTE) in many circumstances. However, medical students have minimal curricular exposures to TEE and no integrated hands-on experience. Without hands-on experience, students are unlikely to use TEE on a point of care basis. After completion of the short simulation based didactic session, students should gain the ability to use TEE to obtain four focused TEE views. This study aims to show that TEE-naïve medical students can develop significantly increased understanding of TEE acquisition including transducer manipulation, image acquisition, TEE generated anatomy, and interpretation of the images. **Methods:** A cohort of fourth year medical students will participate in a 2-hour didactic session which will utilize the high-fidelity simulator HeartWorks (Inventive Medical LTD., London, United Kingdom) and underscore TEE basic principles. Specifically, the session will include information on TEE indications with emphasis on when TEE is superior to TTE, TEE transducer features, the diagnostic utility of the four views (mid esophageal four

chamber, mid esophageal long axis, trans gastric short axis, and bicaval,) as well as the anatomical features necessary to include in the four views. A pretest and posttest will be administered to measure learner understanding of TEE features as well as normal imaging findings. Additional ungraded content in the pretest and posttest will measure prior exposure to TEE, student comfort with using TEE, student understanding of when TEE could be beneficial, and student likeliness to use TEE in the future. Immediately following the 2-hour didactic, students will be tested on their ability to achieve four views and their images will be graded by focused ultrasound experts based the number of essential anatomical features present in each image. **Results:** We plan to collect pretest and posttest data pertaining to TEE basic concepts and normal anatomical findings as well as image quality judged as defined above . Additional data will include subjective information related to learner experience and confidence with TEE as defined above. Data collection is pending the finalization of the study training program and participant recruitment. **Conclusion:** We expect that this study will show that a short didactic session utilizing the HeartWorks simulator can improve the ability of students to analyze basic TEE findings and generate four TEE views in a simulator.

Co-Author(s): Michael Prats, Ohio State University College of Medicine, Steven Shen, The Ohio State University, John Su, Ohio State University College of Medicine, David Bahner, Ohio State University

Does Early Education Help Medical Students Understand Ultrasound?

Rebecca Lufler PhD, Tufts University School of Medicine

Introduction: Ultrasound (US) is becoming more pervasive across medical specialties and therefore requires training and education earlier in the undergraduate medical curriculum. Given the difficulty of handling, acquiring and interpreting US, early exposure is imperative. Combined and integrated learning has been shown to be beneficial and has led to integrated curricula in medical schools across the country. Finding the right place to integrate US is the challenge. The purpose of this study is to evaluate the effectiveness of the US curriculum based on student's perceptions of US, confidence in interpreting and acquiring US images, and performance on US exam questions. **Methods:** An US curriculum was developed and incorporated into the first-year medical clinical anatomy course at Tufts University School of Medicine. Student participation in the study was voluntary and the study was granted exempt status by the Institutional IRB (#12737). Students were asked to complete an online pre-survey evaluating their confidence in using US and their perceptions of US prior to the start of the US curriculum in the anatomy lab using an 11 point Likert Scale. Students rotated through an US station during 6 labs, covering 6 different regions during the anatomy course. Students had the opportunity to

watch US being performed, as well as gain hands on experience acquiring US images. Video primers for each lab were posted for students to prepare and use as study tools for exams. US questions were included on all written and practical exams. Students completed a post-survey evaluating their changes in confidence and perceptions. Mean Likert ratings on pre- and post- surveys were compared to evaluate student's perceptions and confidence. Performance on US based exam questions were evaluated as percent correct. **Results:** Students reported significantly higher mean confidence ratings on understanding US, ability to operate US, ability to obtain US images, ability to recognize artifacts, and ability to interpret normal anatomy images ($p<0.0001$) after completing the US curriculum. Students also reported that US reinforced anatomy concepts, as well as clinical correlations ($p<0.0001$). Students disagreed with items stating learning US is not too difficult for a student to learn (1.2, 2.2 SD) and that it interfered with learning anatomy (0.68, 1.7 SD). On the four course exams, the average percent correct on US questions for each exam was 94.2 (Back and Lower Extremity), 91.6 (Upper Extremity and Thorax), 80.6 (Abdomen and Pelvis), and 96.7 (Head and Neck). **Conclusions:** This US curriculum has proven to bolster students' knowledge and perceptions of bedside US, and has given them confidence in image acquisition.

Co-Author(s): Linda Afifi, Tufts University School of Medicine, Robert Willson, Tufts University School of Medicine, Peter Croft, Maine Medical Center

Teaching Neurological Disorders with Ultrasound: A Novel Workshop for Medical Students

Varun Shah B.S., The Ohio State University

Introduction: Ultrasound is one of the safest medical imaging modalities due to its lack of harmful radiation. Additionally, it allows physicians to make quick and accurate diagnoses of a wide variety of medical problems and assists them in performing invasive procedures, ranging from central lines to intraoperative ultrasound. Due to its portability and versatility, ultrasound is a large part of the medical school curriculum at The Ohio State University College of Medicine (OSUCOM). There has been evidence that the use of ultrasound in teaching parts of the medical school curriculum greatly improves knowledge retention and performance. Ultrasound has been widely used in diagnosing neurological disorders, but there are advancements being made that will further its use in the neurological field. To the best of our knowledge, we offered the first neurological disorders ultrasound workshop for medical students that has been reported in the literature, and hypothesize that students will make significant gains in their ability to apply and retain concepts related to neuroanatomy and neurophysiology. **Methods:** This was a prospective quasi-experimental study to evaluate student performance through a

within population pre-posttest design for students participating in an optional ultrasound workshop. This workshop was offered to first year medical students in the neurological disorders block during Spring 2018. Purposive sampling was used to recruit students for this study. The students rotated between 6 stations that connected the diagnostic, procedural, and therapeutic aspects of ultrasound to neurology. The 6 stations were as follows: transcranial doppler, optic ultrasound, ultrasound guided external ventricular drain placement, high intensity focused ultrasound for ablation of brain lesions, carotid scan, and ultrasound guided central line placement. To evaluate the effectiveness of the ultrasound workshop, and measure medical student knowledge and opinions related to neurological disorders and ultrasound, multiple sources of data were collected including: pre-workshop survey, pre-workshop test, post-workshop survey, post-workshop test. After all data were collected comparisons were made between at the aggregate and individual levels. **Results**: 22 first year medical students consented to participate in this study. 18 of 22 consenting students completed the pre-workshop test, and of these students, 13 completed the post-workshop test. All 22 students completed the pre-workshop survey, and of these students, 18 completed the post-workshop survey. The Wilcoxon Signed Rank Test was conducted to test whether there was a difference in medical knowledge related to neurophysiology, anatomy, and ultrasound among first year medical students from the pre- to post-test (n = 13). The results showed a statistically significant difference in medical knowledge after students participated in the optional neurological disorders ultrasound workshop (Z = -3.100, p = .002). Results suggest participants demonstrated higher levels of medical knowledge related to neurophysiology, anatomy, and ultrasound after participating in the event. The Wilcoxon Signed Rank Test was conducted to test whether there was a difference in first year medical students responses to the pre- and post-survey item, “Ultrasound will be a useful tool in my medical practice in the future” on the pre- and post-survey (n = 18). Results suggest participants attributed greater value to ultrasound as a useful tool for their future medical practice after participating in the event (Z = -2.45, p = .014).Conclusions: In this small pilot study of a neurological disorders ultrasound workshop, results showed that students made a significant gain in medical knowledge related to neuroanatomy and neurophysiology, along with learning ultrasound skills. Participants also saw ultrasound as a useful part of their future medical practice after participating in the event. Although this workshop was small (n = 18 pre-workshop, n = 13 post-workshop), the results suggest there is value in integrating experiences with ultrasound into the neurological disorders block of medical school. Future studies, with a larger sample size, are needed to further explore the efficacy of this workshop in knowledge retention.

Co-Author(s): Maureen Cavalcanti, Seth Scheetz, Ryan Zeh, Sarah Burns, Tala Nashawati, Toacca Taylor, David Bahner, Ohio State University, Michael Prats, Ohio State University College of Medicine

The Ultrasound Digital Badging Curriculum of Eastern Virginia Medical School: A Competency Based, Self-Directed Roadmap to RDMS

Craig Goodmurphy Ph.D., Eastern Virginia Medical School

Introduction: The inclusion of ultrasound training within Undergraduate medical education (UGME) continues to grow. However, lack of institutional resources, faculty expertise, and curriculum time are great limitations to its inclusion. Digital badging platforms have demonstrated that knowledge and skills training can be validated asynchronously via gamification. By marrying these methods together EVMS has developed A Competency Based Digital Badging Ultrasound Curriculum with intra-curricular and (self-directed) extra-curricular components that will allow students to build a digital badge portfolio assessing their skills and competencies. By completing the badging curriculum student can be eligible to challenge both the nationally recognized SPI (Sonographic Principles and Instrumentation) and the RDMS (Registered Diagnostic Medical Sonographer) Abdomen exams. **Methods:** The curriculum is based on dividing the SPI and RDMS (abdomen) requirements into three badging blocks each with approximately 30 badges per level. The Bronze block is composed of ultrasound sessions contained within the first two years of the integrated Care Forward EVMS curriculum while Silver and Gold badging blocks are extracurricular in nature and require students to be self-directed and intrinsically motivated for completion. However, the badging is designed to provide a road map for those that wish to seek RDMS certification prior to graduation. For those intending to match into US heavy programs that wish to take our 4th year US elective (after 2020) they must complete the silver badging prior to acceptance into that elective. This step will ensure they are SPI eligible and have completed the modules that would be necessary for success in the SPI exam. Students can complete the rest of their clinical scans necessary for RDMS eligibility and will also teach in the bronze pre-clinical badging curriculum to complete their Gold set of badges. Each badging block combines sono-savvy components (knowledge and attitudes) using SonoSim® video modules and the integrated mastery based quizzing prior to skills labs and image generation, annotation and archival requirements. Students will then either complete intra-curricular scanning labs for Bronze badges or build an individual badging portfolio in Bb where they can gather and submit resources for each badge requirement. Some completed badge requirements are controlled automatically thru Bb “Achievements” while other badges will require students to submit components for review and qualified faculty will manually audit the submitted images as a form of quality control. Each badge block will include a final “review badge” that incorporates a Bb based review of the blocks materials, a 50 question quiz and a final OSCE examination that will ensure students are sono-skilled and sono-savvy. It is intended that the EVMS Digital Ultrasound Badging Curriculum could be developed into a certification program offered to students, faculty or other health professionals. It may serve as an option for those institutions struggling with the heavy demands of incorporating ultrasound into an

already packed undergraduate medical education curriculum. Quantitative analysis and satisfaction will be derived by following the metrics of students who complete badges, skills assessments, and SPI and RDMS eligibility and completion rates. Qualitative data will be obtained through evaluations measuring attitudes, responses, and overall student satisfaction with the curriculum at set intervals throughout the implementation. Competency will be based on live OSCE and SonoSim® assessments which will be evaluated by EVMS ultrasound faculty. Competency and skills degradation will also be monitored via the review badges at each level. **Results:** The curriculum components have each been trialed at different times and the curriculum will go live in August 2018. The presentation will lay out the components of the curriculum with examples of the modules, badges and badge blocks as well as the formats of assessment and mastery levels for each stage. We are confident that this program will be motivational, engaging and progressive while meeting the LCME mandate for including self-directed learning, narrative feedback and competency based skills as well as inter-professionalism into the existing curriculum. **Conclusion:** By coupling the strengths of digital badging technologies and the difficulties of delivering a competency based ultrasound curriculum we feel there is great promise for the EVMS Ultrasound Digital Badging Curriculum as an effective pedagogical tool to provide the fundamental knowledge of ultrasound for achieving RDMS eligibility and competency. This model also has great promise for expanding ultrasound skills with other national accreditation standards in the future. As ultrasound continues to struggle with logistical difficulties of curricular inclusion, we feel that a digital and independently paced program will be of interest to the institutional communities mandated to include ultrasound in their curriculum.

Co-Author(s): Lane Fortney, Eastern Virginia Medical School, Ciara Jenkins, Eastern Virginia Medical School, Katherine Schaffer, EVMS, Felicia Toreno, EVMS, Bradford Boyette, EVMS

Poster Sessions – September 14, 2018

Session 1 (0800 – 1130) - Ultrasound Applications

Poster 1

Utilization of Ultrasound in Diagnosis of Pediatric Pneumonia

Anthony Hawkins MD, US Army - Madigan Army Medical Center, JBLM, WA

Introduction: Community-acquired pneumonia (CAP) is the most common reason for admission in children1,2. The incidence requiring hospitalization is 61 per 10,000 in patients under one year old3. Chest radiograph is currently the standard for imaging, though limitations include delay in diagnosis and radiation exposure. Point-of-care ultrasound (POCUS) is highly sensitive and specific for pediatric pneumonia4. **CaseA**: 2-year-old female was brought to her primary physician by her mother for persistent fever and dyspnea. The previously healthy patient developed a fever of 103oF and a non-productive cough three days prior. The mother also reported intermittent grunting and intercostal retractions since then. At her the clinic, the patient was noted to have an increased work of breathing with diminished breath sounds in the left lung, and was sent to the ED. Upon arrival, the patient was ill-appearing, with notable intercostal retractions. She was afebrile and tachypneic at 45, tachycardic at 160 and oxygen saturation of 92% on room air. A portable chest radiograph showed complete opacification of the left hemithorax. Pending the radiologist's interpretation, the ED team performed chest POCUS. This revealed a large pleural effusion around the left lung, with moderate consolidation. These findings suggested pneumonia with a parapneumonic effusion. Within the next ten minutes, treatment with intravenous antibiotics was started, and the inpatient team was consulted for admission. **Discussion**: This case illustrates how the speed of POCUS can lead to rapid diagnosis, treatment and disposition of pediatric pneumonia. It is a valid diagnostic alternative to radiographs in pediatric patients suspected of having pneumonia.

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Co-Author(s): Michael Perreault, US Army - Madigan Army Medical Center, JBLM, WA, Matthew Nilan, US Army - Madigan Army Medical Center, JBLM, WA

Poster 2

Poster 3

Immediate Emergency Department Diagnosis of Pyloric Stenosis with POCUS

Nicole Dorinzi MD, West Virginia University

A 15 day-old-male who was born at term presented with non-bilious projectile vomiting. He was nontoxic and abdomen was benign without masses. Point of care ultrasound (POCUS) showed hypertrophic pyloric stenosis (HPS). Typical findings include: target sign, pyloric muscle thickness greater than three millimeters (mm), channel length greater than 15-18 mm, and lack of gastric emptying. The patient was admitted, consultative ultrasound (US) was negative, but repeated 48 hours later for persistent vomiting. This second US was interpreted as HPS which was confirmed surgically. Pyloromyotomy was successful. Few reports describe POCUS by general emergency physicians to diagnose HPS. Here, we emphasize the value in repeat ultrasound for patients with persistent symptoms.

Co-Author(s): Justine Pagenhardt, West Virginia University, Melinda Sharon, West Virginia University, Kristine Robinson, West Virginia University, Erin Setzer, West Virginia University, Nicolas Denne, West Virginia University, Joseph Minardi, West Virginia University

Poster 4

Ultrasound for Confirmation of Gastrostomy Tube Replacement in Children: A Case Series

Stephen Alerhand MD, Rutgers New Jersey Medical School

BACKGROUND: Gastrostomy tube related complaints such as tube dislodgement represent a frequent presentation in children to the emergency department (ED). After early tube replacement to avoid stoma stenosis, physicians classically order a contrast-enhanced radiograph to confirm placement. This confers a longer ED stay for the patient as well as radiation. **CASES:** We present three cases in which point-of-care ultrasound (POCUS) was used to accurately confirm tube replacement, which thus decreased cost, avoided radiation, and likely decreased the patient's length-of-stay. **SCAN TECHNIQUE:** With the patient lying in the right lateral decubitus position, the linear probe is placed in close proximity to the entry site in the left upper quadrant. This allows for visualization of the hyperechoic balloon within the hypoechoic stomach lumen. Using color Doppler, the G-tube can also gently be shaken such that the oscillation of the tip is seen due to motion artifact. Saline is then flushed through the G-tube port and visualized on the monitor, with or without color Doppler. Once completed, the patient is

administered her/her medications through the G-tube and observed for vomiting, abdominal distention, G-tube leak or resistance, and/or pain. **CONCLUSIONS:** This case series demonstrates that US guidance can be accurate for G-tube replacement in children, while decreasing cost and avoiding radiation. Though it requires further study, US guidance would likely decrease ED LOS. Especially given the apparent short learning curve, this technique should be incorporated into practice in pediatric ED's. Though complications are very rare, confirmatory x-rays may be considered in those patients with immaturity of the tract or trauma to it. Future clinical studies should examine possible associations with body habitus, time since index G-tube placement, and training level of the sonographers.

Co-Author(s): Ee Tay, New York University Langone Health

Poster 5

Ultrasound anatomical criteria to accurately measure the adult right liver lobe

Barbara Riestra PhDc, UPR School Professional Health, Medical Sciences Campus

Introduction: Ultrasound is an evaluation and diagnostic tool commonly used when liver disease is suspected. It is a common clinical practice to first assess liver health through 2D ultrasound when the patient presents right upper quadrant (RUQ) pain, RUQ inflammation, elevation in liver enzymes or liver disease is suspected. The objective of this study is to establish objective anatomical criteria to obtain accurate measurements of liver size by ultrasound while considering sex and anthropometry of the patient. **Methods:** Thirty-three (n = 33) participants underwent two-dimensional (2D) and panoramic (PAN) ultrasound imaging of the right liver lobe (RLL) in the anterior axillary region (AAR). Each measurement was performed in standard oblique and craniocaudal planes. Body mass index, waist circumference, age, and sex of the participant were also registered. Pearson analysis was conducted to evaluate correlation between measurements. Two-tail paired T test, ANOVA followed by Tukey post hoc or Kruskal-Wallis followed by multiple pairwise comparisons using Dunn's procedure were used to compare groups. Statistical significance was attained at $p < 0.05$. **Results:** The proposed craniocaudal 2D RLL size was 13.1 ± 1.5 cm for females and 14.1 ± 1.3 cm for males ($p = 0.05$), whereas PAN RLL size was 13.7 ± 1.8 cm for females and 15.0 ± 1.1 cm for males ($p = 0.02$). A strong correlation between the proposed 2D craniocaudal measurements of the RLL with craniocaudal PAN measurements was found: females ($r2 = 0.68$, $r = 0.82$), males ($r2 = 0.84$, $r = 0.92$), and for both sexes ($r2 = 0.74$, $r = 0.86$). In contrast, 2D oblique and CC panoramic concordance was: for females ($r2 = 0.30$, $r = 0.55$), males ($r2 = 0.51$, $r = 0.71$), and for overall ($r2 = 0.42$, $r = 0.65$). Both in 2D and in PAN, changes were noted for CC

measurements in obese BMI category and large waist circumference category ($p < 0.05$). **Conclusion:** CC measurement of the RLL by 2D ultrasound in AAR is a precise measurement for males and females across anthropometric profiles, which may allow for the routine monitoring of RLL size for patients across time.

Co-Author(s): Wilma Rodríguez-Mojica, Director of Ultrasound, Department of Radiology, School of Medicine, University of Puerto Rico, Juan Carlos Jorge, Department of Anatomy and Neurobiology, School of Medicine, University of Puerto Rico

Poster 6

Non-symptomatic changes in liver anatomy detected by ultrasound among Hispanic Diabetes Mellitus Type II females

Barbara Riestra PhDc, UPR School Professional Health, Medical Sciences Campus

Introduction: This study evaluates by ultrasound the pathophysiological consequences of Type 2 Diabetes Mellitus (T2DM) on the liver among non-symptomatic Hispanic T2DM female patients. **Methods:** Right liver lobe (RLL) ultrasound in panoramic view was used to measure craniocaudal (CC) length, liver texture and hemodynamics of portal vein and hepatic artery among non-T2DM and T2DM Hispanic female patients (N = 20/group). In addition, HbA1C, fasting blood sugar (FBS), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), lipid profile (low and high-density lipoprotein cholesterol; LDL and HDL), and triglycerides were monitored. Shapiro-Wilk test, one-way ANOVA followed by Tukey post hoc test, Kruskal-Wallis followed by multiple pairwise comparisons using Dunn's procedure and Mann-Whitney test, paired t-tests were employed with significance attained at $p < 0.05$. **Results:** Non-controlled T2DM patients exhibited higher ALT, lower HDL and higher triglyceride levels than non-T2DM female patients. In addition, non-symptomatic differences in liver anatomy were detected: (1) The size of the RLL was larger among non-controlled T2DM female patients with large waist circumference ($p = 0.04$); (2) Non-controlled T2DM had larger RLL than non-T2DM patients ($p = 0.04$) ; (3) The diameter of the main portal vein (MPV) was larger among non-controlled T2DM than that of non-T2DM patients ($p = 0.04$); (4), Hepatic artery resistive index (RI) was higher among controlled T2DM female patients when compared to non-T2DM patients ($p = 0.04$). These differences were not accounted by fatty infiltration. **Conclusion:** It would be clinically advantageous to routinely monitor liver health by ultrasound among Type 2 Diabetes Mellitus patients.

Co-Author(s): Loida A González-Rodríguez, Department of Medicine-Endocrinology, Diabetes and Metabolism Division, School of Medicine, UPR, Wilma Rodríguez-Mojica, Director of Ultrasound, Department of Radiology, School of Medicine, University of Puerto Rico, Luis E. Vázquez-Quiñones, School of Sciences and Technology, Universidad Metropolitana- Sistema Ana G. Méndez, Juan Carlos Jorge, Department of Anatomy and Neurobiology, School of Medicine, University of Puerto Rico

Poster 7

New Applications of Ultrasound: Utilization of POCUS in the Diagnosis and Management of Necrotizing Fasciitis: A Case Report

Christopher Merritt MS1, University of South Carolina School of Medicine

Introduction: Necrotizing fasciitis (NF) is a rare infectious disease caused by virulent toxin-producing bacteria that occurs in the fascia and subcutaneous tissue.1 NF has a high mortality rate requiring prompt intervention through surgical debridement/amputation and antibiotics, but classic clinical findings of local swelling/erythema, fever, pain and tenderness are often nonspecific. 1 As such, NF incidence is often underestimated with only 15-34% of NF patients being properly diagnosed at admission due to few clinical features present at the onset of the disease 1,2 Imaging may be helpful to make the diagnosis and recently interest has grown in the use of ultrasound, particularly the STAFF (subcutaneous thickening, air, and fascial fluid) protocol, offering an opportunity for clinicians to increase early diagnosis and improve patient outcomes through rapid treatment of NF.3 The authors present a case that illustrates how such use of point-of-care ultrasound (POCUS) may not only diagnose NF, but also track disease progression. **Case:** A 56-year-old man with a history of poorly-controlled, insulin-dependent type 2 diabetes mellitus presented to the emergency department (ED) with left lower extremity erythema and edema that began near a chronic, left foot ulceration. In the ED he was afebrile, but tachycardic at 138 bpm with a leukocytosis of 21.1 K/uL. Upon the initial examination by the IM admitting team, there was diffuse edema without crepitus of the left foot and ankle. Ultrasound of the foot was performed to examine for abscess, but showed signs of air in the fascial planes of the lateral ankle, prompting concern for NF. The orthopedic team was initially unsure about the diagnosis of NF, but the patient was started on broad-spectrum antibiotics for presumed sepsis secondary to a complicated diabetic foot ulcer, with concern for left-sided cellulitis versus osteomyelitis. Left foot and ankle MRI performed 18 hours after the initial assessment ultrasound showed cellulitis and abscess formation with subcutaneous gas extending above the ankle. The patient refused below the knee amputation but consented to irrigation and debridement of the left foot and ankle. Approximately 48

hours after presenting to the ED, ultrasound was repeated, now showing pyomyositis and free air extending above the knee joint, with similar findings demonstrated on a repeat MRI. The patient did eventually agree to have an amputation, but an above knee amputation was required, rather than BKA, due to progression of disease. He improved rapidly following this and antibiotics were able to be discontinued. **Imaging Findings:** Characteristic findings of NF on ultrasound include thickening and distortion of the deep fascia, turbid fluid collection along the deep fascia, swelling/cobblestone appearance of the subcutaneous tissue, and soft tissue free air buildup. 1 The initial ultrasound showed all of these findings. The follow-up examination after initial surgical management showed progression to pyomyositis, consistent with the MRI findings which revealed focal areas of sludging air/pus mixtures within the muscular compartments, particularly the anterior tibialis muscle. **Conclusion:** This case demonstrates how ultrasound may not only facilitate the early diagnosis of NF, but also track the progression of disease following initial surgical management. The incidence of NF often is underestimated, especially in its early stages, as it can be mistaken for other soft tissue infections such as cellulitis. POCUS is a readily available imaging modality that may be used at the bedside to facilitate early diagnosis and management of necrotizing soft tissue infections. As demonstrated here, the use of POCUS allowed for the identification of possible NF 18 hours before confirmation through MRI. Such use of POCUS could possibly increase the rates of early diagnosis of NF and allow for a more timely intervention, thereby reducing NF mortality and related complications. Further, this case illustrates a new application of POCUS to monitor NF progression and facilitate management in later stages of this rapidly progressing disease. POCUS is readily available, portable, and therefore easily repeatable, offering promise to more rapidly track progression of a disease that is not adequately controlled by initial surgical management. Such use is demonstrated by identification of disease progression in the current patient who failed debridement and ultimately required amputation for both NF and pyomyositis. Future studies should explore the use of ultrasound not only for initial diagnosis, but also to track progression of a disease with high morbidity and mortality.

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Co-Author(s): Jimmy Epps, University of South Carolina School of Medicine, Keith Barron, Palmetto Health Richland Hospital

Poster 8

Poster 9

Using Ultrasonography as a Diagnostic Technique for Pneumoperitoneum from a Small Bowel Perforation Following Colonoscopy

Matthew Taylor MS, University of South Carolina School of Medicine

Introduction: Acute abdominal pain is a common symptom seen in emergency departments around the world, with many cases requiring immediately medical intervention. The key to providing a rapid and accurate diagnosis involves a detailed patient history and thorough physical exam. Bedside ultrasound is a rapid diagnostic tool that can be performed on all patient populations. Using ultrasound to detect pneumoperitoneum can both lead to faster treatment times or prevent patients from being exposed to unnecessary radiation. **Case Presentation:** An 81 y/o African American female presented to the ED with pelvic bleeding. Patient was diagnosed with diverticulosis. Several hours after diagnostic colonoscopy

was performed, free air was found intraperitonially via ultrasound and KUB radiography. After surgical intervention was declined by the family, rapid decompensation occurred, and the patient expired two days later. **Discussion:** Abdominal ultrasound was used to visualize the intraperitoneal free air along with other imaging modalities. Ultrasound provided a rapid diagnosis to a decompensating patient and helped streamline further treatment. **Conclusion:** Ultrasound is a viable tool for diagnosing pneumoperitoneum and should continue to be explored by clinicians to narrow the diagnosis of acute abdominal pain.

Co-Author(s): Carter Degennaro, University of South Carolina School of Medicine, Keith Barron, Palmetto Health Richland Hospital

Poster 10

Syncope evaluation using point of care ultrasound

Emmanuel Addo-Yobo MD, East Tennessee State Univeristy

While syncope represents a common presentation of cardiovascular compromise, it is rarely the first presenting symptom of a pulmonary embolism (PE). If syncope occurs, delay in therapy can quickly become fatal. We describe a complex presentation of syncope in which bedside point-of-care echocardiogram would have directed appropriate management of a PE.

Eighty seven year old male with no significant cardiac history presented with three syncopal episodes. There were no prodromal symptoms or evidence of seizure activity. Blood pressure of 76/42 mmHg and pulse of 118bpm were recorded by paramedics. Electrocardiogram (EKG) showed atrial fibrillation with rapid ventricular response. Upon arrival at our facility, he was hypoxemic and hypotensive. Labs showed serum troponin of 3.7 ng/mL and acute renal insufficiency. EKG showed no acute ischemic changes. Head imaging showed no acute intracranial pathology.

Acute coronary syndrome protocol with low intensity heparin drip was initiated. The patient refused cardiac catherization and opted for medical management. A few days later he was transitioned to apixaban for stroke prophylaxis due to the new onset of atrial fibrillation. Transthoracic echocardiogram (TTE) on the fourth day showed characteristic signs of right heart strain. This prompted a computer tomography (CT) with pulmonary embolism (PE) protocol, which then showed a large central pulmonary embolus in the right lung with additional multifocal segmental and sub segmental PE throughout both lungs. Subsequent lower extremity ultrasound showed a non-occlusive deep vein thrombosis (DVT) in

the left lower extremity. Treatment teams all agreed to continue the current management with apixaban since the patient was oxygenating well on nasal cannula and was hemodynamically stable.

Syncope is an uncommon presentation for PE. Even when an alternative reason for syncope exists, some studies estimated that PE is present in up to 12% of patients with syncope. Our patient presented with syncope in the setting of ACS, new onset atrial fibrillation and hypotension. His pretest probablity for PE was low; a calculated wells' score of 1.5 for tachycardia. The echocardiography showed the Mcconnel sign, a finding which has a 94% specificity for a pulmonary embolus. The Mcconnel sign is a pattern of right ventricular dysfunction with akinesia of the mid wall and hyper contractility of the apical wall. If point-of-care ultrasonography (POCUS) was part of the initial evaluation, the patient's presentation would have been appropriately managed for a hemodynamically unstable PE. This would have included consideration for thrombolytic therapy or embolectomy. Fortunately, this patient did well despite being treated for the confounding atrial fibrillation and non-ST segment myocardial infarction. In hindsight, application of POCUS would have made the biggest difference during his complex initial presentation. It would have shown evidence of right heart strain or the Mcconnel sign and this would have ultimately prevented the delay in treatment of an unstable pulmonary embolism.

Co-Author(s): Jennifer Treece, East Tennessee State University, Mariam Alawoki, East Tennessee State University, Neha Kakkar, East Tennesee State University, Shelby Shamas, VA Mountain Home

Poster 11

CORRELATION OF BRAIN MIDLINE SHIFT, USING TRANSCRANEAL ULTRASOUND VERSUS COMPUTERIZED AXIAL TOMOGRAPHY

Felipe de Jesus Montelongo profesor/medical doctor, Instituto de salud del Estado de Mexico

Background: Ultrasonography performed by non-radiologists is a tool that contributes to the diagnosis and monitoring of neurocritical patients, as well as being an inexpensive, accurate, non-invasive tool that can be performed at the patient's bedside, considering that the vast majority of patients Neurocritical patients are in hemodynamic instability. **Objective:** Demonstrate the correlation of the measurement of brain midline shift using transcraneal ultrasound versus the "gold standard" Computerized Axial Tomography. **Materials and Methods:** The study was carried out in a period that ran from January to October 2017 in 113 patients whit traumatic severe cranial injury, cerebral tumor and hemorrhage intracranial, applying the ultrasonographic technique proposal by Montelongo MD, comparing it whit the measurement brain midline shift whit computerized axial tomography, of the

Neurocritical Care Unit of the General Hospital of Ecatepec "Las Américas". **Results:** An average measurement of 7.492 millimeters, was obtained for patients who were measured of brain midline shift, using transcranel ultrasound, and an average of 6.656 millimeters for patients with computed tomography of the skull. It was correlated by Pearson, obtaining a correlation of 0.961 (95% CI); which translates a strong positive linear correlation; crossed tests were performed to determine the sensitivity of the transcranial ultrasound obtaining a sensitivity of 96.4% and specificity of 96.5%. **Discussion:** There is no study in the literature that covers different neurological pathologies for measurement of the cerebral midline; the results obtained in our study demonstrate a high sensitivity and specificity of transcranial ultrasound, with a high positive linear correlation. **Conclusion:** We propose the measurement brain midline shift in patients with neurologically progressive neurological deterioration to decide medical or surgical conduct in the areas where this type of patients is handled and that computerized axial tomography is not available. Although a greater number of studies is required to be concluding.

Co-Author(s): Edgar Manuel Gómez, Institutode Salud del Estado de Mexico, Pablo Calzada, Instituto de Salud del Estado de Mexico

Poster 12

EFFECTIVENESS AND SAFETY OF THE SWAN GANZ CATHETER PLACEMENT TECHNIQUE GUIDED BY ULTRASOUND

Felipe de Jesus Montelongo profesor/medical doctor, Instituto de salud del Estado de Mexico

Background: The use of a pulmonary artery catheter (Swan-Ganz) has been discussed; however, it is still a useful tool for hemodynamic monitoring. **Objective:** Provide an alternative in the placement of Swan-Ganz catheter by ultrasound in less time and without complications. **Material and methods:** Thirty patients with various pathologies were assigned to aminergic and inotropic monitoring, a pulmonary artery catheter; Evaluating placement times and associated complications after placement. The introduction of the catheter was performed under the "Las Americas" technique of ultrasound guided placement, create by Montelongo MD. **Results:** A mean of 101.6 seconds of placement was obtained after insertion of the tip of the catheter by venodisection, median of 80 seconds; Maximum set time of 240 seconds and minimum of 36 seconds. There were 0.0% of complications. **Discussion:** The use of ultrasound offers an alternative method of placement of the catheter without support of fluoroscopy, monitoring curves or intracavitary pressures, whit middle time of 2700 second reported in the literature.

Conclusions: The placement of Swan Ganz by ultrasound is an alternative and safe method for placement with an average time of 101.6 seconds in its insertion; without complications during the procedure.

Co-Author(s): Edgar Manuel Gómez, Instituto de Salud del Estado de Mexico, Pablo Calzada, Instituto de Salud del Estado de Mexico

Poster 13


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Poster 14

Poster 15

Emergency Ultrasound Detection of Valsalva Retinopathy

Stephanie Angel MD, Carl R. Darnall Army Medical Center

Introduction: We present a previously healthy active duty patient who arrived to our emergency department with sudden onset of a right sided central visual scotoma while doing sprints. Ocular ultrasound revealed a well demarcated preretinal hyperechoic lesion located within the macula. Both dilated ocular exam and optical coherence tomography findings were consistent with a likely premacular hemorrhage secondary to Valsalva retinopathy. Valsalva retinopathy is a rare condition resulting in retinal hemorrhaging with only a few documented cases. 1-6 Ocular ultrasonography can be a reliable diagnostic study to evaluate for preretinal bleeding with a sensitivity and specificity of 100% in one retrospective study.7 **Case Presentation**: A previously healthy 26 year old active duty female presented with eight hours of right sided vision loss. It started suddenly while doing sprints for physical training. It was described as a bright central scotoma that later became a dark oblique line across her central vision. The painless defect had since remained unchanged and moved predictably with her eye movements. Visual acuities were 20/100 on the right and 20/20 on the left. She had an overall normal limited

funduscopic and slit lamp exam with no afferent pupillary defects and normal intraocular pressures. Ocular ultrasonography was performed and revealed a well-demarcated hyperechoic lesion in the posterior segment of the right eye (Image 1). There was no similar lesion found in her left eye (Image 2). In clinic, her visual acuity was 20/50 in the right eye and 20/20 in the left eye. Dilated funduscopic exam revealed an oblique streak of preretinal hemorrhage in the right eye (Image 3). Optical coherence tomography further revealed a preretinal or subinternal limiting membrane hemorrhage (Image 4). The patient's history and exam were most consistent with Valsalva retinopathy. **Discussion**: Valsalva retinopathy was first described in 1972 by Thomas Duane as a preretinal hemorrhage secondary to sudden increases in intraocular venous pressure. 8 Hemorrhage occurs as a result of the incompetent or nonvalvular venous system of the head and neck in which sudden elevations of venous pressure cause a decompensation of the retinal capillary bed. Commonly these bleeds are limited to the subinternal limiting membrane, but may sometimes break through.1,4 Maneuvers known to result in this condition include exercising, straining, vomiting, coughing, labor, etc. It clinically presents with sudden dramatic loss of vision typically in healthy young adults.5 Ultrasound has been found to have a sensitivity and specificity of 100% respectively in correctly identifying a preretinal bleed.7 This study only included patients requiring surgery and may therefore bias for larger bleeds. Our case demonstrates ultrasound still has a role in diagnosis of smaller ocular bleeds. Ultimately direct ophthalmoscope in the emergency department or with ophthalmology is still needed. Therefore, we suggest routine use of ocular ultrasonography for a sudden onset of visual scotoma associated with exertion. This may readily identify a preretinal bleed induced by Valsalva retinopathy, while also evaluating for multiple other pathologies and may expedite management. Image 1. Transverse view of right eye. (Arrow) Sharply demarcated hyperechoic lesion consistent with a premacular hemorrhage. Image 2. Transverse view of the left eye Image 3. Dilated funduscopic exam of right eye. (Arrow) Oblique streak of preretinal hemorrhage located above macula. Image 4. Optical coherence tomography of right eye. (Arrow) Sub-intimal limiting membrane hemorrhage. **References**: 1.Balaratnasingam, Chandrakumar et al. "Intrabursal and Subhyaloid Hemorrhages in Valsalva Retinopathy" Retina The Journal of Retinal and Vitreous Disease 37.1 (2017): e1-e32.García Fernández et al. "Long-term evolution of Valsalva Retinopathy: a case series" Journal of Medical Case Reports 6:346 (2012)3.Gibran, S K et al. "Changes in the Retinal Inner Limiting Membrane Associated with Valsalva Retinopathy." The British Journal of Ophthalmology 91.5 (2007): 701–702.4.Kumar, Vinod et al." Dissociated optic nerve fibre layer after Nd:YAG laser membranotomy for premacular hemorrhage" Canadian Journal of Ophthalmology 51.5 (2016): e139 - e1415.Nagar A, et. Al. "Valsalva retinopathy" Postgraduate Medical Journal 93.1097 (2017): 174.6.Xie, et al. "Macular hole secondary to Valsalva retinopathy after doing push-up exercise" BMC Ophthalmology 14.98 (2014)7.Swapnil Parchand et al. "Reliability of ocular ultrasonography findings for pre-surgical evaluation in various vitreo-retinal disorders" Semin Ophthalmol. 29.4 (2014): 236–241.8.Scaraffia, Alejandra, and

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Co-Author(s): Kyle Couperus, Madigan Army Medical Center, Noah Kim, Madigan Army Medical Center, Michael Perreault, Madigan Army Medical Center

Poster 16


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Poster 17

The V Sign and Persistence of the Left Superior Vena Cava

Fernando Félix Montes Tapia PhD, “Dr. José Eleuterio González” University Hospital and Medical School

Introduction: Incidental puncture of the subclavian artery when performing a puncture of the subclavian vein using anatomic landmarks is reported in 3.1 to 4.9% of cases. This can be immediately recognized in a hemodynamically stable patient by the return of pulsatile blood through the puncture needle or on the chest x-ray film with the catheter or guidewire descending on the left side of the spine. The use of real-time ultrasound for canalization of the subclavian vein has reduced the incidence of complications such as pneumothorax or arterial punctures. **Methods:** Case 1: A male term newborn of 3200 grams of weight is admitted to the neonatal intensive care unit with a diagnosis of polycythemia. He develops late-onset sepsis; therefore, a central venous catheter is requested for antibiotic administration. A 2-lumen, 13-cm, 4 Fr catheter is placed in the left subclavian vein guided by ultrasound with no complications during the procedure. Case 2: A male term newborn with 2900 grams of weight is admitted to the neonatal intensive care unit with a diagnosis of respiratory distress and congenital heart disease. A central 2-lumen, 13-cm, 4 Fr catheter is placed in the left subclavian vein guided by ultrasound without complications during the procedure. **Results:** Puncture techniqueIn both cases, an EDGE (SonoSite FujiFilm Inc., Bothell, WA, USA) portable ultrasound with a 7-13 MHz hockey stick transducer was used. The transducer is placed oblique on the left clavicle to locate the long axis of the subclavian vein. A subclavian vein is visualized that merges with the left internal jugular vein forming a "V"; and in the confluence of these two veins a venous vessel descends in the left thorax (Figures 1 and 2). Likewise, there is no visible left innominate vein that continues to the subclavian vein. A subclavian vein puncture was performed on long axis with a short 22 Ga venous catheter, and a catheter (4 Fr) was inserted with the Seldinger technique. In case 2, the guidewire that descended into the left vena cava was seen. X-ray, confirmed the paravertebral location of the catheter, consistent with a diagnosis of persistent left superior vena cava (PLSVC) (Figures 1a and 2a). **Conclusions:** PLSVC is the most common congenital vascular anomaly of the thorax, which in 40% of cases is associated with cardiac anomalies as

in one of our patients. We describe the "V" which is the confluence of the left internal jugular vein and the left subclavian vein draining into the PLSVC. Finding the "V" sign in the long-axis pre-puncture evaluation of the left subclavian vein should lead us to infer that the patient has a persistence of the superior left vena cava, which will be visualized on the chest radiograph with the catheter descending to the left of the spine.

Co-Author(s): Norma Olivia de la O Escamilla, “Dr. José Eleuterio González” University Hospital and Medical School, Bárbara Cárdenas del Castillo, “Dr. José Eleuterio González” University Hospital and Medical School, Isaías Rodríguez Balderrama, “Dr. José Eleuterio González” University Hospital and Medical School, Manuel Enrique de la O Cavazos, “Dr. José Eleuterio González” University Hospital and Medical School

Poster 18

Ultrasound beyond the grave: cadaveric uteri detection to facilitate body donor triage

Timothy Flynn DO, Oregon Health & Science University

Objectives: To determine if ultrasound can be used to reliably determine the presence or absence of a uterus in female cadavers. **Background**: Ultrasound is increasingly utilized by physicians at the bedside for both diagnostic assessment and procedural guidance. As proficiency and understanding of the technology evolves within the medical community it is important to consider prospective uses outside the realm of direct patient care. One potential application may be the verification of cadaver anatomy prior to dissection to improve appropriate allocation of the resource. The efficacy of ultrasound in evaluating cadaveric tissue has not been extensively evaluated. Cadavers have been shown to be an affective simulation modality for ultrasound guided regional anesthesia, joint injections and renal biopsies. [1-8] Ultrasound appears to adequately evaluate more superficial structures in cadavers including abscess and carpal tunnel [9, 10], however data is more limited in evaluation of deeper structures. Ultrasound visualization of abdominal and retroperitoneal structures in cadavers is more difficult due to soft tissue swelling and artifact created as a consequence of the embalming process. [11-13] Schramek et al compared the performance of CT, MRI and ultrasound in imaging cadaver tissue and found that ultrasound had relatively poor performance in evaluating the kidneys. [14] It should be noted, however, that their threshold for adequate imaging involved more precise criteria (ie visualization of long axis with both poles visible, transverse length, renal cortex, renal pelvis) rather than simply identifying presence or absence of the organ. Beige et al demonstrated that ultrasound can

adequately identify the kidney for the purpose of training Nephrology fellows in ultrasound-guided kidney biopsies. [8] On our search of the literature there are no publications regarding the ability of ultrasound to reliably detect the presence or absence of the uterus in human cadavers.In 2017, the cadaver lab at our academic medical center received 119 body donations. Of these, 53 (44.5%) were female. Of the 53 female donors, 11 (20%) were deemed to have a uterus through history, family reports and/or digital exam. A uterus was felt to be present in 21 (39%) and was unable to be confirmed in the remaining 21 (39%) donors. Gross dissection findings are only available on 4 of the donors that were used for a pelvic anatomy course. Of those 4 donors, 2 (50%) were found to not have a uterus after being deemed to have one through digital exam and/or history. The study herein is meant to evaluate the reliability of bedside ultrasound to determine the presence or absence of a uterus in female human cadavers donated to the university. The availability of this information prior to gross dissection would help to ensure appropriate allocation of cadavers with intact female reproductive anatomy to learners and courses where this is a requirement. **Methods**: We conducted a prospective single-blinded study evaluating the accuracy of bedside ultrasound for detecting the presence or absence of a uterus in cadavers donated to Oregon Health and Science University (OHSU) Body Donation Program. In the initial phase of the study, we evaluated the ability of ultrasound experts within our institution to make the assessment. This group of experts included the director of point of care ultrasound (POCUS) education, the current Internal Medicine POCUS fellow, and an educational sonographer with previous experience in maternal-fetal medicine ultrasound scanning. Staff from the OHSU Body Donation Program notified POCUS staff when a donation was received. POCUS staff then arranged to perform an ultrasound scan on the donated cadaver within 24-48hrs. Scanners were blinded to any historical data or digital exam findings that may have been available prior to the scan. Exams were performed with a Sonosite Edge. Exam was initially performed transabdominal (TAB) with a curvilinear transducer, followed by intracavitary transvaginal ultrasound (TVUS) transducer with sterile probe cover. Ultrasound results were recorded as “yes” or “no” for presence or absence of uterus respectively. TAB evaluation was discontinued after 22 exams due to significantly inferior image quality and inability to reliably visualize anatomy with this approach. Data regarding embalming status (fresh vs fixed), digital exam findings (recorded after ultrasound assessment) were also recorded. Cadavers were subsequently used for simulation or anatomy dissection lab with medical trainees as previously arranged by the Body Donation Program. Ultrasound findings were compared to a gold standard of gross dissection as this information became available. **Results**: To date gross dissection results are available for 6 cadavers after the cadavers were used for a surgical simulation course for the department of Obstetrics and Gynecology. 5/6 (83%) were confirmed to have an intact uterus. 1/6 (17%) did not have a uterus, but was believed to have one based on digital exam prior to the course. Transvaginal ultrasound was able to identify the uterus in 5/5 donors where it was present, and appropriately determined the absence of a uterus in the

6th donor. At the time of scanning, 2/6 (33%) donors were fresh while 4/6 had been frozen and underwent thawing process prior to scanning. None of the 6 donors were preserved through embalming. **Conclusion**: In the initial phase of a pilot study designed to improve appropriate utilization of human cadavers in medical training at our institution, use of transvaginal ultrasound was found to have 100% accuracy in identifying the presence or absence of a uterus in 6 cadavers used for a simulation course in Obstetrics and Gynecology. Further study is warranted to obtain a larger volume of examinations in order to better assess the accuracy of this modality. Future study should also investigate the ability of non-ultrasound trained faculty to identify uteri in human cadavers.

Co-Author(s): Renee Dversdal, Oregon Health and Science University, Christine Schutzer, Oregon Health and Science University, Tamara Ostervoss, Oregon Health and Science University

Poster 19

Developing a Differential Diagnosis List for the Sonographic Bimanual Examination in Emergency Department Patients Presenting with Pelvic Pain.

Courtney Cassella MD, University of Pennsylvania

Introduction: Differentiating the etiology of pelvic pain in the non-pregnant female can be difficult given the bimanual pelvic examination has poor inter examiner reliability and lacks sensitivity for adnexal masses. The sonographic bimanual examination (SBME) increases confidence in the bimanual examination and may affect the differential diagnosis for pelvic complaints. The purpose of this retrospective review was to characterize the use of the SBME in the emergency department and correlate with final diagnosis. **Methods:** This was a retrospective chart review of non-pregnant women presenting to the emergency department (ED) at an urban academic medical center who underwent bedside pelvic ultrasonography with SBME. Credentialed ED sonographers performed the ultrasounds. Medical records were reviewed for chief complaint; history of present illness; medical, surgical, and sexual history; physical examination findings; laboratory results; additional diagnostic testing; and final diagnosis. Descriptive statistical analysis is reflected by percentages with confidence intervals. **Results:** Fifty-three patients were identified, median age 20.7 years (Standard Variance 33.6, SD 5.8). Patients who underwent SBME presented with lower abdominal pain complaints (83%, 95% CI 71-92%), vaginal bleeding (13%, 95% CI 6-25%), or vaginal discharge (4%, 95% CI 1-13%). Fifty-one percent (95% CI 36-64%) had a positive SBME for tenderness to sonopalpation. Only sonographic cervical motion tenderness (sCMT) with or without ovarian tenderness to sonographic palpation (TTSP) was associated

with the final diagnosis of PID. Ovarian TTSP was correlated with PID (28%, 95% CI 11-54%), hemorrhagic cyst (22%, 95% CI 7-48%), ovarian cyst (17%, 95% CI 4-42%), and abdominal pain (17%, 95% CI 4-42%). In addition, for all diagnoses, some patients had a negative SBME. The highest percentage of patients with a negative SBME were ultimately diagnosed with abdominal pain (30%, 95% CI 15-50%) or non-gynecologic diagnoses (19%, 95% CI 7-39%). Differential diagnoses of various SBME findings will be presented. **Conclusion:** Our results demonstrate that differential diagnoses vary depending on SBME findings. Sono-CMT was more often associated with PID with or without ovarian TTSP; while a negative SBME did not rule out pelvic pathology (49% non-gynecologic complaint).

Co-Author(s): James Tsung, Mount Sinai

Poster 20

Evaluating the Use, Workflow Documentation, and Billing of Point-of-Care Ultrasound for Evaluating Cutaneous Abscesses in the Emergency Department: an Informatics Study

Stephen Alerhand MD, Rutgers New Jersey Medical School

BACKGROUND: Point-of-care ultrasound (POCUS) has been associated with superior diagnostic ability in evaluating for cutaneous abscesses. It has also been shown to increase the safety for performing incision and drainage (I&D) procedures when abscesses are found. The development of formal ultrasound workflow solutions in emergency departments (ED's) has helped standardize POCUS as a billable procedure resulting in increased revenue. However, emergency physicians (EP's) may not always follow this departmental protocol.

OBJECTIVES: Our study sought to investigate the frequency with which emergency physicians (EP's) actually use POCUS when confronted with potential abscesses, and if so, whether the proper electronic medical record (EMR) workflow is followed appropriately. Our hypothesis is that EP's are implementing neither POCUS nor the proper workflow sufficiently, resulting in the loss of revenue. **METHODS:** We retrospectively reviewed all Epic electronic medical records containing the diagnosis of "abscess", "boil", or "cyst" over the 2016 calendar year in the Mount Sinai Hospital ED (n=2240). We excluded those abscesses in which advanced imaging was performed, the abscess was draining already, and those for which POCUS would not reasonably be performed. The following binary data points were collected: Was a POCUS performed, ordered in Epic, interpreted in Epic, and saved in the SoftLink server? Also, was the POCUS procedure billed out to the payer and collected? **RESULTS:** At this point, we have performed data extraction from the first 6 months (January-June) of data collection for the 2016 calendar year (n=971).

There were 296 abscesses (30.5%) that met inclusion criteria. 127 (43.0%) POCUS were performed, 78 (26.4%) were ordered, 80 (27.0%) were interpreted, and 67 (22.6%) were saved in SoftLink. The number of POCUS procedures billed and collected have not yet been obtained. An I&D was performed in 260 (87.8%) of cases. **CONCLUSIONS:** EP's are using POCUS to evaluate cutaneous abscesses in a suboptimal number of cases. This may compromise the safety of management, including I&D. EP's are also not sufficiently documenting POCUS through the proper EMR workflow. This may result in the loss of revenue for the ED.

Co-Author(s): Kevin Hu, Icahn School of Medicine at Mount Sinai, Carl Mickman, Icahn School of Medicine at Mount Sinai, Donald Apakama, Icahn School of Medicine at Mount Sinai, Jonathan Mishoe, Icahn School of Medicine at Mount Sinai, Zachary Wilson, Icahn School of Medicine at Mount Sinai, Bret Nelson, Icahn School of Medicine at Mount Sinai

Poster 21

The Effect of Point-of-Care Ultrasound for Cutaneous Abscesses on the Decision to Perform Incision and Drainage

Hailey Rosenthal Medical Student, Icahn School of Medicine at Mount Sinai

Introduction: Point-of-care ultrasound (POCUS) has been shown to improve both the sensitivity and specificity of the clinical exam for cutaneous abscesses in patients of all ages.1-3 POCUS can be used to differentiate between cellulitis and abscess,4-6 which may impact the approach to treatment of these patients in the emergency department (ED). The goals of this study were to determine whether the use of POCUS for evaluating cutaneous abscesses affects the likelihood that a patient will undergo an incision and drainage (I&D) procedure. We also sought to assess the relationship between the use of POCUS for abscesses and ED length-of-stay (LOS). **Methods**: Electronic medical record (EMR) data from patients in the Mount Sinai Hospital ED with discharge diagnoses of “abscess,” “boil,” or “cyst” from January 2016 to December 2016 were retrospectively reviewed. Cases were excluded if POCUS would not reasonably be performed, the abscess was already draining significantly, advanced imaging was performed, or a consultant was involved in the medical decision-making. The following data points were abstracted from the EMR: patient age, sex, triage time, discharge time, and whether or not the patient had a POCUS and/or I&D performed. ED LOS was calculated from the triage and discharge times. **Results:** In 2016, 2240 patients in the Mount Sinai Hospital ED had discharge diagnoses of “abscess”, “boil” or “cyst.” Of these, 711 (32%) met the inclusion criteria for the study. Median age was 33 years

old (IQR 24-49 years) and 357 (50.2%) were male. POCUS was performed on 283 (39.8%) patients, and I&D was performed on 579 (81.4%) patients. Controlling for age and sex, a logistic regression demonstrated that those patients who had POCUS performed were 1.58 times more likely to have I&D performed than those who did not (95% CI 1.07- 2.34). Neither POCUS nor I&D contributed significantly to ED LOS. **Conclusions:** POCUS for evaluating cutaneous abscesses is associated with an increased likelihood that the emergency provider will perform an I&D. It is unclear whether the POCUS is uncovering the abscess, or if the POCUS is performed to assist with the I&D. Patient safety is improved in both cases. As POCUS did not significantly affect ED LOS, it can reasonably be performed without delaying patient care and disposition.

Co-Author(s): Stephen Alerhand, Rutgers New Jersey Medical School, Bret Nelson, Icahn School of Medicine at Mount Sinai

Session 2 (1300 – 1630) - Ultrasound Curriculum Development

Poster 1

Ultrasound Course Taught by First Year Medical Students: an Evaluation of Tanzanian Student Perspectives

Emma Cooper B.S., University of California, Irvine

Introduction: Ultrasound technology has been shown to significantly affect treatment, clinical skills, and medical operations in developing regions of the world. Additionally, previous data suggests that trained first-year medical students can effectively teach an introductory ultrasound course to healthcare students in Mwanza, Tanzania. While this course provides students with a basic understanding of ultrasound technology, little is understood about students' perceptions of ultrasound technology as well as perceived barriers to its practical use. Furthermore, as distance technology and telemedicine continue to expand and alter treatment strategies, several barriers, including lack of internet access, may prevent these innovative tools from reaching low and middle income countries. **Methods:** In this study, first year medical students from the University of California, Irvine assessed pre-course and post-course survey data from 56 healthcare students in Mwanza, Tanzania who participated in a three-week long ultrasound course. To better understand obstacles that prevent these students from learning and applying this ultrasound curriculum, previous exposure to ultrasound, opinions on ultrasound technology, primary language, internet access, and opinions regarding course structure were evaluated. **Results and Conclusions**: Preliminary data analysis suggests that students have variable perspectives on ultrasound technology, limited internet access, and minimal exposure to ultrasound clinically. Further analyses will be conducted upon completion of the course and collection of post-course survey data in July, 2018. This information is critical in developing appropriate curriculum for students with limited access to resources.

Co-Author(s): Andreea Dinicu, University of California, Irvine School of Medicine, Elizabeth Crawford, University of California, Irvine, Alexa Lucas, University of California, Irvine, Danielle Zezoff, University of California, Irvine, Kevin Bera, University of California Irvine School of Medicine, Ava Runge, UC Irvine School of Medicine, Justine Chinn, University of California School of Medicine, Justine Maher, University of California, Irvine, Kayla White, University of California, Irvine, Ariana Naaseh, UC Irvine School of Medicine

Poster 2

Efficacy of a two-year preclinical ultrasound curriculum in preparing medical students for clerkship rotations in their junior year

Kevin Phelan Ph.D., University of Arkansas for Medical Sciences

INTRODUCTION: The University of Arkansas for Medical Sciences instituted a preclinical ultrasound (US) curriculum in 2015 that emphasizes small group hands on scanning of standardized patients using GE dual probe Vscan devices. The curriculum includes 10 separate sessions (5 each in the M1 and M2 years), inclusion of 3 questions related to the US sessions on each subsequent module exam, and end-of-year US focused objective structure clinical exams (a single station OSCE in the M1 year and a two station OSCE in the M2 year). Our program has not yet formalized US instruction for the required or selective clerkship rotations in the M3 and M4 years. In order to assess the effectiveness of our curriculum in preparing students for US experiences encountered in their clerkship rotations, we surveyed the inaugural class of students that completed our two-year preclinical US curriculum. **METHODS**: Students were asked to complete an anonymous online survey at the end of their M3 year. The survey consisted of demographic information related to their gender, elective clerkship rotations and likely choice of residency field as well as LIKERT type and open-ended response questions. We asked students to identify US related experiences in each of their required and selective clerkship rotations and to comment on how the curriculum in their M1 and M2 years prepared them for these encounters. The response rate to the survey to date is 50.6% (88/174). **RESULTS**: Despite the absence of a formalized US curriculum in the M3 clerkship rotations, students reported that they often discussed archived (41.0%), observed live scans (97.7%) and had an opportunity to perform an ultrasound scan (63.6%) on patients during their clerkship rotations. A significant number of students agreed/strongly agreed that the US curriculum we offered in their M1 and M2 years was valuable (84.9%), had adequately prepared them for their rotations (83.9%), and allowed them to focus on the clinical knowledge during rotations rather than trying to understand the US scanning (67.4%). A significant proportion of students agreed/strongly agreed that they felt prepared to understand the US related issues discussed in their rotations (92.0%), to recognize structures in the US scans seen during rotations (89.6%), and how to hold and position the probes properly for US scans (95.4% and 81.6%, respectively). Almost three quarters of the students (72.4%) reported that they would rate their US knowledge as about the same or better than the interns they encountered during their rotations. Given our exclusive use of the hand held devices in our preclinical US curriculum, it was not surprising that students reported that they did not feel prepared to select the proper probe for a specific scan during their clerkship rotations (36.1% disagreed/strongly disagreed) or how to use the various knobs/sliders on the laptop US devices used on

the rotations (72.4% disagreed/strongly disagreed). One particular area of deficiency identified in student comments was that the US curriculum did not include training on how to measure fetal heads and amniotic fluid levels which was something they often encountered in their OBGYN rotations. Another helpful student suggestion was that we should offer a quick summary and/or review of some of the more common sonographic targets to students just before they begin their M3 year of rotations. The vast majority of students reported that they thought that US skills will be necessary for their planned choice of residency (78.2%) and that our two-year preclinical US curriculum had given them a head start on these skills (70.1%). **DISCUSSION**: The data from this survey indicates that our two-year preclinical US curriculum using only hand held US devices appears to have adequately prepared students for the informal but broad US experiences they encountered in their clerkship rotations. However, the survey identified some areas that will need to be addressed as we look at revising our preclinical curriculum to better prepare our students for their clerkship rotations.

Co-Author(s): Gregory R. Snead, University of Arkansas for Medical Sciences, Gitanjali Bajaj, University of Arkansas for Medical Sciences

Poster 3

Survey of ultrasound experiences during junior clerkship rotations in a medical school with only a formalized two-year preclinical ultrasound curriculum

Gregory R. Snead MD, University of Arkansas for Medical Sciences

Introduction: The University of Arkansas for Medical Sciences just finished its third year of a preclinical ultrasound (US) curriculum though we have not yet established any formalized US curriculum in the clerkship rotations. As a first step in assessing the extent to which students are being exposed to US in the junior year, we surveyed M3 students at the end of their junior year. This particular group of students was our inaugural class to complete our formal two-year preclinical US curriculum. **Methods:** Students were asked to complete an anonymous online survey at the end of their M3 year. The survey consisted of demographic information related to their gender, elective clerkship rotations and likely choice of residency field as well as LIKERT type and open-ended response questions. We asked students to identify US related experiences in each of their required and selective clerkship rotations and to comment on specifics of their US experiences in their rotations. The response rate to the survey to date is 50.6% (88/174). **Results:** The vast majority of students (97.7%) reported observing sonographic scans being conducted on patients during their required rotations (average 3.2 out of 7 required rotations,

45%). The degree of exposure varied between the rotations with OBGYN (96.6%), Surgery (77.3%) and Internal Medicine (60.2%) having the highest rates of exposure followed by Pediatrics (38.6%) and Family Medicine (31.8%) and then NeuroOphthalmology (11.4%). Almost two thirds of students (63.6%) reported having the opportunity to conduct their own supervised scans on patients in at least one of their required rotations (average 1.0 of 7 rotations, 14.7%). The bulk of these experiences were encountered in the OBGYN rotation (54.6% of students) followed by Surgery (18.2%), Internal Medicine (13.6%) and Family Medicine (12.5%) and then Pediatrics (4.6%). Students also reported a significant exposure to ultrasound imaging in their selective rotations with 69.3% of students indicating that they observed sonographic scans being conducted on patients. The highest rates of exposure were in the Emergency Medicine (87.5%), Anesthesiology (75%), Radiology (57.1%), and Urology (45.5%) rotations followed by Physical Medicine and Rehabilitation (23.5%), Orthopedics (21.4%), ENT (15.4%), and then Pathology (7.7%). Just over a third of students (35.2%) were given opportunities to conduct their own scans on patients in four of the selective rotations with the following rates of exposures: Anesthesiology (43.8%), Emergency Medicine (37.5%), Urology (27.3%) and Radiology (14.3%). In addition to seeing and performing sonographic scans in their clinical rotations, 40.9% of students indicated that ultrasound scans were discussed in one or more of their rotations. The combined ultrasound experiences of junior students at our school included a wide range of imaging through multiple systems with the greatest exposures for heart, liver, gall bladder, kidney, bladder, uterus and fetus. Their ultrasound exposure also included the demonstration of US guided procedures including most notably nerve injections, central venous line placement, FAST exams, spectral Doppler imaging and fetal measurement. The majority of the demonstrated sonographic imaging in the junior clerkship rotations was conducted by residents (34.0%) and clinical faculty (25.5%) followed interns (18.7%) and sonographers (17.9%) with the rest being conducted by either a nurse (3.0%) or another practitioner (i.e. technologist, advanced practice provider)(0.9%). A small percentage of students (12.5%) reported attending ultrasound related simulations during their junior year clerkship rotations. **Discussion:** Our survey indicates that even in the absence of a formalized ultrasound curriculum in the junior year, most of our students are gaining a broad range of sonographic imaging experiences including significant hands-on opportunities. The absence of a formalized clerkship rotation US curriculum likely contributes to the reported significant variation in the extent of sonographic experiences encountered by individual medical students. This variability likely reflects the constraints of the patient population as well as staffing and timing issues. The broad exposure to ultrasound revealed in the present survey reflects an increasing adoption of US by clinicians in a variety of clinical specialties. This survey data provides valuable information as we revise our existing preclinical curriculum and tailor any proposed clerkship US curriculum to our students needs.

Co-Author(s): Kevin Phelan, University of Arkansas for Medical Sciences, Gitanjali Bajaj, University of Arkansas for Medical Sciences

Poster 4

Poster 5

Wireless Portable Ultrasound Accessibility Improves the Learning of Integrated Basic Sciences (Anatomy, Physiology, Pathology)

Fauzia Nausheen MBBS, FCPS, MSc, California University of Science and Medicine

Introduction: At California university of science and medicine, school of medicine, we have designed a clinical presentation-driven, system-based, fully integrated, active learning curriculum. The integrated active-learning sessions are conducted by teams of students that belong to specific learning units referred to as "colleges". This curriculum is an amalgam of different pedagogical methods which also include modified versions of traditional team-based and problem-based learning. To complement the active, team-based learning pedagogy, ultrasound laboratory sessions are incorporated to support the learning of integrated anatomy, physiology and pathology by the interpretation of normal images during the system-based courses in year 1 and 2. The ultrasound anatomy laboratory sessions held each Friday will be aligned with the clinical presentations, clinical skills and case sessions of the week. Anatomy will also be taught on prosections, models, multimedia, online anatomy as well as radiology images. The objective of this study is to evaluate the student and instructor perception of teaching and learning of integrated basic sciences (Anatomy, Physiology and Pathology) with the use of wireless portable ultrasound scanners that will work on computer tablets provided to each team in the anatomy laboratory. **Methods:** The inaugural class will have 60 students, who will be divided into 6 colleges. Each college is composed of 10 students divided into two teams of 5. The members of each team will work together during lecture discussions in flipped classrooms, clinical case analysis and clinical skills activities which include role playing sessions and integrated laboratory sessions. Because of the increasing role of ultrasound in the clinical evaluation of patients, almost all system-based courses have developed and incorporated hands-on ultrasound experience. In each anatomy session, each team will have 2 wireless portable ultrasound scanners to perform ultrasound on each other or simulated patients and and identify the structures at different plane of sections for that specific lab as described in lab manual. The scanners have linear, phased and convex array with the ability to scan superficial and deep structures in different systems of the body. They will identify the structures for the specific session and have their findings confirmed by the facilitators. To achieve the designated learning outcomes, the ultrasound lab activities have been divided in three sessions: 1) information gathering and independent self-directed learning: self-study from resources. 2) identification of structures on ultrasound and confirmation by instructors: 3) interactivity and integration followed by presentation and discussion: the focus of this session is on problem solving exercises, critical-thinking and presentation by the teams. The problems will focus on related anatomical appearances on ultrasound. During the discussion the students will be

encouraged to justify their answers based on ultrasonographic principals and extra bonus points will be given by identifying the abnormality or related structures on ultrasound images. **Results:** Years 1 and 2 have 11 system-based courses and each course has multiple ultrasound sessions depending on the weekly clinical presentation theme. Live ultrasound scanning is synchronised with the anatomy curriculum of each system by anatomic sections and location of different body parts that form the system. The following is an example of sessions and overall outcomes for ultrasound hands-on lab session in some of our systems-based courses; In “The Scientific Foundation of Medicine:” course , we will have ultrasound sessions on introduction to medical imaging, doppler ultrasound, knobology, ultrasound physics and basics of ultrasound imaging. The learning outcome is : to differentiate the hyperechoic organs from the hypoechoic organs and explain the reason of their appearance based on ultrasound imaging principals. In “The Structural Integrity of the Human Body”; (i.e., Integumentary and musculo-skeletal systems), we will have session on ultrasound of shoulder, wrist, knee and ankle joints with identification of the bones and ligament and muscles moving the joints. The learning outcome is : to identify and differentiate the normal appearance of bones, muscles and tendons of shoulder, elbow, knee, hip and ankle joints. In “The Sustenance of the Body “(i.e., Gastrointestinal system and nutrition), we will have session of ultrasound on major abdominal vessels and organs including the Morison pouch, and introduction to FAST exam. The learning outcome is : to locate liver, gall bladder, spleen, pancreas, aorta and IVC on abdominal ultrasound and perform Doppler scan to show the direction of blood blow. In “The Depurative Functions of the Body” (i.e., renal system), we will have session on ultrasound of kidneys and urinary bladder. The learning outcome is : to locate kidneys, and urinary bladder on abdominal ultrasound. In “The Transport and Delivery of the Life’s Elements “(i.e., cardiorespiratory systems);we will have session on ultrasound appearance of normal lungs, ribs and pleural cavities and cardiac ultrasound four chamber view, cardiac cycle and valvular events. The learning outcome is : to locate four chambers of heart and identify the valves on subcostal and parasternal cardiac view. In “The Propagation of Life “(i.e., reproductive system), we have session of ultrasound of the pelvic organs and breasts. The learning outcome is : to locate uterus ovaries and prostates on pelvic ultrasound. In “The Foundation of Life’s Functions” (i.e., endocrine system), we have session of ultrasound of neck (thyroid glands). The learning outcome is : to locate thyroid gland on neck ultrasound. In “The Integration of Life’s Processes” (i.e., neurosciences), we have session of ultrasound of major vessels in the neck (carotids, jugular veins). The learning outcome is : to locate major neck vessels and perform doppler scan to show the blood flow. In “The Continuum of Life” (i.e., from the beginning to the endo of life), we have ultrasound session of introduction to POCUS (point of care ultrasound). The learning outcome is : to review the principals of point of care ultrasound. The laboratory exam will assess the student’s skills to perform ultrasound and locate the appropriate structure in the correct plane and identify the anatomical relations on simulated patients. Students and faculty will be given evaluation forms to get

feedback about their perception of anatomy teaching and learning with wireless portable ultrasound scanners at the end of each system-based course and their suggestions to improve the sessions. **Conclusion:** Wireless portable ultrasound scanners accessibility in all system-based courses in anatomy lab will be a bridging device between the integrated basic sciences and clinical practice. This early exposure of portable wireless ultrasound imaging technique in all organ systems will prepare our medical students for later ultrasound encounters of clinical years.

Co-Author(s): Sherif S Hassan, Rajunor Ettarh, Alfred Tenore, Robert Suskind

Poster 6

A brief ultrasound session is highly effective in teaching basic ultrasound skills and is well-received by senior medical students

Kimberly Rathbun MD, PhD, MPH, East Carolina University

Introduction: Ultrasound has become increasingly prevalent in undergraduate medical education, particularly as part of Emergency Medicine (EM). The M4 EM rotation dedicated one half-day of educational time to basic ultrasound education. The students learn basic ultrasound physics, machine operation, image acquisition, and image interpretation. There is a didactic component as well as a hands-on component where the students perform ultrasound scans on a standardized patient. The purpose of this study is to evaluate the effectiveness of this educational time as well as the students' perception of the usefulness of including introductory ultrasound training part of their education. **Methods:** All M4 students rotating through the M4 EM rotation participated in the 3-hour educational activity as part of the didactic curriculum. The students received basic instruction regarding ultrasound physics and machine use. They received didactic training immediately followed by hands-on practice of three types of common ultrasound scans used in the Emergency Department: FAST, gallbladder, and aorta. Prior to the session, students completed a brief pre-test. After the educational activity, students complete a post-test and a survey regarding the usefulness of ultrasound in medical education and the effectiveness of the educational session. The pre- and post-tests consisted of 12 questions covering knowledge of basic ultrasound physics, interpretation of ultrasound images, and clinical application of ultrasound findings. The survey addressed prior ultrasound experience and used a 5-point Likert scale to assess students' attitudes toward the course and ultrasound training as part of the educational curriculum. **Results:** In a one-year period, 87 students participated in this session. Students have shown a significant increase in basic ultrasound knowledge. Means of the pre- and post-test scores were 53.5%

correct (median 58.3%) and 80.3% correct (median 83.3%), respectively ($p<0.01$). The students found the educational session both enjoyable and relevant both to the EM rotation and their future careers. **Conclusions:** A brief ultrasound course is highly effective in increasing senior medical students' knowledge of ultrasound physics, interpretation of ultrasound images, and clinical application of ultrasound findings. Senior medical students feel that ultrasound is relevant to their medical training and they would like to have ultrasound integrated into all four years of the medical school curriculum.

Poster 7

Poster 8

Does Early Education Help Medical Students Understand Ultrasound?

Rebecca Lufler PhD, Tufts University School of Medicine

Introduction: Ultrasound (US) is becoming more pervasive across medical specialties and therefore requires training and education earlier in the undergraduate medical curriculum. Given the difficulty of handling, acquiring and interpreting US, early exposure is imperative. Combined and integrated learning has been shown to be beneficial and has led to integrated curricula in medical schools across the country. Finding the right place to integrate US is the challenge. The purpose of this study is to evaluate the effectiveness of the US curriculum based on student's perceptions of US, confidence in interpreting and acquiring US images, and performance on US exam questions. **Methods:** An US curriculum was developed and incorporated into the first-year medical clinical anatomy course at Tufts University School of Medicine. Student participation in the study was voluntary and the study was granted exempt status by the Institutional IRB (#12737). Students were asked to complete an online pre-survey evaluating their confidence in using US and their perceptions of US prior to the start of the US curriculum in the anatomy lab using an 11 point Likert Scale. Students rotated through an US station during 6 labs, covering 6 different regions during the anatomy course. Students had the opportunity to watch US being performed, as well as gain hands on experience acquiring US images. Video primers for each lab were posted for students to prepare and use as study tools for exams. US questions were included on all written and practical exams. Students completed a post-survey evaluating their changes in confidence and perceptions. Mean Likert ratings on pre- and post- surveys were compared to evaluate student's perceptions and confidence. Performance on US based exam questions were evaluated as percent correct. **Results:** Students reported significantly higher mean confidence ratings

on understanding US, ability to operate US, ability to obtain US images, ability to recognize artifacts, and ability to interpret normal anatomy images ($p<0.0001$) after completing the US curriculum. Students also reported that US reinforced anatomy concepts, as well as clinical correlations ($p<0.0001$). Students disagreed with items stating learning US is not too difficult for a student to learn (1.2, 2.2 SD) and that it interfered with learning anatomy (0.68, 1.7 SD). On the four course exams, the average percent correct on US questions for each exam was 94.2 (Back and Lower Extremity), 91.6 (Upper Extremity and Thorax), 80.6 (Abdomen and Pelvis), and 96.7 (Head and Neck). **Conclusions:** This US curriculum has proven to bolster students' knowledge and perceptions of bedside US, and has given them confidence in image acquisition.

Co-Author(s): Linda Afifi, Tufts University School of Medicine, Robert Willson, Tufts University School of Medicine, Peter Croft, Maine Medical Center

Poster 9

How to Reach - Expanding the Community of Practice

Our Medical Student Ultrasound Interest Group: Year in Review

Grant Barker B.S., University of Miami

Our Medical Student Ultrasound Interest Group: Year in ReviewGrant Barker, BS, (MD Candidate), Leila L. PoSaw, MD, MPHIntroductionMedical students want to learn ultrasound. They not only recognize the utility of ultrasound to augment their formal medical school curriculum, but also recognize increasing ultrasound clinical use by a broad range of specialties. Two years ago, passionate students at the University of Miami Miller School of Medicine started a grassroots, student-run ultrasound interest group (USIG). Formal ultrasound training is not available at their medical school and they believed that an USIG would be the most effective way to build an "organic learning community that is less reliant on leadership." The philosophy, structure, and activities of this USIG are presented. The challenges and successes faced by the USIG, along with its methods for engaging learners, are also presented. **Methods**: The USIG was two-years in the making. Four broad goals were envisioned: (a) to appeal across specialty interest, (b) to supplement and be temporally correlated to mandatory coursework, (c) to reach the largest number of students without compromising quality, and (d) to emphasize peer learning and peer mentorship. Several barriers including organizational logistics, and the lack of equipment and space were faced and overcome. Four two-hour long workshops, on the respiratory, renal, gastrointestinal and musculoskeletal systems, were organized during the second-year medical student academic year.

Several activities were conducted in these workshops. Activities included scanning high fidelity simulation models like cadaveric kidneys with renal stones and scanning low-fidelity simulation models, such as beef liver simulating pulmonary consolidation. Real time dynamic activities, such as drinking seltzer to visualize bubbles through the upper gastrointestinal system and eating donuts after a period of fasting to visualize gallbladder contraction were conducted. Patient scanning in the emergency department to visualize pulmonary pathology was also conducted during the pulmonary workshop. Each workshop was organized on a scaffolding of Pre-learning, Learning, Doing and Teaching. Pre-learning was made possible by the distribution of 'mini-libraries' of relevant information prior to the workshops. The Learning phase involved a brief lecture related to practical scanning and didactic presentations on anatomy and pathophysiology at stations at each workshop. The Doing phase consisted of hands-on scanning with the assistance of peers and expert instructors. The Teaching phase is scheduled to take place at workshops in the following academic year. Four students have been selected in advance to become dedicated Trainers and will lead future workshops. **Results**: The second-year medical student class enthusiastically received the workshops. Three of the four on-line workshop registration sign-ups filled up in less than 5 minutes. Each workshop had space for 12 students, including the Trainers. Thus, over the year, 36 students or nearly one-fourth of the 149-student second-year class could potentially participate in the workshops.The more engaging activities, such as the selzer-bubbles activity, generated the most interest and were regarded most highly by students. Due to patient availability, scanning patients in the emergency department proved to be the most challenging activity. One organizer felt that "providing students with hands-on access to ultrasound machines rather than simply demonstrations and lectures was a remarkable achievement." Another organizer commented, "competency requires continued exposure which is difficult to achieve when meeting every two months" and wished to meet more frequently. The workshops were effective at educating students in ultrasound technique, anatomy and pathophysiology. Knowledge assessments with pre-session and post-session tests demonstrated significant gains. **Discussion**: The USIG has had a successful inaugural year. The biggest contributor to success was student motivation, the drive and the desire to learn ultrasound. Faculty guidance and the organization of interactive and engaging workshops also contributed significantly. The biggest challenges were the availability of machines and of ultrasound experts, which affected the number of medical students who could participate at each workshop. The USIG plans to continue to develop through the organization of more events and activities and hopes to expand to all medical student years.

Co-Author(s): Leila PoSaw

Poster 10

Medical Student Ultrasound Interest Group: The Musculoskeletal Workshop

Grant Barker B.S., University of Miami

Introduction: Passionate students at the University of Miami Miller School of Medicine recognize the need to learn ultrasound early in their medical education and have formed an Ultrasound Student Interest Group (USIG). The philosophy of this group is to enhance their formal medical school education with ultrasound. This past year, the USIG conducted several workshops, one of which was Musculoskeletal (MSK). The goal of this workshop was to learn the anatomy and pathophysiology of the knee, wrist and shoulder with ultrasound. The format of this workshop, along with its challenges and successes are presented. **Methods**: The MSK Workshop was a two-hour session, consisting of a brief introductory lecture followed by rotations through three hands-on ultrasound-scanning stations. Learning resources (articles, websites, videos) were made available to students prior to the workshop. At each scanning station, students were given a learning tool: a relevant anatomy drawing to label. Knowledge gain was assessed with pre- session and post-session multiple question tests. A general qualitative evaluation, along with student and organizer feedback was solicited at the end of the session. **Results**: Quantitative analysis of the workshop found a significant difference in the scores of the pre-test (M=4.5, SD=1.65), and the post-test (M=7, SD=2); t (9)=4.79, p=0.001. Qualitative analysis rated the effectiveness of the workshop as high. Comments mainly focused on the use of ultrasound and its role in enhancing learning. Positive feedback included “actually getting to practice”, “small groups”, and “hands on time”. One commenter remarked that the session could be improved by “use of 3D anatomy to understand the structures”. **Conclusion**: Our MSK workshop is an effective way for medical students to enhance their knowledge of musculoskeletal systems with ultrasound. We hope that other USIGs can use our materials and experience to hold similar workshops at their institutions.

Co-Author(s): Leila PoSaw, Jackson Memorial Hospital, Robert Irwin


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Poster 11

Poster 12

Assessing medical student improvement and perceptions of a student-developed and student-run point-of-care ultrasound interest group

Shelby Payne Medical Student, Vanderbilt University School of Medicine

Introduction: Point-of-care ultrasound (POCUS) is a rapidly expanding practice by which physicians in diverse medical specialties are improving outcomes and expediting care while reducing radiation exposure and cost. While POCUS has been integrated into the formal curricula of some U.S. medical schools, it continues to be infrequently and informally taught at many others, with these efforts largely being faculty-driven. The purpose of this study was to assess the improvement in ultrasound knowledge and comfort levels in undergraduate medical students at Vanderbilt University School of Medicine (VUSM) who participated in the student-developed and student-run POCUS interest group with an established curriculum. We also assessed the students' perceptions of the re-designed curriculum and format of the interest group in an attempt to continue to improve the way that ultrasound is taught in undergraduate medical education. **Methods:** Curriculum development focused on teaching basic ultrasound physics, proper machine use, probe selection, and scanning technique, as well as five POCUS examinations (FAST, Aorta/IVC, Thoracic, Renal, and Cardiac Echo). Emergency medicine physicians with fellowship training in POCUS were consulted for quality assessment of didactic material. Students were recruited in two phases over twelve months, resulting in 60 students in this cohort. There were 17 student teachers who previously completed the curriculum. Students' test scores on faculty vetted pre- and post-tests were assessed before and after each peer taught hands-on ultrasound session. Analysis of variance (ANOVA) was performed to assess pre- and post-test score differences for each scanning session. Student-perceived levels of comfort with performing ultrasound examinations before and after the POCUS education sessions were assessed on a 7-point Likert scale. ANOVA analysis was performed to assess pre- and post-session comfort level differences for each scanning session. An anonymous Red Cap survey was sent at the end of the 12-month period to assess overall satisfaction with POCUS education and satisfaction with peer teaching. 50 students responded to the survey. **Results:** Of the 50 survey respondents, 12 (24%), 15 (30%), 17 (34%), and 6 (12%) were 1st, 2nd, 3rd, and 4th year students respectively. Overall, 91.7% reported being satisfied or very satisfied with the didactic material, 93.7% were satisfied or very satisfied with student-led hands-on training sessions, and 94% were satisfied or very satisfied with the quality of peer teaching. While 94% of students reported being satisfied or very satisfied with the program overall, only 39.6% were satisfied with the amount of faculty involvement. After completion of at least one didactic and hands-on session, 42 (85.7%) of students reported feeling comfortable or very comfortable with using an ultrasound machine. After completion of the following

scanning sessions, students reported feeling comfortable or very comfortable performing the scan: 71% (FAST), 71.1% (Renal), 61.7% (Cardiac), 60.5% (Thoracic), and 50% (Aorta and IVC). The ANOVA analysis for the difference in means of the pre- and post-test scores showed significant P values ($P < 0.001$) for all five scanning session categories. In addition, ANOVA results showed that students' reported comfort level with scanning improved significantly ($P < 0.001$) from the pre-session assessment to the post-session assessment for all five scanning sessions. **Conclusions:** A student-run point of care ultrasound group can provide introductory education for most basic ultrasound examinations with a high percentage of student-perceived effectiveness and satisfaction. 94% of students were either satisfied or very satisfied with the quality of peer teaching, and 94% of students were either satisfied or very satisfied with the overall POCUS program. Students demonstrated a significant overall increase in post-session test scores after all five POCUS peer-taught scanning sessions. $P < 0.001$ for pre-test vs post-test scores for all five types of scanning sessions offered. Students demonstrated a significant overall increase in comfort level for each scan. $P < 0.001$ for the change in comfort levels from before to after sessions for all five scanning sessions. **Future Directions:** The POCUS interest group has plans to partner with other departments such as anesthesiology, sports medicine, cardiology, pediatrics, critical care, and OB/GYN to offer educational sessions about the application of ultrasound in these fields. The group will continue to train new student teachers to allow more students to learn POCUS in addition to their standard medical school curriculum. Students who have completed all five hands on sessions are being scheduled for Emergency Department scanning shifts with faculty to further refine their ultrasound skills in a one to one faulty to student setting. There are plans to add an ultrasound procedure lab to the curriculum. Currently, about 25% of our medical student body takes part in the POCUS interest group. With a marked growth of interest since the creation of POCUS, we hope to involve many more students in the future and to ultimately make our curriculum translatable for other medical schools to implement their own student-run POCUS curriculum to fill the existing gap in undergraduate ultrasound education.

Co-Author(s): Sydney Payne, Vanderbilt University School of Medicine, Joseph Wong, Vanderbilt University School of Medicine, Lauren Matevish, Vanderbilt University School of Medicine, Robinson Ferre, Vanderbilt University Medical Center


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Poster 13

Poster 14

Undergraduate Ultrasound Training in Osteopathic Medical Education and Various Healthcare Colleges at Des Moines University

Kevin Carnevale MD, Des Moines University

Des Moines University is currently developing a vertically integrated ultrasound (US) curriculum into a multidisciplinary healthcare educational system. One of the unique advantages and complications with the school is the large class size matriculating approximately 220 osteopathic medical students, 50 physician assistants, 53 podiatric medicine students, and 52 doctoral physical therapy students annually. This work outlines how we have implemented US throughout the medical training in different healthcare curricula to help students feel confident operating an US machine, performing exams to find the desired image through proper probe selection and manipulation, and interpreting the digital images with proper communication relative to their training. All students are exposed to US during their first-year anatomy training and then their training is tailored to the needs within professional disciplines. We review the US training in different healthcare curriculum, student champions, student teaching assistants, limited faculty champions, equipment and resources needed to deliver US training in interdisciplinary healthcare professional undergraduate education. Attendance at open lab sessions have increased significantly and osteopathic students who are confident or extremely confident using ultrasound equipment has grown markedly over the past three years.

Co-Author(s): Thomas Benzoni, DMU, Donald Matz, DMU, Sarah Clayton, DMU, Bret Ripley, DMU, Craig Canby, DMU, James Mahoney, DMU, Steve Harder, DMU, Jason Kessler, DMU, Juanita Robel, DMU, Nathan Spencer, DMU, Marshall Sheide, DMU, Tyler Loomer, DMU, Christopher Ruettinger, Des Moines University, David Marshall, DMU, Zachary He, DMU, Scott Nguyen, DMU, Brady Bollinger, DMU

Poster 15

Medical Student Ultrasound Interest Group: The Pulmonary Workshop

Leila PoSaw MD, MPH, Jackson Memorial Hospital

Introduction: Medical students recognize the need to learn ultrasound early in their medical education and have organized themselves into extra-curricular interest groups. At the University of Miami Miller School of Medicine, enthusiastic medical students have formed the Ultrasound Student Interest Group (USIG). One of its activities is a Pulmonary Workshop, an anatomical and pathophysiological exploration

of the lung with ultrasound. This is held concurrently with the second year formal Respiratory System block. The course materials for this Pulmonary Workshop are presented, along with student feedback and evaluations. **Methods:** The Pulmonary Workshop consisted of a two-hour session. A mini-library was available to the participants prior to the session. The session comprised of an opening and closing presentation, two small group activities, and 2-4 instructor-led bedside patient stations in the emergency department. A quantitative knowledge pretest and posttest as well as a qualitative program evaluation were conducted. Teaching methods included peer assisted learning and simulation. **Results:** Our USIG generated considerable interest such that one third of the second year class signed up for the Pulmonary Workshop. Due to size limitations, however, only 12% of the second year class could be accommodated. There were significant gains in knowledge and students were satisfied overall with the workshop. Seats in the next workshop filled up in less than five minutes. **Discussion:** The Pulmonary Workshop, organized by the USIG, is a popular and effective method for students to explore and learn pulmonary anatomy and pathophysiology with ultrasound.

Co-Author(s): Erik Anderson, University of MIami, Miller School of Medicine, Yuval Peleg, University of Miami, Miller School of Medicine

Poster 16

Integration of Ultrasound Sessions into a Clinical Anatomy Curriculum: Lessons Learned Regarding Timing

Vaughan Lee PhD, University of South Alabama

INTRODUCTION: Ultrasound imaging is rapidly becoming an important and widely used tool for physicians at the point of care. To prepare our students for this skill, Texas Tech University Health Sciences Center/School of Medicine (TTUHSC/SOM) has incorporated ultrasound techniques in all four years of the undergraduate medical curriculum. Ultrasound imaging naturally integrates with teaching anatomical orientation by providing a method to visualize the underlying structures in a clinically relevant manner. **METHODS:** Three ultrasound sessions were designed for first year medical students and integrated with previously established presentation and dissection activities for specific regions. These included the shoulder, neck and abdomen (right upper quadrant). Prior to each session, students were provided online modules with instructions for performing the ultrasound evaluation of specific structures within each region. Students were organized in pairs with one ultrasound machine and each student examined their partner for the shoulder and neck sessions. Students were organized in groups

of five for the ultrasound assessment of the abdomen (liver and gall bladder) where each student conducted the examination on a standardized patient. The sessions were scheduled either after (shoulder), before (neck) or during (abdomen) the relevant laboratory dissection. Knowledge acquisition was assessed with pre- and post-quizzes and student attitudes evaluated through the end of course survey. **RESULTS:** Average student performance on these assessments was significantly increased from pre-quiz to post-quiz for all three sessions ($p<0.0001$). Students ranked the overall experience with ultrasound sessions highly. The rankings for timing of the sessions were after (3.91), during (3.70), and before (3.08) on a five-point Likert scale. **CONCLUSIONS:** Supplementing anatomical dissection sessions with ultrasound imaging can augment the students understanding of the underlying anatomy and introduce students to clinical applications of ultrasound skills. Students prefer having the ultrasound sessions after or during the dissections compared to before. Students have a strong desire for more time in the curriculum to practice and learn ultrasound skills. We thank the TTUHSC Willed Body Program donors and TTUHSC/SOM for helping make this study possible.

Co-Author(s): Greg Brower, TTUHSC/SOM, Gurvinder Kaur, TTUHSC/SOM

Poster 17

Ocular Point of Care Ultrasound: Efficacy and Knowledge Retention of a New Teaching Workshop for Medical Students

Pouya Bandegi MSc, McGill University

Introduction: Ultrasonography is being widely incorporated into multiple medical disciplines and has evidence of improved patient outcomes1. Therefore, it is becoming more important to introduce ultrasound in undergraduate medical education. In the literature, medical students' feedback in regard to the utility of early ultrasound education has been overwhelmingly positive2,3. However, few studies have evaluated medical students' retention of point-of-care ultrasound (PoCUS) knowledge objectively. **Methods:** We designed a one-hour teaching workshop of ocular ultrasound. Teaching objectives included a review of ocular anatomy, technique of ocular POCUS scanning, and review of major ocular pathology including the assessment of retinal detachment, posterior vitreous detachment, vitreous hemorrhage, and optic nerve sheath diameter. This was followed by bedside ocular scanning of normal volunteers. Scanning was done under the direct supervision of the authors (PB, NA, JT). Immediately prior to the session, we evaluated the medical student's prior knowledge in general ocular anatomy, general principles of ocular ultrasound and sonographic findings in ocular pathology. Students were also

asked to rate their perceived confidence in performing these various scans on a 10-point Likert scale. Immediately following the session, the same test was provided to the students to assess their short-term knowledge gain. Finally, we repeated the evaluation three months after the workshop to assess the students' level of long term retention. The results for the 3-month post-workshop evaluation will be available in July and ready to be presented at the congress. Data was analyzed using paired T-test and statistical significance was set at 0.006 with adjustment of multiple comparisons. **Results:** A total of 17 students participated in the workshop. There were 2 first-year, 10 second-year, and 5 third-year students. Self-reported students' confidence in assessing traumatic and non-traumatic visual complaints when reported on a 10-point Likert scale increased from 4.1 to 6.5 ($p<0.006$). Perceived knowledge about ocular anatomy increased from 5.7 to 6.9 ($p<0.006$) and perceived knowledge of ocular PoCUS increased from 2.1 to 4.5 ($p<0.0001$). Prior to the session, the mean final score measuring their knowledge of anatomy, PoCUS techniques, and ocular pathology was 43.7%; Immediately following the session, this increased to 65.6% ($p<0.0001$). Students were overwhelmingly in favor of the session and felt that the best time for this type of workshop was during second or third year of medical school. **Discussion and conclusion:** A one-hour workshop of ocular ultrasound was offered to McGill medical students. Students' self-reported confidence of ocular complaints and ocular PoCUS skills increased after the workshop. Importantly, students objectively improved in knowledge level regarding ocular anatomy, ocular PoCUS techniques, and recognizing ocular pathology on ultrasound. Results from the three-month post-workshop will be intriguing as they will have implications for retention of this knowledge long-term and thus utility of such workshop as an adjunct to undergraduate medical education.

Co-Author(s): Nebras Alghazawi, McGill University, Joel Turner, McGill University

Poster 18

Poster 19

Lung Ultrasound Education: Determining Effective Teaching Strategies for Medical Students

Miles Reese MD Candidate, Univeristy of South Carolina School of Medicine

Introduction: Ultrasound education has become integrated into many medical schools' curriculums. One area that has yet to be fully explored and incorporated is the utility of ultrasound in lung pathology diagnostics. Ultrasound is being utilized more and more as a tool to assess lung pathology such as pneumonia, pleural effusions, pneumothoraxes, pulmonary edema and chronic obstructive pulmonary disease. Incorporating the basics of using ultrasound to diagnose lung pathology would be beneficial for both a student's education during their basic science years and in their preparation for their clinical years. A variety of educational methods have been described for teaching lung ultrasound. Traditionally these methods have included classroom lectures and online modules. More recently, educators have incorporated the use of sponge phantoms. To date, sponge phantom education has focused on the identification of A-lines and B-lines but has yet to be incorporated into the education of lung ultrasound in the diagnosis of lung pathologies.We sought to incorporate the sponge phantom into an educational lecture on lung ultrasound and lung pathology given to medical students, which was compared to the more traditional lecture based model. It was hypothesized that the group taught with the novel sponge method would show improved performance and better retention when compared to the group taught by a traditional method. Equipped with the knowledge gained from this study medical institutions will be better able to institute an effective lung ultrasound curriculum for medical students. **Methods:** First and second year medical student volunteers (30 students) were randomized into two different groups: the traditional group and sponge group. Both groups received a one hour didactic lecture on lung

ultrasound. The traditional group scanned each other while the sponge group incorporated the use of sponge phantoms to demonstrate and further explain A-lines, B-lines, lung sliding, lung point, pneumothorax and lung consolidation. Both groups were given a 16 question multiple choice test on ultrasound clips showing lung pathology before the educational intervention (pre-test), immediately after their respective educational interventions (post-test), and one month preceding the education (retention-test). The participants also filled out a subjective survey following their session. A 2x3 mixed analysis of variance (ANOVA) was conducted to compare the main effects of the three time points (pre-test, post-test and retention-test), the two groups (traditional group and sponge group), and the interaction between the two on lung ultrasound test scores. **Results**: The traditional group scored 47.7 ± 10.7 on the pre-test, 63.7 ± 11.2 on the post-test and 60.9 ± 13.8 on the retention-test. The sponge group scored 47.3 ± 8.7 on the pre-test, 64.7 ± 13.6 on the post-test and 55.8 ± 14.8 on the retention-test. There was a statistically significant difference across the three time points of lung ultrasound test scores ($p<0.001$). There was not a statistically significant difference between the traditional groups lung ultrasound test scores and the sponge groups lung ultrasound test scores ($p=0.657$). There was also no statistically significant interaction between the two groups and three time points on lung ultrasound test scores ($p=0.482$). **Conclusion:** It was concluded that the incorporation of the hands on sponge phantom during the didactic lecture in place of scanning other students did not statistically make a difference in the student's test scores; however, both were statistically effective across time. The sponge group did respond with a better satisfaction rating of their hands-on experience (8.6/10) than the traditional group (7/10). Several students commented that it was not only helpful to obtain the scan, but using the phantom also helped them understand why different pathologies present radiographically the way they do on ultrasound. Several students even expressed a desire to have a similar teaching method incorporated into other areas of ultrasound education as well. An important limitation of the study is that 86.7% of the participants were M1s who have had very little education or exposure to lung pathology. This was reflected by the survey results, in which student responses acknowledged that they felt as though they learned from the educational interventions, but taking the test was difficult due to their unfamiliarity with the medical terminology such as pleural effusion, pneumothorax and pulmonary edema. Overall, M1s scored a 62.3 ± 10.8 on the post-test compared to the M2s who scored a 76.6 ± 14.8. The feedback serves as a reminder of the importance of taking into account the student's knowledge base when developing curriculum. A future study focusing on educating M2s prior to having education in lung pathology would be beneficial, as well as increasing our sample size. Overall, both educational modalities were effective and did not statistically differ from one another. However, the students in the sponge group were more satisfied with their education. This should be considered when developing curriculum. More research needs to be done to investigate the use of sponge phantoms in lung ultrasound education.

Co-Author(s): John Metz, University of South Carolina School of Medicine, Samuel Scoma, University of South Carolina School of Medicine, Michael Wagner, University of South Carolina School of Medicine

Poster 20

Peer-led female pelvic point-of-care ultrasound: impact of teaching and simulation workshop on undergraduate medical students' learning and confidence level

Alexandre M. Bélanger M.D.,C.M. candidate 2019, McGill University

Introduction: Pelvic ultrasound is the most useful imaging modality to differentiate intrauterine from ectopic pregnancies in the first trimester (1). Sonographic evaluation performed by Emergency Physicians (EP) have been shown to be very accurate for assessing pelvic complaints in pregnant patients (2,3) as well as to decrease the length-of-stay in the Emergency department (ED) (4). Student-performed point-of-care ultrasound (POCUS) has also been shown to be feasible as well as beneficial for patients' management in the ED (5). This imaging modality is therefore an important tool that undergraduate medical students need to acquire in their training. Through a peer-led teaching and simulation workshop on female pelvic POCUS, we evaluated the impacts on medical students' knowledge and confidence. **Methods:** A 1-hour peer-led female pelvic POCUS workshop was offered to all medical students at McGill University. Volunteers participated in the session in groups of 8-10. The main learning objective was the assessment of abdominal and pelvic complaints in the first trimester. Preparation for the workshop consisted of a 15-minute video and a pre-workshop questionnaire evaluated participants' knowledge and level of confidence with pelvic POCUS. The teaching session was divided in two parts: a didactical presentation reviewing anatomical landmarks, pelvic scanning techniques and criteria for definite intra-uterine pregnancy, followed by a practical teaching period under direct supervision on live models (transabdominal approach) and on a Blue Phantom© simulator (transvaginal approach). Participants then completed a post-workshop questionnaire immediately after the session and one month later to assess their learning curve and knowledge retention. The questionnaire comprised of 14 questions, evaluating mainly anatomy and ultrasound knowledge. **Results:** A total of 18 volunteers participated in 2 teaching sessions held in April 2018; two 1st-year, nine 2nd-year, four 3rd-year, and three 4th-year students. All had received prior teaching on general ultrasound techniques, and about half had received prior teaching on female pelvic POCUS specifically, although not as detailed as in this workshop. Students' score increased on average by 5.4 (4.5 - 6.3, $p<0.01$) points between the pre- and post-workshop questionnaires, which represents a 38.6% improvement. Eight students completed the 1-month post-workshop questionnaire. Their mean score remained 4.8 (2.9 - 6.6, $p<0.01$) points higher

than prior to the workshop and their mean score was 0.8 (-2.3 - 0.8, p=0.32) lower than immediately after the session. When asked to assess their own skills on a 10-point Likert scale, students reported a mean increase of 2.4 (±0.8, p<0.01) and 2.9 (±0.9, p<0.01) in their knowledge of female pelvic POCUS and in their level of confidence, respectively. Qualitative comments were generally positive, with all students recommending the workshops for their fellow colleagues. **Conclusion:** All students had a significant increase in their scores following the workshop, which was maintained one month after the session, demonstrating an adequate learning curve. This initiative also reiterates the positive effect of female pelvic POCUS workshop on students' learning curves and level of confidence while demonstrating the importance of peer-led teaching in undergraduate medical education.

Co-Author(s): Claudèle Brault, McGill University Health Center, Joel Turner, McGill University

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Saturday September 15, 2018

Oral Abstract Sessions

Session 3A (1000 – 1130) – How to Reach – Expanding the Community of Practice

A Study of Ultrasound Training for Assessment of Left Ventricular Function by Physician Assistants

Robert Baeten Physician Assistant, Home

Despite literature demonstrating similar practice patterns, outcomes, litigation, and patient complexity across the spectrum of clinicians (PA/NP/physician), there has been little data to support the theory that physician assistants (PAs) can be as accurate as physicians performing and interpreting Point of Care Ultrasound (PoCUS). While this particular PA skill has not been well published in previous studies, there is extensive evidence to support that thousands of PAs are already using PoCUS in their scope of practice. In 2013, the American Academy of Physician Assistants (AAPA) surveyed PAs working in critical care and reported 81% of PAs use ultrasound for line placement, 39% use ultrasound for limited echocardiograms, while another 17% use ultrasound for at least one other bedside application. A 2017 Society of Emergency Medicine Physician Assistants (SEMPA) survey reports 44% of EM PAs perform ultrasound guided procedures, and 51% of EM PAs perform diagnostic ultrasound as a procedure. The National Commission on the Certification of Physician Assistants surveyed over 9,000 PAs in 2015 in regard to how often they use ultrasound in their practice and found nearly half of the surveyed PAs use ultrasound at least monthly. Our pilot study was designed to compare the diagnostic accuracy of focused cardiac ultrasound (FoCUS) for left ventricular systolic function performed by PAs, to those obtained by formal echocardiography. The PAs that participated in this study were trained in FCU by a PA residency faculty member. PAs were responsible for obtaining the images and interpreting the findings. The ejection fraction diagnosis was binary, "normal" or "abnormal" and for the purposes of this study there was no attempt made to quantify the ejection fraction. The diagnostic accuracy was measured against the gold standard of expert echocardiogram and interpretation by a board-certified cardiologist. Methods: This study took place at a 643 bed community, quaternary care center with

approximately 64,000 inpatient admissions annually. The study was approved by our hospital's Scientific Review Committee and Institutional Review Board who have no affiliation with FujiFilm SonoSite, the manufacturer of the ultrasound devices used in this study. A total of 8 clinically practicing cardiology PAs elected to participate. Their cardiology experience ranged from 1 to 16 years, with a mean of 8 years. The three PAs with the least amount of experience completed a one year postgraduate advanced cardiology PA residency which included training in echocardiography. Prior to the study, minimum training for each PA included observation of at least 5 formal echos performed by an echo technologist, review of instructional materials on obtaining and interpreting basic transthoracic echo images, and a minimum of an hour of hands-on instruction with a PA residency faculty member. All study participants had used the ultrasound machine for other imaging modalities and were sufficiently capable with its basic functionality.The FoCUS exams used in this study were performed on patients who already had a formal echo ordered so that the findings on FoCUS did not influence the decision to obtain a formal echo. The patient population was mostly composed of adult ICU patients, however, some non-ICU patients were included as well. The PAs performing FoCUS at the bedside were also caring for these acutely ill patients and could not be blinded to the patient's clinical condition. All of the PAs who participated in the study consented to being evaluated for research purposes. The PA's ability to determine Left Ventricular systolic function as "normal" or "abnormally low" was later compared to formal echocardiography. The formal echo images were captured by a technologist, and interpreted by a board-certified cardiologist with a minimum of Level II echocardiography training with a Level III lab director. The FoCUS exams were performed with a SonoSite Edge I using a P21 phased-array probe. The formal echocardiograms were obtained using a Siemens S2000 with a 4V1c probe.Results: A total of 88 FoCUS scans were obtained between April 2016 and April 2017. These were all performed at the bedside on cardiology patients admitted to both the ICU and the cardiac telemetry floor. The maximum number of scans performed by a single PA was 44 and the least performed was 2. The mean number of scans was 11. Of the 88 FoCUS scans performed, only 80 were included in the study due to incomplete formal echos. Of the 80 scans, 49 were interpreted by the PA as abnormal and 31 were interpreted as normal. Of the 49 that were labeled "abnormal" by the PA, 4 of the formal echocardiograms were interpreted by a physician as having a normal LVF (EF less than 50%). Of the 31 labeled by the PA as "normal," 1 was interpreted as having a low EF of 40%.The sensitivity and specificity of FoCUS when compared with formal echocardiography for abnormal LVF were 0.91 (95% CI, 0.79 to 0.97) and 0.96 (95% CI, 0.81 to 0.99). Given the high possibility of agreement due simply to chance, Kappa (κ) statistics were performed for the assessment of LVF between FoCUS and formal echocardiography. Agreement (κ) between FoCUS and formal echocardiography was good with $\kappa = 0.87$ (95% CI, 0.76 to 0.98).The PAs performing the FoCUS scans for the purpose of this study ranged in clinical experience from 1 year to 16 years with a mean of 8 years. PAs with less than five years experience had 81% accuracy while those

with more than five years had 100% accuracy. Of those with less experience, three had completed a post-graduate PA residency with ultrasound introduced as part of the program. **Discussion:** Based on the combined findings of our study, our entire cohort of PAs were able to perform and interpret Focused Cardiac Ultrasound with 91% accuracy. Additionally, LVF assessment interpreted as "normal" was accurate 97% of the time. These results correspond to other similar studies involving medical residents and novice attending physicians.Further analysis of the results showed that the inaccurate interpretations were by obtained PAs with less than five years of clinical experience and did not complete a postgraduate residency. While all the PAs received similar training, those with over 5 years of cardiology experience were able to determine normal vs abnormal LV function with 100% accuracy as were the PAs with less experience but whom had completed a PA residency in advanced cardiology. **Conclusions:** Our study adds to the growing body of data that FoCUS can be performed accurately by professionals practicing medicine, including PAs. Residency training and increased experience yielded better results with FoCUS accuracy for PAs. However, even PAs with a wide range of experience can perform FoCUS with an average accuracy greater than 90% with hands-on training in the field.

Co-Author(s): Frank Norman, The Society of Point of Care Ultrasound, Sharon Masinelli

Integrating Competency Based US into the Physician Assistant Curriculum: Competent but for how long?

Craig Goodmurphy Ph.D., Eastern Virginia Medical School

Introduction: Ultrasound education is expanding rapidly in both the UGME (Undergraduate Medical Education, GME (Graduate Medical Education) and even amongst professional medical standards. It has been relatively slow to grow in the shorter and very intensely packed MPA (Masters of Physician Assistant) Programs. The same difficulties of integrating a labor and resource intensive skill exist for MPA programs as it would MD programs but the shorter timeline and competing needs make meaningful integration extremely difficult. The current study aims to not only integrate the ultrasound competency training into the program but also looks to assess the degradation curve associated with competency measures over time. This will be fundamental to assessing whether US can be integrated in such a short period of time beyond being sono-savvy but also sono-skilled as the MPA student enter clinical training. **Methods:** EVMS has a relatively robust architecture for US training and in January of 2018 the MPA program decided to realign their curriculum to include a longitudinal US component into the 27 month program. The 82 matriculating students were provided with 3 introductory experiences in their Spring Anatomy course. Consisting of online videos introducing the basics of scanning, scanning of

the thorax and scanning the abdomen followed by 30 minutes scanning labs to familiarize them with probes and image acquisition within each area. They were required to save images of clinical relevance and complete a post knowledge assessment to a mastery level of 75%. Any students not meeting knowledge or skills standards were made to repeat the skills or knowledge component until the standard was achieved. During their Summer term of Clinical Skills and Therapeutics course the program invested into a more robust revision of these regional skills. Each student was now provided a SonoSim© license and 6 sessions of 2 hours scanning sessions per student that focused on the e-Fast exam (and aorta). Each session was composed of three components -- Knowledge acquisition using SonoSim© video modules and the mastery quiz, 2 hour scanning labs where they must produce a clinically relevant image, annotate and archive, self reflect and peer evaluate the image followed by narrative faculty feedback of each image. Following the skills session students were then assigned several relevant clinical cases from the SonoSim© case library and asked to acquire a clinically relevant image from the case, annotate it as it would be in clinic and save it for faculty feedback. Following the 6 sessions there was an OSCE (Objectively Structured Clinical Exam) and knowledge based post-test required, to a mastery level of 75%. The OSCE was performed using SP's pre-screened to ensure they were not unduly difficult for cardiac windows. The OSCE was a timed (5 min) FAST exam with a Mindray 7, portable machine and a phased array probe starting with FAST exam presets. Each of the FAST images was saved and printed with 5 minutes following their capture for specific artifacts and labels prior to printing each of the 4 images. Following the OSCE students were without ultrasound training for 2 months prior to being retested in groups with components of the OSCE and the knowledge test to measure the degradation of skills and knowledge. **Results:** During the Anatomy portion of the training students meet standard in both knowledge (73 or 91% passing (7 students below standard) during the first attempt while the skills components were passed by 71 or 86% (11 students below standard) during the first attempt. All students met proficiency by the second attempt in the skills component and 3 students of the 7 needed three attempts to meet proficiency in the knowledge component (theses students did self-profess that they did not complete the formative quizzes during the training). The second phase of training in the Clinical Skills and Therapeutics course was not completed at the time of this submission but will be completed by the time of the presentation. **Conclusion:** The MPA program is a suitable avenue for bringing students a specific ultrasound skill set. There is however a need for a well sequenced and timed inoculation of skills to avoid a steep degradation curve as part of the planning process if students are to maintain proficiency standards. More investigation is needed on how and what types of training can serve as the most effective formats of reducing skill degradation. This will continue to be pursued as the MPA curriculum is rolled out at Eastern Virginia Medical School.

Co-Author(s): Bradford Boyette, EVMS, Felicia Toreno, EVMS, Ciara Jenkins, Eastern Virginia Medical School, Katherine Schaffer, EVMS, Lane Fortney, Eastern Virginia Medical School

Use of Point of Care Ultrasound by Physician Assistant Students in Clinical Rotations

Amy Dereczyk PA-C, University of Detroit Mercy

Introduction: Point of Care Ultrasound (POCUS) is increasingly incorporated into medical and allied health curricula. The Physician Assistant (PA) curriculum typically is made up of one year of didactic course work and one year of clinical rotations based on the third year of medical school. While students may not have formal ultrasound training from their PA program, they are commonly exposed to POCUS during their clinical education, especially during the Emergency Medicine rotation. Three years ago, an ultrasound curriculum was introduced into a Midwestern urban PA program curriculum. At the end of the didactic year and just prior to the start of clinical rotations, PA students are required to attend a 2-day POCUS course at a local teaching hospital that has an established POCUS course for healthcare providers. A refresher course is offered at the midpoint of the clinical year. The purpose of this study was to evaluate PA student POCUS use during their clinical rotations. **Methods**: PA students are required to document the patients they encounter during their clinical rotations using a patient tracking system called Typhon. The students enter the patient demographics, reason for visit, ICD-10 codes, as well as any procedures they perform. The students are required to document any POCUS studies they perform. They do not document studies that they only observe. The POCUS studies are broken down into FAST, e-FAST, abdomen, cardiac, DVT, fetal, foreign body identification, joint, lumbar puncture, ocular, paracentesis, thoracentesis, and vascular access. The data was downloaded into an excel spreadsheet for descriptive analysis. In addition, qualitative data was obtained via a survey during the POCUS refresher course. **Results**: This cohort is made up of thirty-five students. Over the course of seven rotations, the students documented 250 POCUS studies. The studies were spread out over all of the specific ultrasound studies: fetal (135), vascular access (31), abdomen (19), joint (15), paracentesis (13), cardiac (10), thoracentesis (9), FAST (8), lumbar puncture (4), e-FAST (3), DVT (1), foreign body (1), ocular (1). Ten students did not document any POCUS studies. Overall, students felt it was important to have an ultrasound curriculum. The majority felt that it should be introduced earlier in the PA curriculum and with more frequent intervals. **Conclusion**: A specific POCUS curriculum was implemented three years ago into a PA program. This academic year was the first year that PA students were required to document the POCUS studies they performed. The results indicate that students are utilizing their ultrasound skills when they have the opportunity to do so. PA students overall feel that the ultrasound curriculum is important and that they will use their skills in future practice. They also

relay that they have positive feedback from their preceptors about their skills. Further research is needed on the preceptor's perception of POCUS, the PA ultrasound curriculum and the PA students' skills. In addition, the ten students who did not document any POCUS studies should be interviewed to reveal barriers to performing and documenting POCUS studies. The first limitation in this study is that often the PA student is trained in POCUS and their preceptor is not or the clinical site does not have an ultrasound machine. Therefore, students are not able to use their skills even though the patient would benefit from a POCUS study. Another limitation is that although students are required to document the ultrasound studies they perform, there is no definitive way to ensure that students document every study. We will explore the use of a wireless archiving system to better facilitate image storage and to provide appropriate and timely feedback to students.

Co-Author(s): David Amponsah, Henry Ford Health System, David Dereczyk, Henry Ford Hospital

Implementation of POCUS in a Physician Assistant Curriculum

Mark Perdue PA-C MHS, University of Oklahoma

Abstract Purpose: This study evaluated the benefits and challenges of implementing point-of-care ultrasound (POCUS) training in a physician assistant (PA) program curriculum. **Methods:** After Internal Review Board approval, the study participants were provided with a description of the study which included an opportunity to opt out of the study without adverse effect on student grade or standing. All students agreed to participate in the study and written informed consent was obtained. 1st year PA students were introduced to POCUS in two semesters of a Physical Diagnosis course. Ultrasound lecture and lab sessions were integrated into the Physical Diagnosis curriculum so that ultrasound applications were demonstrated as a compliment to history and physical examination. Ultrasound training sessions consisted of a brief interactive lecture on an ultrasound application and instructor-guided lab time to perform the scans and identify all of the relevant structures. Lecture and lab times for each application were recorded. At the end of the sessions, students took a 5 question multiple choice quiz to assess their understanding of the clinical application of the scan which included concepts such as scan indications, abnormal images etc. After all sessions were completed, the students underwent a summative ultrasound examination in which they performed all ultrasound applications on a standardized patient. Effectiveness in obtaining adequate images of target anatomy was assessed by instructor observation using a 5 point rubric. In addition to image acquisition, the time interval required for students to obtain images was recorded. Students' attitudes toward POCUS training were assessed using a 5 item Likert scale. Lastly, the total time burden and costs associated with implementation were

recorded. **Results:** After 3 clock hours of lecture and 9 clock hours of supervised hands-on laboratory training the students were able to perform ultrasound scans on thyroid/neck, lung, heart, abdominal aorta, abdomen, ankle-brachial index and compression ultrasound of the deep veins of the lower extremities. The students' understanding of POCUS in clinical applications, including recognition of abnormal scan images etc., was assessed at an average of 85% (4.25 out of 5). The summative evaluations were performed 7 months after initial training to assess retention of ultrasound image acquisition. The students were able to obtain all of the target anatomy and describe the associated structures with an average accuracy rating of 96% (4.8 out of 5). A post-training survey showed that students were positive toward POCUS training. The estimated cost of implementation, in our setting, was approximately $72,000 which included two laptop-based ultrasound machines and training for two faculty. The individual time burden for each faculty member's instructional training was approximately 25.5 hours. **Conclusion:** The inevitable increasing utilization of POCUS in modern medicine warrants widespread implementation in PA curricula. Our study confirms that initial implementation of POCUS training can be performed with faculty time burdens and costs that are not prohibitive. Student evaluations and surveys confirmed that the learners were capable of acquiring quality ultrasound images, demonstrated good clinical understanding of applications and expressed positive attitudes towards the importance of POCUS. These learning outcomes were achieved with only 12 clock hours of combined didactic and hands-on training.

Co-Author(s): Bobby Bosse, University of Oklahoma, Jabraan Pasha, University of Oklahoma School of Community's Medicine

All together now! A mixed-methods evaluation of an interprofessional, peer-led point-of-care ultrasound workshop

Chris Smith MD, FACP, University of Nebraska Medical Center

Introduction: Point of care ultrasound (POCUS) training is rapidly expanding in both medical schools and internal medicine (IM) residency programs, but lack of trained faculty is a major barrier at many institutions. Two pedagogical approaches that may mitigate lack of POCUS-trained faculty include interprofessional education (IPE) and peer-led teaching. IPE occurs when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes. In the context of POCUS education, IPE allows curriculum directors to leverage faculty expertise from a variety of backgrounds to meet the growing demand for training. Peer-led teaching also has several potential advantages, including creation of a more comfortable learning environment;

enhancement of leadership, communication, and organizational skills; and curricular sustainability when teaching resources are limited. Combining peer-led teaching and IPE strategies has proven beneficial in other settings, but has not been explored in teaching POCUS. The goal of this project was to determine the feasibility of having diagnostic medical sonography students (DMS) teach IM residents to perform abdominal POCUS. **Methods:** An interprofessional team developed a 3-hour workshop in which DMS students (n=6) from the College of Allied Health served as near-peer coaches to first-year IM residents (n=24) learning abdominal POCUS. Residents had received prior training in cardiopulmonary and procedural POCUS, but not abdominal scanning. Workshop content included exam preparation and image acquisition of kidneys, bladder, and gallbladder. The course utilized a flipped-classroom approach with pre-course instructional videos used to maximize hands-on scanning time. Residents rotated through 4 scanning stations facilitated by DMS student-coaches in which they practiced on live models. Faculty were available for technical problems, but otherwise did not participate in the hands-on training. Prior to the workshop, DMS students participated in a 2-hour train-the-trainer session in which they reviewed coaching and feedback strategies, followed by simulated cases highlighting common coaching scenarios. **Assessment**: A mixed-methods approach was used to evaluate educational outcomes of the IPE workshop. Residents completed an objective structured clinical exam (OSCE) to evaluate their image acquisition skills and a course evaluation. The OSCE included evaluation of POCUS exam preparation, scanning technique, image acquisition quality, and image interpretation. Preparation and scanning technique were scored in real-time by an in-room faculty evaluator. Saved OSCE images were scored after the workshop by two blinded faculty members. The course evaluation included 11 questions with responses on a 5-point Likert Scale (1=strongly disagree, 5=strongly agree). IM residents and DMS student coaches also participated in 40-minute focus group interviews following the workshops to learn about their experiences during the training and garner feedback. Interviews were recorded and transcribed verbatim. Qualitative data analysis was conducted using narrative analysis methodology. Two coders performed 2 rounds of selective coding to generate major themes. Responses were validated via member checking of participants. **Results:** Twenty-four of 24 (100%) IM residents completed the OSCE and course evaluation. Residents scored an average of 91% (SD 4.8) on the OSCE. Residents gave almost globally positive course evaluation responses. They reported the workshop improved their clinical skills (mean 4.7, SD 0.5), POCUS skills (mean 4.8, SD 0.4) and that they would recommend it to other residents (mean 4.5, SD 0.6). Residents also reported DMS student coaches created a non-threatening learning environment (mean 4.8, SD 0.4), provided helpful feedback (mean 4.8, SD 0.4), and inspired learning (mean 4.5, SD 0.6). Twenty three of 24 residents (96%) and 6/6 DMS students (100%) participated in focus group interviews. In the qualitative analysis, IM residents reported that DMS peer-led training was complimentary to traditional faculty-led workshops. Whereas DMS student coaches were more proficient in acquiring images (“They know how to navigate the little

twists and turns that you might find or that might be puzzling for a novice."), faculty had a better understanding of the clinical applications of POCUS ("Listening to the faculty's perspective knowing that this is going to be applicable and we're going to rely on it to make clinical decisions."). DMS students reported residents were sometimes constrained by the step-wise approach to scanning outlined in the pre-course videos (They'd go where there the video told them to go and not listen to what I was trying to say."). Both groups suggested allotting time for DMS student-coaches to demonstrate scanning technique prior to IM resident scanning ("Have the sonographer go through every organ..that way we can see different techniques..and take which one works best for us"). Having a shared vocabulary in describing probe orientation and manipulation was also emphasized ("Their lingo is a little bit different."). **Conclusion:** This pilot study found that an interprofessional, peer-led approach is an effective strategy for teaching abdominal POCUS. This approach may allow broader adoption of POCUS in medical education, especially when faculty expertise is limited. Care should be taken to establish mutual understanding of course objectives, prior experiences, and terminology between the groups to optimize the learning environment.

Co-Author(s): Tabatha Matthias, University of Nebraska Medical Center, Elizabeth Beam, , Lea Pounds, , Devin Nickol, , Kathyrn Wampler, , Kimberly Michael, University of Nebraska Medicine


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Session 3B (1000 – 1130) – How to Reach – Expanding the Community of Practice

Remote Real-Time Supervision via Tele-Ultrasound in Focused Cardiac Ultrasound: A Single-Blinded Cluster Randomized Controlled Trial.

Stig Holm Jensen BSc.med., Regional Hospital West Jutland & Research Center for Emergency Medicine, Aarhu sUniversity Hospital

Introduction: Despite clinical recommendations and the advancement of small, mobile, and cheaper US systems, the usage of focused cardiac ultrasound (FOCUS) remains unequally distributed between academic and non-academic facilities. Supervision via tele-ultrasound presents a remedy for lacking on-site supervision, but knowledge of its impact is largely absent. We aimed to investigate tele-supervised physicians' cine-loop quality compared to that of non-supervised physicians and compared to that of experts. **Methods:** We conducted a single-blinded cluster randomized controlled trial in an emergency department in western Denmark. Physicians with basic ultrasound competence scanned a convenience sample of admitted patients non-supervised (control) or tele-supervised (intervention). All examinations included four cardiac views: subcostal four-chamber, parasternal long and short axis, and apical four-chamber views. Before intervention or control scan, all physicians performed non-supervised scans, and finally, experts in FOCUS scanned the same patient. Both physicians and experts stored cine-loops from all views and selected the best one from each view after each exam. Two blinded observers graded cine-loops on a one-to-five scale. The primary outcome was the mean summarized scan gradings compared with a linear mixed-effects model. **Results**: In each group, 10 physicians scanned 44 patients. From the mean summarized gradings, on a scale from 4-20, the second non-supervised scan grading was 10.9 (95% CI 10.2–11.7), whereas the tele-supervised grading was 12.6 (95% CI: 11.8–13.3). From the first to the second scan, tele-supervised physicians moved 9% (1.09; 95% CI: 1.00–1.19; p=0.041) closer to the experts' quality than the non-supervised physicians. **Conclusion:** Tele-supervised physicians performed scans of better quality than non-supervised physicians whose ultrasound learning stagnated without supervision. The present study supports the use of tele-supervision for physicians with basic focused ultrasound competence in a setting where on-site supervision is unavailable.

Co-Author(s): Jesper Weile, , Rasmus Aagaard, Kåre Melchior Hansen, Troels Bek Jensen, Morten Christopher Petersen, Jacob Juul Jensen, Poul Petersen, Hans Kirkegaard

Ultrasound Basics for Entering Medical Professionals

Courtney Vandermeersch B.S. in Genetics, MS 2, University of South Carolina School of Medicine - Columbia

Introduction: Beginning ultrasound students need time to become comfortable with the multiple tasks, and movements needed to perform ultrasounds. We have designed a self-guided curriculum with focused faculty assessment to occur before the on-set of clinical ultrasound scanning; with the goal of instilling confidence and competency in the following areas of ultrasound: image optimization, image formation, probe movement, and visual mapping. This curriculum will lead to better understanding of the ultrasound machine, as well quicker acquisition and comprehension of images scanned on the body. **Methods:** The curriculum consists of six self-guided modules with focused faculty assessment, and a post-module assessment for each module. The aim of each module is that the students accrue understanding of an ultrasound component, while showing continued competency in previous module components. In order to move from one module to the next, the student must pass the post-module assessment with a minimum of 90% proficiency. If the student does not pass the module they are to attend a remedial session on that module the next day, and must pass the assessment before continuing to the next module. Preparatory Module – The student will be given a Power-Point presentation alongside an interactive hand-out, as well as assigned reading and videos that will introduce them to common ultrasound terminology and other basics of ultrasound. Module 1 – Image Optimization:The student will become oriented to the ultrasound machine knobs. They will learn how to choose the applicable pre-set, and delineate the advantages/dis-advantages of each probe. In addition, they will learn how to use various functions on the ultrasound machine in order to produce the ideal image. Materials: transparent fluid-filled container, transparent flat surface cover(s) marked with various lines, and a cylinder. Module 2 – Understanding the Image Created by the Ultrasound Probe: The student will learn how to predict what image will be produced when the probe is placed in a specific location, and where to place the probe to re-create an image shown to them. Materials: transparent fluid-filled container, transparent flat surface cover(s) marked with various lines, cylinder, legged-cylinder, and a cone. Module 3 & 4– Understanding Probe Movements: Simple and Complex ObjectsThe student will learn what images are produced by the various probe movements (sliding, rotating, rocking, and tilting), and be able to determine which probe movement must be made in order to obtain a specific image. Materials: Transparent fluid-filled container, transparent flat surface cover(s) marked with various lines, cylinder, cone, legged-cylinder, headed-cylinder, broken stick, and disarticulated stick.Module 5 – Visual Mapping: The student will learn, using an opaque fluid-filled container and an opaque flat surface cover, how to identify the object they are scanning and its' orientation in space. Materials: opaque fluid-filled container, opaque flat surface cover with no lines, cube, headed and legged-cylinder, pyramid,

snowman, hour-glass, and a cross. **Results:**The curriculum modules presented above aid students in navigating and understanding the multiple components of ultrasound. The preparatory module develops an understanding of the basic ultrasound components including the physics of ultrasound, the definition of ultrasound, the various transducers, common terminology, optimum image components, and artifact production. Module one establishes skills needed for image optimization. These skills include appropriate use of various knobs and functions on the ultrasound machine such as label, freeze, measure, depth, focus, gain, and various presets. The student, in module two, is able to acquire the skills needed to predict what image will be produced when a probe is placed in a specified location, as well as how-to place a probe on a surface to re-create a specified image. In addition, it allows for strengthened retention of the "IDEAL" mnemonic for image optimization through repetition across each inanimate object and surface cover. Module three and four establish comfort in sliding, rotating, rocking and tilting the probe through a gradual increase in complexity of inanimate objects being scanned. These modules, like the last, continue to foster the skills that were achieved in the previous modules. Module five's use of an opaque-unlined-flat surface cover allows the student to further demonstrate their proficiency in the previous module material, while acquiring the capability to identify an unknown object and its' orientation in space. Over two and a half weeks' students will commit around eleven hours to the curriculum. The preparatory module is self-guided with no organized class time, and has been allotted a maximum of two hours for completion and retention. Each week the student will spend three hours in class, and have two assessments a week. One of the quizzes each week will be an on-line format for students to complete on their own time before a specified time. This curriculum allows students the flexibility to complete tasks on their own time, and at their own pace. Faculty commitment varies by position. The positions include project leader, class-room material facilitators, and assessment facilitators. Project leaders will commit two and a half hours a week, but need to be flexible if needed. Class-room facilitators will commit ten hours and twenty minutes a week to the curriculum. Assessment facilitators time commitment will vary between weeks; week one will be 2 hours, week two will be an hour and ten minutes, and week three will be around three hours. The dedicated faculty time is divided to allow faculty to be engaged in other tasks while the curriculum is being implemented. **Conclusion:** This curriculum will serve as a learning tool for developing competency and comfort in ultrasound for entering medical professional. The curriculum incorporates introductory ultrasound information, image optimization, image creation, probe movements, and visual mapping into its' modules. This creates a foundations that will enhance comfort and understanding when applying the above principles learned to clinical ultrasound scanning.

Co-Author(s): Sarah White, Wake Forest School of Medicine, Sarah Shepard, Wake Forest School of Medicine, Melissa Kozakiewicz, Wake Forest School of Medicine, Joshua Nitsche, Wake Forest School of Medicine, Brian Brost, Wake Forest School of Medicine

"My Social Media #Ultrasound #MedEd Success Story"

Daniel Migliaccio MD, UNC

I am currently the Head of Ultrasound Education in the Department of Emergency Medicine at the University of North Carolina at Chapel Hill. I completed my residency in Emergency Medicine at Stanford University. While at Stanford, I obtained an Honors Certificate in Medical Education from the Clinical Teaching Scholars Program and was fortunate enough to be able to focus on my ultrasound skills. I was awarded the “Outstanding Achievement in Ultrasound Certificate” from the Stanford Emergency Department. While at UNC, I has received the Socrates Award for outstanding didactic and clinical teaching. Using social media, I present cases to bring home the learning done in didacts for medical students, residents and fellow attendings. I have instructed the class of first year medical students at UNC about POCUS in the classroom and I use social media to drive those points home!My particular success story involves that of a resident who was able to apply my discussion and images regarding cardiac tamponade posted on Twitter on shift to save a patients life while working with a faculty member that was not versed in ultrasound! It was readily available and a quick/efficient learning avenue for all those involved in the case. I am passionate about medical education, point of care ultrasound, and optimizing patient care and safety using current literature and cutting edge ultrasound. I would be honored to present at WCUME!Thank you for the consideration.Daniel Migliaccio, MDTwitter: @TheScanimal

Ultrasound Student Interest Groups as a Vehicle for Individual and Institutional Ultrasound Advancement: How to Create and Develop Successful USIGs

Jennifer Cotton MD, RDMS, University of Utah Hospital

Introduction: Ultrasound student interest groups (USIGs) provide an environment for medical students to develop their ultrasound skills and foster the creation of future leaders in point of care ultrasound. The structure and purpose of these organizations vary significantly depending on the level of ultrasound exposure and educational experience within an individual medical school's curriculum. Many students

have little to no meaningful exposure to ultrasound in their medical school curriculum. For these students USIGs actually expose them to the existence of point of care ultrasound and provide learning opportunities that don't exist elsewhere in their education. It also creates a community of students who share common goals and an enthusiasm for ultrasound, allowing them to support one another and create focused pressure for ultrasound integration into their medical school's curriculum. In this way USIGs are a tool to provide immediate ultrasound education to current medical students and also drive curriculum integration for future students. In medical schools with more substantial ultrasound integration into their curriculum USIGs allow for more advanced study and development of ultrasound within their medical school. Instead of providing basic education USIGs can build on the basic skills already learned in the curriculum to provide more advanced or specialty specific education. Their structure also allow for the inclusion such activities as development of research projects, coordination for conference travel, providing ultrasound education outreach to surrounding medical schools, pathology review sessions, individual ultrasound portfolio tracking, structured mentoring, and more. Students ability to engage in ultrasound in such USIGs are only limited by their imagination and ability to invest time. Because of these reasons both types of USIGs greatly enhance medical student education; allowing for the advancement in individual students' education, creating an environment to develop future ultrasound leaders, and helping drive ultrasound integration in to medical school curriculums.

Workshop Proposal: Objectives: The purpose of this workshop is to provide tools for educators and students to develop USIGs, and share experiences creating in USIGs from two medical schools with very different levels of ultrasound curriculum integrations. Attendees with no ultrasound and advanced ultrasound curriculum integration would be able to take away a model for successfully developing a new USIG or enhancing an existing USIG based on their institution's level of ultrasound integration. Everyone at a conference for ultrasound in medical education would benefit from improving USIGs and a workshop centered on developing USIGs tailored to their individual needs would do just this. At the conclusion of this workshop a community of USIG faculty and student leaders would be created to help one another to celebrate successes, share learning experiences, and navigate future challenges as they arise.

Structure: The workshop would consist of two portions: an initial panel with question and answer sessions, followed by breakout groups, and concluding with wrap up comments from workshop leaders and participants.

The initial panel would consist of multiple educators and students from the two different types of USIGs outlined above. Attendees would hear about the experiences in creating and running successful USIGs from the founders/students of a USIG providing education in a medical school with little ultrasound

curriculum integration and the founders/students of a USIG providing advanced education and leadership in the context of more significant ultrasound curriculum integration. Both USIGs would discuss the structure of their individual USIG, pitfalls and tips learned along the way, and tools they used to build their USIGs. Each USIG would share a toolbox of resources for creating new or building up existing USIGs based on the specific level of ultrasound integration at an institution. A question and answer session would conclude the initial panel.

In the breakout groups attendees would work with small group facilitators to help develop a plan for creating or building up their own USIG. Students and faculty would be initially present in each type of breakout groups (little to no ultrasound integration or significant ultrasound integration). Group leaders would facilitate the discussion of ideas within the group, hear the goals of the attendees, and help equip attendees with tools to develop successful USIGs. Students and faculty would also separate into subgroups after a time, so they can more freely discuss their specific experiences and needs. Following the conclusion of the breakout groups, the workshop would come together for final advice from workshop leaders, discuss meaningful learning points brought up in individual small groups, and answer any remaining questions.

Co-Author(s): David Bahner, Ohio State University, Creagh Boulger, The Ohio State University College of Medicine, Carolyn Martinez, , Charles McCombs, The Ohio State University College of Medicine, Michael Howell, The Ohio State University College of Medicine

POCUS in the era of #POCKUS: Novel Approaches to Global POCUS Education

Elias Jaffa MD, MS, Duke University Hospital

Recent advances in ultrasound technology have resulted in a rapid increase in the number and quality of low-cost ultra-portable smartphone-based ultrasound platforms, including the Philips Lumify and the Butterfly iQ. Coupled with modern mobile-based communications and telehealth platforms, these new technologies have the potential to drastically change the way POCUS education is delivered, particularly to remote or resource-limited areas with minimal to no local expertise. This didactic will focus on recent experiences, from the perspective of both an academic hospital center (Duke University Hospital) and an independent physician-led non-profit group (EM Global), providing both on-the-ground and ongoing off-site POCUS education in Tanzania, as well as the impact of this technology (both commercial and open source) on efforts to provide education and build local expertise and capacity.

Co-Author(s): Erica Peethumnongsin, Duke University Hospital, Taft Micks, University of Manitoba, Winnipeg, Canada, Barbara Tatham, London Health Sciences Centre, London, Ontario, Canada, Alicia Cundall, Stratford University Hospital, Ontario, Canada, Francis Sakita, Kilimanjaro Christian Medical Center, Moshi, Tanzania, James Edward, TPC Hospital, Moshi, Tanzania

Session 4A (1300 – 1430) - How to Reach – Expanding the Community of Practice

The structure and challenges in the implementation of ultrasound education in low and middle income countries

Andreea Dinicu , University of California, Irvine School of Medicine

Introduction: Ultrasound is a powerful diagnostic tool for numerous reasons; it is portable, non-invasive, applicable to the vast majority of medical scenarios, and relatively low cost compared to other imaging methods. Introducing ultrasound to low and middle income countries has been shown to significantly alter patient management. However, obtaining adequate ultrasonography training in these countries continues to be an important challenge to implementing ultrasound as part of routine care. Since 2013, first year medical students from the University of California, Irvine have been teaching a three to four week ultrasound course at the Tandabui Institute of Health Sciences and Technology in Mwanza, Tanzania. This course has been demonstrated to be effective in teaching health care students, including clinical officer and pharmacy students. In spite of some students' success in the course, critical obstacles remain, including language barriers, difficulty in communicating, and variable attendance. **Methods:** In this study, we aimed to outline and assess the effectiveness of our ultrasound course structure, discuss the challenges we faced, and suggest potential solutions. Pre-course examination scores, weekly quiz scores, final examination scores, final practical scores, attendance, and pre-course and post-course surveys from participants (n=64) were analyzed. In addition, information regarding primary language, attendance, and methods of communication was collected. **Results and Conclusions:** Preliminary data indicates that lack of attendance and barriers in communication impede the implementation of a successful ultrasound course. Identifying these obstacles and proposing alternate solutions is essential to the improvement of this course and its further application to other regions in low and middle income countries.

Co-Author(s): Emma Cooper, University of California, Irvine, Ariana Naaseh, UC Irvine School of Medicine, Ava Runge, UC Irvine School of Medicine, Justine Maher, University of California, Irvine, Justine Chinn, University of California School of Medicine, Elizabeth Crawford, , Alexa Lucas, UC Irvine School of Medicine, Kayla White, University of California, Irvine, Danielle Zezoff, University of California, Irvine, Kevin Bera, University of California Irvine School of Medicine

Comparison of learning outcomes for teaching focused cardiac ultrasound to physicians: a supervised human model course versus an eLearning guided self-directed simulator course.

David Canty MD, PhD, University of Melbourne and Monash, Australia

Background: Focused cardiac ultrasound is established in anesthesiology and critical care practice. Ability to scale teaching is restricted by cost and availability of instructors. We compared ultrasound image acquisition and interpretation learning outcomes between a supervised instruction workshop with human models and an eLearning guided, self-directed ultrasound simulator program. **Methods:** In this single centre prospective observational study, participants enrolled in both courses had identical pre-course eLearning (20 hours), followed by practical learning with either a human model workshop (1.5-days) or simulator program guided by the eLearning course (3 hour workshop then 10 self-directed simulator cases). Assessment of learning after practical training included image acquisition quality obtained on human models, and interpretive knowledge using 20MCQ tests, which was repeated after 3 months. **Results:** Of 161 eligible, 145 participants consented. Interpretive knowledge (simulator vs. human) was not different between groups before (78.6% vs. 79.0%), after practical training (74.7% vs. 76.1%) and at 3 months (81.0% vs. 77.0, all P. 0>10). Image quality scores were higher in the simulator group (95.2% vs. 66.0, P<0.001) and also higher for each view (all P< 0.001). Participant course satisfaction was similar (95% vs. 93%, P=1.0). The simulator course had lower direct costs per participant (AUD$374 vs. 991) and lower instructor (0.5vs.1.5 days) and participant time (2.5vs3.0 days). **Conclusions:** Interpretive learning outcomes were similar, but image acquisition was superior for self-directed simulator learning of focused cardiac ultrasound compared with supervised human model workshop course. Direct costs, instructor and training time were lower for the simulator course.

Co-Author(s): Jennifer Barth, Western Health, Yang Yang, Western Health, Nathan Peters, Royal Brisbane and Women's Hospital, Andrew Palmer, Menzies Research Institute, Alistair Royse, University of Melbourne, Colin Royse, University of Melbourne


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"My Social Media #Ultrasound #MedEd Success Story - #POCUSart"

John Eicken MD/Ed.M, Greenville Health System

Introduction: Social media is increasingly being used by the medical educators as an educational medium1. Increasing numbers of physicians, particularly those younger in their careers as well as student learners2, are utilizing social media to augment their education on a regular basis. Social media platforms, such as Twitter, have disrupted the classic paradigm of “classroom” and “bedside” teaching by enabling medical educators to easily distribute educational material to learners they previously

would not be able to connect with. Point-of-care ultrasound has developed a significant presence within the social media medical community and #FOAMed (Free Open Access Medical Education) movement. This likely relates to ultrasound being image-based which is favorable for a social media platform such as Twitter. Critics of social media have highlighted concerns about the wide variance of quality of social media as well as the lack of a standard peer review process that is typically incorporated into journal and textbook publications. A proxy that has been considered to help sort the quality of educational material on Twitter is the number of "retweets" and "likes". Proxies that estimate the reach of the educational material include "engagements", which represents the number of learners who interacted with the tweet, and "impressions" which represents the potential number of learners who viewed the educational material. Although "retweet" and "like" proxies are not equitable to a rigorous peer-review process it may estimate the community and learners' perception of the quality of the post. In an effort to enhance the ultrasound education of learners around the world a unique combination of "app-smashing" was implemented to create #POCUSart. The goal of the #POCUSart educational series is to create unique drawings and animations which simplify anatomy, highlight common applications of ultrasound, and add labels and color to augment the standard black, white, and gray colors present on B-mode ultrasound. **Methods**: "App-smashing" refers to the process of using multiple apps to create a richer and enhanced final product. The apps used to create #POCUSart drawings are Doceri and GIF Brewery in combination with the use of an iPad and Twitter. Doceri allows each pen stroke of the educator to be captured as well as allow the educator to edit mistakes and add various colors, textures, and labels to the educational material. The captured pen strokes are then combined to create an animation that is capable of being exported in .mp4 format. In order for the animation to be in an acceptable format and size capable of being posted on Twitter it is converted to a .gif using Gif Brewery. Finally the POCUSart is posted in a tweet on Twitter and accompanied by links to peer-reviewed ultrasound educational content. The hashtag #POCUSart was inserted into each tweet to allow for ease of searching for the tweets. As opposed to educational material drawn in a classroom, once posted on Twitter the educational material is ever-present and available to learners unless the post is removed.**Results**: #POCUSart educational material lead to a large number of retweets, likes, impressions, and engagements around the world suggesting the educational content was of interest to educators and learners. As of July 2018, the six tweet series of #POCUSart educational content had resulted in 374 "retweets", 378 "likes", 3,071 "engagements", and 56,413 "impressions". The #POCUSart tweets also led to other medical educators providing additional education and teaching pearls which further added to the educational content of the initial tweet. **Conclusion**: The method of "app smashing" used to create #POCUSart facilitates the creation of a virtual whiteboard that is easily posted on social media. #POCUSart posts led to a large number of "likes", "retweets", "engagements", and "impressions" amongst educators and learners in the world of social media. If #POCUSart had only

been delivered to learners in a physical classroom whiteboard or at the bedside of a patient it is unlikely that the #POCUSart content would have benefited the same number of learners that it was able to reach via a social media platform. Additionally, #POCUSart content is always available to learners as opposed to content which is eventually erased from physical whiteboards. Medical educators who utilize social media to enhance the education of their learners should be aware of this form of "app smashing" used to create "#POCUSart given it is highly generalizable to many medial topics outside of ultrasound.

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Session 4B (1300 – 1430) - How to Teach – Innovation in Education

Novel Sonographic Model for Simulating Human Fetal Anatomy Scans

Courtney Vandermeersch B.S. in Genetics, MS 2, University of South Carolina School of Medicine - Columbia

Introduction: Simulator-based training is a highly-regarded, safe and effective teaching aid. However, current obstetric simulators cost thousands of dollars for each unit, leading to limited or no access to learners across the nation. We created a low-cost, high-fidelity obstetrics simulator with the purpose of increasing training opportunities for medical students/professionals. These task trainers can be configured in a variety of orientations and combinations, in order to learn the skills needed to proficiently perform obstetric ultrasounds prior to learner interactions with patients in a clinical setting. **Methods:** Preserved fetal pigs of various sizes (1-3, 3-5, 5-8 inches and larger) can be purchased individually, or in an intact pig uterus from biologic supply companies. Individual, or multiple fetal pigs can be placed in a formalin filled bag (to represent oligo to polyhydramnios) and be heat sealed for ease of use in future sessions. Multiple aspects of this model can be altered such as gestational number, gestational age, placental position, adipose thickness, and amniotic fluid levels. The learner can now perform a variety of scans including a fetal biometry scan, a basic fetal anatomic survey, as well as a detailed fetal anatomic survey. **Results:** Obstetric scanning elements that can be performed on this simulation model are presented in the following text. Fetal presentation, position, and number; placental location; and amniotic fluid levels can be assessed. Fetal biometry measurements that are able to be collected include biparietal diameter, head circumference, abdominal circumference, femur length, humeral length, and estimated fetal weight. The images obtained from a basic fetal anatomic survey, as outlined by ISUOG, show that the following structures on the fetal pig have high correlation to the human fetus: upper lip, all levels of the spine, stomach (presence, size, and situs), kidneys, diaphragm, umbilical cord insertion site, as well as upper and lower extremities. The ultrasound images attached illustrate a comparison of fetal pig anatomic structures to the corresponding anatomic structures in a human fetus. This model was unable to be used to obtain images of “human” brain structures, the heart/outflow tracts, and the bladder. Following CPT 78611 guidelines for a detailed fetal anatomic survey, the following areas can be scanned and compared to that of a human fetus: integrity and shape of cranial vault, neck, profile of face, coronal face (nose/lips/lens), mandible, and tongue, ear position and size, orbits, lungs, integrity of diaphragm, ribs, small and large bowel, liver, renal arteries, integrity of abdominal wall, integrity of spine and overlying soft tissue, shape and curvature of spine, and hooves (hands/feet). Structures of note that can intrigue the learner on this model includes the fetal pig nose, ear shape, hooves, presence of a tail, and views of the face. Cost of a

single preserved uterus with 6-12 fetal pigs is currently ~ $20-40. **Conclusion:** It was shown that multiple structures on the fetal pig were synonymous on ultrasound imaging to those of a human fetus; all levels of the spine, stomach, kidneys, diaphragm, umbilical cord insertion site and vessel number, upper and lower extremities, as well as other structures noted above. Although some facial features of the fetal pig are dissimilar to those of the human fetus, it is still possible to obtain transverse and sagittal scans of the fetal pig head to view the orbits, snout, lips, tongue, mandible, and ears. These structures, although all are not similar to humans, can still allow for practice in acquiring transverse and sagittal views of the head. Overall, this design model serves as a low-cost, yet high fidelity alternative to current obstetric simulators utilized in medical education.

Co-Author(s): Mallory Alkis, Wake Forest School of Medicine, Melissa Kozakiewicz, Wake Forest School of Medicine, Joshua Nitsche, Wake Forest School of Medicine, Brian Brost, Wake Forest School of Medicine

The Tactile Trainer: A Novel and Better Method to Teach Ultrasound Guided Procedures

Jennifer Cotton MD, RDMS, University of Utah Hospital

Objective: Ultrasound guidance makes many procedures safer and more successful. However poor technique results in loss of needle control, exposing patients to potential harm. Unfortunately, new learners are often unaware of when they lose needle control and as a result are overconfident relative to their actual skill. To address this we developed a “tactile trainer” to teach procedural ultrasound. With this trainer learners guide their needle to progressively smaller solid targets, receive tactile feedback from the target, and can compare the needle’s true location to where it appears on the screen. **Methods:** Sixteen new emergency medicine interns were randomized into two groups. Groups received the same duration of training and learning objectives. The experimental group received tactile trainer teaching and then traditional blue phantom simulated vessel teaching. The control group received the traditional method of training. Clips of needle guidance to a simulated vessel were recorded, rated by a blind reviewer, and compared. Learners also completed a post-training survey. **Results:** Learners who received the tactile training had superior needle control compared to the control group. Their technique was significantly better than controls for all measures related to needle tip control including: overall control, control near the target vessel, control in the near field, and controlled advancement into vessel. Despite difference in learners’ skill, there was no difference between groups’ comfort regarding performing future procedures. **Conclusions:** This method of providing real time tactile feedback of the actual location of a needle creates learners with better needle tip control. Learners can compare the

tactile feedback from hitting the target with where their needle appears to be located on the ultrasound screen, allowing them to more easily identify errors in technique. Our new method of teaching ultrasound procedural guidance is superior to traditional methods and helps develop better ultrasound guided technique for the clinical environment.

Co-Author(s): Bradley End, , Creagh Boulger, The Ohio State University College of Medicine

Using Anatomic Body Painting with Ultrasound to Enhance Anatomy Education

Cynthia Bennett MD, Assistant Professor, Elon Univ. Physician Assistant Student Society

Introduction: Anatomy education presents a challenge to other health care education programs because student contact time is limited and clinical relevance is a necessity. Since the early 2000s, several countries have turned to anatomic body painting (ABP) as a teaching tool at their medical schools. Studies from these programs have found ABP to be an effective teaching tool that is well-accepted by students and proves to be both fun and educational (1, 2, 3). With the increasing presence of ultrasound in the clinical setting, medical schools and physician assistant programs have integrated ultrasound into anatomy courses to provide a dynamic and clinically relevant anatomic depiction (7). **Methods:** Presenter one has used ABP at their institution since 2013 as an adjunct to the human donor dissection experience (5). ABP has proven inexpensive, easy to facilitate, and effective in teaching anatomic structures and correlations (6). ABP has the advantage of adding movement to structures that are static in the dissection lab, which helps many students in their comprehension of musculoskeletal physiology. Visualization of structures in a moving form also improves understanding of clinical tests and physical examination findings. Presenter two has successfully integrated ultrasound at their institution since 2017. Now, presenter one's PA Anatomy program is integrating ultrasound with ABP to teach anatomy. Ultrasound has the advantage of providing visual confirmation of the location of structures important to the region that is being painted and presented. It can reveal whether students have correctly located bony landmarks, accurately detected soft-tissue structures, and correctly determined the direction of muscle fibers. It also may provide reassurance to those with artistic or clinical skills discomfort while they perform ABP. Hands-on experience with ultrasound prior to the clinical setting also may serve to 'de-mystify' the modality, helping students better understand its uses, limitations, and advantages. **Results:** Incorporating the familiar skill of palpation and the visual cues of painting may help students understand more about what they are seeing in ultrasound images, making their future learning curve for clinical ultrasound less steep. **Conclusion:** Combining the two novel anatomy education tools of anatomic body painting and ultrasound has potential for more in-depth

anatomical knowledge and increased clinical relevance than a traditional classroom and gross-dissection experience alone. **Objectives:** In this presentation, participants will learn how to conduct an Anatomic Body Painting session with incorporation of ultrasound. Participants will:1. Examine the use of Anatomic Body Painting as a teaching tool, including how one institution uses ABP in PA Education. 2. Discuss guidelines for conducting an effective, educational body painting session at their own institutions, and learn how these guidelines may differ from those at institutions outside the United States (4,5).3. Identify strategies to incorporate ultrasound into the process to create a more dynamic, engaged and clinically relevant learning process. 4. Discover how to obtain all the materials needed for holding an ABP and ultrasound session.References: 1.Op Den Akker J.W., Bohnen, A., Oudegeest W.J, And Hillen, B: Giving Color To A New Curriculum: Bodypaint As A Tool In Medical Education. Clin. Anat. 15:356 –362, 2002.2.McMenamin, P. G. (2008), Body painting as a tool in clinical anatomy teaching. Anat Sci Ed, 1: 139–144. doi: 10.1002/ase.323.Finn, G. M. and McLachlan, J. C. (2010), A qualitative study of student responses to body painting. Anat Sci Ed, 3: 33–38. doi: 10.1002/ase.1194.Finn, GM, Twelve tips for running a successful body painting teaching session. Med Teach. 2010;32(11):887-90.5.Bennett, C, Anatomic body painting: where visual art meets science. J Physician Assist Educ. 2014;25(4):52-4.6.Bennett, C, Efficacy of Anatomic Body Painting in Physician Assistant Education (Med Sci Educator, 2018; pending publication)7.Rempell, J.S., Saldana, F., DiSalvo, D., Kumar, N., Stone, M.B., Chan, W., Luz, J., Noble, V.E., Liteplo, A., Kimberly, H. and Kohler, M.J. 2016. Pilot Point-of-Care Ultrasound Curriculum at Harvard Medical School: Early Experience. The Western Journal of Emergency Medicine 17(6), pp. 734–740.

Co-Author(s): Janelle Bludorn, University of North Carolina at Chapel Hill


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the 3D-printing software PreForm 2.14.1. The “one-click print” feature was used to automatically determine the appropriate orientation and placement of scaffolding for best printing results; additional scaffolding was manually added as needed. Models were 3D printed on a Formlabs Form2 printer (www.formlabs.com), using 0.1mm resolution and Grey V3 (FLGPGR03) resin. **Results:** After editing, each model took around six to eight hours to print and used ~90 mL of resin, including scaffolding, which is necessary to anchor the model to the printer’s build platform. Furthermore, these adaptations to the model for anatomical accuracy and printing durability were deemed necessary only after multiple hours spent editing and printing proto-types. However, once the ground-work has been done, these models can be saved and reprinted as needed. Our methods initially required approximately twenty-hours to make and edit the initial model in Geomagic; as we became more efficient, our second model (created from the same digital heart but cut in a new ultrasound view) was created withan appreciable reduction in time. The process of making models anatomically accurate and durable for printing, as well as the time and resources needed for the actual printing, should be carefully considered as part of the process when incorporating 3D-printed models in a medical curriculum. Additional costs may include software purchases, if not already available in research labs; although, many freeware 3D digital modeling packages are available. **Conclusion:** Now that the appropriate protocols for creating the 3D models have been established, we will be incorporating the models into our anatomy and ultrasound curriculum at Des Moines University. Starting with the Physician Assistant (Summer 2018) and Osteopathic Medical (Fall 2018) curriculum, we will be reviewing the progress of students’ cardiac anatomic and ultrasound understanding through performance trends in formative assessments (i.e., lecture- and practical-based multiple choice examinations). As previous research shows that models improve the educational environment for students(5,6,7), we are excited to share our implementation of 3D modeling to enhance the student learning environment for a combined ultrasound and anatomy curriculum at Des Moines University. 1. Teichgräber UKM, Meyer JMA, Poulsen Nautrup C, Berens von Rautenfeld D. 1996. Ultrasound anatomy: a practical teaching system in human gross anatomy. Medical Education 30(4): 296-298.2. Tshibwabwa ET, Groves HM. 2005. Integration of ultrasound in the education programme in anatomy. Medical Education 35(11):1148.3. Lane N, Lahham S, Joseph L Bahner DP, Fox JC. 2015. Ultrasound in medical education: listening to the echoes of the past to shape a vision for the future. European Journal of Trauma and Emergency Surgery 41: 461-467.4. Valverde I. 2017. Three-dimensional printed cardiac models: applications in the field of medical education, cardiovascular surgery, and structural heart interventions. Revista Española de Cardiología (English Edition) 70: 282-291.5. Kah H, Lim A, Loo ZY, Goldie SJ, Adams JW, McMenamin PG. 2016. Use of 3D printed models in medical education: A randomized control trial comparing 3D prints versus cadaveric materials for learning external cardiac anatomy. Anatomical Science Education 9: 213-221.6. El Sabbagh A, Eleid MF, Al-Hijji M, Anavekan NS, Holms DR, Nkomo VT et al. 2018. The various applications of 3D printing in cardiovascular

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Co-Author(s): Lauren Butaric, Des Moines University, College of Osteopathic Medicine


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Poster Sessions – September 15, 2018

Session 3 (0800 – 1130) - How to Reach – Expanding the Community of Practice

Poster 1

Introduction to Point of Care and Emergency Medicine Ultrasound Practicum – IPOCUS-EM

David Resuehr Ph.D., UAB

Introduction: In recent years, Ultrasound (US) has begun to encroach on auscultation as the primary mechanism for investigating structural function1. Furthermore, US has become increasingly miniaturized, user-friendly, and cost-effective. Several studies have illustrated that medical students equipped with US and as little as 18 hours of training were more able to accurately diagnose cardiac abnormalities than board-certified cardiologists utilizing auscultation2. Despite these advancements, two milestones need to be met before the point-of-care US will equal, or surpass, the stethoscope. Firstly, US units need to be further miniaturized and coupled with increased ease of use functionalities, such as amplification of breath sounds. Secondly, US training needs to become a mainstay of undergraduate and graduate medical education. The first milestone will be reached by the never-ending push for technological progress. The second milestone, however, will require active effort by the medical community to embrace and nurture US in curriculum3. Currently, few institutions integrate US into the undergraduate medical curriculum. Thus, a need exists for an avenue for medical students to gain experience in US, notably prior to their clinical years. By doing so these students would arrive on the wards with a skillset that would allow them to contribute more to the team, thus increasing learning opportunities. The goal of the course presented is to produce a student with the ability to independently conduct Echo, eFAST, RUQ, Vascular Access Techniques, and MSK exams. This course would include a comprehensive overview of theory, hands-on exposure to US at every session, and comprehensive review on a weekly basis. **Methods:** This course occurs over a 17-session timeframe, partitioned into modules covering each US exam. Each module consists of a faculty-led instructional lecture, a Team-Based Learning session with faculty supervised hands-on practice, and an OSCE style assessment with accompanying debriefing and formative feedback session. Students will have the opportunity to gain hands-on US proficiency on both commercial or custom-made phantoms and healthy volunteers. Faculty

will include School of Medicine Faculty, Emergency Medicine and Internal Medicine attendings, Residents, and Upper-Level Medical Students. Data obtained via voluntary student surveys, student OSCE assessments, and Faculty feedback will be utilized to gauge the efficacy of the course curriculum and develop the curriculum for future course iterations. **Conclusions:** Student subjective proficiency in Echo, eFAST, RUQ, Vascular Access Techniques, and MSK exams increased at the conclusion of the course. Student objective performance on each US exam increased from the relevant module OSCE assessment to the Final Comprehensive examination.

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Co-Author(s): Walter Holloway, II, UASOM, Anna Tyson, University of Alabama at Birmingham

Poster 2

The Implementation of Resident Driven Web-Based Point of Care Ultrasound Journal Club

Jason Arthur MD, MPH, University of Arkansas for Medical Sciences

Introduction: Point-of-Care Ultrasound (POCUS) has become a cornerstone of the diagnosis and management of acutely ill patients in the Emergency Department (ED). The role of POCUS is constantly being expanding and refined, with research in new modalities, applications, and protocols supporting the use of POCUS at the bedside. The American College of Emergency Medicine (ACEP) has recommended education in ultrasound for Emergency Physicians since 2001. While initial POCUS guidelines from ACEP outlined six scanning protocols considered appropriate for the ED, the 2016 iteration describes eleven. While nationally recognized guidelines describe the components of current protocols, Emergency Ultrasound Fellowships continue to develop and research new uses of POCUS. Emergency Medicine faculty and residents can find it challenging to keep abreast of the ever-expanding scope of POCUS using traditional courses and books alone. As a result, a substantial amount of ultrasound education now occurs online via Free Open Access Medical Education (FOAMed). Unfortunately, relatively few of these resources provide an overview of a specific study, discussion of the study design, and education on the scanning protocol studied. Even fewer allow for real-time interaction with faculty. **Methods**: To create a resident-driven forum for the discussion and expansion of

POCUS, we began a monthly Emergency Ultrasound Journal Club (EUSJC) online. EUSJC uses a web-based video conferencing program (Zoom) to allow participants to view the presentation in real time from anywhere in the world by logging into a designated videoconference room. If a participant does not have internet access, a phone conference line is also available to allow audio participation. Use of a web-based video conferencing program additionally allows participation to be logged for conference credit for faculty and residents. Additionally, use of this specific conferencing program automatically records the presentation, allowing it to be seamlessly incorporated into existing FOAMed resources. Lastly, use of a web-based system allows multiple institutions the opportunity to participate.Studies for EUSJC are chosen and presented by Emergency Medicine residents. Emergency Ultrasound faculty approve the study and provide expert advice during discussion of the paper. Invitations to participate are sent via email list serve and posted on Twitter. Presentations begin with an instructional component designed to decrease the implementation threshold. During this time the resident explains the scanning protocol used in the study and provides examples of normal and abnormal findings. After the instructional component the resident then presents the article, including a review of the study design and statistical analysis. Following the presentation participants ask questions of Emergency Ultrasound faculty, discuss the case, and weigh the impact of the study on their practice. EUSJC is designed to take one hour, with 15 minutes reserved for the presentation and 45 minutes for discussion. **Results**: Since its inception in July 2017, there have been eleven EUSJC meetings and the following topics have been presented (Figure 1). Initially EUSJC meetings included solely the University of Florida Health Jacksonville Emergency Department. While our initial target audience was Emergency Medicine residents, Emergency Medicine faculty have consistently been the majority of attendees. As time has gone on, other departments at the University of Florida Health Jacksonville have expressed interest in attending, and members of the Departments of Pediatrics and Surgery have attended EUSJC sessions. Members of the Departments of Emergency Medicine at Rush University and the University of Arkansas for Medical Sciences have also attended, expanding the EUSJC to a national forum. An unintended consequence of developing the EUSJC has been to inspire residents to continue to pursue Emergency Ultrasound education. Two residents involved in EUSJC (CK & JA) are now beginning their Fellowships in Emergency Ultrasound. **Conclusions**: An EM resident driven on-line journal club can improve education and interest in POCUS and create a forum to enrich resident and faculty utilization of Point of Care Ultrasound in the Emergency Department. It has also demonstrated the importance of an interdepartmental collaboration utilizing POCUS to improve patient care for all ED patients. Figure 1. Table with POCUS for Pulmonary Embolism, Transcranial Doppler, Pediatric Thoracic Ultrasound for Pneumonia, Evaluation for Aortic Dissection, The Triple Scan, 3-in-1 Ultrasound Guided Femoral Nerve Blocks, Peritonsillar Abscess, Small Bowel Obstruction, Ultrasound for Flexor Tenosynovitis, Ultrasound for Retinal Detachment, Ultrasound for Pediatric Septic Hip.

Co-Author(s): Christopher Kumetz, University of Florida - Jacksonville, Andrew Shannon, University of Florida- Jacksonville, Petra Duran-Gehring, University of Florida- Jacksonville

Poster 3

Point-of-Care Ultrasound Training in Pediatric Resident Education

Charles McCombs Medical Student, The Ohio State University College of Medicine

Background: Point-of-care ultrasound (POCUS) is increasingly being used in pediatric subspecialties such as PEM, PICU, and NICU for education and medical-decision making. However, it is not routinely being taught to pediatric residents.Objectives:Our study sought to determine pediatric resident interest in learning POCUS during residency. Our secondary objective is to ascertain if residents with prior ultrasound experience feel that their earlier exposure and training has been helpful in learning anatomy/physiology, procedural guidance, and the diagnosis/management of patients. **Methods:** Our study utilizes a cross-sectional survey of all pediatric residents (N=156) from a single pediatric academic institution. A 14-item questionnaire regarding POCUS education and attitudes was distributed over an 8-week period through RedCap, an electronic data-capture system. Weekly reminder emails were sent to those who had not yet responded. **Results:** We had a response rate of 81.2%, of which 84 (67.2%) were female, 74 (59.2%) were in PGY-1 or PGY-2, and 56 (44.8%) had ultrasound education in medical school. Of these 56, 25 (44.6%) responded that it was required, 11 (19.6%) responded that it was optional, and 20 (35.7%) received both optional and required ultrasound education. 102 (81.6%) of residents agreed that formal POCUS education should be included in a pediatric residency educational curriculum and 117 (93.6%) residents felt that it would be a useful tool for teaching certain procedures. Residents with previous ultrasound education were more likely to agree that formal opportunities for POCUS education were an important factor in deciding which pediatric residency to choose compared to those without (19.6% vs. 4.5%, p-value = 0.0017). 102 (81.6%) respondents expressed interest in receiving POCUS education in residency and 74 (59.2%) believe that POCUS education could have a significant benefit to their chosen specialty. **Conclusions:** Our results suggest that POCUS education is of interest to pediatric residents and would likely improve the resident training experience as a teaching adjunct for medical evaluation of patients, procedural guidance, and improving patient safety. In our single site study, the pediatric residents feel there is a gap in their ultrasound education that may affect their careers as pediatric subspecialists. As such the creation of a formal POCUS education curriculum in pediatric residency may be beneficial.

Co-Author(s): Delia Gold, Nationwide Children's Hospital

Poster 4

A Point-of-Care Ultrasound Curriculum Increased Resident Procedure Experience in a Community-based Internal Medicine Residency Program

Duncan Vincent MD, Cone Internal Medicine Residency Program

Introduction: Internal medicine physicians are increasingly utilizing point-of-care ultrasound (POCUS) to assist in bedside procedures. Growing evidence suggests that POCUS can improve diagnostic accuracy, reduce procedural complications, and may reduce medical expenditures. In July 2017, we implemented a longitudinal ultrasound curriculum at the Cone Internal Medicine Residency Program, which is a community-based training program with 18 categorical residents and 4 preliminary interns. Prior to 2017, our program noticed a decline in the number of procedures our residents were performing. There had been a clear shift in our group's practice to utilize interventional radiology, orthopedics, or sports medicine to perform the procedures that historically have been within the scope of practice of the internist. Limited procedural experience was a consistent deficit noted by our trainees on our post-graduate surveys and was an area in need of improvement in our program. **Methods:** Our POCUS curriculum begins with a didactic lecture on the fundamentals of ultrasonography. We developed hands-on workshops across the academic year to practice the core ultrasound-guided procedures on advanced simulators. Our department acquired a tablet-based ultrasound to be dedicated for the inpatient teaching teams and the outpatient clinic so POCUS could be incorporated into patient care with real-time faculty feedback. We collaborated with sports medicine teaching faculty on musculoskeletal ultrasound techniques and give recurring didactics on ultrasound best practices. We required bedside ultrasound be used with three core invasive procedures: central line placement, paracentesis, and thoracentesis. We encouraged ultrasound utilization in musculoskeletal procedures such as arthrocentesis, bursa injection, and lumbar puncture. We surveyed our trainees about their experience with the curriculum. We tracked POCUS utilization and resident procedure logs for the academic year preceding and after curriculum implementation. **Results:** One hundred percent of our survey respondents either agreed or strongly agreed that a POCUS curriculum made them more comfortable with ultrasound-guided procedures (n=19). Our inpatient and outpatient utilization of bedside POCUS has steadily increased across our program with 53% of ultrasound-guided procedures occurring in the

outpatient setting. Resident procedure experience increased by nearly 400% after implementation of the ultrasound curriculum. So far in the post-intervention academic year, residents have performed 64 procedures, compared to only 17 procedures during the same time period in the pre-intervention academic year. **Conclusion:** A longitudinal curriculum for point-of-care ultrasound increased resident comfort with ultrasound-guided procedures and dramatically increased their procedure experience over the academic year. This curriculum was viewed as a positive change to our program, and is likely to increase resident satisfaction with their training experience. Outpatient musculoskeletal ultrasound has been an especially high area of utilization for our program.

Poster 5

Direct Observation Testing for Extended Focused Assessment with Sonography for Trauma (E-FAST): A Multi-specialty Training Collaboration with Emergency Medicine and Trauma Surgery Residents

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

Background: Point of care ultrasound (PoC US) is an essential skill for both emergency medicine (EM) and trauma surgeons (TS) in the care of trauma patients in the emergency department (ED). The purpose of this study was to incorporate extended focused assessment with sonography in trauma (E-FAST) training to improve image acquisition and interpretation for both Emergency Medicine (EM) and Trauma Surgery (TS) residents utilizing direct observation assessments on normal and live pathology models. **Methods**:This study describes a half-day hands-on course that teaches E-FAST to trauma surgery and emergency medicine resident physicians. The educational material was standardized using core teaching objectives along with a PowerPoint file of ultrasound videos. The participants completed an E-FAST normal station on a live model followed by an E-FAST pathology station on a peritoneal dialysis model. The course had pre and post direct observation assessment by ultrasound faculty. The direct observation testing provided 0 to 3 points for right upper quadrant, left upper quadrant, suprapubic, cardiac, left anterior lung and right anterior lung. The participants completed a web based pre and post data collection with a multiple choice-test focused on image acquisition and image interpretation. **Results**:There were statistically significant improvements overall and within each specialty from pre to post direct observation testing. Overall, the mean pre-E-FAST score improved 46% from 7.3 to 15.7 out of a maximum 18 points. Individual lung testing improved 62% from 2.0 to 5.7 points and FAST testing improved 39% from 5.3 to 10.0 points. Although EM residents received higher mean post testing scores, TS residents showed greater improvement of 10.4 points compared to EM at 6.5 points. Furthermore, there was significant improvement in pre versus post web based testing

focused on confidence, image acquisition and interpretation of ultrasound images**. Conclusions**: Our study showed that a half day E-FAST training program significantly improved TS and EM resident confidence and ability to acquire and interpret E-FAST images. It was evident that both TS and EM specialties shared in the benefits of this realistic multispecialty E-FAST collaboration.

Co-Author(s): David Manthey, , David Masneri, , Mathew Riester, , Aarti Sarwal, Wake Forest School of Medicine, David Cline, , Martin Avery

Poster 6

Teaching experience of an online bedside ultrasound course in infectious diseases and imported pathology

Cesar Henriquez MD, PhD, Hospital Universitario Ramón y Cajal

Introduction: Bedside Ultrasound can be used in different clinical scenarios related to infectious diseases. Ultrasound can be easily learned even using online resources. The objective was to develop an online course of basic bedside ultrasound in infectious diseases and tropical medicine. **Methods:** An online audiovisual training area of 9 modules was implemented within the website of the Spanish Society of Internal Medicine (SEMI-FEMI), which included the following subjects: management of sepsis and septic shock, pneumonia and pleural effusion, soft tissue and osteoarticular infections, endocarditis, pericarditis, intra-abdominal and urinary tract infections, tropical pathology, tuberculosis, clinical ultrasound evidences, and clinical cases. The course was designed for 20 teaching hours with a passing grade of 6 out of 10 to be considered approved. Those who completed the course carried out a satisfaction survey consisting of 26 questions (assessed on a decimal scale) in which the interest, scientific quality, usefulness in the usual work, learning methodology and teacher evaluation were evaluated. **Results:** in a first edition (November 2017 to January 2018) 304 people were enrolled, of which 265 (87%) completed the course and 248 (81.6%) approved the course. 19 (6%) students obtained the highest score: 10. Six students belong to South American countries (Argentina, Costa Rica, Ecuador, Paraguay, Peru, and Uruguay). In a second edition (January 2017 to March 2018) there were 272 registered. Of these, 3 were from Peru, Uruguay and Chile. The overall grade of the course was 8.71, with the highest score being tropical pathology and tuberculosis (9.65) and the lowest score being endocarditis (8.36). The satisfaction survey among 202 respondents yielded the following results: interest awakened: 8.8, scientific quality: 8.6, usefulness in regular work: 8.26, learning methodology: 8.25 and teacher evaluation: 8.68. The lowest score was 7.7 for the lack of information prior to the

course. The highest score was 8.8 for the interest aroused by the subjects taught. The overall assessment of the course was 8.41. **Conclusion:** the implementation of an online course of bedside ultrasound in infectious diseases had a satisfactory acceptance and high assessment by the students. It is necessary to make a greater diffusion for following editions.

Co-Author(s): Gonzalo Garcia-Casasola, Hospital Infanta Cristina, Juan Torres, Hospital Infanta Cristina, David Chaparro, Hospital Clinico San Carlos, Carlos Guillen, Hospital Universitario Ramón y Cajal

Poster 7

Musculoskeletal Ultrasound Immersion into Graduate Medical Education

Nayan Shah BS, Ohio State University College of Medicine

Introduction: This study evaluates the effectiveness of a program for integrating musculoskeletal (MSK) ultrasound (US) and physical exam education into first year resident orientation across multiple, specialties. Prior studies have revealed deficiencies in undergraduate medical education with regard to the musculoskeletal physical exam. Ultrasound is increasingly being used across disciplines to aid in clinical care but has not been used as an adjunct to improve the physical exam. Prior studies have shown that the identification of soft tissue landmarks has improved after concentrated hands-on MSK ultrasound instruction. The goal of this project was to determine if similar levels of improvement to landmark identification could be achieved by teaching musculoskeletal ultrasound to incoming residents. **Methods:** With IRB approval newly arriving first year residents were recruited to participate in this study during their first week of residency. Participation was entirely voluntary, however we promised to provide dinner to all participants. The population was comprised of residents from the specialties of emergency medicine, family medicine, internal medicine, and orthopedics. Upon arrival, we collected baseline information about resident knowledge of the musculoskeletal system and of ultrasound. We also asked them about their level of experience and confidence with musculoskeletal examinations and with the use of ultrasound. All residents then received a standard didactic lecture on the shoulder and knee physical exam by a sports medicine trained physician (PI of the study). Residents were randomly stratified to two groups by specialty and gender. One group was immediately assessed on their ability to perform a physical examination on Standardized Patients (SP). The second group received hands-on, small group, MSK US instruction from MSK US trained physicians. Members of the second group were provided time to conduct US scans and acquire images on the knee and shoulder by scanning trained simulated ultrasound patients (TSUP). Finally, the two groups switched and Group 1 got

instruction and Group 2 was assessed on their physical examination skills. Performance data will be compared across discipline and levels of experience, in addition to analyzing the effect of the brief, hands-on MSK US training session. **Results:** All data for this study has been collected, coded and entered and is in the hands of a qualified data analyst. We are anticipating the data analysis report within the next two weeks. **Conclusion:** The literature on musculoskeletal ultrasound has demonstrated that it has a positive impact at improving the visualization of musculoskeletal anatomy and therefore improves palpation of anatomical landmarks, ie. physical exam skills. Prior studies have shown that ultrasound is most beneficial to helping medical students palpate important soft-tissue landmarks. We are anticipating that we will see a similar affect with regard to the more experienced incoming interns.

Co-Author(s): Nicholas Farrar, The Ohio State University, Bryant Walrod, Ohio State University Wexner Medical Center, Mark Conroy, Ohio State University Wexner Medical Center, Laura Boucher, Ohio State University Wexner Medical Center, Kendra McCamey McCamey, Ohio State University Wexner Medical Center, Steven Albrechta, Ohio State University Wexner Medical Center, Edward Oberle, Nationwide Children's Hospital, Jonathan Goike, Ohio State University Wexner Medical Center, Larry Nolan, Ohio State University Wexner Medical Center, Scott Lenobel, Ohio State University Wexner Medical Center, Paul Krebs, Ohio State University Wexner Medical Center, Michael Jonesco, Ohio State University Wexner Medical Center, Emily Bordern, Ohio State University Wexner Medical Center, David Bahner, Ohio State University

Poster 8

A Longitudinal Ultrasound Curriculum for Emergency Medicine Residency Training

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

INTRODUCTION: The performance and interpretation of Point-of-Care Ultrasound (POCUS) has been recognized as a core component of the practice of emergency medicine (EM) with ultrasound instruction being a mandatory requirement of residency training. Currently there is wide variability in both curriculum structure and assessment of resident POCUS education. The current block curriculum schedule has shown challenges with access to supervised scanning, early remediation identification, and inconsistent timing of exposure. A longitudinal intern ultrasound experience was developed to compare curricula. **METHODS**: From July 2016 to July 2018 30 intern EM residents participated. The curricula were standardized including ultrasound scanning shifts, recorded lecture material, online quizzes, participation in ultrasound boot camp, direct observation testing (DOT) and access to ultrasound faculty.

In 2016-17, the class completed the standard 4-week block curriculum with anesthesia in the morning followed by ultrasound teaching in the afternoon. In 2017-18, the longitudinal curriculum was initiated including two 3-hour ultrasound shifts during each EM block. In January and June of each respective year the faculty performed DOT of cardiac and focused assessment of sonography in trauma (FAST) along with online testing. **RESULTS:** The longitudinal curriculum had statistically significantly higher DOT scores in both January and June, 16.5 and 20.8 respectively versus the standard block curriculum scoring13.4 in January and 17.8 in June 2017. Survey data revealed higher scores for knowledge retention and skill set progression for longitudinal curriculum. 89% of residents preferred longitudinal curriculum with supervised bedside scanning being the preferred means of delivering education, however there was a preference for scheduling with the block curriculum. The knowledge based quiz scores of 89.5% versus 87.7% were not statistically significant. **CONCLUSIONS:** This innovative longitudinal POCUS curriculum is superior to the traditional block curriculum in developing and improving POCUS skills throughout EM intern year. This preferred approach provides a consistent POCUS education experience that has the potential to change EM residency curriculum across the country.

Co-Author(s): Casey Glass, Wake Forest School of Medicine, David Masneri, Blake Briggs, , Manoj Pariyadath, Cedric Lefebvre, David Cline

Poster 9

Train the Trainer Model of POCUS teaching for Internal Medicine Residents at University of Toronto

Wasim Mansoor MD, University of Toronto

Background: Point of care ultrasound (POCUS) in internal medicine is evolving as an integral part of patient assessment both in the emergency department as well as on the wards. Unfortunately, lack of trainers within internal medicine residency programs represents a significant barrier to appropriate knowledge dissemination. As residency programs shift the teaching paradigm to competency-based design, there is a greater need for implementation of new teaching models for acquisition of these skills for core general internal medicine residents. As such, this study aimed to assess if implementation of a resident-driven longitudinal didactic teaching curriculum would help fulfill the trainer void while improving comfort around POCUS use amongst PGY-1 internal medicine residents at University of Toronto (UofT). Ultrasound competencies were chosen in accordance with the recently published Canadian Internal Medicine Ultrasound (CIMUS) guidelines1. **Methods:** At UofT, there is a year-round

chief medical resident (CMR) present at each of the six teaching hospitals in the city. We identified that the CMR would be the cornerstone of our teaching model where we would train the CMR's who in turn would act as longitudinal trainers to junior residents at their respective hospital sites. As such, phase one of the study included a standardized 6-month POCUS training program run by faculty instructors for the 6 incoming 2017-2018 CMRs. Following this, in phase 2 of the study, the CMR then ran longitudinal teaching programs for the 2017-2018 PGY-1 residents (IPR) at their respective hospital sites. To further standardize the teaching process, an 8-hour POCUS symposium was organized for the IPR group to reinforce these principles. Competencies were selected based on the recently published CIMUS guidelines for core PGY 1-3 internal medicine residents1. Data was collected through a pre and post implementation questionnaire that rated comfort of each competency via a likert scale ranging from 1 to 7 (1 – strongly disagree, 4 – neutral, and 7 – strongly agree). IPR's completed a survey at the beginning of the 2017-2018 academic period and subsequently completed a post-implementation questionnaire at the end of the academic year. Furthermore, the 2016-2017 outgoing PGY-1 residents (OPR) who had no such longitudinal resident-led teaching initiative were also surveyed at the end of the academic year to compare to our IPR cohort. **Results:** We received 57/65 (88%) pre-implementation responses from the IPR group who were then subsequently enrolled in this study. In the post-implementation phase, we received a IPR response rate of 47/57 (82%) of which 81% (38/47) had attended the ultrasound symposium or the CMR-led ultrasound teaching sessions. We received 31/60 responses from the OPR group (52%) who acted as an additional comparative group for post-implementation analysis. Our analysis showed that 89% (51/57) of IPRs felt that POCUS would prove to be beneficial in their future practices, and 93% (53/57) felt that there should be a formal POCUS training program in the core internal medicine program. When asked whether they felt confident using ultrasound to supplement their physical examination, 4/31 (12.9%) of the OPR group (no intervention) felt comfortable (defined as likert scale of 5, 6, or 7) compared to 28/47 (59.5%) of the post-intervention IPR group ($p<0.001$). In response to whether residents felt confident using ultrasound for procedures, 11/31 (35.4%) of the OPR group felt comfortable compared to 32/47 (68.1%) of the IPR group ($p=0.005$) **Conclusion:** Although there are limitations of this study in measuring objective POCUS competencies of residents, our data suggest that employing a "train the trainer" model and a resident-driven longitudinal didactic teaching program may be an effective training model in increasing residents' confidence of POCUS use in clinical settings. This is especially important in programs where there is a paucity of ultrasound trainers often akin to many internal medicine residency programs.

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Co-Author(s): Evan Ailon, University of Toronto, Alberto Goffi, University of Toronto, Jasmine Grenier, University of Toronto

Poster 10

Poster 11

Educational Approach to the Internal Medicine Ultrasound Community of Practice

Jennifer DeSalvo B.S., The Ohio State University College of Medicine

Introduction: The Internal Medicine Community of Practice (IM COP) is an organization created to explore the applications of point-of-care ultrasound (POCUS) within Internal Medicine (IM). It consists of faculty, resident, and medical student leaders at various levels of training with the shared goal of increasing the use of ultrasound through education, research, and clinical experience. The applications of POCUS in IM encompass procedural assistance and focused diagnostic exams to answer specific clinical questions. Currently, the Accreditation Council for Graduate Medical Education (ACGME) does not require formal ultrasound education in IM. Despite this, a national study surveying IM residency program directors showed that they value POCUS as an important skill and useful tool in procedures and diagnoses, although only 25% reported having formal curricula to teach POCUS. The Society of Critical Care Medicine outlines general requirements for achieving and maintaining clinical competency in critical care ultrasound and focused cardiac ultrasound but consensus about an appropriate POCUS curriculum for IM residency training programs is lacking. Therefore, the primary goal of the IM COP is to develop a curriculum for medical students and residents to improve their knowledge and training to

achieve POCUS competency within IM. Secondary goals include supporting the use of POCUS for IM residents and medical students in their delivery of clinical patient care and creating a POCUS research platform. **Methods:** To achieve primary and secondary goals in the IM COP, progress was measured according to established COP milestones in four major domains, including clinical patient care, administration, research, and education. These milestones were measured using a scale similar to ACGME milestones, with level 1 representing a beginning achievement and level 5 representing an aspirational achievement. The milestones were measured throughout the year to track productivity among the IM COP and provide a framework to guide future achievements. **Results:** The IM COP created an administration consisting of 12 medical students, 1 IM resident, 18 pulmonary critical care fellows, and 1 attending who met quarterly to coordinate roles and responsibilities. At the first meeting, an IM Ultrasound handbook was created and distributed to IM COP members to provide background information and protocols to perform procedures and ultrasound scans commonly used in IM. Throughout the past year, the IM COP has organized four educational didactics on the use of POCUS in critical care medicine with 15-20 attendees at each session, in addition to 9 didactics tailored to pulmonary critical care fellows. These didactics included topics such as general introduction to POCUS, shock pathology, procedural ultrasound, and basic thoracic, abdominal and cardiovascular ultrasound. Hands-on application of ultrasound knowledge consisted of "MICU rounds," a program that allowed three medical students this year to improve their ultrasound acquisition skills with faculty trained in ultrasound in order to identify pathology among patients in the medical intensive care unit (MICU) and discuss diagnoses and management. Information technology was also made available to allow learners to save and review images for future publication or research and allow for quality improvement review. In addition, the IM COP has established a research database of more than 20 journal articles on the applications of ultrasound within IM and organized two journal club meetings in which trainees selected an article and discussed its impact on ultrasound within IM. As a result, the IM COP measured its success over the past academic year by achieving the following measurements among the four COP milestones: level 2 for clinical patient care, level 3 for administration, level 1 for research, and level 3 for education. **Conclusion:** The IM COP has organized administration and established educational, clinical patient care, and research curricula that address its primary and secondary goals within four established milestones to achieve POCUS competency in IM. This organization has successfully achieved new levels in all four milestones through administrative organization and execution of written curricula, ultrasound protocols, didactics, hands-on clinical ultrasound sessions, multimedia materials, research database, and journal club meetings for medical students, residents, fellows, and attending physicians over the past year. Future directions of the IM COP involve expanding the number and variety of educational experiences through lectures, online resources, hands-on clinical experiences and simulations, and research

opportunities. Through these achievements and plans, the IM COP seeks to serve as a framework for other institutions hoping to implement an ultrasound curriculum within IM.

Co-Author(s): Stephen Politano, Ohio State Univerisity College of Medicine, Antoinette Pusateri, , Serena Hua, , David Bahner, Ohio State University, Vincent Esguerra

Poster 12

Building an Ultrasound Community of Practice in the field of Otolaryngology

Christine Barron BA, MD Candidate, The Ohio State University College of Medicine

Introduction: At Ohio State University College of Medicine (OSUCOM), we define an Ultrasound Community of Practice (COP) as a team of attendings, fellows, residents, and medical students who are dedicated to advancing sonography within their specialty through education. Currently, there are several COPs within OSUCOM with varying levels of maturity; however, until recently there was no group with a specific focus on head and neck ultrasound. Therefore, over this past year, a group of students and a faculty mentor at OSUCOM with a shared interest in otolaryngology and ultrasound education founded the ENT Ultrasound COP. The goal of the ENT Ultrasound COP is to advance clinical practice, education, and research within the field of otolaryngology. We hypothesize that ENT ultrasound COP can serve as a framework for organizing ultrasound resources and identifying new areas of advancement in POCUS. **Methods:** Milestones for COPs have previously been developed at OSUCOM to gauge progress in the areas of education, research, clinical practice, and administration. In our first year, the ENT Ultrasound COP has chosen to focus mainly on education and research. We plan to hold four ENT ultrasound scanning shifts or procedure workshops that allow attendings to teach residents and medical students relevant head and neck pathology and improve scanning techniques. We also plan to hold two interactive case lectures reviewing interesting head and neck ultrasound cases. Our research goals include holding two journal clubs in which a junior resident will lead discussion on current ENT POCUS literature. We also hope to create a database of relevant articles that will allow the COP to identify gaps in the current literature, with the ultimate goal of providing resources for students, residents, and faculty to pursue research projects in the field. We will use COP milestones previously created by OSUCOM's Ultrasound Interest Group (USIG) to evaluate our progress at the end of the academic year and identify barriers to further growth. A COP liaison will meet with the USIG executives quarterly to report COP progress and facilitate collaboration with COPs in other fields to overcome obstacles. **Results:** In the development of the ENT COP, an event was held that brought together

medical students, residents, and attending physicians to discuss ultrasound in the realm of thyroid pathology. This was used as an opportunity to showcase current topics being investigated at our institution, as well as give each individual an opportunity to hone their technique by scanning each other and practicing procedures on neck phantoms. Recent literature was discussed and distributed, and plans for future growth and increased department involvement were created. **Conclusions:** We anticipate that using the COP to gather a group of medical students and physicians dedicated to learning and teaching ENT POCUS will facilitate collaboration between current and rising specialists, improving academic outcomes. Further research and data collection will analyze COP progression and look for these improvements in medical student and physician ultrasound use, knowledge, and skill. A more focused assessment of the state of ultrasound within otolaryngology is needed to guide the future of this organization to optimize the academic and clinical goals of the community.

Co-Author(s): Sean McDermott, The Ohio State University College of Medicine, Michael Howell, The Ohio State University College of Medicine, David Bahner, Ohio State University, Garth Essig, The Ohio State University College of Medicine

Poster 13

Teaching Nurse Anesthetists to perform transversus abdominus plane blocks using a portable handheld ultrasound device while on a surgical mission to Biri Island, Philippines.

R. Petter Tonseth MD, UBC

Introduction: Biri Island is a municipality in the province of Northern Samar, Philippines with a population of 11,767 (2015 census). International Surgical Missions (ISM) has been travelling to Biri island every year for over a decade, bringing equipment to create a basic surgical suite, with 4 OR tables, anesthesia equipment and surgical supplies. 39 volunteers were present on the latest mission in February 2018, including 5 nurse anesthetists, 5 general surgeons, 2 subspecialist uro/gyn surgeons, 2 gastroenterologists, 1 pathologist, 1 radiologist as well as nursing and OR support staff, for the first time with access to portable ultrasound.The transversus abdominis plane block is a well-established procedure to provide perioperative pain relief for multiple surgical procedures, and ultrasound is required to accurately guide the needle tip into the appropriate plane before injecting local anesthetic. **Methods:** Five nurse anesthetists were part of the surgical team that traveled to Biri Island in February 2018 and although some were familiar with using ultrasound to guide regional blocks at their home institutions, none had used portable ultrasound in a remote surgical mission setting.A one-hour group

orientation to the operation of the ultrasound device was followed by individual supervision while performing TAP blocks on patients in the OR prior to reversal of general anesthesia following surgical procedures for which TAP blocks would be appropriate.Following a series of supervised injections with demonstration of appropriate technique and needle placement, the anesthetists were given independent access to the portable ultrasound device to enable unsupervised TAP blocks. **Results:** The one-hour orientation was deemed sufficient by the participants to provide the basic principles of operation of the ultrasound device and the supervised injections were deemed sufficient to allow independent performance of TAP blocks in appropriately selected patients.Through the viewing of images captured by the ultrasound device during unsupervised TAP block injections, appropriate needle placement was confirmed. **Conclusion:** It is possible to introduce ultrasound guided regional anesthesia techniques to nurse anesthetists during a surgical mission in a low resource setting.

Co-Author(s): Kira Bruck, Anna Hsu, David Hudson, Jim Woelk

Poster 14

Focus on Faculty: The Benefits of a Point of Care Ultrasound Course for Emergency Medicine Faculty

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

Introduction: There are multiple challenges that exist for supervising physicians to be able to obtain point of care ultrasound (PoC US) continued education and hands-on training. This study evaluated the benefits of a one-day, hands-on PoC US course prepared for 24 attending emergency physicians at an academic institution. **Methods**: The participants rotated through 6 stations which included cardiac, first trimester pregnancy, aorta, biliary, E-FAST/renal, and a "Flex" Station. A web based pre and post-test with survey were performed to assess baseline knowledge, image interpretation and comfort level of interpreting bedside ultrasound. **Results**: Overall, there was a statistically significant interval improvement of 5.8 points comparing pre and post testing for PoC US knowledge and image interpretation. There were no significant differences identified when the individual modalities were compared however. After completion of the course, there was a trend toward increasing comfort level of the attending physician with performing and interpreting PoC US. The course feedback supported the benefits of offering both standardized and flexible PoC US faculty training opportunities. **Conclusions**: It is imperative that attending physicians in academic institutions be able to adequately teach and evaluate residents with PoC US. Future education opportunities for both standardized and open-forum

hands-on instruction will provide an ideal balance to build and maintain faculty PoC US knowledge and skill set.

Co-Author(s): Mathew Riester, David Masneri, , Casey Glass, Wake Forest School of Medicine

Poster 15

A Curriculum for Teaching Emergency Nurses Ultrasound Guided Peripheral Intravenous (USGPIV) Placement in Community Emergency Departments

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

A Curriculum for Teaching Emergency Nurses Ultrasound Guided Peripheral Intravenous (USGPIV) Placement in Community Emergency Departments. Joshua Zavitz, DO; Melissa Browning, BSN, RN, CEN; David Yao, MD. **INTRODUCTION**: The demand for teaching ultrasound guided peripheral intravenous (USGPIV) placement has extended into the community emergency departments. Traditionally, point of care ultrasound is taught in academic centers and performed by resident physicians, supervising physicians or advanced practice providers. Utilization of USGPIV in the emergency department has been shown to expedite throughput times while maintaining high patient satisfaction. The primary goal was to find an efficient means of regularly training USGPIV to emergency nurses in our community health system**. METHODS**: This study was performed with registered nurses at the Moses Cone Hospital community emergency department sites from January 2015 until January 2018. The sites included Moses Cone Hospital, Alamance Medical Center, Annie Penn Hospital, MedCenter High Point, and Wesley Long Hospital. Every other month Wake Forest ultrasound directors reached out to the nursing leadership of community emergency departments to gauge demand for USGPIV training. The day of the course involved signing in and acknowledging completion of pre-course education material. The first station was a 25 minutes PowerPoint lecture given by an ultrasound director reviewing indications for USGPIV placement, ultrasound physics, probe selection, safety, sterilization, needle approach and methods of confirming placement. The second station involved the nursing staff being placed into small groups for hands-on experience reviewing machine functionality, identifying vein versus artery on another participant and placement of USGPIV on a gel phantom. The third station included successful USGPIV placement on a live patient in the Emergency Department or a fellow nurse. The recommended goal was to complete at least 5 successful supervised USGPIVs. At the end of the course the nurses completed a post-course competency test. **RESULTS**: Over a 3 year period the emergency medicine (EM) ultrasound directors were able to train 125 ED nurses including 65 emergency nurses. In April

2018 a post survey was emailed to all Cone EM nursing staff with 22 responses. 70% of nurses felt it improved their patient's time to disposition and 80% of the time it improved the patient's experience. 80% found USGPIV improved confidence with obtaining difficult IV's as well as decreasing the number of attempts. 50% of the participants felt they required <10 attempts to gain confidence while 50% needed up to 20 attempts. 41% have performed <10, 23% between 10 and 20 and 32% >20 successful USGPIV attempts since they took the course. 64% have had a >75% success rate in placing USGPIV. We found that 80% of nurses prefer the transverse approach. Survey responses had representation from all EM sites. The low number of responses was in part due to nurses changing specialties or hospital sites. **CONCLUSIONS**: Extending USGPIV training to our community ED nurses has been a huge success for providers, nursing staff and patient care. Overall, with this approach we were able to successfully train 125 nurses during a 3 year time period.

Co-Author(s): David Yao, Wake Forest Baptist, Melissa Browning, Moses Cone Hospital

Poster 16

ArkanSONO: Using Ultrasound Technology to Promote Diversity of Students Entering Science, Technology, Engineering and Mathematics (STEM) Fields

Kevin Phelan Ph.D., University of Arkansas for Medical Sciences

INTRODUCTION: Arkansas is a rural state with one of the lowest per capita income and education levels in the country. It faces the same challenges as other states in trying to prepare for the demands of a properly educated and diverse science, technology, engineering and mathematics (STEM) workforce. Resources in private and charter schools are generally larger than that in the public school systems where budgetary constraints limit opportunities for students to experience advanced technologies. In addition, a disproportionate number of students in public schools represent economically disadvantaged and underrepresented minorities that lack adequate STEM role models that could encourage them to pursue a STEM career. The first step towards changing these statistics is that students must understand the choices before them and be able to envision themselves in a STEM related job. Recent advances in ultrasound technology have provided hand-held devices and realistic simulators that can be used in the classroom for student learning. The opportunity now exists to see if these powerful new technologies can be used to stimulate student interest in STEM fields of study. ArkanSONO was established as a partnership between University of Arkansas for Medical Sciences (UAMS) faculty and Little Rock School District (LRSD) that takes advantage of technological advances in simulation and ultrasound technology

to provide students with an opportunity to experience first-hand the transformative power of these new educational tools. **METHODS**: In the Spring of 2017, ArkanSONO program staff undertook a pilot outreach program to 9th grade students in 4 LRSD high schools in over 30 physical science classrooms, and reached ~750 students. Faculty brought portable hand-held ultrasound devices (GE Vscans) to the classroom to allow students hands on experience scanning the faculty's neck and arms. Faculty distributed a double-sided color handout that summarized the information presented in the session and sample images of the scans the students were going to do on one side. The other side provided examples of careers using ultrasound, general facts about STEM jobs in the economy and QR codes with links to selected age appropriate STEM links. Each session began with an 8-10 minute introduction on the physics of sound (as found in their textbook), a definition of ultrasound and the terminology of ultrasound imaging, a brief description of the technology underling how ultrasound devices work, and a discussion of Doppler imaging. The students were then broken down into 3 or 4 small groups and allowed to use the devices to scan the faculty. They identified the thyroid gland and major blood vessels in the neck and observed the difference in responses of veins and arteries to pressure. In the last 10-15 minutes of the session, students were brought back together to discuss what they discovered in the small groups. The session was concluded with a short application exercise where students applied their new knowledge to predict how ultrasound could be used in a case-based scenario (a patient with an unknown bulge in their neck). Finally, the STEM career information on the handout was discussed and the room opened up to questions. **RESULTS**: The ArkanSONO pilot program established the feasibility of using hand held ultrasound technology in an outreach project to high school students. It also provided program faculty with invaluable feedback from students and teachers and helped refine the presentation. Informal polling in the high school classes (show of hands) revealed that ~40-60% of students said that they had seen a live ultrasound though this did not hold for the ESL classes since most of the students were from outside the US (mostly Central America). Only 20-25% indicated an interest in a STEM career. Almost 100% of students indicated that they enjoyed the hands on aspect of the session, would welcome a return visit, and learned something in the process. Many of the student questions at the end of the sessions were on jobs, salaries, and the difference between medical doctors and PhDs. One teacher's feedback summarizes the success of the pilot project "The content was easily incorporated into my physics curriculum. Students were engaged during the program, and enjoyed the interactivity with the devices and medical professionals. There were many good questions asked even after the presenters left, indicating some lasting influence. Students would like to hear more of specific uses for ultrasound and additional demonstrations" (A 9th grade physical science teacher at Central High School). The ArkanSONO program staff used these pilot data to support a pending $1.25 million grant application to the NIH NIGMS funded Science Education Partnership Award (SEPA) program with the underlying theme of cardiovascular health and disease. We received a high priority score and are

awaiting final notification of award from NIH. **DISCUSSION**: Technology has always had a transformative effect on education. Students in Little Rock are in dire need of any educational intervention that has the potential to spark their interest in science, technology, engineering and mathematics (STEM). ArkanSONO is strategically positioned to be just that spark and to serve as a model for other school districts throughout the nation to ensure that the STEM workforce of the future better reflects the diverse population of the US. Our novel outreach program takes advantage of the availability of portable US devices and related imaging technology to stimulate student interest in STEM.

Co-Author(s): Noor Akhter, Department of Neurobiology and Developmental Sciences, University of Arkansas for Medical Sciences, Mohsin M. Syed, Department of Neurobiology and Developmental Sciences, University of Arkansas for Medical Sciences, Karen Yanowitz, Department of Psychology and Counseling, Arkansas State University, Gregory R. Snead, University of Arkansas for Medical Sciences, Billy R. Thomas, Department of Pediatrics, University of Arkansas for Medical Sciences

Poster 17

Implementation of an Emergency Department Technician Led Ultrasound Guided Midline Team Decreases Central Line Days and Associated Bloodstream Infections

Petra Duran-Gehring MD, University of Florida- Jacksonville

Study Objectives: Intravenous catheters are routinely inserted in patients presenting to the Emergency Department (ED) for blood draws, fluids, and medication administration. Critically ill patients may require a central venous catheter (CVC), which has a higher associated complication rate including central line associated blood stream infections (CLABSI). Midline catheters (MLC) are longer than traditional peripheral IVs and have a dwell time of up to 29 days, however, they must be placed via ultrasound guidance and are passed over a guidewire using Seldinger technique. Conventionally, MLC are placed by specialized nursing teams or by physicians, such as Interventional Radiologists. We sought to train ED Technicians (EDTs) to place midline IV catheters in patients going to the medical intensive care unit (ICU), for use once the CVC was discontinued. We hypothesized that the EDTs could learn to successfully place MLCs in ICU patients and therefore, decrease the length of CVC dwell time and decrease the rates of their resultant infections. **Methods:** Training EDTs in midline placement was done on a voluntary basis. Only EDTs who had successfully completed prior ultrasound guided peripheral IV training in our ED and had completed 50 successful ultrasound guided peripheral lines were considered. Participants were required to complete a didactic module outlining the MLC placement procedure and

complete a skills lab to practice the procedure on ultrasound phantoms. The EDTs then demonstrated procedural competency by performing 5 successful proctored MLCs in the ED. Proctors could be peers who had already completed the training or the Emergency Medicine Physician trainer. Once completed, EDTs were certified to perform MLCs independently. All MLCs and CVCs were tracked, and infection rates calculated. **Results**: The MLC pilot program began in April of 2015 with 6 EDTs completing all portions of the training initially and providing limited MLC placement daily. Once deemed competent, these EDTs began placing midlines in all ED patients going to the ICU in October 2015. Ten more EDTs achieved certifications within the first year of the program, allowing the MLC team to provide 24 hour a day MLC placement. Since the implementation of the EDT MLC team, the mean number of MLC placed monthly is 471 lines. As a result, CVCs in the ICU are removed once the patient has been weaned from all vasopressors for 24 hours and the MLC is used as the main IV access. From October 2015 to December 2017, CVC line days have decreased by 39% from 2630-line days to 1600-line days per month. The CLABSI rate has also reduced from 9.33 to 3.75 infections per month, a 59.8% infection rate reduction. **Conclusion:** The implementation of a midline team comprised of only Emergency Department Technicians can successfully decrease the dwell time of central venous catheters and reduce the blood stream infections associated with them.

Co-Author(s): Andrew Shannon, University of Florida- Jacksonville

Poster 18

Point of Care Ultrasound Program for Advanced Practice Providers in Community Emergency Practice

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

INTRODUCTION: Ultrasound use in the emergency department has increased over the past 10 years. We have seen significant growth in the number of advanced practitioners (APP) working in our emergency departments. This growth has led to improved POCUS utilization and demand for POCUS education in the clinical setting. The majority of APP training programs do not have a formal POCUS curriculum. This has required the APP to gain hands on education at their employment site or separate ultrasound conferences which has financial and time commitment while working clinical shifts. **METHODS**: This pilot APP POCUS program was established at the Moses Cone Emergency Department/ Greensboro Region of Wake Forest Baptist Medical Center in 2016. The goal was to develop a POCUS training program for APP graduates to allow practitioners to gain experience and advance their professional careers. All new hires and current APPs are highly encouraged to take a 2 hour introduction

to ultrasound course with the ultrasound directors to review basic machine use, billing for clinical POCUS, peripheral IV placement, soft tissue ultrasound for abscess versus cellulitis, ocular ultrasound for retinal detachment and renal ultrasound for hydronephrosis. Further advanced training is offered in separate ultrasound events including "Downtown Ultrasound" where we teach three different modalities along with our Sports Medicine and Family Medicine resident colleagues. As a social event we coordinate an annual "Ultrasound in the Woods" where a dinner event followed by POCUS education with hands on instruction takes place at a physician's residence. Lastly, to further encourage the APPs to strengthen POCUS training a bonus advancement program was initiated. The requirement to meet this financial bonus for the group was to complete 10 POCUS studies of each introduction modality and complete two ultrasound training sessions with the directors. These would be monitored by maintaining personal logs and QA review by the ultrasound directors. **RESULTS**: This pilot program has been successful for the APPs that have participated. Approximately 25 APPs have completed the introduction to ultrasound course. We have had 20 APPs participate in advanced ultrasound instruction at our annual social events. Furthermore, one APP has completed the bonus advancement program successfully to achieve financial incentive for their efforts. The ultrasound directors performing QA have seen an increase in soft tissue and ocular studies performed by APPs. **CONCLUSION**: A clinical focused APP POCUS program that provides flexibility and financial incentive allows both new and experienced APPs to further their emergency ultrasound skill set and career goals while working full time clinically.

Co-Author(s): David Yao, Wake Forest Baptist

Poster 19

Seeing With Sound - Establishing an Ultrasound Scholarly Concentration Program

Keri Cowles MD Candidate, UNC School of Medicine

Introduction: With a growing body of research surrounding the use of ultrasound as a valuable educational tool for preclinical medical students to enhance their understanding of anatomy, physical exam techniques, and diagnostic ability, the addition of ultrasound training in undergraduate medical education has gained some momentum in recent years. Despite the enthusiasm, several barriers have been named that prevent schools from being able to implement robust ultrasound training in existing medical curricula, such as financial commitment and faculty availability. At the UNC School of Medicine, Scholarly Concentration Programs exist to allow medical students to explore a discipline of their choice with a depth that may not be experienced within the general curriculum. Our goal is to create a

longitudinal Ultrasound Scholarly Concentration Program at UNC that would provide extensive ultrasound training for a select group of interested medical students while utilizing existing infrastructure. **Methods:** At the UNC School of Medicine, the Translational Education at Carolina (TEC) curriculum is separated into the Foundation, Application, and Individualization Phases. Our program is longitudinal and tailored to the educational goals and priorities of each phase. In the Foundation Phase, students will be exposed to the basic fundamentals of ultrasound and will be given opportunities for clinical experience and participation in education. Students will participate in an existing ultrasound elective course offered during their first year of medical school. In the summer after their first year, students will participate in ten clinical sessions in settings such as the emergency department and cardiology clinic, as well as with ultrasound technicians and nursing in a hospital setting. During this time, students will begin to develop a 50-100 scan portfolio, which they will complete over the course of the curriculum to be reviewed by faculty. The nature of the program is self-perpetuating, with students that are further along in the program assisting faculty in teaching those behind them. In their second-year, students will assist as teaching assistants for the ultrasound elective and will hold open sessions for interested classmates to be able to practice and develop their ultrasound skills. Additionally, students will participate in their first ultrasound clinical skills exam (CSE), which will require students to perform a history and focused physical exam, formulate a differential diagnosis, and perform point-of-care ultrasound. The Application Phase is intentionally flexible to allow students to focus on their primary clinical responsibilities. Students will be encouraged to utilize ultrasound skills in a self-directed manner as frequently as possible which will allow for development of their ultrasound portfolio. Students will be required to document at least two case studies with attached ultrasound images for peer discussion in ultrasound case conferences. The Individualization Phase requirements will consist of the following: an ultrasound boot-camp, which will provide a comprehensive training and overview of the most practical ultrasound skills for residency, a final CSE, and completion of their portfolio. Finally, students will complete a final project in one of the following topics: ultrasound education, research, or completion of an acting internship focused on ultrasound training. **Results:** Students will complete three surveys throughout the length of the program. At the start of the program, a pre-survey will be completed that determines their initial level of confidence in utilizing point-of-care ultrasound in clinical practice. A post-match survey will not only reassess their confidence level, but will ask students how the ultrasound scholarly concentration impacted their interviews with residency programs. Finally, a post-intern year survey will assess the quantitative and qualitative impact that the ultrasound scholarly concentration had on students' first year of residency. We anticipate that students will feel that their medical education has been enriched by this program and that the program will strengthen the participants application to residency. We also anticipate the students that have completed the program will feel a high level of confidence in their ability to use ultrasound both diagnostically and procedurally

as they begin their residency programs. **Conclusions**: The purpose of this project is to create an Ultrasound Scholarly Concentration Program at the UNC School of Medicine that will allow a small subset of students to pursue further ultrasound training while also expanding the level of ultrasound exposure through the opportunities created by students within the program. We hope that this project will provide a framework for other medical schools to begin to integrate more in-depth ultrasound training for their students on a small scale that could set the stage for more extensive curricular changes in the future.

Co-Author(s): Daniel Bacon, UNC Chapel Hill

Poster 20


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Poster 21

How to Teach - Innovations in Education

The POCUS Atlas

Michael Macias Medical Degree, University of California, San Diego

Point-of-care-ultrasound (POCUS) has become an essential skill in Emergency Medicine with concordant integration throughout resident and medical student education. This has been accompanied by the organic growth of many POCUS oriented FOAMEd (Free and Open Access Medical Education) resources including websites, podcasts and blogs. Despite this abundance of resources, it remains difficult for learners and educators to find high quality POCUS clips that demonstrate exemplary pathology. We have created The POCUS Atlas to fill this educational need. Create a crowdsourced, open-access atlas of high quality POCUS images edited by ultrasound fellowship trained Emergency Medicine facultyEncourage captions that highlight the clinical case, ultrasound physics or operating characteristics of each caseProvide opportunities for POCUS learners and educators to share their images with the academic community. The POCUS Atlas (www.thepocusatlas.com) capitalizes on FOAMEd principles to democratize POCUS education by allowing learners and educators of all levels to rapidly find high quality clips of normal, abnormal, common, or rare pathology. The intended use is for bedside teaching or download for use in educational content without copyright concern. The atlas was built via crowd-sourcing with contributions from around the world. Each submission is reviewed and edited by our team and exemplary submissions are uploaded to the atlas. Clips and cases are hosted on our site and shared throughout FOAMEd channels and social media. The POCUS Atlas has also recently introduced a new section “The Evidence Atlas” which provides a useful display of the most current evidence behind point-of-care ultrasound applications.The POCUS Atlas has over 200 publications and has been viewed by more than 5,000 unique users with over 15,000 page views in the first year. The atlas continues to expand and has partnered with ultrasound departments to encourage submissions as educational exercises for their learners. We are also transitioning our library to a mobile app, integrating our image library into other FOAMEd resources and assisting medical schools in creating POCUS curriculums.

Co-Author(s): Matthew Riscinti, Kings County/SUNY Downstate Medical Center

Session 4 (1300 – 1630) – How to Teach – Innovation in Education

Poster 1

"It's a white fuzzy mess and they're able to hone-in and get a great image." A mixed-methods evaluation of how interprofessional point-of-care ultrasound education impacts participants' perceptions of interprofessional learning and stereotypes.

Chris Smith MD, FACP, University of Nebraska Medical Center

Introduction: As point-of-care ultrasound (POCUS) education becomes more common in undergraduate and graduate education, many programs struggle with a shortage of POCUS-trained faculty. Interprofessional education (IPE) in which "students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes," may offer a solution by expanding the available faculty pool and leveraging expertise from other professions. Prior studies have found that IPE is valued by learners, fosters collaborative team behavior, and mitigates biases towards other health professions, but medical trainees have less positive attitudes towards interprofessional education and practice than learners' in other professions. There is little research investigating the role of IPE in POCUS education. The purpose of this study was to determine the impact of an IPE workshop on participants' perceptions towards interprofessional education, collaboration, and stereotypes. **Methods:** The intervention took place at a large health sciences university. Students in the Diagnostic Medical Sonography (DMS) program (n=6) served as coaches for first-year internal medicine (IM) residents (n=24). Residents had received prior training in cardiopulmonary and procedural POCUS, but not abdominal scanning. Prior to the IPE workshops, DMS students participated in a 2-hour train-the-trainer session in which they learned principles of POCUS, coaching strategies, and methods for providing formative feedback. They participated in 4 simulation-based cases in which they worked through common coaching scenarios, during which they received feedback from peers and expert POCUS educators. In the IPE POCUS workshops, DMS students coached IM residents to acquire images of the kidneys, bladder, and gallbladder. The course utilized a flipped-classroom approach with pre-course instructional videos used to maximize hands-on scanning time. During a brief didactic lecture, DMS coaches and residents learned about one another's educational background and experiences. Residents then scanned live models at 4 different stations, each lasting 30 minutes and facilitated by a different DMS coach. Faculty were available for technical problems, but otherwise did not participate in the hands-on training. **Assessment:** We conducted a mixed methods evaluation of participants' attitudes towards interprofessional education, collaboration, and stereotypes. Participants completed

pre/post online surveys and participated in post-intervention focus group interviews. The 24-item survey was adapted from previously published, validated instruments with responses reported on a 5-point Likert scale (1=strongly disagree, 5=strongly agree). Paired survey results were analyzed via Wilcoxon signed-rank test. Following the workshop, DMS students and IM residents participated in 40 minute semi-structured focus group interviews. Interviews were recorded, transcribed, and analyzed via narrative analysis. Two coders performed selective coding to generate major themes, which were validated by member checking. **Results:** Twenty-four of 24 (100%) IM residents completed the pre- and post-intervention surveys. There was statistically significant improvement ($p<.05$) for 8 of 14 questions addressing perceptions of IPE including, "learning with other health professionals is a worthwhile use of my time," "it is beneficial to learn clinical problem-solving skills from health professionals outside my own college or department," and 'It is important for my training program to provide interprofessional learning opportunities." There were significant improvements in 9 out of 10 questions regarding stereotypes towards DMS, including their academic, leadership, interpersonal, and teaching abilities. Twenty three of 24 residents (96%) and 6/6 DMS students (100%) participated in focus group interviews. Two major IPE themes emerged from the analysis: 1) the learning environment and 2) appreciation for skills and contributions of other disciplines. IM residents felt the IPE workshop provided a more relaxed learning environment than traditional training sessions ("It made it easier to just try and see what happens"). DMS students felt the experience encouraged deliberate consideration of their scanning technique, which could improve their future performance ("It helps you become a better scanner because you really have to think about what you want them to do to make the image better). Working together led both groups to better appreciate the other's profession. IM residents had misconceptions corrected and gained new respect for the DMS coaches ("I just thought it was like being and LPN..but they have so much training..it made me feel a lot more comfortable in their decision-making capabilities"). IM residents expressed interest in seeking additional IPE opportunities not related to POCUS, including with nursing, respiratory therapy, and physical therapy ("In nursing..some of the practical stuff we don't have a full understanding of.") **Conclusion:** This study found that interprofessional POCUS education can improve participants' perceptions towards interprofessional education, dispel stereotypes amongst health professionals, and motivate interest in future interprofessional collaboration.

Co-Author(s): Kimberly Michael, University of Nebraska Medicine, Kathyrn Wampler, Devin Nickol, Lea Pounds, Elizabeth Beam, Tabatha Matthias, University of Nebraska Medical Center

Poster 2

Steps and Criteria for Acquiring the "IDEAL" Image

Courtney Vandermeersch B.S. in Genetics, MS 2, University of South Carolina School of Medicine - Columbia

Introduction: Beginning learners of sonography tend to focus almost exclusively on obtaining a specific image without thinking about optimizing the details, features, or characteristics of an image. It is hard for novice learners (and some advanced practitioners) to make sure to optimize the position, depth, size, focal points, and gain before saving each image to the medical record. The goal of this presentation was to develop a mnemonic to aid in remembering the steps needed to obtain an IDEAL ultrasound image, and criteria for the learner to be able to self-assess the characteristics of each image before review with their faculty, or supervising provider. **Methods:** The mnemonic and criteria were developed by consensus through the Delphi group. The mnemonic “IDEAL" represents the following characteristic features to be optimized before each image is captured:•I - intensity (gain)•D - define borders (size)•E – extent of the image (depth)•A - area of interest (focus)•L - location of the object/structure (position)The “IDEAL” criteria are as follows:•Intensity – start with the image bright and darken until visualization of object/structure begins to become impaired, then begin to brighten again until optimal visualization of object/structure is obtained. •Definition of borders – have the object/structure’s size fill 2/3rds of the image field.•Extent – adjust the depth to include the whole object/structure of interest in the image field.•Area of interest – set focal zone in the target center (or in some cases, the lower border) of the target.•Location – have object/structure of interest centered in the screen; keeping note that the ultrasound beam is perpendicular to the object of interest.Expert sonographers and ultrasound faculty were given a survey to evaluate this new memory tool. The survey will be used to gauge feedback on aspects of the mnemonic such as ease of retention, usefulness, and completeness. The survey used a combination of “yes/no”, free-response, and scaled questions. The scales were as follows: for ease of retention 1 = easy, 2 = medium, 3 = average, 4 = difficult, and 5 = challenging; for usefulness 1 = poor, 2 = fair, 3 = average, 4 = good, and 5 = excellent. **Results:** Of the seventeen people whom completed the survey, nine were sonographers and eight were faculty. 88.2% of participants noted the mnemonic was “excellent to good” at achieving its’ goal of functioning as a memory tool for those learning sonography. When it came to how easy it was to remember what each letter of the mnemonic stood for 70.6% of participants said it was “average” or easier to remember. There was a 100% consensus that the parameters in the mnemonic were areas the participants focused on when teaching new students/sonographers. When asked if they would add/subtract any terms from the mnemonic 82.4% said “no” and 17.6% said “yes”. The five steps in the mnemonic were five of the most common steps

those who held a professional role as a sonographer stated they used to optimize their ultrasound images. Eight of the seventeen participants when asked to list what steps they used to optimize an image, listed the same five (depth, gain, focus, position, and size) the mnemonic aids to remember. The remaining nine participants listed a combination of three of the mnemonic parameters (depth, gain, focus, position, and size), and added parameters such as zoom, orientation of probe, position of patient, and angle of probe. 94.1% of the participants stated the "IDEAL" criteria illustrated the steps needed to optimize an image. **Conclusion:** Overall, the results show the IDEAL mnemonic and "IDEAL" criteria would well serve the purpose of assisting in the recall of the steps needed to optimize an image, and would be of positive-value in the teaching of ultrasound to new learners.

Co-Author(s): Melissa Kozakiewicz, Wake Forest School of Medicine, Mallory Alkis, Wake Forest School of Medicine, Joshua Nitsche, Wake Forest School of Medicine, Brian Brost, Wake Forest School of Medicine

Poster 3

Evaluating Scanning Proficiency in Students, Residents, and Fellows

Brian Brost M.D., Wake Forest School of Medicine

Introduction >Diagnostic medical and physician training programs help students, residents, and fellows learn obstetric sonography. This involves helping trainees develop an understanding of anatomy and pathology, use ultrasound machines, obtain necessary images, and evaluate organ systems. With many sonographers and physicians teaching and evaluating trainees, it is difficult to ensure that trainees are increasing scanning skill level and becoming proficient in the many aspects of obstetric ultrasound. We developed a single page form to track trainee scanning progress and evaluate proficiency of maternal intrauterine and fetal anatomy imaging. **Methods** >First we listed all of the maternal intrauterine and fetal anatomy that must be evaluated by ultrasound. We also included important information such as fetal number, position, Doppler's, and soft marker pathology. We divided our proficiency criteria into organ systems and similar image groups. We listed our proficiency criteria with increasing difficulty in obtaining the image to divide our criteria into skill sets. We marked the skills with light to dark shading according to level of difficulty. This allows trainees to know what proficiencies to begin working on first and what to strive towards. **Results** >The Wake Forest School of Medicine Scanning Proficiency Form follows the parameters set forth by AIUM Guidelines for obstetrical ultrasound examinations with added detailed anatomic examination of the fetus. This form allows the educator and the trainee to have a

clear understanding of goals, objective and progression at a glance. We compiled proficiency criteria into a one page, easy to read chart. The sonographer or physician to objectively evaluate a trainee's progress and level of proficiency in obstetric ultrasound. This allows trainees easy access to periodic assessment and constructive feedback. Each proficiency can be graded as one of the following: not assessed, unacceptable, major revision, minor revision, or acceptable. This form provides instructors a standard assessment tool to evaluate trainee's beginning proficiency, progress, and ending competency. **Conclusions** >The Wake Forest School of Medicine Scanning Proficiency Form provides the trainee a clear understanding of current and future scanning goals, while streamlining and standardizing the evaluation process in tracking a trainee's scanning progress through the program.

Co-Author(s): Diane Hanks, Wake Forest School of Medicine, Graciela Rivera, Wake Forest School of Medicine, Sarah Shepard, Wake Forest School of Medicine, Sarah White, Wake Forest School of Medicine, Courtney Vandermeersch, University of South Carolina School of Medicine - Columbia, Joshua Nitsche, Wake Forest School of Medicine

Poster 4

Teaching the FAST Exam: Hands-on Instruction compared to an Ultrasound Simulator

Kimberly Rathbun MD, PhD, MPH, East Carolina University

Introduction: Ultrasound has become a widely used modality for bedside imaging across specialties and ultrasound training is increasingly becoming incorporated into undergraduate medical education. The need to effectively train large numbers of learners drives the need for comparison of longstanding methods of education with less labor-intensive new innovation. We compared time-to-image attainment of the five views of the FAST exam between participants trained using standardized patients versus those trained using a SonoSim® ultrasound simulator. **Methods:** This was a prospective, blinded, controlled educational study. Participants were ultrasound naïve first and second year medical students. All participants viewed the SonoSim® generalized ultrasound machine and eFAST exam module standardized lectures. The students were then randomized into a control group and an intervention group. The control group received traditional, hands-on teaching using standardized patients through both group and individual instruction. The intervention group received virtual training using the SonoSim® simulator. Participants in this group were instructed on how the task trainers worked, simulations to explore, and general use of the trainer. On a subsequent day, participants were tested on acquisition and interpretation of the four FAST exam views. Time-to-image attainment was recorded for

all five views as well as total time for FAST exam completion. An ultrasound-trained attending who regularly evaluates ultrasound performance determined the adequacy of image attainment. **Results:** The mean time to image attainment of the didactic group assigned to training using a standardized patient was slightly decreased compared to the group assigned to SonoSim training particularly for both bladder views. The mean time to image attainment between the two groups only reached statistical significance for the transverse bladder view. **Conclusions:** Traditional ultrasound training that relies on the use of standardized patients can be supplemented, if not substituted, by self-directed learning using SonoSim® for the FAST exam in ultrasound naïve first and second year medical students. With the increasing presence of ultrasound training in medical schools, training larger number of learners efficiently is a challenge. This study suggests that using the SonoSim® for FAST training is as effective as hands-on training face-to-face with an instructor using a standardized patient. Using the SonoSim® for introductory ultrasound training could be time and potentially cost saving. This is a preliminary study with a small number of participants. Further investigation into other types of ultrasound examinations is also needed to determine if the SonoSim® is equivalent to hands-on training for those exams

Co-Author(s): Bryan Zorko, East Carolina University

Poster 5

eFAST Exam Performance with a Novel vs Conventional Ultrasound Transducers; a Comparative, Crossover Study

Jonathan Monti DSc, PA-C, RDMS, Madigan Army Medical Center

Introduction: Significant advances in the portability and miniaturization of ultrasound have allowed the machines to be increasingly utilized in remote, austere environments, where the technology has proven itself invaluable as a diagnostic adjunct in the medical decision making of those providing care. The machines, however, remain underutilized for a myriad of reasons, those primarily being a lack of adequate training by those providing far-forward care, and the added logistical burden that traditional machines can create. Most portable ultrasound machines allow for only a single transducer to be connected at a time forcing users to carry two separate transducers for performing high and low frequency exams. This also requires users to perform a “hot swap” of transducers to complete exams such as the eFAST which often require both high/low frequency transducers. The time required to swap transducers mid-exam may decrease exam efficiency of performance. A single probe containing both a high-frequency linear, and a low-frequency phased array transducer could therefore allow for 1)

expanded versatility in the performance of a myriad of ultrasound exam applications with a single transducer, 2) reduced the time required to perform exams, such as the eFAST, that require both high and low frequency transducers, and 3) reduced logistical burden with the user only having to carry a single transducer. Such a transducer, which combines both a phased array and high-frequency linear transducers in a single, finger-worn probe, was designed via the DoD-funded Joint Warfighter Medical Research Program by Sonivate Medical Inc., (Portland, OR). The transducer connects to a mountable/wearable beam former which transmits images to a smartphone device display which allows the user to manipulate machine settings for image optimization. The transducer design, which is suggested to be more intuitive for novice sonographers, may improve functionality while reducing logistical burden of a machine that requires two separate transducers. Investigators hypothesize that this transducer will allow medics to perform ultrasound exams more efficiently with this highly portable, novel ultrasound device as compared to currently-available ultrasound devices. **Methods:** This study was approved by in Institutional Review Board at Madigan Army Medical Center. US Military Medics with no prior formal ultrasound training and less than 5 eFAST scans performed were recruited from across Joint Base Lewis McChord to participate in this study. Volunteer participants underwent focused didactic training in the performance of the extended Focused Assessment with Sonography for Trauma (eFAST) ultrasound exam, lasting approximately 1 hour. Participants were then randomized to one of two groups: Group 1 underwent hands-on training using either conventional ultrasound transducers (phased array and high frequency linear) while Group 2 trained with the novel finger-worn ultrasound transducer, with each group crossing over to the opposite transducer upon completion of initial transducer training. Both novel and conventional transducers were linked to a traditional cart-based ultrasound system, eliminating the graphical user interface as confounding variable in exam performance. Participants then underwent an Objective Structured Clinical Exam (OSCE) and their eFAST exam performance on a simulated ultrasound phantom model was assessed using a validated Task-Specific Checklist (TSC). Primary outcome measure was time to performance of complete eFAST exam using conventional vs novel transducers. Secondary outcome measures include a comparison of diagnostic accuracies by eFAST windon, and exam technical adequacy using conventional vs novel transducers, and subjective survey (Likert) scores on ease of use and transducer preference. **Results:** Data collection was recently completed. Data analysis is ongoing, and will completed this summer. **Conclusion:** Increasing portability is primarily considered an advantage for those providing care in austere, resource-limited environments. This data has potential to demonstrate the impact of extreme portability on ultrasound exam performance and whether modified form transducer form factors impact exam performance. Investigation into performance with a highly-portable novel transducers and devices, is crucial in determining its potential for employment by medical personnel operating in unconventional environments.

Co-Author(s): Brian Ahern, Madigan Army Medical Center, Aaron Cronin, Madigan Army Medical Center

Poster 6

Rising to the top of the CLASS a novel logic for grading point-of-care ultrasound image quality using heartworks

Caleb Taylor MD MPH, Ohio State University

Introduction: Obtaining, interpreting, and making medical decisions from POCUS images is an ongoing challenge for new and experienced learners. Instructors also have to adjust to the challenges of teaching and assessing competency in a dynamic training and evolving clinical practice environment. Heartworks - a simulation software application by Medaphor - may present a solution on both fronts. Heartworks allows novice, intermediate, and advanced users to acquire ultrasound images in the standardized cardiac views in a simulation environment. Current medical literature has limited material for objectively evaluating the quality of cardiac ultrasound images. Cardiac imaging has many nuances that impair effective image acquisition. A logic that identifies exemplar images, adequate images, and inadequate images could be used to teach both image acquisition and interpretation skills to instructors and eventually learners of all skill levels. The following is a derivation of the development of a rubric for assessing image quality using Heartworks. It is recognized that there may be differences between image quality in the clinical environment and the simulation environment. **Methods:** A representative team convened to determine the most easily made errors in obtaining cardiac ultrasound images. To mimic these errors, images were acquired under faculty supervision to create exemplar images for the 4 most common transthoracic echocardiography (TTE) views (Subxiphoid, parasternal long, parasternal short, apical 4 chamber). From these exemplars, the probe drivers were then instructed to intentionally manipulate their images to simulate common errors. These images were collected, digitized and then collated by views. Each image was graded via the acronym CLASS: Chirality, Location of relevant anatomy within image, Anatomy structures, Size and shape of anatomy, the Septal orientation. By analyzing the collection of images, an objective rubric was drafted by denoting the differences between exemplar and non-exemplar images. Each category was set as one point of a five-point scale and given an equal weight and the images were graded as 0-5. **Results:** By analyzing the collection of images, an objective rubric was drafted by denoting the differences between exemplar and non-exemplar images. Based on these differences, objective rubric criteria were drafted to address the most common errors.. Over 25 images representing varying degrees of quality were compiled for final review by ultrasound faculty. Ultrasound-affiliated faculty will be exposed to the CLASS rubric and logic before grading each

image. **Conclusions:** The CLASS acronym is a standardized approach to grading cardiac ultrasound images that is objective and easily remembered. The goal for this project was to create a validated rubric that users could not only use to grade but easily identify and correct common image acquisition mistakes. The CLASS rubric is twofold used to standardize image grading and as a new learning tool for simulated cardiac ultrasound. More research will be needed to validate this tool among those cohorts that use the cardiac simulator including faculty, residents and medical students.

Co-Author(s): Steven Shen, The Ohio State University, John Su, Ohio State University College of Medicine, Rohit Menon, Ohio State University, David Bahner, Ohio State University

Poster 7

The Simulated Shock Objective Standardized Clinical Exam (OSCE)

John Su Doctor of Medicine, Ohio State University College of Medicine

INTRODUCTION: Shock, in its many forms, is one of the leading causes of death around the world. Early care for shock is essential while delayed treatment or a misdiagnosis is associated with adverse consequences. Point-of-care ultrasound (POCUS) can be used to diagnose undifferentiated shock to improve patient outcomes during emergency care. Yet, the training and assessment tools to evaluate shock competency remain variable. Ultrasound simulators are becoming more popularly integrated in the medical education curriculum for its valuable potential as a teaching tool. This study aims to develop an Objective Structured Clinical Examination (OSCE) on shock ultrasound using the Heartworks Trans-Thoracic Echocardiography (TTE) Simulator (Inventive Medical LTD., London, United Kingdom) and to validate the instrument on fourth-year medical students. **Methods:** All fourth-year medical students will participate in a 2-hour Advanced Medicine and Hospital Based Care – Emergency Medicine (AMHBC-EM) seminar on shock, a standard, mandatory educational component in Part 3 or the final unit of the Lead. Serve. Inspire (LSI) medical curriculum at the Ohio State University College of Medicine (OSUCOM). Every senior must attend this monthly-held seminar prior to graduation. The Simulated Shock OSCE is an optional assessment that students may choose to participate without any penalty towards fulfilling graduation requirements. In the experimental group, eligible participants will be students who have completed the AMHBC-EM seminar between June and October 2018 and choose to take the OSCE after the AMHBC-EM seminar. In the control group, eligible participants will be students who will complete the AMHBC-EM seminar between November and May 2019 and choose to take the OSCE at an earlier date but will not have yet completed the AMHBC-EM seminar during our study period from June to

October 2018. Participation in this IRB-approved study requires all participants to complete the OSCE enrollment process. Students in both our experimental and control groups will be given instructions about how to participate in this study. These instructions include reviewing the Consent Script, scheduling a session to use the Heartworks Simulator, and filling out a Demographic Survey on Qualtrics (Qualtrics, Seattle, USA). Qualtrics is a web-based software that was used to create secure assessments and surveys. Students will give consent to participate in the research when they complete these listed requirements in the instructions on their own personal device. After enrolling into the study, the test administrator will send a randomly generated User ID and password that will be needed to take the Simulated Shock OSCE. This will ensure privacy among participants and the ultra-sonographer grading their ultrasound images. An excel file, kept securely by the test administrator, will match participant names to their login, demographic information, and the final composite score. The Simulated Shock OSCE has a knowledge and simulated component. The 20 multiple-choice question knowledge component will test participants on basic concepts about shock ultrasound. Each question will be awarded 1 point for a correct answer towards the participant's final composite score. Participants will receive a password protected link to take the knowledge component on Qualtrics on their own personal device. After completing the knowledge component, participants will review pertinent video tutorials prior to arriving to the Clinical Skills Education and Assessment Center (CSEAC) facility to complete the simulated component of the OSCE. Using the simulator, participants will acquire and interpret ultrasound images based on different shock pathologies on the Heartworks Simulator's Student Assessment and Review Tool (START) feature. Within START, 3 simulated shock cases have been constructed and include: Cardiac Tamponade, Global Left Ventricle Dysfunction, and Hypovolemia. For each shock case, participants will complete 3 scans to acquire 3 specific TTE views on the simulator. Participants will interpret these ultrasound images and answer relevant questions on Qualtrics on their personal device that will accompany the START portion of their shock case. For each case, participants will answer 6 multiple choice questions about their shock pathology. Expert sonographers will review and grade anonymized ultrasound images that participants obtained for the simulated component of the OSCE. All ultrasound images will be graded and awarded either 0 points (inadequate), 1 point (adequate), or 2 points (exemplar). All accompanying questions in the case will be awarded 1 point for the correct answer. The points in the simulated component of the OSCE, alongside the initial knowledge exam, will total for a composite score of 56 possible points. Lastly, participants will complete a 6-item Post-OSCE Evaluation Survey to give feedback about the Simulated Shock OSCE. **Results:** Data collection is on-going with the intent to recruit 30 test subjects. In the experimental group, we will recruit 15 students who have completed the seminar between June and October 2018 and choose to take the OSCE after the AMHBC-EM seminar. In the control group, we will recruit 15 students who will complete the AMHBC-EM seminar between December and May 2019 and choose to take the OSCE at an earlier

date but will not have yet completed the AMHBC-EM seminar during our study period from June to October 2018.A 24-item Demographic Survey was constructed to ask participants about ultrasound training in medical schools and how many scans they have taken from either models or patients. Questions also consisted of an IRB-approved five-point Likert-like ranging from 1 (very unskilled) to 5 (very skilled) to assess competency with acquiring 5 cardiac views: Subxiphoid, Parasternal Long Axis, Parasternal Short Axis, Apical 4 Chamber and Inferior Vena Cava. The results of the Demographic Survey will be used to draw conclusions about the OSCE with respect to individual cohorts and students with variable ultrasound experiences. The Simulated Shock OSCE consists of a knowledge and simulated component. The 20-question knowledge assessment in Qualtrics is oriented around the 5 different categories of shock: Hypovolemia/Hemorrhagic, Obstructive, Cardiogenic, and Distributive. There is a maximum of 20 possible points participants can earn towards their final composite score. Following that, between the 3 shock cases, participants will obtain 9 TTE images on START and answer 18 additional questions on Qualtrics. Given that each TTE image, as graded, is worth 0, 1 or 2 points, the simulated component of the OSCE consists of a maximum of 36 possible points participants can earn towards their final composite score. All data will be collected and stored in secure, encrypted Qualtrics servers and will analyzed in an Excel database. The data will document each participant's response to the Demographic Survey as well as scores for the knowledge and simulated components of the Simulated Shock OSCE. Once data is collected, ANOVA will be used to compare between the experiment and control groups. Results will be posted when all the data has been graded and analyzed for statistically significant relationships. **Conclusion:** As the importance and popularity for point-of-care ultrasound continues to grow, it demands new modalities to teach learners how to use this operator dependent machine. Literature suggests that the use of ultrasound simulators can be one such modality that can effectively complement how learners can improve on how they acquire and interpret ultrasound images. Simulation provides learners a non-threatening environment that can help them master the basic ultrasound skills and make a tremendous impact in emergent clinical scenarios such as shock. In that regard, the Simulated Shock OSCE was developed using a cardiac ultrasound simulator to assess shock competency and was tested on 4th year medical students. More research will be needed to validate this tool among other cohorts that use the cardiac ultrasound simulator including faculty, residents and other medical students.

Co-Author(s): Steven Shen, The Ohio State University, David Bahner, Ohio State University, Lauren Branditz, Ohio State University College of Medicine

Poster 8

Competency Based Assessment for Thoracic Point of Care Ultrasonography in Undergraduate Medical Education

Michael Woo MD, University of Ottawa and Ottawa Hospital

Introduction: Point of care ultrasound (POCUS) training in postgraduate medicine has recently moved to a competency based model. The performance of undergraduate medical students using the same competency assessment tools as residents is unknown at our center. This study examines the results of using a competency assessment tool for a defined thoracic POCUS undergraduate medical education program. **Methods:** Forty 1st year medical students participated in a thoracic POCUS workshop consisting of a 30-minute didactic lecture followed by a 1.5-hour small group scanning session led by POCUS proficient Emergency Physicians. Student competency was evaluated using a pre-post test method and live scanning assessment. Evaluations were designed to assess specific outcomes about basic ultrasound anatomy, scanning technique and image interpretation. Pre- and post-tests consisted of 10 expert validated multiple-choice questions and post-tests were administered at two time points: post lecture and post small group session. Scanning assessments were performed by direct observation using an objective structured assessment of technical skill (OSATs) using the O-score at the end of the workshop. Paired and unpaired t-tests were used to compare test scores within and between each assessment group. **Results:** There was significant improvement from pre-test to post-test scores administered after the didactic lecture (Mean difference: 21%; 95%CI 13-31, $p<0.05$) and after the scanning session (Mean difference: 49%; 95%CI 41-58, $p<0.05$). However, students tested prior to the scanning session scored lower with outcomes assessing technique and image recognition (Mean difference: 28%; 95%CI 20-36, $p<0.05$). The mean student OSAT 'O-score' was 2.8/5 (a score of 3 corresponds with "I had to prompt them from time to time") with higher scores in image acquisition and pathology identification however these differences were not significant. **Conclusion:** Competency assessment tools can be used in undergraduate medical education to assess POCUS competency. Further study is required to see if there are any changes in the competency assessment scores over time.

Co-Author(s): John MacIsaac, University of Ottawa, Youstina Hanna, Univeristy of Ottawa, Nora Ahmad, , Luke Edgar, , Chris Ramnanan, , Paul Pageau


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Poster 9

Poster 10

Poster 11

A Novel 'Train the Trainer' Emergency Medicine Resident Point-of-Care Ultrasound Course: A Feasibility Study.

Jereme Long D.O., Lakeland Health

Introduction: A novel multi-site 'train the trainer' point-of-care ultrasound (POCUS) training course was designed to meet the graduate medical learning needs of a geographically dispersed consortium of community-based emergency medicine (EM) residency programs. **Objective:** The purpose of this study was to explore the feasibility of using volunteer EM physicians who were novices with ultrasound as instructors for an ultrasound course. Additionally, the authors evaluated the effectiveness and consistency of a POCUS course delivered over multiple sites to enhance EM residents' ultrasound knowledge and skill acquisition. **Methods:** For the initial session the lead instructor conducted a focused course with the novice instructors. A subsequent session was then repeated for EM residents whereby the aforementioned novice instructors provided the hands-on instruction. The residents were given pre- and post-course tests to a sample of to gauge the effectiveness of the instruction model. After the

course, a satisfaction survey was administered to the resident participants and a qualitative open-ended survey the volunteer EM physicians who served as instructors. **Results:** Forty-two EM residents from 11 different residency programs attended at one of the three courses that were offered. Thirty five (87.5%) of total sample resident learners' scores increased from pre to post-test scores, with five (11.9%) other residents maintaining their pre-course score levels and only two (4.8%) residents experienced a post score decline. In addition, resident participants responded favorably to a post course summary evaluation with an average response of 4.8 (0-5 Likert scale) demonstrating overall satisfaction with the course. In the separate qualitative survey given to instructors, comments consistently conveyed a perceived benefit for the volunteer EM physicians. **Conclusion:** The evaluation of this novel model supports the feasibility of the 'train the trainer' program. Not only was the model beneficial for the residents taking the course, but also for the instructors who taught; delivering on both teaching the residents as well as extending the knowledge and skill within current EM physicians. This model provides an additional option for EM residency program educators to consider when developing their POCUS training courses.

Co-Author(s): Nikolai Butki, Michigan State University Statewide Campus System, Andrew Butki, Michigan State University Statewide Campus System

Poster 12

Just Add Water: Evaluation of a Novel Ultrasound Gel for Austere Environments

Jonathan Monti DSc, PA-C, RDMS, Madigan Army Medical Center

Introduction: Resource and logistical constraints may limit the availability of commercial ultrasound transmission gel (USTG) for medical personnel operating in austere environments. Glucomannan powder, a dietary fiber supplement, can be mixed with tap water to form a gel that may be a field expedient substitute for USTG. We compared glucomannan gel to a commercial USTG for ultrasound (US) diagnostic adequacy and image quality. **Methods:** A single clinician obtained 193 US video clips from 14 different examinations on live-tissue and simulation training models using both commercial and glucomannan USTGs. Four US fellowship trained providers, blinded to type of gel used, independently reviewed the randomized US video clips. The primary outcome of US image adequacy was scored as "yes" or "no" and analyzed using Pearson's chi-squared analysis. The secondary outcome of image quality was rated on a 0-5 Likert scale and analyzed with the Independent t-test. **Results:** For US image adequacy, commercial USTG was superior to glucomannan gel ($p = 0.042$, 95% CI 96.58% - 96.62%), with

commercial USTG resulting in 96.6% of images (375 of 388 "Yes") deemed adequate, while glucomannan USTG resulted in 93.5% (359 of 384 "Yes") of images being adequate. For US image quality there was no statistically significant difference between the two USTGs (p = 0.176, 95% CI 93.47% - 93.53%), with commercial USTG rated at 3.4±1.0 and glucomannan gel at 3.3±1.1 **Conclusion:** Despite a high US image adequacy rate, glucomannan USTG proved inferior to commercial USTG for rate of US image adequacy, but demonstrated equivalent image quality. Glucomannan USTG may be a reasonable substitute when commercial USTG is unavailable/unobtainable. KEYWORDS: Ultrasound; Austere; Point-of-Care; POCUS

Co-Author(s): Sandra Milton, Madigan Army Medical Center, Aaron Cronin, Madigan Army Medical Center

Poster 13

A Simple, Realistic, Inexpensive Nerve Block Phantom

Kimberly Rathbun MD, PhD, MPH, East Carolina University

Background: Ultrasound guided nerve blocks are a common procedure done for both diagnostic and therapeutic purposes. Ultrasound phantoms are frequently used in procedural teaching to improve learner's familiarity and comfort with the procedure before performing the procedure on patients. A few nerve block phantoms have been developed. We believe we have an improved model based on ease of construction combined with more realistic nerve appearance. **Methods:** The nerve block model was made with a core of hot dog embedded in a gelatin mold.Results: This nerve block model realistically simulates the sonographic appearance of a nerve with decreased posterior shadowing compared to other models and avoids the risk of bacterial contamination that exists with poultry or pork meat. **Conclusion:** This nerve block phantom is inexpensive and easily constructed. It allows medical students and residents to realistically simulate nerve-targeting procedures to increase their comfort level and skill before attempting procedures on patients.

Co-Author(s): William Brader, East Carolina University, John Norbury, East Carolina University

Poster 14

Use of homemade phantoms in the training of vascular access guided by ultrasonography: Evaluation by inexperienced medical students.

Marcus Bastos MD, PhD, Federal Univdersity of Juiz de Fora

Introduction: Ultrasonography (US) performed at the bedside is a fast, non-invasive procedure and also allows for safer invasive procedures. Among the procedures performed in clinical practice, central venous access (CVA) is particularly important. Simulated US guided CVA training has been used effectively to integrate didactic knowledge and technical skills. In this study, the effectiveness of venous access guided by US using different phantoms models was evaluated among medical students. **Methods:** 13 undergraduate students from the first period of our medical course, naive in ultrasonography, participated in the study. They watched video prerecorded lectures on image acquisition and US guided vascular access techniques, and attended a hands-on ultrasound training sessions on vascular access. Four different phantoms were used: one commercial (CP) and three homemade: tofu cheese (TCP), gelatin (GP) and chicken breast (CBP), with simulated vessels inside. We evaluated: 1. the similarity of the carotid and internal jugular vein images obtained from a human model (HM) with those obtained with the four phantoms, using a Likert scale (maximum of 52 points); 2. qualitative assessment (0 to 4+) of visualization of the needle's path till to the inside of "blood vessels"; 3. number of attempts for insertion of the needle in the vessels; and 4. the time (in minutes) used for successful "vascular cannulation". **Results:** Relative to the image obtained in the HM, the scores with the phantoms CP, TCP, GP and CBF were, respectively, 7, 28, 34 and 47 ($p < 0.05$). The qualitative assessment of the needle visualization of the homemade phantoms were superior to the CP. The "vascular" needle insertion in a first attempt was 54% with the homemade phantoms and 23% with CP ($p < 0.05$). Time of successful "venous" cannulation <1 minute was 77% using homemade phantoms and 54% in the CP. **Conclusion:** Medical students with short-term theoretical and practical training presented high performance in the simulation of vascular cannulation guided by ultrasonography. The use of homemade phantoms made of TCP, GP and CBF, of low cost, showed better image quality and favored in a superior way the training of US guided vascular cannulation.

Co-Author(s): Aline Pereira, Federal University of Juiz de Fora, Raquel Dias, Federal University of Juiz de Fora, Talita Menon, Funadação IMEPEN, Ramon Dalamura, Funadação IMEPEN

Poster 15

Low-Cost Vascular Simulation Model for Use in Medical Eduction

Courtney Vandermeersch B.S. in Genetics, MS 2, University of South Carolina School of Medicine - Columbia

Introduction: Current vascular simulation models available are high-cost items, leading to limited or no use in medical training. The objective of this design was to produce a low-cost, high-fidelity vascular simulation model that could be used to teach ultrasound and/or ultrasound guided needle procedures. **Methods:** Silicone tubing with a specific hardness was obtained, and in this design three tubes of appropriate length and diameter were coiled to resemble an umbilical cord. A silicone tube was shaped into a typical coil-pattern with a copper wire for internal support for the simulated umbilical vein. Two additional appropriately sized lengths of tubing were coiled using the first as a support structure. Ballistic gel was then poured over the vessel model, with slow rotation to ensure even coverage and to prevent drip marks. Once cool, the vessel model was ready for use. Areas that will be assessed on the vascular simulation model include the following: durability, functionality, and similarity of sonographic characteristics to that of a real vessel. The cord will be punctured with a needles of various size, and in various places to ensure it can withstand repeated. Fluid will also be run through the vessels to see if proper laminar blood flow can be simulated in the vessels. The current cost of silicone tubing is ~$10 for 25 linear feet. The estimated cost of the vascular model is $0.70 per one-foot of vessel. **Results:** The silicone tubing infrastructure was coated with multiple layers of melted ballistic gelatin. The silicone tubing was not malformed by the heat of the ballistic gel and adhered in a uniform manner along the length of the tubing. Ultrasound images confirmed the vascular model resembled that of a human umbilical cord in the transverse and long planes. The cord was then tested, and shown to hold up to multiple punctures, with no sign of structural demise. When fluid was run through the tubing to mimic the flow in human umbilical arteries and vein, Doppler imaging showed there was minimal turbulent flow created after repetitive puncturing of the cord. **Conclusion:** The vascular model was able to tolerate numerous punctures, it had proper fluid flow in the lumen, and on ultrasound was shown to have a high degree of realism to real-life vascular structures. This low-cost, high fidelity model will be of educational benefit by increasing vascular training opportunities for medical students, residents, fellows, and professionals. The model designed above could be used for percutaneous umbilical cord sampling. In addition, this vascular model is suitable, if modified slightly, for other invasive vascular procedures such as central line placement and angioplasty.

Co-Author(s): Joshua Nitsche, Wake Forest School of Medicine, Melissa Kozakiewicz, Wake Forest School of Medicine, Mallory Alkis, Wake Forest School of Medicine, Brian Brost, Wake Forest School of Medicine

Poster 16

A novel task trainer and targeting tasks for ultrasound guided invasive procedures

Joshua Nitsche MD, PhD, Wake Forest School of Medicine

Introduction: It can be difficult to properly train residents and fellows in ultrasound guided invasive procedures given the increasing number of trainees, duty hour restrictions, and the large number of procedures that now employ ultrasound guidance. Thankfully, there is considerable overlap in the psychomotor skills used in different invasive procedures, so with the correct training strategy trainees can prepare for several procedures simultaneously. The American Institute of Ultrasound in Medicine (AIUM) recognized this in their Practice Statement on Selected Ultrasound Procedures and outlined a set of specific needle localization and guidance techniques common to the vast majority of procedures. The skill set consists of the in-plane guidance and out-of-plane guidance approaches, as well as the probe translation, probe rotation, and heel-toe oblique standoff needle image optimization techniques. To allow for more efficient training we have constructed a novel task trainer and targeting tasks that allow practice of these core skills in a safe simulated setting. We have gathered validity evidence for their usefulness in ultrasound guided invasive procedure training in the 5 validity domains described in the Standards for Educational and Psychological Testing: content, response process, internal structure, relations with other variables, and consequences. Here we report the results of our validity investigations of the task trainer and targeting curriculum. **Methods**: Model Construction and TasksTargeting models made from wooden dowels, drinking straws, wooden beads, Lego blocks, Styrofoam, and wooden blocks were secured to the bottom of the task trainer container, and the container was filled with water. A circular piece of ballistic gelatin was placed on top of the container. Participants placed an ultrasound probe on the ballistic gelatin, and the targeting models served as echogenic targets in a series of targeting tasks that are described below. The task trainer and targeting models are shown in the figure. In-Plane Dowel Task. Participants obtained a cross-sectional image of the dowels, inserted a needle into the task trainer, and touched a dowel using an in-plane approach. In a random order, the participants adjusted the needle within the ultrasound plane and touched another dowel without removing the needle.Out-of-Plane Dowel Task. Participants obtained a cross-sectional image of the dowels, inserted a needle into the task trainer, and touched a dowel using an out-of-plane

approach. In a random order, the participants adjusted the needle within the ultrasound plane and touched another dowel without removing the needle.Straw Task. Participants obtained a longitudinal view of a straw lumen, inserted the needle into the task trainer, and guided it into lumen of the straw without touching the sides using an in-plane approach. In a random order the participants inserted the needle into another straw removing the needle from the trainer in between each straw. Ball Task. Participants obtained an image of a ball, inserted the needle into the task trainer, and touched the ball with the needle using an in-plane approach. In a random order the participants rotated the ultrasound plane view, obtained an image of another ball, moved the needle into the new ultrasound view, and touched the new target without removing the needle.Heel-Toe Task. Participants obtained a longitudinal view of a straw and inserted the needle into the task trainer, and guided it into the lumen of the straw to the base of the construct without touching the sides using an in-plane approach. In a random order the participants inserted the needle into another straw removing the needle from the trainer in between each straw. The straw lumens can only be accessed by inserting a needle close to perpendicular to the simulated skin which requires the examinee to use the heel-toe technique to complete the task.To provide an objective assessment of trainee skill the tasks were timed and the number of times the trainee misses the target or losses view of the needle were counted. To provide a summary measure of speed and accuracy an error adjusted completion time was calculated by adding 5 seconds for each error to the raw completion time. Validity EvidenceResponse Process. Obstetric providers performed the tasks and completed surveys using 5-point Likert scale questions about the task trainer's and targeting tasks' usefulness.Internal Structure. First year medical students were recorded performing the in-plane dowel and straw tasks. These recordings were scored for number of targeting errors by 2 examiners and an interclass correlation coefficient (ICC) was calculated for inter-rater reliability. A subset of the videos was scored twice by the same examiner, and an ICC was calculated for intra-rater reliability. An ICC of the pre- and post-test scores of the residents in the control group was calculated for test-retest reliability.Relationship Other Variables (level of training). The raw completion time, number of targeting errors, error adjusted completion time (raw completion time + 5 seconds/error) for all 5 targeting task were compared between inexperienced and experienced OB providers using a t-test for independent measures.Consequences. A receiver operator characteristic (ROC) curve analysis was performed using the data from experienced compared to inexperienced OB providers. The cutoff values for number or errors and error adjusted completion time were chosen using the Youden index and sensitivity, specificity, positive likelihood ratios (PLR), and negative likelihood ratios (NLR) were calculated**. Results Content:** The targeting tasks include all of the guidance approaches and needle localization techniques outlined in the AIUM's Practice Statement on Selected Ultrasound Procedures.Response Process. Nearly all of the 47 OB providers (3 OB/GYN residents, 18 MFM fellows, 4 OB/GYN attending physicians, and 22 MFM attending physicians) that performed the

targeting tasks and completed surveys either agreed or strongly agreed that the targeting tasks would be helpful in building clinical skill, improve trainee hand-eye coordination, and should be used in resident and fellow training.Internal Structure. Thirty-two medical students were recorded performing the tasks. The test-retest ICCs for the dowel task were 0.50, 0.65, and 0.61 for raw completion time, number of errors, and error adjusted completion time, respectively. For the straw task the corresponding values were 0.62, 0.78, and 0.69, respectively. For the scoring of targeting errors the inter-rater ICC was 0.85 and 0.93 for the dowel and straw tasks, respectively. The intra-rater ICC was 0.99 and 0.99 for the dowel and straw tasks, respectively. Relationship with Other Variables (level of training). Twenty-one inexperienced (16 residents and 5 1st and 2nd year fellows) and 14 experienced OB providers (8 3rd year fellows and 6 faculty) completed the in-plane dowel, straw, and ball tasks. Fifteen inexperienced (7 residents and 8 1st and 2nd year fellows) and 10 experienced health care providers (3 3rd year fellows and 7 faculty) completed the heel-toe standoff and out-of-plane dowel tasks. Although the raw completion times were similar between experienced and inexperienced health care providers in all but the heel-toe task, the numbers of errors (average errors for each task: 2-8 vs. 11-19) and error-adjusted completion times (average time for each task: 252-360 vs. 356-680 seconds) were significantly lower in the experienced providers for all tasks except the out-of-plane dowel task.Consequences. In the ROC analysis with number or errors the AUC ranged from 0.93-0.98 and the cutoff scores ranged from 6-14 errors. The sensitivities and specificities were 100% and 76-86%, respectively. The PLRs and NLRs were 4.2-7.0 and <0.001, respectively. For error adjusted completion time the AUC ranged from 0.67-0.84 and the cutoff scores ranged from 270-319 seconds. The sensitivities and specificities were 60-79% and 62-93%, respectively. The PLRs and NLRs were 1.9-9.0 and 0.3-0.4, respectively. **Conclusions**: We have now completed extensive validation of our novel ultrasound guidance task trainer and targeting tasks. Our curriculum allows for repetitive practice of all of the core guidance skills outlined by the AIUM (content domain). Based on the survey responses from both experienced and inexperienced providers practice with our task trainer would be expected to improve the clinical skill of trainees (response process domain). The usefulness of the trainer and curriculum is further supported by the relationship between task performance and level of clinical experience (relationship with other variables domain), and the ability of task performance cutoffs to distinguish between experienced and inexperienced providers (consequences domain).Given the high levels of inter-rater, intra-rater, and test-retest reliability (internal structure domain) of the targeting tasks, they will also allow for an objective assessment of trainee skill. This is particularly important given the difficulty of assessing competence in complex procedural skills including ultrasound guided invasive procedures. We propose a training schema in which trainees would be assessed with the targeting tasks at the start of their training to determine their natural baseline hand-eye coordination and allow for individualization of their specific training regimen. They would continue to practice until they reached a

predetermined level of skill prior to performing real-life procedures. Once they reach this level of skill their training would shift to specific procedures to master the subtle differences among the various ultrasound guided procedures within their scope of practice.

Co-Author(s): Mallory Alkis, Wake Forest School of Medicine, Melissa Kozakiewicz, Wake Forest School of Medicine, Brian Brost, Wake Forest School of Medicine

Poster 17

Training the Trainers; a Near Peer Proctoring Program at Ohio State University

Martina Diaz Bobillo Medical Student, The Ohio State University College of Medicine

Objective: The Ultrasound Interest Group (USIG) at The Ohio State College of Medicine (OSUCOM) is one of the largest student organizations on campus, hosting hundreds of medical students interested in learning point-of-care ultrasound. These medical students can participate in USIG's ultrasound curriculum in a multitude of ways, with the goal of learning image acquisition and interpretation. During scanning sessions, students are taught by medical students in addition to residents and ultrasound faculty. We aim to define and evaluate the effectiveness of a medical student proctoring program within this organization. **Methods:** The OSUCOM USIG hosts an elective, longitudinal curriculum for all levels of medical students. The curriculum has three year-long components intended to correlate with the first three years of medical school; we call these components Beginner, Intermediate, and Advanced Ultrasound. At these sessions, medical student proctors instruct groups of learners on proper image acquisition and interpretation techniques using medical student models from our Trained Simulated Ultrasound Patient (TSUP) program. To be qualified to proctor a scan, we require that the medical student have already completed that component of the USIG curriculum and have completed TSUP training as well. We provide the proctors with proctor guides for each scan created by senior medical students and approved by ultrasound faculty. In addition, we hold a 30-minute review for proctors before each scanning session where they can receive instruction from ultrasound faculty and practice scanning the TSUPs before teaching the lesson. In addition to helping with the USIG curricular scans, the proctors also help with OSUCOM and Wexner Medical Center ultrasound sessions, including house staff training workshops and Ultrafest, USIG's annual ultrasound conference. A survey will be created to assess the value of the proctoring program during the recently ended academic year and distributed to all medical student proctors. The survey will consist of questions evaluating the educational value of the program, including acquisition and retention of ultrasound knowledge, and comfort with ultrasound

using a 5-point Likert scale. The medical student proctors for the summer , fall, and spring sessions will be asked to complete the survey. **Results:** We believe that encouraging medical students to proctor ultrasound scans for other students facilitates learning on all sides; the proctors benefit from repetitively scanning the TSUPs as they teach, and the learners benefit from being taught by other medical students familiar with the school's curriculum. In addition, when the students teach the house staff, they're able to make professional connections that can potentially benefit their careers. After establishing a training program for proctors this summer we had 15 students (years M2-M4) sign up for the 7 summer sessions, compared to 7 proctors last year for 8 sessions. We expect that our survey results will reflect that students are more likely to sign up to proctor and are more comfortable doing so with the establishment of this teaching program. **Conclusion:** It's well-established that teaching can be an effective way to master a topic. We believe that this remains true for point-of-care ultrasound education in medical school. Not only does allowing medical students to teach scans to students and residents give them additional time to practice scanning, it also fosters mentorship between medical students with other students and physicians We will use our survey data to assess and improve our proctoring program. Possible future changes include requiring proctors to demonstrate skill for each scan before they're permitted to teach, and creating additional educational materials for proctors to utilize during teaching sessions.

Co-Author(s): Michael Howell, The Ohio State University College of Medicine, Jessica Everett, Ohio State University, Creagh Boulger, The Ohio State University College of Medicine, David Bahner, Ohio State University

Poster 18

Emergency Medicine Community of Practice: A Framework For Improving Ultrasound Research and Education

Michael Howell B.A., The Ohio State University College of Medicine

Introduction: The Ultrasound Interest Group (USIG) at the Ohio State University College of Medicine (OSUCOM) has developed the Community of Practice (COP) concept over the last several years. We define a COP as a group of physicians, scientists, and students dedicated to furthering ultrasound research, education, and clinical application within their specialty. The Emergency Medicine (EM) COP was recently created to organize ultrasound resources and identify new areas for advancement within point-of-care ultrasound (POCUS). We believe that this administrative framework will help coordinate

activities, facilitate mentorship, and improve overall academic outcomes in emergency medicine ultrasound. **Methods:** Residents, faculty and students were surveyed to ascertain interest in emergency medicine and point of care ultrasound utilization within the field. Residents were recruited from the ultrasound track, a dedicated curriculum with requirements like those of an emergency ultrasound fellowship. Faculty were selected from the Division of Ultrasound within the Department of Emergency Medicine. The medical student constituent was recruited from the ultrasound interest group based on their self-reported interest in emergency medicine. The COP was then evaluated using milestones previously created at OSUCOM, focusing on progress in four areas: education, research, clinical application, and administration. **Results:** The EM COP has 14 members, including 6 faculty, 2 residents, and 6 medical students. After organizing the leadership, the COP was evaluated based on milestones—it earned 4 points in clinical application, 3 points in educational projects, 1 point in research output, and 1 point in administrative development. COP leaders have chosen to focus on education and research goals for this academic year. Current projects include establishing a journal club, arranging a database with current EM POCUS literature, holding scanning shifts in the emergency department, and designing an interactive didactic series intended for medical students. **Conclusions:** The EM COP at OSUCOM is an administrative construct that can help focus those interested in accomplishing academic ultrasound goals. We expect that as we continue to grow the COP, we will improve ultrasound education and research output at OSUCOM. More research is needed as to whether EM COP mechanism can improve academic metrics at other institutions.

Co-Author(s): Martina Diaz Bobillo, The Ohio State University College of Medicine, Jessica Everett, Ohio State University, Creagh Boulger, The Ohio State University College of Medicine, David Bahner, Ohio State University

Poster 19

Incorporating Ultrasound Education into the Third-Year Medical Student Clinical Clerkship Curriculum: The Ground School Program

Anthony Sanchez B.S. University of Notre Dame, Ohio State University College of Medicine

Introduction: Ultrasound training is not yet a core component of medical education at most institutions. The Ohio State University College of Medicine (OSUCOM) has been working to implement structured ultrasound education within the Lead Serve Inspire (LSI) curriculum. Currently, ultrasound is being taught primarily during the first and second years of medical school in anatomy, and the fourth year

when students have their emergency medicine rotations. The third year poses a challenge to ultrasound education as students are rotating through several different specialties, few of which prioritize the use or education of ultrasound to students. OSUCOM has developed an ultrasound curriculum for third year students involving a series of specialty-specific workshops that are administered before rotations at three intervals throughout the year. This project evaluates the structure of this curriculum and students' strengths and weaknesses using an ultrasound knowledge quiz at the end of the year, after the completion of all the workshops. **Methods:** A total of 110 third year students participated in this study. At three points during the year before beginning a set of specific rotations, there is a week-long orientation called Ground School. This prepares students with specialty-relevant lectures and interactive workshops where they are able to learn and practice exam and procedural skills. This includes an ultrasound session to learn about and practice various ultrasound techniques. Scans and topics that are taught include: FAST, cardiac, lung, ob/gyn, aorta, vascular access, knobology, and others. This study looked at the effectiveness of the Ground School Ultrasound Workshops by assessing medical student ultrasound knowledge with a fifty-question multiple choice quiz that was administered at the end of the third year (after every student completed all three workshops). In addition to calculating quiz averages, individual questions were analyzed. Questions were categorized by their corresponding subject focus and individual scores per question were used to determine those that were most commonly missed. **Results:** Results from this quiz showed an average of 68%, with most students (n=26) falling within the 70-74% range. The questions that were most commonly missed were defined as those that >50% of students got incorrect. Of all questions, those related to the subxiphoid scan (66%, 2 of 3), physics (60%, 3 of 5), and lung scan (40%, 2 of 5) fell into this category. Questions related to knobology were least likely to be missed by >50% of students (11%, 1 of 9 incorrect). Overall, out of the 12 most commonly missed questions, the majority (n=7) belonged to one of the three groups described above (subxiphoid, physics, and lung). The remaining 5 were spread out evenly among other groups. **Conclusions:** These results suggest that this ultrasound education curriculum has both areas of strength and weakness with respect to its effectiveness in teaching specific ultrasound topics. Specifically, knobology represents an area of strength, while subxiphoid, lung and physics related topics are possible areas of improvement. Using this data, appropriate changes can be made to the curriculum that will result in improved education, and this will help medical students gain ultrasound knowledge and techniques during their third year.

Co-Author(s): Lauren Mamer, Ohio State University College of Medicine, David Bahner, Ohio State University, Creagh Boulger, The Ohio State University College of Medicine

Poster 20

Building up ultrasound Communities of Practice: A leadership initiative within USIG to improve engagement and productivity

Stephen Politano MD Candidate, Ohio State Univerisity College of Medicine

Introduction: The Ohio State University College of Medicine's (OSUCOM) student-led Ultrasound Interest Group (USIG) developed the idea of the ultrasound Community of Practice (COP) to facilitate collaboration between students and physicians. Currently at OSUCOM, there are ten specialties with ultrasound COPs at differing stages of maturity and productivity according to our milestones. These milestones (i.e., Clinical, Education, Research, Administration) provide an outline for which USIG can monitor COPs' needs. Through meeting with various COP representatives, we have identified several barriers to progression including lack of student and faculty initiative, difficulties with COP administration, and attrition at the end of the academic year. Our goal is to provide a framework for COPs to maintain interest and grow their cohort to self-sufficiency. **Methods**: In order to increase faculty interest, we are encouraging student and faculty COP members to reach out within their specialty to other possible interested physicians. In addition, we will create a brochure that explains the purpose and benefits of the COP concept for distribution to potential members. Finally, we will invite COP faculty leaders to lead USIG didactics and scanning sessions for medical students and residents. To increase medical student involvement, we will hold a COP Fair during the first USIG general student body meeting of the academic year. We will also advertise via email to all incoming first year medical students and upperclassmen. Administrative issues will be addressed by developing an explicit set of guidelines for COP infrastructure, including clarifying leadership roles and streamlining event planning. We will hold individual, yearly meetings between the COPs and USIG executives to discuss (1) scheduling meetings for each quarter in advance, (2) designating a liaison responsible for reporting to USIG after each quarter, and (3) identifying barriers towards each specific COP achievement. **Results**: Currently there are 2 active COPs, while the remaining 8 inactive. Of the two most active COPs, both have reported meeting notes to USIG executives along with meeting milestone criteria. Specifically, the Internal Medicine COP has submitted 5 reports this last academic year, while the EM COP has only submitted 1. Additionally, both have had coordinated events with physicians and medical students. They have not provided a yearly or quarterly calendar for events, and they only notified USIG of meetings a few weeks in advance. Most notably, the EM COP has the most advanced milestone of a 4/5 in clinical, but both EM and IM COPs average 2.0 for their milestones across the board currently compared to 1.0 in the summer of 2017. The remaining 8 COPs have not reported to USIG on a consistent basis. However, there were 3 inactive COPs that sent at least one report to USIG this past academic year, but lack of coordination led to relegation

of active status. All COPs have some faculty and/or medical students that have expressed interest in leadership in the past year, though lack general member interest. The overall means from all COP milestones is 0.35 in the summer of 2017 to 0.63 currently. We expect that our planned modifications to the COP architecture will help solidify COP leadership, increase overall membership, and streamline administrative tasks. **Conclusions**: COPs have proven to be a valuable tool at Ohio State by providing excellent learning/academic opportunities if they remain active. Coordination between USIG and COPs is essential to continue identifying barriers to progress and solutions to those problems. Previous successes can be attributed to transparent communication between physicians and medical students plus clear communication between USIG and COPs. By helping COPs coordinate their membership and communicate with potential members, we expect to improve COP involvement and, ultimately, academic outcomes by achieving landmarks within each milestone. Future studies should include more data from year to year as well as calculated progression from each report regarding specific COPs.

Co-Author(s): Sean McDermott, The Ohio State University College of Medicine, Michael Howell, The Ohio State University College of Medicine, Creagh Boulger, The Ohio State University College of Medicine, Michael Prats, Ohio State University College of Medicine, David Bahner, The Ohio State University College of Medicine

Poster 21

Advanced Ultrasound Program Development

Amber Gombash BS, The Ohio State University College of Medicine

Introduction: The Ultrasound Interest Group (USIG) at The Ohio State University has a longitudinal curriculum consisting of Beginner, Intermediate, and Advanced Ultrasound programs. This curriculum is intended to expose students to Point of Care Ultrasound (POCUS) throughout their medical school career and help prepare medical students for the 4th year longitudinal advanced competency in Honors Ultrasound. Beginner and Intermediate Ultrasound focus on articulate modules, pre-quizzes, and scanning sessions, while AUS, instead focuses on live pathology lectures from expert ultrasound educators and corresponding normal anatomy scanning sessions. **Methods:** Students were invited to participate in AUS based on successful completion of Intermediate Ultrasound. The course ran from June 2017-April 2018. Six unique pathology presentations were developed from current literature, QPath™(the system-wide ultrasound database at OSU), and prior archived USIG material. Guest lecturers, including The Ohio State University Director and Associate Director of the Division of

Ultrasound, pediatric emergency medicine faculty, and senior emergency medicine residents were also encouraged to contribute their own slides. Each hour-long pathology session had a corresponding 30 min scanning session later in the month. Pathology sessions consisted of chest pain; dyspnea; deep vein thrombosis; musculoskeletal pathology; procedures; and pediatric abdominal pathology. Scans consisted of E-point septal separation (EPSS), tricuspid annular plane systolic excursion (TAPSE); lung sliding, seashore sign, curtain sign; leg veins with compression, augmentation, and phasicity; rotator cuff tendons; north star technique for vascular access; and the appendix. Open scanning sessions were encouraged to make up missed scans. Participants submitted a final project consisting of all of their saved scans and feedback on the AUS program. **Results:** Twelve students submitted AUS final projects and consistently attended both pathology and scanning sessions. Approximately ten additional students attended at least one of the six pathology and/or scanning sessions. Participants enjoyed the live pathology sessions and the opportunity to ask questions and network with ultrasound experts. They found open scanning sessions useful to make up missed scans or further practice their POCUS skills. One area of improvement most frequently noted by participants was the amount of hands-on time with the probe at scanning sessions; participants wanted longer sessions or fewer scanners per Trained Simulated Ultrasound Patient. Additionally, participants requested more proctors at the scanning sessions to teach the advanced scans. **Conclusions:** AUS provided participants access to new scanning opportunities not previously found in Beginner or Intermediate Ultrasound. Students were able to make clinical correlations during the pathology sessions. The presentations developed prior to each pathology session can be used in subsequent years and allow for a more consistent AUS program. Future directions include maximizing scanning time, mandating proctoring hours for beginner scans, and providing more instruction during scanning.

Co-Author(s): Rohit Menon, Ohio State University, David Bahner, Ohio State University

Poster 22

Probeficiency: an innovative peer-led model for providing weekly free and open-access Point of Care Ultrasound (PoCUS) education

Natasha Caminsky BSc, MSc, McGill University

Background: Point of Care Ultrasound (PoCUS) has become increasingly prevalent in both undergraduate and postgraduate curricula in recent years. While medical trainees are exposed to PoCUS at various points in their training, few programs provide hands-on teaching of PoCUS skills, making

application of this knowledge challenging. Therefore, trainees report a reluctance and lack of confidence in bringing these skills to the clinical setting. Furthermore, a lack of residents, and often staff, trained in PoCUS is an added barrier in that there is a lack of individuals able to supervise and provide feedback for a trainee eager to exercise and practice their knowledge and skills. **Objectives:** Our primary objective was to create a new standard of care for patients by building a healthcare workforce that is confident and capable in its PoCUS skills. To achieve this goal, we aimed to create a model for PoCUS teaching and training for healthcare trainees with the following characteristics: accessible, free of charge, quality assurable, and sustainable. **Method:** Access to 6 examination rooms with ultrasound machines was obtained courtesy of the Department of Obstetrics and Gynaecology at the Royal Victoria Hospital (tertiary-care McGill University teaching hospital). Instructors included medical students and residents who (1) had passed an informal practical test following a Probeficiency teaching session and were supervised when they taught for the first time, (2) had been trained to teach ultrasound within the undergraduate medical education (UGME) curriculum, or (3) were Canadian PoCUS (cPoCUS) independent practitioner (IP) certified. Models for scanning consisted of the session participants taking turns modeling for one another. Sessions were held roughly every 10 days, alternating between weeknights and weekend mornings. Teaching used a flipped-classroom approach and course content was modeled off the cPoCUS and McGill UGME ultrasound curriculum. The learner to instructor ratio was 3:1 or less. Information on session scheduling and sign-up was disseminated via a listserv and on our website (www.probeficiency.com). Verbal and written subjective feedback was solicited from participants following each session. **Results:** Sixty-two (62) two-hour-long peer-run workshops were held between November 30 2017 and June 17 2018 on 24 different dates, with up to 5 sessions held simultaneously. Topics covered included: free fluid in the abdomen, pleural effusion and pneumothorax, first trimester pregnancy, subxiphoid view of the heart, advanced cardiac views, abdominal aortic aneurysm, gallbladder, inferior vena cava, and hydronephrosis. These sessions were attended by 84 different learners, with 30 having attended more than 1 session, for a total 288 person-hours of teaching. Participants consisted of 54 McGill students, 28 University of Montreal students, and 3 McGill residents from internal medicine and family medicine. As of June 17 2018, Probeficiency's potential instructor pool consisted of 63 individuals, 10 of which were Probeficiency learners who taught on average 2.7 sessions (range 1-6). Despite sessions being open to staff physicians and allied healthcare professional, none have participated to date. Qualitative feedback from participants has been positive, reporting an appreciation for increased scanning time, a systematic approach to scans, and increased comfort level with the use of PoCUS.Conclusion: Probeficiency is an educational service that has successfully provided quality PoCUS teaching to medical students and residents across two medical schools in Montreal via peer-led sessions held at an accessible location and time, free-of-charge. Our model allows for increased comfort with PoCUS, including knowledge consolidation, by leveraging peer-

to-peer teaching as a key vector for learning and empowerment. Probeficiency addresses some major barriers to PoCUS teaching including equipment access, model mobilization, and PoCUS-trained faculty involvement in teaching. With a low administrative burden and an ever-growing body of peer-instructors, Probeficiency has proven a sustainable model for free, open-access delivery of PoCUS education with immense untapped potential.

Co-Author(s): Xin Mei Liu, McGill University, Brian Tran, McGill University

Sunday September 16, 2018

Poster Sessions

Session 5 – (0800 – 1130) – How to Reach – Expanding the Community of Practice

Poster 1

The Creation and Validation of a Transesophageal Echocardiography (TEE) Objective Standardized Clinical Exam (OSCE)

Steven Shen BA, The Ohio State University

Introduction: For many years, ultrasound has served the medical field as a powerful diagnostic tool that has seen increasing popularity due to its low-risk, quick, and non-invasive nature. More recently, transesophageal echocardiography (TEE) has gained popularity and has been more widely implemented in managing patients with cardiac arrest. Transesophageal echocardiography (TEE) offers many benefits over transthoracic echocardiography (TTE) in cardiac resuscitation. Specifically, some of the advantages of TEE over TTE include a lower amount of time spent off the patient's chest during compressions and a higher resolution image that is less confounded by the presence of excessive visceral tissue or artificial equipment in the thorax. Despite the increase in the use of TEE, it remains a complex skill with multiple steps that is highly operator dependent. As such, the rise in the number of TEE scans being performed begets a need for more training options. Recent studies suggests that simulation may be a feasible alternative training methodology in acquiring the technical skills necessary to perform a TEE scan. HeartWorks (Inventive Medical LTD., London, United Kingdom), a cardiac ultrasound simulator, offers an avenue for training medical learners in both TEE and TTE. Using the HeartWorks simulator, an Objective Standardized Clinical Exam (OSCE) has been created to assess the competency levels of participants in TEE. The goal of this project is to construct a standardized assessment tool for TEE that can be validated in accurately determining the relative skill, knowledge, and attitude of its participants. **Methods**: Content experts in TEE were recruited as part of the research design team to find participants with experience in TEE that could participate in this study. As such, the target cohort for our study is a combination of residents and fellows specialized in Anesthesiology. An IRB approved waiver of consent document and a copy of our honor code were made available to all participants in the study. The TEE OSCE is comprised of multiple components using two different software platforms. The first of these platforms is Qualtrics (Qualtrics, Seattle, USA), an online testing software in which the multiple-choice

components of our exam were built. A 31-item demographic survey was also constructed using Qualtrics to gather data about our participants including medical specialty, previous TEE experience, and confidence in performing a TEE scan. The data for each participant in our study will be segregated based on the answers in their demographic survey. Following the demographic survey, participants will continue in Qualtrics to a 10-item knowledge assessment featuring multiple choice questions testing aspects of TEE including anatomy, probe manipulation, and cardiac pathology. Each question will be awarded 1 point for a correct answer towards the participant's composite score.Participants will then schedule a 1-hour appointment with the OSU Clinical Skills Education and Assessment Center (CSEAC) where our simulator is housed. Prior to their arrival, all participants will be sent a de-identified login and video tutorials pertaining to the remaining components of the exam. At the CSEAC, participants will complete the second half of the OSCE that has components both in Qualtrics and our second testing platform, HeartWorks START (Inventive Medical LTD., London, United Kingdom). START is a testing software built into the HeartWorks simulator that allows users to acquire ultrasound images and answer corresponding questions regarding those images. Within START, 5 individual case assessments have been constructed that will test the ability of participants to obtain and interpret ultrasound images. These 5 simulated cases feature a normal physiology TEE scan and 4 TEE scans presenting with abnormal ultrasound findings. The 4 pathologies are as follows: Global Left Ventricle Dysfunction, Insufficient Cardiac Pre-load, Cardiac Tamponade, and Pulmonary Embolism (PE). A Qualtrics component will accompany each of these cases that will ask additional questions relevant to the respective case. Each participant will complete one normal physiology TEE scan and 2 TEE scans featuring a randomized abnormal pathology from the list above. In the normal physiology TEE scan, participants will be asked to obtain 7 specific TEE images and answer another 10 knowledge questions pertinent to the case. For each TEE scan featuring pathology, the participant will be asked to obtain any 2 images that appropriately visualize the abnormal ultrasound findings and answer an additional 2 questions about the case. All ultrasound images saved from the exam will be graded by an expert in ultrasound and awarded either 0 points (inadequate), 1 point (adequate), or 2 points (exemplar). All accompanying questions in these cases will also be awarded one point for the correct answer. These points will be totaled alongside the initial knowledge exam for a composite score of 46 possible points. Upon completion of the TEE exam, participants can optionally complete a TTE component in HeartWorks in which they will obtain 5 specific TTE images. This design element was incorporated as a method of addressing any confounding variables that may arise from prior TTE ultrasound experience in our cohort. This portion will not be factored into the final composite score of the OSCE. Lastly, all participants will be invited to complete a feedback survey for our TEE OSCE in Qualtrics.Results:A TEE OSCE has been constructed consisting of 3 main elements: a meticulously constructed a 30-item demographic survey, a 10-item TEE multiple choice knowledge assessment, and a 31-item TEE simulation component.The demographic survey

consists of three types of questions: multiple choice, fill in the blank, and an IRB-approved 1-5 Likert scale (1=Very Unskilled, 3=Intermediately Skilled, 5=Very Skilled). The results of these demographic surveys will be used to classify and segregate the final data of our study.The exam consists of a 10-question multiple choice assessment in Qualtrics and a dual platform simulation component using both Qualtrics and HeartWorks START. This 10-question multiple choice assessment forms the first 10 possible points of the participant's composite score. Following that, between the 3 TEE scans on START and the accompanying questions in Qualtrics, the participants will obtain 11 TEE images and answer an additional 14 multiple choice questions. As each TEE image will be graded on a scale of being worth anywhere from 0-2 points, the simulated component of the exam comprises the other possible 36 points of a participant's composite score. Qualtrics will output responses into an Excel database which will document each participant's OSCE including their demographic survey, scores for each section, and their composite score. Our design team consists of Anesthesiology faculty who have forwarded recruitment materials to their departments. In the Anesthesiology department, approximately 40 residents and 5 fellows received our recruitment materials. Once the study has concluded, simple T-Tests will be performed to analyze the final data. **Conclusions:** Paralleling the rise of ultrasound popularity in the medical field, simulators in medicine have become a more prevalent modality of training and have demonstrated efficacy as a strong compliment to the standard medical curriculum. As shown in recent studies, simulating various medical scenarios can aid learners by drawing attention to gaps in clinical skill that form in the practice of learning to apply conceptual knowledge. For ultrasound specifically, simulation offers a non-threatening environment in which learners can safely develop the psychomotor and decision-making skills to better approach real world scenarios. In this study, simulation yields another avenue through which the complex skillset of TEE can be taught. While learners who are proficient in a simulated setting may not necessarily be adequately equipped to perform the technique in a clinical setting, we believe that the scaffolding of conceptual knowledge to a simulated environment may provide the some of the steps towards mastering the skill. In this project, we have created a standardized assessment tool for TEE that evaluates the relative skill, knowledge, and attitude of its participants. As we continue to do additional research in this area, we hope to continue exploring means of assessing TEE competency as well as potential avenues for reframing the way the technique is taught.

Co-Author(s): Michael Prats, Ohio State University College of Medicine, John Su, Ohio State University College of Medicine, David Bahner, Ohio State University

Poster 2

Establishing normal carotid artery intima thickness values and assessing their correlation with conventional CVD risk factors in rural Panama

Emily Frisch MD, University of California Irvine School of Medicine

Introduction: A team of seven first year medical students performed a carotid ultrasound and administered a cardiovascular informational survey to the Ngäbe community of Bocas Del Toro, Panama. The purpose of the study was to correlate carotid artery intima-media thickness (CIMT) and cardiovascular disease (CVD) risk factors. CIMT has been shown to be prognostic for atherosclerosis and coronary artery disease, which is the leading cause of death and disability in Central American Latino populations (1, 2). CVD risk factors, such as tobacco smoking and pre-existing medical conditions, were discussed through the questionnaire at the time of the scan. **Methods:** Ultrasound scans of the right and left carotid artery were obtained for 109 patients over the age of 18 that presented to Floating Doctors' clinics as part of their standard of care. An oral questionnaire regarding possible risk factors was administered at the time of the scan. **Results:** Our results show healthy left and right CIMT (average 0.468mm). The questionnaire indicated that 19% of patients were on blood pressure medication and 7% on cholesterol medications. Only 1% of patients reported a previous diagnosis of heart disease. 23% of patients had previously smoked and 7% currently smoke. **Conclusions:** By correlating CIMT values and CVD risk factors, we found that the CIMT is within healthy range (under 0.8mm) and that the Ngäbe community has low CVD risk factors. This study enabled earlier detection of CVD and prevention of associated complications in rural Panama through ultrasound.

Co-Author(s): Param Bhatter, Louie Cao, Kaosoluchi Enendu, Laura Cuevas, Sophia Raefsky, Austin Crochetiere, UC Irvine School of Medicine


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Poster 3

Poster 4

Global Ultrasound Curricula: A Systematic Review of Teaching Strategies

James O'Brien Medical Student, 1993

Intro:Ultrasound is useful in diagnosing a wide variety of conditions and assisting with procedures. The relatively low price and portability of ultrasound combined with its diverse application has led the World Health Organization and other global bodies to advocate for its implementation in low resource settings. These benefits are increasing as the technology is providing better imaging in smaller devices and more applications are being described each year. To our knowledge, there is no consistent curriculum used to teach new learners in these settings how to utilize ultrasound. Our objective was to identify and summarize the previously published methods of ultrasound instruction used in developing nations.Methods:Using the help of a medical librarian we searched four different databases for articles involving ultrasound and the developing world. Originally we were going to use a third search term, “education,” however we found this to limit our search results so only two terms and their synonyms were used; “ultrasound” and “developing country.” We then exported these searches to a program called Covidence which organizes the articles and deletes any duplicates. Once all of the articles were uploaded two researchers voted on the articles using specific inclusion and exclusion criteria and a third researcher was the tiebreaker. Results:We searched four different databases, PubMed, EMBASE, CAB Global Health, and SCOPUS obtaining 10,817 results. All databases were searched using the terms “ultrasound” and “developing country” as well as multiple synonyms for these terms. PubMed resulted in 5607 articles, EMBASE in 4391 articles, CAB Global Health in 563 articles, and SCOPUS in 256 articles. Preliminary results show that very few articles exist within the literature covering this important topic. Most of the articles reviewed thus far describe educational missions or how to set up educational programs in developing nations. Conclusions:There are an extensive variety of methods described for teaching ultrasound in developing nations. These differ in multiple factors and are subject to the unique restrictions of each program. Research aimed at developing a standardized core training platform that can be flexibly adjusted to meet the needs of each setting could have strong implications on the utility and clinical impact of ultrasound in the developing world.

Co-Author(s): Irene Mynatt, The Ohio State University, David Bahner, Ohio State University

Poster 5

University Compliance with Ultrasound Protocols and the Need for Improvement

Bridget Onders MD, Ohio State University

Introduction: As point of care ultrasound has expanded in utilization by emergency medicine physicians, many protocols have been put in place to direct acquisition of images. These protocols often have recommended images/views to be obtained for a given ultrasound. These protocols are in place to establish a standard of care and baseline level of ultrasound image acquisition deemed appropriate for a given workup. Although there is room for deviation given a patient's overall status and stability, the protocol is aimed to be used as the standard of care whenever possible. **Methods:** A retrospective chart review of point of care ultrasounds performed in emergency departments linked to our academic institution (one at a tertiary care academic center, and one in a linked community emergency department) was performed using a cloud based point of care ultrasound workflow manager. Cardiac ultrasound was chosen as the initial scan to be used to assess compliance with protocol as this scan is one of the most common scans done in the emergency department, out of the 22 different types of scans done by practitioners during this time period. Point of care ultrasounds performed during a 3-month time period (January, February and March 2018) were analyzed to determine complete vs incomplete acquisition of all recommended images for that study. During the time period of this evaluation, a total number of 1813 scans were performed. Of those focused ultrasounds, 11.1% (201) were categorized by the physician performing that examination as cardiac ultrasounds. Educational scans and scans that noted use during a cardiac arrest were excluded. The remaining 194 scans were evaluated. Analysis involved review of the presence of absence of ultrasound views and study information deemed necessary, by our protocol, for that study to be considered "complete": Patient ID, patient name, accession #, exam type, operator name, attending name, submission for quality assurance review). Per our instutution's protocol, views required for a focused cardiac view to be considered complete include: subxiphoid, parasternal short axis, parasternal long axis, apical four chamber, and inferior vena cava views. **Results:** Data demonstrated poor compliance with acquisition of all recommended views. Of these scans, only 26.8% (52) had all 5 images deemed to be standard of care. The average number of views obtained during a cardiac ultrasound was found to be 3.515 with the protocol recommending 5 scans. **Conclusion:** Protocols with recommended images to be acquired are growing in popularity as more physicians are performing bedside ultrasound on a more frequent basis. These protocols establish a standard of care for a given ultrasound study with the ultimate goal of improving patient care. Compliance with these protocols has been demonstrated to be poor. As more physicians begin to use point of care ultrasound in their daily practice, more protocols will likely be developed with the goal of standardizing and guiding the images acquired. However, these protocols are of little value if their implementation and compliance remains low. There is a need for improvement in

the way in which these protocols are taught and implemented in order to increase compliance, allowing them to serve their intended function. At our own institution, methods to improve compliance with recommended protocols are in development.

Co-Author(s): Lauren Branditz, Ohio State University College of Medicine, Creagh Boulger, The Ohio State University College of Medicine

Poster 6

Poster 7

Point of Care Ultrasound Opportunities for Family Medicine Residents

Julian Greer MS4, University of South Carolina School of Medicine

Introduction: My name is Julian Greer, and I am a fourth year medical student at the University of South Carolina School of Medicine (USC SOM). I have experienced three out of four years of an integrated ultrasound curriculum, which has proven to be an outstanding addition to my education. After learning the basics of ultrasound, I was so excited that I rented a pocket-sized ultrasound device. I used the ultrasound for educational scans at a family medicine practice during the summer after my first year of medical school. The patients and doctor at the clinic thought it greatly improved patient care and satisfaction, and this has led me to become passionate about family medicine and incorporating POCUS into my future practice. I hope to continue my ultrasound education in residency, but as far as I know, there is not an up-to-date resource that details what opportunities are available for ultrasound training in family medicine residency programs in the United States.This survey aims to ask family medicine program directors regarding the existence and/or robustness of POCUS training at their respective institution. This would help medical students get a better idea of what family medicine residency programs are offering to incoming residents. I think this will be a great way for residencies to share information about their POCUS opportunities and may help recruit potential applicants. **Methods**: A 13 question survey was generated through the RedCap survey system. Survey participants were asked to give consent for results of the survey to be published prior to starting the survey. Programs that are currently without ultrasound opportunities will not be identified individually and negative results will be presented in the aggregate form.Program identifiers, such as the name of the program, location, and survey participant's role at their institution, were obtained. A screening question, "do residents have an opportunity to use point of care ultrasound (POCUS) in your family medicine residency program or at your institution?" was used to identify programs with opportunities already in place, developing opportunities, or no opportunities available. Specification of whether there is formal training, for the family medicine residents, in performing POCUS was stratified. Survey options included a longitudinal three-year curriculum, dedicated ultrasound elective, developing a curriculum, no formal curriculum, or other.The settings an ultrasound machine is available for family medicine residents to use was assayed. Survey options included outpatient clinic, inpatient floor, intensive care unit, labor and delivery, emergency department or other.We investigated who does the POCUS training. Survey options were Cardiologists, Critical Care/ICU faculty, Emergency Department faculty, Family Medicine faculty, Internal Medicine faculty, OB/GYN faculty, Radiologists, Sonographers and other.The number of family medicine faculty members who use POCUS was investigated, as well as the number of faculty members from

other specialties who use POCUS and are willing to work with family medicine residents.The types of POCUS exams that the residents perform was evaluated. Survey options included were AAA screen, Cardiac, Central line placement, FAST exam for trauma, Gastrointestinal, Hepatobiliary/Spleen, Joint injections, DVT screening, Lung, Musculoskeletal, Obstetrics, Paracentesis, Renal/Genitourinary, Skin/Soft Tissue, and Other. We asked about what resources are available to family medicine residents for ultrasound education. Options included dedicated ultrasound elective rotation, hands-on bedside POCUS training with faculty, lectures/didactics on POCUS, Standardized patients for residents to practice POCUS, Ultrasound Simulator, Ultrasound image quality analysis with feedback and Other.The frequency of ultrasound training, with opportunity for personalized feedback for family medicine residents, was investigated.Lastly, we asked about opportunities for medical students to learn POCUS during their clerkships, either for students at their affiliated medical school, or for visiting students.The survey was sent out through the family medicine program director list serve.There will be no intervention, no patient involvement, no collection of personal health-related data, and does not study a vulnerable population. This is a voluntary survey about current, standard operations. It has been determined that the proposed activity is exempt from the Protection of Human Subjects Regulations by the USC IRB committee. **Results**:The deadline for survey completion is July 1, 2018. We currently have 48 complete responses. Data analysis will occur during the months of July and August 2018. **Conclusions**: We expect to see a wide range of opportunities available for point of care ultrasound training in family medicine residency programs due to recent growth of interest. We hope to follow up this survey in the future to assess progress in the availability of ultrasound training in family medicine residency.

Co-Author(s): Joy Shen-Wagner, Greenville Health Systems USC, Paul Bornemann, University of South Carolina School of Medicine, Andrea Lewis, Southern Colorado Family Medicine

Lectures/Panels/Workshops

Thursday September 13, 2018

Ultrasound Phantom Creation Workshop

Dustin Morrow MD, Greenville Health System / USC School of Medicine Greenville

As bedside ultrasound is becoming standard of care, many ultrasound trainers have hit the market to enable learners to practice through simulation prior to their first interaction on living patients. It is a wide market, from simple procedural trainers like peripheral intravenous access models, to complicated diagnostic trainers. Their prices range from $500 to above $100,000. The procedure models have a limited number of procedure attempts before being rendered useless and become a perpetual renewal cost on strained academic budgets; the diagnostic trainers are also subject to renewal to keep up with rapidly advancing technology. The high costs, both initial and hidden, have led to a rise in do-it-yourself (DIY) ultrasound phantoms using existing gel simulants (found in culinary ingredients, industrial plastics, and even duct tape) to create shockingly similar and reasonably priced models. The goal of this workshop is to instruct educators in the production of a variety of DIY ultrasound skills trainers to meet their educational needs at a much lower cost.

Multi Booth Setup

Brief talks about models for audience then majority of time letting audience go around and make the models from booths of their choosing and take home recipes and samples.

Dustin Morrow

Nerve Block Models

Fracture Models

Aarti Sarwal

Central Access / Lumbar Puncture Models

Suean Pascoe

Mike Wagner

Lung Sponge Model

Demonstration of a Novel Task Trainer and Targeting Tasks for the Training and Assessment of Ultrasound Guided Invasive Procedures

Joshua Nitsche MD, PhD, Wake Forest School of Medicine

Background

Ultrasound is used to guide needle or other devices in a variety of invasive procedures across a wide range of medical specialties. With the introduction of resident duty hour restrictions and the replacement of invasive procedures with non-invasive tests, it is now difficult for trainees to gain enough real-life experience during residency or fellowship to independently perform these procedures after graduation. The classic "see one, do one, teach one" training paradigm has become unsustainable, and more efficient training regimens will be required moving forward. In addition to the lack of clinical training opportunities training in ultrasound guided invasive procedures has historically been hindered by a lack of consensus about the requisite set of skills needed to safely perform the procedures, what constitutes competency, and how to objectively measure trainee procedure performance.

The AIUM has addressed the first issue in its Practice Statement on Selected Ultrasound Procedures where it outlines specific needle localization and guidance techniques necessary to safely perform these procedures. They recommend that all providers be proficient with both the in plane guidance approach—where the needle path and ultrasound beam are within the same plane—and out of plane guidance approach—where the needle path crosses the ultrasound beam at a single point. They also outline a variety of needle visualization optimization techniques that can be used during in plane needle guidance including probe rotation, probe translation, and the oblique heel-toe standoff technique. This still leaves the issues of defining competence and objectively measuring trainee performance unresolved.

We have created a novel ultrasound guidance task trainer and targeting curriculum that address all of the issues discussed above. Delineation of the core guidance skills by the AIUM suggests a different approach for the teaching and assessment of ultrasound guided invasive procedures. We have formulated a curriculum of 5 specific targeting tasks that allows for trainees to practice the core guidance skills, functioning in a very similar way to the Fundamentals of Laparoscopic Surgery. By focusing on the core skills which common to all ultrasound guided invasive procedures our curriculum can decrease the dependence of training on real-life patient encounters.

As mentioned above skill assessment for most ultrasound guided invasive procedures is often subjective. Typically a procedural checklist is used to grade the performance of a simulated or real-life

invasive procedure. While such assessments do provide some objective information they still rely on the often subjective assessments of those scoring the checklist and judging the provider's skill. By timing the performance of these tasks and recording targeting errors the trainer allows for a more objective assessment of provider skill. Finally, by comparing the task performance of novices and experts we have begun to set thresholds for competence that trainees should meet prior to performing ultrasound guided invasive procedures in a real-life clinical setting.

Our proposed workshop will begin with a short didactic summary of the relevant literature regarding the benefits of using ultrasound during invasive procedures and how to best prepare novice providers to perform them. The hands-on portion of the workshop will begin with an introduction to the basics of needle guidance, such as how probe and needle positioning effect the appearance of the ultrasound image, and provide a structured way to present these basics to the novice learner. We will then move on to the targeting tasks and allow attendees to perform them illustrating how they allow for the practice of the core skills outlined by the AIUM. We will again provide a structured way to introduce the tasks to novice learners. Finally, in order to demonstrate how the targeting tasks relate to actual procedures, the attendees will be split up into different groups and rotate through stations with procedure specific simulators for paracentesis, central line placement, ultrasound guided peripheral IV placement, abscess drainage, and deep tissue biopsy.

Learning Objectives

This workshop will serve:

1. To familiarize the participants with a novel ultrasound guidance task trainer and targeting curriculum

2. To appreciate how the targeting tasks allow trainees to practice guidance skills relevant to all ultrasound guided invasive procedures

3. To demonstrate how the targeting tasks can be used to objectively assess a provider's skill with ultrasound guided invasive procedures.

4. To explain how the task trainer can be constructed and the targeting tasks implemented at a participants home institution

Demonstration Outline

20 minutes. The course will begin with a short introduction to the course and a didactic session reviewing the evidence regarding the benefits of using ultrasound during ultrasound guided invasive

procedures, how to train novice providers to perform them, and how much practice is required to obtain competence.

30 minutes. The course faculty will demonstrate the use of the device by first outlining how they teach novice trainees needle guidance basics, such as the use of difference probe orientation, and how the relationship between the needle and the probe affect the point and angle of needle entry on the ultrasound screen. Real time images of the ultrasound screen and the instructors' hands will be projected side by side during the demonstration so attendees can better appreciate the trainer and tasks. Examples of items covered include the difference between holding the probe parallel or perpendicular to the provider's shoulders and having the needle appear on the left or right side of the ultrasound screen. The instructors will then demonstrate how each of the tasks are performed, while focusing on how the tasks replicate the needle redirections often needed to complete real-life invasive procedures.

20 minutes. Attendees will be selected at random and the instructors will then teach them either needle guidance basics or how to perform the tasks based on their level of prior experience with ultrasound guided invasive procedures. The instructors will demonstrate the techniques and teaching strategies they use with their own trainees.

20 minutes. The last 15 minutes of the demonstration will be set aside for attendees to come up and examine and use the models as time allows. There will also be a Q&A with the instructors about how the trainers are constructed and their experience using the targeting tasks to train medical students and residents.

Co-Author(s): Brian Brost, Wake Forest School of Medicine

Scanning with a purpose! Utilizing POCUS on real clinical cases to make the diagnosis.

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

Present POCUS enthusiasts with case presentation and have them utilize POCUS to assist with management including differential diagnosis, therapy and treatment. Goal is to have learners rotate through each room having a different model/ actor representing a variety of cases.

POCUS learners will utilize various POCUS modalities depending on differential diagnosis. The educator will help guide through the case and provide immediate feedback with pathology videos on a laptop/screen as they are scanning working toward the correct diagnosis.

Educators provide feedback on alternate approaches or variations to utilizing POCUS in the clinical setting.

Cases are flexible with focus on either acute care or general.

Number of learners depends on clinical rooms/ models and demand.

Ideally 12 learners for 6 rooms, 6 models, 6 machines.

2 hr workshop (allows 15 minutes per case and 5 minutes for questions/ flow between rooms).

Acute Care Focus

Case Examples:

Acute PE (lung and cardiac and DVT)

New onset CHF (lung and cardiac)

Intraperitoneal bleed/Trauma/ Pneumothorax (E-FAST)

Abdominal Aortic Aneurysm (Aorta and Kidney)

Hypotension/ RUSH (either pre-renal or Tamponade)

Sepsis/ Fluid assessment (Cardiac/ IVC/ VTI)

Genera Medicine Focus

Cases examples:

Pleural effusion

Gallstones

Kidney stones/ Hydronephrosis

Retinal detachment

CHF

Urinary retention

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SIXTH WORLD CONGRESS
ULTRASOUND IN MEDICAL EDUCATION

Wake Forest® School of Medicine

Friday September 14, 2018

Ultrasound Education in Anesthesiology

Yuriy Bronshteyn M.D., Duke

The field of anesthesiology has championed several ultrasound applications (notably the use ultrasound for regional anesthesia, vascular access, and TEE). However, anesthesiology has also fallen behind other acute care specialties in the utilization of other POCUS domains such as focused cardiac ultrasound, pleural/pulmonary ultrasound, renal/GU ultrasound, FAST exam, and DVT scanning. This panel would focus on the following: (1) reviewing POCUS applications of relevance to anesthesiologists; (2) discussing ways of systematically incorporating POCUS teaching into anesthesia training.

Tropical Medicine Ultrasound

Stephanie Doniger MD, RDMS, NYU Winthrop Hospital, St. Christopher's Hospital for Children

POCUS in Resource-Limited Settings…

(This is a 2 part Didactic lecture)

Part 1) How to Tailor Educational Initiatives to the Local Practice Environment

As clinicians, we often have the best of intentions when going abroad to provide our clinical expertise. Particularly with point-of-care ultrasound, we have the potential to bring a revolutionary technology and access to resource-poor communities. However, in developing educational initiatives abroad, we often use our experiences and try to implement them to the local community without the consideration of the local environment, limitations, and pathology specific to that region. This may limit the success of the long-term utilization and success of the project.

Part 1 of this lecture will discuss the following objectives:

1) How to develop and implement POCUS teaching in resource-limited environments,

2) Provide examples of programs that have been successful, and those that have been unsuccessful abroad,

3) Present challenges and limitations unique to developing POCUS educational initiatives in the Developing World/resource limited environments,

4) Discuss resources that aid in the development of longitudinal teaching projects abroad, and

5) Present future ideas in the development of large scale teaching projects in resource-limited environments

Part 2) Tropical Medicine Ultrasound

Integral to maximizing the impact of POCUS in resource-limited settings, is developing a familiarization with sonographic findings found in tropical infectious diseases.

As part of developing POCUS educational initiatives abroad, there should not only be an understanding of fundamental POCUS applications, but also an understanding of local pathology. This includes infectious diseases common in the Tropics, which are unique to each region of clinical practice.

Part 2 of this lecture will focus on the following objectives:

1) Present clinical cases common to the Tropics including but not limited to Echinococcus, Fasciola, Schistosomiasis, HIV/TB, and other diagnoses with specific sonographic findings,

2) Discuss the FASH examination (Focused Assessment Sonography for HIV/TB),

3) Discuss the potential role for the RUSH examination for identifying severe Dengue,

4) Provide resources for learning more about Tropical Medicine Ultrasound, and

5) Present future ideas and directions in teaching Tropical Medicine Ultrasound

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Taking the Pulse: The State of Point-of-Care Ultrasound in Pediatrics Training

Delia Gold MD, Nationwide Children's Hospiral

The goal of this presentation will be to describe the current state of point-of-care ultrasound (POCUS) in pediatric medical education and training. I plan to trace the development of pediatric POCUS, with its start in the subspecialties, pediatric emergency medicine in particular. There will be a review of the current literature regarding POCUS education and curriculum in the subspecialities, with an emphasis on educational milestones or the lack thereof. We will end by discussing the some future research projects in this arena that I am a part of.

Maternal-Fetal Sonologist: The Creation of a New Role in Underserved Countries

Lisa Leote RVS, RAVS, FMF, RE, BAMC

Introduction: Access to education is a basic human right. Nothing has proven this more powerfully and effectively than the education of our community volunteers who are the backbone of Mimsi International's (test organization) mobile prenatal care efforts in rural Haiti. We pour our knowledge into the volunteers and encourage them to share with their neighbors what they have learned. As a result, armed with knowledge and skills, the community volunteers go out and educate women in their communities about the importance of prenatal care—they, in fact, go on and deliver this care. This transforms the culture from the inside out. **Method**: This program curriculum intends to address the limited access to ultrasonography by instituting a Maternal-Fetal Sonologist program for the community volunteers in Mimsi. Ultrasound is routinely performed as the imaging method to assess and document the development of the pregnancy. Unfortunately, developing countries seldom have a proper education platform or verification standards to acknowledge an individual demonstrates the appropriate clinical competency and skill set to perform these studies. The Maternal-Fetal Sonologists will be taught and assessed by qualified field experts in our 12-month program and are offered an opportunity to sit for the National Certification Medical Association's MFS-I credentialing examination upon successful demonstration of the requirements and established standards. Attainment of this credential serves as verification of clinical competency and proper application and interpretation of the examination.ResultsMimsi has performed over 4800 ultrasounds; in the same period our students perform 1/4 of them. The increased demand from our villages has Mimsi currently performing 80-100 ultrasounds during each day of a 6-day clinic cycle. Due to the training of MFS, and the intervention of Ultrasound, the mortality rate among Haitian mother's went from 1 in 83, to 1 in 1200. We directly

attribute this change to our Sonologist's ability to successful perform ultrasounds, and identify common risks such as multiple gestation, placenta previa, congenital abnormalities, etc. **Results**: The creation of Maternal-Fetal Sonologists in impoverished countries such as Haiti has made an extremely positive impact. Not only has this program provided education to allow for professional development, it also has greatly decreased the mortality rate in pregnancy/child birth. We will be expanding our reach and testing this model and curriculum in other countries soon to determine if the results achieved have the same impact in different regions around the world.

Including Ultrasound in Clinical Skills Teaching: a tool to teach high-value traditional exam skills

Michael Wagner MD, Univ of South Carolina School of Med

Ultrasound (US) is increasingly utilized at the undergraduate level to augment courses such as anatomy and physiology. Its use in physical diagnosis and clinical skills courses is also increasing, though at a slower rate. One potential barrier to integration of US in this area is the perception that traditional physical diagnosis skills are eroding, and teaching US to students will result in further deterioration of important traditional skills.

Rather than teaching attendees how to perform US, this workshop will review techniques in which teachers can use US to augment the instruction of traditional exam skills, with a particular emphasis on traditional exam skills which are difficult to learn/teach, have good supporting evidence, and/or have been shown to retain high value in an age of advanced technology. Examples will include cardiac US paired with heart sounds and murmurs, lung auscultation paired with lung US, providing feedback on percussion skills (necessary for shifting dullness and hepatosplenomegaly), Murphy's sign, joint effusions, impingement syndromes, and more. A brief example of these techniques can be found here: https://youtu.be/h8gedUqmVw0

We did a physical diagnosis workshop at WCUME 4 in Texas and there was a very high demand for this workshop (standing room only). If accepted for WCUME 6, something different for this year would be experts in physical diagnosis teaching and members from organizations such as Directors of Clinical Skills Courses (DOCS) and Society of Bedside Medicine would be personally invited to collaborate as instructors for this workshop, hopefully paving the way for future societal collaborations with SUSME. Thus, US educators who want to sharpen their traditional exam skills would have something to learn, in addition to having teachers unfamiliar with US learn the basics of using it as a tool for the classroom/bedside. The goal of this workshop would be to build excitement for the use of US as a

teaching tool and break down perceived barriers between traditionalists and US innovators. Both groups want to return to the bedside and the workshop would emphasize the common pathways to get there, while enhancing teaching satisfaction.

This workshop is targeted towards instructors but all attendees who have an interest in teaching or learning the bedside exam would be welcome. It would be well suited for a 3 hour time block, but could be condensed to a 90 minute block given the right space.

SIXTH WORLD CONGRESS
ULTRASOUND IN MEDICAL EDUCATION

Wake Forest® School of Medicine

Saturday September 15, 2018

Medical Student Driven Ultrasound Education (Didactic Proposal)

Jennifer Cotton MD, RDMS, University of Utah Hospital

Introduction:

Medical students are a motivated, smart, invested, and underutilized group of stakeholders in the effort to integrate ultrasound into medical education and provide ultrasound education to current students. Students can do things that even the most motivated individual faculty members simply cannot do. For example, medical students have significant numbers and can use those number to create significant pressure on medical school administrators. With guidance from a single supportive faculty member, medical students can be empowered to create and run their own entirely extracurricular ultrasound curriculums and student organizations. This simultaneously prevents the loss of education for current students while formal curriculums are in the process of being developed and politely shame medical schools for not providing education that students are motivated enough to self organize. Medical students are a powerful group that just need inspiration and a road map for creating student driven ultrasound education to both further their own education and accelerate ultrasound integration efforts in medical schools.

The Lecture:

The purpose of this didactic session is to provide a in depth overview the concepts of student driven ultrasound education, inspire and empower students to invest in their own education, and introduce faculty to the powerful tool that student driven ultrasound education can be for curriculum integration efforts.

This is a version of a lecture I have given in the past to inspire the individual medical school groups I have had the pleasure of teaching. Most recently, I gave this lecture as a keynote speech for a regional medical student education symposium. If you would like references from ultrasound faculty who have heard this lecture, please contact Creagh.Boulger@osumc.edu. It is approximately one hour as it is written now, but could be shortened if necessary. A link the presentation can be found here, http://prezi.com/wlhmiy42nvz-/?utm_campaign=share&utm_medium=copy&rc=ex0share.

SIXTH WORLD CONGRESS
ULTRASOUND IN MEDICAL EDUCATION

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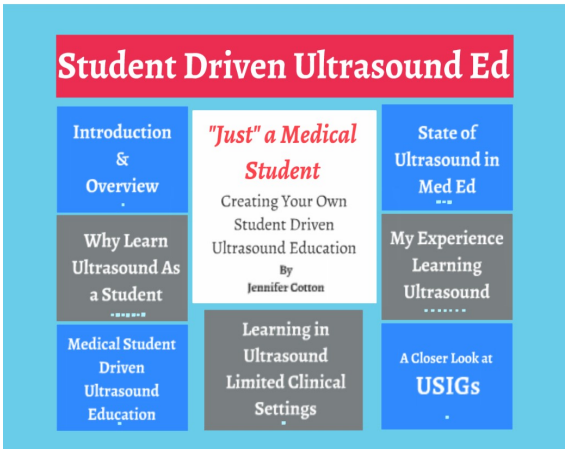

Lecture Outline:

A. Introduction & Overview
    a. Who I am and what I have done with ultrasound
B. My Experience Learning Ultrasound as a Student
    a. Medical school with no ultrasound in curriculum
    b. Accidently discovering ultrasound and finding a mentor
    c. The things I was able to do with ultrasound without an ultrasound in my medical school curriculum
        i. Creating electives
        ii. Creating Ultrasound Student Interest Groups
        iii. Global health ultrasound
        iv. Research
        v. Creating website to help other learners connect with ultrasound resources
        vi. Traveling to conferences and engaging with larger ultrasound community
        vii. Affecting patient care
        viii. Creating a medical student culture of ultrasound
C. Why Learn Ultrasound as a Student
    a. Be a better student
        i. Immediate feedback on physical exam
        ii. Watch anatomy and physiology in real time and learn 3D relational anatomy as it corresponds to external anatomy

iii. Be an ultrasound superstar on your clinical rotations

b. Now is the best time to learn ultrasound
   i. Residency is hard and your time is limited
   ii. Ultrasound varies by speciality
   iii. Some schools are already learning this and you will get left behind

c. Develop mentoring relationships
   i. Get a mentor. Be a mentor.

d. Show initiative and get into residency

e. Be a better doctor
   i. The ultimate goal
   ii. Be better prepared for intern year, residency, and beyond
   iii. Save lives

D. State of Ultrasound in Medical Education
   a. Curriculum integration varies significantly
   b. Intro to faculty drive versus student driven ultrasound education efforts

E. What Is Medical Student Driven Ultrasound and Why It Works
   a. What student drive ultrasound education is
   b. How to create your own student driven ultrasound education
   c. How student driven ultrasound education influences ultrasound integration into medical school curriculums
   d. How student driven ultrasound education can help positive affect ultrasound culture at an institution
   e. An example of student driven ultrasound education, the University of Kentucky experience

F. Ultrasound Student Groups and How They Fit In
   a. How USIGs work
   b. Basic components of a USIG
   c. Advanced extras for overachieving and awesome USIGs
   d. Value of student mentors in a USIG
   e. Using existing resources to build a USIG
   f. How to create a brand new USIG

G. Learning Ultrasound When Learning in Ultrasound Limited Clinical Settings

a. The problem of trying to learn ultrasound when your clinical teachers don't know much about ultrasound
b. Resources to quickly look up information
c. Tips and tricks
d. Responses to expect
e. Improving patient care as a student
f. Medical students as ultrasound ambassadors to influence culture at your institution
g. Conclusions and questions

Who I Am:

I am Dr. Jennifer Cotton, an emergency medicine resident and the founder of the ultrasound education site SonoMojo.org. Currently, I am third year emergency medicine resident and ultrasound chief resident at Ohio State University. At the time of this presentation I will be an ultrasound fellow in emergency medicine at the University of Utah. As medical student I founded a successful USIG that provided ultrasound education to hundreds of medical students, won the first WCUME Ultrasound World Cup, and presented both original research and invited lectures at national/international conferences. As resident I have engage heavily in medical student education, presented at multiple conferences, and continued developing my clinical emergency ultrasound skills. I am an ultrasound enthusiast and want to share my experiences of student driven ultrasound to help inspire and infect medical students to love ultrasound as much as I do.

Bedside Ultrasound Guided Resuscitation of the Critically Ill Patient

John Eicken MD/Ed.M, Greenville Health System

Workshop Submission:

Course Objectives:

1. Understand how to apply bedside ultrasound in the management of a hypotensive patient.

2. Be able to utilize bedside ultrasound to help guide care for patients who are undergoing ACLS protocol from an undifferentiated etiology.

3. Understand the role that bedside ultrasound has in the care of a critically ill patient who presents with undifferentiated tachycardia, tachypnea, and/or hypoxia.

Brief Course Description:

Critically ill patients who present to the emergency department require prompt evaluation and intervention. Oftentimes the history available for these patients is limited and the exact cause of their acute illness is unclear. Bedside ultrasound is increasingly being used by emergency providers to improve their diagnostic accuracy in identifying the etiology of the patient's critical illness as well as to expedite and guide treatments and interventions. This course focuses on the effective, practical, and efficient manners in which bedside ultrasound can be applied in the care of critically ill patients - particularly those who present with hypotension, those who present with active ACLS protocol in progress, and those who present with undifferentiated tachycardia, tachypnea, and/or hypoxia.

Suggested length:

1 hour of didactic presentation followed by hands-on lab portion

Suggested format:

Lecture followed by lab

Suggested Faculty:

Dr. John Eicken, MD, Ed.M, Greenville Health System, jeicken@ghs.org

Dr. Alex Gleason, MD, Greenville Health System, agleason2@ghs.org

Dr. Dustin Morrow, MD, RDMS, Greenville Health System, dmorrow@ghs.org

Co-Author(s): Alex Gleason, Greenville Health System, Dustin Morrow, Greenville Health System

Pediatrics- The Orphaned Specialty of POCUS

Stephanie Doniger MD, RDMS, NYU Winthrop Hospital, St. Christopher's Hospital for Children

Point-of-care ultrasound has become integral to the practice of Emergency Medicine. More recently, nearly all the medical specialties have incorporated the use of ultrasound within their practices. As a result, POCUS training has become part of most medical specialties.

However, within Pediatrics, Pediatric Emergency Medicine (PEM) and less commonly Pediatric Critical Care Medicine has developed POCUS expertise and guidelines within their fields. However, for the general Pediatrician and the Pediatric Hospitalist this expertise and training has been relatively nonexistent. It is particularly interesting that General Pediatrics has not been included in this widespread sonographic evolution, especially since the majority of PEM physicians completed Pediatric residency training programs prior to subspecialty fellowship training.

In addition, it is surprising that pediatric-specific POCUS training has not become prevalent through General Pediatrics and other Pediatric subspecialties as of yet. It is particularly important to minimize radiation exposure for pediatric patients, since they have a potential for lifetime exposures to cancer-causing ionizing radiation. Thus, for those of us who have been trained in Pediatric POCUS and considered to be experts, we can help to identify those applications that have the most potential to be useful in both the Pediatric outpatient and inpatient hospitalist settings. It is the hope that with more widespread education targeted towards these clinicians and clinical practice settings, that we can improve the care of children. Further, it can serve as the foundation to develop further educational initiatives, research projects, and ultimately expert consensus statements.

Through this lecture, the following objectives will be met:

1) Present the history of Pediatric POCUS,

2) Identify specific applications (through case presentations) that would be the most useful in the pediatric outpatient setting,

3) Identify specific applications (through case presentations) that would be the most useful in the pediatric inpatient setting,

4) Discuss future directions for Pediatric POCUS training for the General Pediatrician (inpatient and hospitalist), and

5) Discuss future directions for the implementation of practice training pathways within undergraduate medical education and within Pediatric residency programs.

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Ultrasound IPE: creating connections across healthcare disciplines

Kristin Henderson MSN, CRNA, Wake Forest School of Medicine Nurse Anesthesia Program

Modern healthcare requires providers to posses interprofessional skills to improve patient safety and outcomes. For this reason, Wake Forest School of Medicine graduate students are exposed to Interprofessional Education (IPE) through curricular design and by working alongside MD, PA and CRNA students and faculty. In the fall of 2016, CRNA education assessed the need for ultrasound instruction for their first-year students. In the effort to increase IPE opportunities, the expert faculty at PA studies were contacted to become partners with the CRNA faculty in this endeavor. What resulted was a 5-Phase process by which CRNA students learn ultrasound application during the second semester of their curriculum. The 5 Phases of IPE instruction will be presented, along with tactics to implement IPE in Ultrasound training for the student and clinician. The benefits of cross-disciplinary education will be discussed, as will the process to overcome challenges to implementation.

Co-Author(s): Ian Smith, Wake Forest School of Medicine PA Studies

Integration of ultrasound into the physician assistant curriculum. Experiences and outcomes from the first two years at Nova Southeastern University - Orlando's physician assistant program

Rachel Krackov PhD, MPAS, PA-C, RVS, Nova Southeastern University - Orlando Physician Assistant Program

Session Objectives:

At the conclusion of this session, participants will:

1) Develop an awareness of physician assistant educators' current thoughts on integrating ultrasound into the physician assistant curriculum as well as student physician assistant interest in point-of-care ultrasound (POCUS).

2) Be able to discuss methods of introducing POCUS into the physician assistant curriculum, eventually building into a complete vertical integration.

3) Be able to describe the barriers to implementation and unique challenges to physician assistant programs.

4) Learn from the experiences of the first two years of implementation at Nova Southeastern University –Orlando's physician assistant program.

Session Description & Summary:

The use of ultrasound by non-radiologists has gained in popularity over the past 10 years not only in the clinic but in medical education as well.1 Research has demonstrated that the use of ultrasound as a didactic tool in basic medical sciences such as anatomy, physiology, and pathology has enhanced learning. The use of ultrasound as an adjunct to teach physical diagnosis courses has also been demonstrated to increase student confidence in physical exam and diagnostic skills. 2-4 According to the American Institute of Ultrasound in Medicine's (AIUM) most recent data, 52 out of 179 medical school programs now include some form of ultrasound instruction with 18 achieving full integration.5 A national survey of physician assistant program directors, performed by the session facilitators, demonstrated that 36% of respondents use ultrasound as a didactic tool in preclinical course work. Sixty-eight percent of subjects felt that hands-on POCUS skills should be taught in physician assistant school, however, only 11% have been able to initiate it. No respondents stated that they had full vertical integration. This presentation will discuss issues surrounding integration of ultrasound into the physician assistant curriculum that are common to our medical school counterparts. These include: where to include ultrasound in the curriculum, what exams to teach, who should teach it, how to determine

competence, and how to access equipment.6 We will also discuss integration challenges unique to physician assistant education such as how to fit it into a two-year time-frame, determining which exams are pertinent to a physician assistant student vs a medical student, and a lack of trained physician assistant faculty. Finally, we will address solutions to these challenges by sharing the initial experiences and lessons learned by the faculty at the physician assistant program at Nova Southeastern University in Orlando, FL which has begun integrating ultrasound into the existing curriculum. The session will conclude with a question and answer dialogue.

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Co-Author(s): Lorilee H. Butler, DHSc, PA-C, Nova Southeastern University Physician Assistant Program - Orlando, Laura Gunder McCLary, DHSc, MHE, PA-C, CLS (ASCP), Nova Southeastern University Physician Assistant Program - Orlando, Denise Rizzolo, PhD, MS, PA-C, Kean University

Apps for the Ultrasound Educator

Benjamin Smith MD, University of Tennessee

This workshop will focus on the use of specific applications to perfect ultrasound educational materials. Students will be encouraged to bring their laptops with software pre-installed, so that they may follow along with the workshop. Application specific topics include:

1. Photoshop
    a. Learn to to edit ultrasound clips: trimming, cropping, masking, brightening, exporting.
    b. How to create educational ultrasound gifs for social media distribution.
    c. Learn how to create an infographics for a presentation or distribution through social media.
    d. Learn how to simplify a graphic to export for Keynote.
2. Screenflow
    a. Learn about value priced audio equipment useful to create a podcast.
    b. Learn how to record, edit, and export a podcast.
    c. Learn how to optimize clips for web distribution.
3. Keynote/Powerpoint
    a. Learn the basics of slide creation
    b. Learn how to properly import ultrasound clips.
    c. Learn how to resize, clip, animate, and loop ultrasound clips.
    d. Learn to animate arrows to point out ROIs, put down the laser pointer!
    e. Learn to stack ultrasound clips and graphics to highlight specific findings or demonstrate anatomy.

Co-Author(s): Jacob Avila, University of Kentucky

Integration of Ultrasound in PA Education

Ian Smith Physician Assistant/PA-C, Wake Forest School of Medicine PA Studies

Ultrasound has been largely absent from PA education curricula. Despite the ever expanding use of ultrasound throughout medical practice, ultrasound remains widely under utilized in PA practice. By introducing ultrasound into the didactic portion of the first year of our program, we hope to lay a better foundation for our students to gain familiarity and comfort with the use of ultrasound in the treatment of their patients.

Presentation outline: 30-60 minutes

-Background, PA education

-Current curricular activities

-Hurdles and resistance

-Student experiences

-Future expansion

-IPE experiences with CRNA/MD

Left Ventricular Diastology: A Complex Assessment Made Understandable

Julian Thomas NBE Board-Certified in Echo, Wake Forest Baptist Health/Wilkes Medical Center

Ideally: 2-lecture session, can be compressed into highly concentrated 1-lecture

1. Detailed overview of fundamentals of LV diastology parameter measurement.

2. Explain the crucial functional applications of LV diastology in the work up of shortness of breath, using rest diastology, diastolic stress tests, and demonstrate diastology use in evaluation of pulmonary hypertension, AV optimization after pacemakers & CRT, differentiate constrictive pericarditis from restrictive cardiomyopathy and show how to discover regional ischemia and detect hidden evidence of recent atrial fibrillation

3. Show how diastology w/u reduces costly excessive testing and show how the results can be made understandable in echo reports for the sonographer, referring provider, cardiologist & pulmonologist

Why I'm in love with Lung Ultrasound

Tomas Villen MD, Francisco de Vitoria University Medical School

Keynote lecture in which the theoretical and pathophysiological bases of lung ultrasound examination are summarized based on 4 different real case reports. These cases show how lung ultrasound is a real game changer even in patients with complex diseases that can be otherwise missed based on a classical approach with physical exam and chest X-Ray.

The lecture is planned as an interactive session with the audience.

Modern POCUS Curriculum Development: Multi-specialty Point of Care Ultrasound Medical Student Elective and Emergency Medicine Intern POCUS Longitudinal Curriculum

Joshua Zavitz D.O., Wake Forest Baptist Medical Center

WCUME 2018

Didactic Proposal: either oral lecture presentation or panel discussion

Presenter: Joshua Zavitz D.O.

Topics: Multi-specialty Point of Care Ultrasound Medical Student Elective

Emergency Medicine Intern POCUS Longitudinal Curriculum

Survey Data

Depending on time and specific didactic arrangement (ie. Curriculum Panel) I would like to discuss the challenges and triumphs of creating a longitudinal intern curriculum along with a multi-specialty POCUS Medical Student elective experience. Discuss pros and cons of these projects compared to what existed previously. Discuss future goals and ideas as well as opportunities for improvement.

The POCUS Medical Student elective maximizes inter-departmental support and initiative to provide students with a broad POCUS experience. There are 8 specialties that cover different weeks during the student rotation including cardiology, vascular surgery, critical care, neurology, emergency medicine,

OB/GYN, radiology and sports medicine. Currently, due to demand and interest we have increased the elective to allow 2 students per block.

The emergency medicine POCUS longitudinal curriculum provides the opportunity for interns to have didactic and bedside teaching throughout the academic year. This is in contrast to the current standard of a single block of POCUS during their intern year and minimal formal instruction otherwise. Discuss avenues to improving collaboration between departments and using coordinators, technicians and physicians. Currently we have two intern residents assigned to “ultrasound shifts” every Wednesday and Thursday afternoon. They have 2 ultrasound shifts during every emergency medicine block during intern year. Furthermore, they have been assigned recorded lectures throughout the year. In January and in July they have direct observation testing to monitor progress throughout the year.

Sunday September 16, 2018

Basic Vascular Anatomy for the Extremities and Neck with Ultrasound

Christopher Keller BS-Sonography, RDMS, RVT, Wake Forest Baptist Health

How to locate and identify basic vascular landmarks and anatomy using ultrasound. The focus will be for pre-procedural imaging as well as POCUS trauma, ICU and ER settings where immediate assessment for vascular injury is needed.

Novel Ultrasound Application/Technology

Lower Extremity Venous Duplex-Basic and Beyond

Christopher Keller BS-Sonography, RDMS, RVT, Wake Forest Baptist Health

Build a Foundation for the POCUS Lower Extremity Venous Duplex Exam

1.Basic Anatomy and how it relates to ultrasound anatomy

2. Ultrasound Anatomy and how to approach the exam

3. Image acquisition and optimization in gray scale and color Doppler

4. Basic protocol criteria and application

5. Next level techniques and diagnostic tools

PEARLS for a core ultrasound physical exam: what to include and how to teach it

Michael Wagner MD, Univ of South Carolina School of Med

As ultrasound machines are beginning to approximate other physical exam tools in size and affordability, their use outside of the Emergency and Critical Care settings will be expected to drastically increase. Dozens of medical schools are now including some ultrasound training into their curriculum to augment anatomy, physiology, and even clinical skills labs. A number of conditions well known to be difficult to detect using traditional exam techniques are readily diagnosed with small ultrasound devices. When

including ultrasound into physical exam instruction, given the broad scope of potential applications it can often be challenging to know what to include. In this sense, ultrasound training can and should mirror how we teach the traditional physical exam. In addition to teaching problem-focused physical examinations which are tailored to the patient's chief complaint and initial history, learners and practicing physicians often are expected to perform a core examination on every patient regardless of their presentation. This helps in two ways: first is to detect unsuspected findings which sometimes impact clinical care. The second, and perhaps more unappreciated component is that it maintains the clinical skills necessary when the examination is clinically indicated and the stakes are higher. At present time no core ultrasound examination exists although numerous protocols have laid the sufficient framework for its design.

In this workshop we will review the multi-organ ultrasound physical examination that we routinely use and teach, applicable to both the inpatient and outpatient setting. We will review real cases highlighting its clinical utility when performed routinely as well as the literature showing changes in clinical care of the patients, particularly the elderly. We will describe how the examination can be scaled for the beginner with limited skills as well as for the clinician with more extensive POCUS experience, as well as our recommendations for when and how to layer different applications. In contrast to specific ultrasound protocols which are problem-focused, this examination will have multiple applications based on the skill set of the learner and can be used as a springboard to grow one's ultrasound skills.

This workshop would build on a webinar on this topic and a planned publication in July (Southern Medical Journal) and would serve as an in-person learning opportunity for those familiar with these.

AIUM Webinar can be found here: https://www.youtube.com/watch?v=ywuIeoEfG1I&t=1547s

Demo comparing ultrasound physical to traditional physical can be found here: https://www.youtube.com/watch?v=YOzi6rnE5qo

Ideally, this would focus on demonstrating the use of pocket sized ultrasound devices (vscan, lumify, iviz, butterfly, etc) and keep a low attendee to instructor ratio (due to small screens). Alternatively, to increase attendee number, the workshop could utilize cart based units for teaching and have 3-4 stations where attendees could try out different PSU devices.

Co-Author(s): Janice Boughton, Gritman Medical Center

Partnership with Canadian Point of Care Ultrasound Society

Chuck Wurster MD, CCFP(EM), CPoCUS

I would like to propose a partnership between WCUME 2018 and the Canadian Point of Care Ultrasound Society. As you may know, our society members contributed a lot of the content, both didactic presentations and workshops for WCUME 2017 in Montreal. We would like to be able to offer our assistance in helping with the content of your conference. We will have many of members attending the conference and can offer multiple varied didactic presentations as well as workshops. Examples may include: (1) Roundtable discussions on how to best assess PoCUS competency (2) "Finding the Holy Grail - a true objective way to assess PoCUS compentency" (3) Canadian experience in undergraduate PoCUS education (4) "Why Canadian's get certified in PoCUS and why our certification is more than just a piece of paper" (5) CPoCUS "Bootcamp" Workshops to run people through our training pathways both for our CORE indications as well our EXPANDED (i.e. advanced) indications. The EXPANDED applications included our Resuscitation track (advanced cardiac, advanced lung and IVC), Diagnostic track (Gallbladder, Renal, DVT, Ocular) and MSK (joints, fractures, tendons, ligaments, dislocations). (6) "Expansion of PoCUS certification in Canada to other specialities". Our society has over 4000 members who could possibly attend the conference and hundreds of great leaders and educators could enhance your program content. I would be happy to discuss these ideas and more with you over the phone (250-616-7964) or email anytime.

SIXTH WORLD CONGRESS
ULTRASOUND IN MEDICAL EDUCATION

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Other

Assessment of an Experiential Learning based Point of Care Ultrasonography Program for 1st year medical students

John MacIsaac MSc (hons), University of Ottawa

Introduction: Point of care ultrasonography (POCUS) is becoming an essential skill for Resident Physicians as its applications continue to increase; yet there remains an absence of structured POCUS training at the medical school level in Canada. There is no clear guidance on how best to incorporate ultrasound into the undergraduate medical curriculum, but successful programs have done so by augmenting a traditional didactic syllabus with additional experiential modalities. The purpose of this study is to assess the ability of such a program to improve students' competency in POCUS with a view to inform the design of a formal medical undergraduate POCUS curriculum. **Methods:** Forty 1st year medical students participated in a 2-hour Thoracic POCUS workshop. This consisted of a 30-minute didactic lecture followed by a 1.5-hour small group live-scanning session led by POCUS proficient Emergency Physicians. Student competency was assessed using a pre-test/post-test method. Post-tests were administered at two time points: post lecture and post small group session. Evaluations were designed using expert validated multiple-choice questions and by direct observation using an objective structured assessment of technical skill (OSATs). Paired and unpaired t-tests were used to compare test scores within and between each assessment group. **Results:** The pre-test mean score was 27%. Post-tests administered after the didactic lecture had a mean score of 52%; post-tests given after the small group scanning session had a mean score of 80%. The difference between post-test scores was significant. Students tested after the small group session performed significantly better on questions assessing technique and pathologic image recognition. Student self-reported confidence levels increased from 1.4/10 to 4.6/10 after the lecture and to 8.1/10 after the scanning session. **Conclusion:** An experiential based model of ultrasound training consisting of a brief didactic presentation and supervised small-group practice examinations is an effective way to teach medical students basic POCUS skills. The addition of experiential training afforded students statistically significant improvement in their ultrasound knowledge, skill and confidence over didactic teaching alone. This study can serve as a model to inform the development of future undergraduate POCUS curricula.

Co-Author(s): Nora Ahmad, University of Ottawa, Youstina Hanna, Univeristy of Ottawa, Luke Edgar, University of Ottawa, Michael Woo, Univeristy of Ottawa

Teaching Point of Care Ultrasound at the medical school level using Peer Assisted Learning: a prospective randomized trial

John MacIsaac MSc (hons), University of Ottawa

Background: A major barrier to the integration of Point of Care Ultrasound (POCUS) into medical school curricula is the availability of enough skilled faculty instructors. Peer assisted learning (PAL) has been utilized successfully at the medical school level to teach other clinical and procedural skills and may potentially serve as a useful source for additional POCUS instructors. The objective of this study is to assess the ability of PAL to teach 1st year medical students basic POCUS knowledge and technique relative to faculty led instruction. **Methods:** Student-teachers were 2nd year medical students, their training consisted of a 1.5 hour eFAST scanning tutorial and 1 week of self-teaching. Fifty 1st year medical students were randomly assigned to a 5-student group led by either a student-teacher or a physician credentialed in POCUS. Theoretical and practical learning outcomes were tested using a 10-question pre/post-test design and an objective structured assessment of technical skill (OSATs) respectively. Paired and unpaired t-tests were used to compare test scores within and between groups. **Results:** Differences between pre-test scores of PAL and physician led groups were insignificant. Evaluation of mean pre- and post-test scores showed no significant difference between the student and physician led instruction (mean difference: 0.8; 95%CI: 0.6-0.9). Mean difference in OSATs scores between groups was also insignificant (0.4; 95%CI: 0.2-0.5). **Conclusion:** PAL based teaching achieved a sufficient level of training in basic eFAST ultrasound relative to physician led instruction. These results show that students may serve as a useful resource for circumstances where the availability of skilled instructors is limited and thus may facilitate the large-scale implementation of POCUS training at the medical school level.

Ultrasound Curriculum Development

Evaluation of Venous Insufficiency

David Murray BA, MHSc, RVT, Nova Southeastern

This courses aim would be to cover the core anatomy and physiology of lower extremity veins (normal and abnormal states), the common sites and patterns of venous insufficiency, and provide tools and hands on experience for evaluation of venous reflux disorders/venous insufficiency.

Hands-On Workshop for Ultrasound-Guided Invasive Procedures

Joshua Nitsche MD, PhD, Wake Forest School of Medicine

Background

Ultrasound is used to guide needle or other devices in a variety of invasive procedures across a wide range of medical specialties. With the introduction of resident duty hour restrictions and the replacement of invasive procedures with non-invasive tests, it is now difficult for trainees to gain enough real-life experience during residency or fellowship to independently perform these procedures after graduation. The classic "see one, do one, teach one" training paradigm has become unsustainable, and more efficient training regimens will be required moving forward. In addition to the lack of clinical training opportunities training in ultrasound guided invasive procedures has historically been hindered by a lack of consensus about the requisite set of skills needed to safely perform the procedures, what constitutes competency, and how to objectively measure trainee procedure performance.

The AIUM has addressed the first issue in its Practice Statement on Selected Ultrasound Procedures where it outlines specific needle localization and guidance techniques necessary to safely perform these procedures. They recommend that all providers be proficient with both the in plane guidance approach—where the needle path and ultrasound beam are within the same plane—and out of plane guidance approach—where the needle path crosses the ultrasound beam at a single point. They also outline a variety of needle visualization optimization techniques that can be used during in plane needle guidance including probe rotation, probe translation, and the oblique heel-toe standoff technique. This still leaves the issues of defining competence and objectively measuring trainee performance unresolved.

We have created a novel ultrasound guidance task trainer and targeting curriculum that address all of the issues discussed above. Delineation of the core guidance skills by the AIUM suggests a different approach for the teaching and assessment of ultrasound guided invasive procedures. We have formulated a curriculum of 5 specific targeting tasks that allows for trainees to practice the core guidance skills, functioning in a very similar way to the Fundamentals of Laparoscopic Surgery. By focusing on the core skills which common to all ultrasound guided invasive procedures our curriculum can decrease the dependence of training on real-life patient encounters.

As mentioned above skill assessment for most ultrasound guided invasive procedures is often subjective. Typically a procedural checklist is used to grade the performance of a simulated or real-life invasive procedure. While such assessments do provide some objective information they still rely on the

often subjective assessments of those scoring the checklist and judging the provider's skill. By timing the performance of these tasks and recording targeting errors the trainer allows for a more objective assessment of provider skill. Finally, by comparing the task performance of novices and experts we have begun to set thresholds for competence that trainees should meet prior to performing ultrasound guided invasive procedures in a real-life clinical setting.

Our proposed workshop will begin with a short didactic summary of the relevant literature regarding the benefits of using ultrasound during invasive procedures and how to best prepare novice providers to perform them. The hands-on portion of the workshop will begin with an introduction to the basics of needle guidance, such as how probe and needle positioning effect the appearance of the ultrasound image, and provide a structured way to present these basics to the novice learner. We will then move on to the targeting tasks and allow attendees to perform them illustrating how they allow for the practice of the core skills outlined by the AIUM. We will again provide a structured way to introduce the tasks to novice learners. Finally, in order to demonstrate how the targeting tasks relate to actual procedures, the attendees will be split up into different groups and rotate through stations with procedure specific simulators for paracentesis, central line placement, ultrasound guided peripheral IV placement, abscess drainage, and deep tissue biopsy.

Learning Objectives

Upon completion of this activity, participants should be better able to:

1. To familiarize the participants with available options for simulating ultrasound guided invasive procedures.

2. To introduce the participants to curricula specific for different ultrasound guided invasive procedures

3. To provide novice participants with instruction on the basics of ultrasound guided invasive procedures

4. To train experienced providers on how to establish a ultrasound guided invasive procedure simulation program at their institution

5. To demonstrate how simulation can be used by experienced providers to maintain skill with low-frequency procedures

Course Outline

20 minutes. The course will begin with a short introduction to the course and a didactic session reviewing the evidence regarding the benefits of using ultrasound during ultrasound guided invasive procedures, how to train novice providers to perform them, and how much practice is required to obtain competence.

20 minutes. Attendees will be divided into small groups with each group having its own task trainers. The hands-on portion of the workshop will begin with introduction into needle guidance basics, such as the use of difference probe orientation, and how the relationship between the needle and the probe affect the point and angle of needle entry on the ultrasound screen. Examples of items covered include the difference between holding the probe parallel or perpendicular to the provider's shoulders and having the needle appear on the left or right side of the ultrasound screen.

60 minutes. Attendees will next perform 3 of the 5 individual targeting tasks. All 5 will not be performed due to time constraints. The groups will spend 20 minutes practicing a task before moving on to another. Focus will be placed on how the tasks replicate the needle redirections often needed to complete real-life invasive procedures.

20 minute. Break.

100 minutes. Attendees will next rotate through 5 procedures specific stations: paracentesis, central line placement, ultrasound guided peripheral IV access, deep abscess drainage, and tissue biopsy. Focus will be placed on how the guidance skills practiced during the targeting tasks can be translated into specific invasive procedures. In addition, course instructors will also discuss how the simulators are operated and, if self-constructed, how they are assembled.

20 minutes. Free practice time. During the last 20 minutes of the course attendees will be allowed to practice any of the targeting tasks or specific procedures they wish.

Co-Author(s): Brian Brost, Wake Forest School of Medicine

How to Teach - Innovations in Education

Designing a vertical ultrasound curriculum for neuroscience/neurology in underground education

Aarti Sarwal MD, Wake Forest School of Medicine

Format : Demonstration on a live model with parallel slides on a presentation

Objective :

-Design of a curriculum that longitudinally mirrors neurosciences/neurology education through 4 years of medical school

-demonstrating components of ultrasound education that can be incorporated into teaching neuroanatomy in 1st year neuroscience block

-describing integration of ultrasound assessments into the 3rd year clinical elective

-subspeciality ultrasound exposure in 3rd/4th year for the aspiring neurology resident

Needs:

TCD /carotid capability machine-POCUS with B mode, high and low frequency probe

Screen connected to display the ultrasound screen to audience different from the screen used to present powerpoint

Live model on a stretcher

Other - Miscellaneous

Artificial Intelligence in Point-of-Care Ultrasound

Yuriy Bronshteyn M.D., Duke

Artificial Intelligence will soon disrupt all medical modalities involving image interpretation. Already, multiple companies and researchers are developing automated image interpretation tools for diagnostic ultrasound. This panel would discuss the impact of AI on POCUS teaching and performance.

Credentialing/privileging for POCUS

Yuriy Bronshteyn M.D., Duke

With the exception of Emergency Medicine, most specialties practicing POCUS (e.g., anesthesiology, critical care, internal medicine) lack clear credentialing/privileging standards for this modality. This panel would provide a forum for providers to discuss their efforts to establish credentialing/privileging standards at their institutions. What has worked and what hasn't? What barriers have you encountered?