



Teaching Point of Care Ultrasound (POCUS) in Austere Environments

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ABSTRACT

Objective: Point of care ultrasound (POCUS) is emerging as a valuable tool for deployed physicians, with demonstrated value in battlefield, disaster relief, and humanitarian assistance missions. However, there is very limited data on teaching POCUS while in an austere environment. We taught POCUS in a humanitarian assistance setting during the February 2019 joint US Brazilian hospital assistance mission aboard NAsH Carlos Chagas along the Madeira River in the Brazilian Amazon. This article describes our methodology, challenges and success to provide a blueprint for others to add to POCUS education as part of their global health contribution.

Methods: Partner nation physicians were offered POCUS training using a handheld IVIZ[®] ultrasound machine loaned for use during this mission by Fujifilm Sonosite, Inc.. Training was conducted by a Family Medicine resident (PGY-3) with asynchronous remote review by a staff physician.

Results: Two partner nation physicians were trained to the level of U.S. credentialing in the Focused Assessment with Sonography for Trauma (FAST) exam.

Conclusions: POCUS can be effectively taught during brief global health engagements, offering partner nations an immediate capacity-building tool.

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Introduction

Point of care ultrasound (POCUS) is increasingly used in primary care in the United States [1,2] and has been shown to provide significant benefit to care in deployed military settings, disaster relief efforts, and humanitarian assistance missions [3-17]. If taught to partner nation physicians, POCUS becomes a capacity building tool in addition to providing clinical utility during the mission. However, there is very little data on teaching POCUS during these global health engagements. This paper describes how we taught POCUS as a capacity building tool during a joint U.S.-Brazilian Navy humanitarian assistance mission.

The Brazilian Navy provides primary medical and dental care to non-indigenous populations living along the rivers in the Brazilian Amazon through bi-annual hospital assistance missions conducted by

four hospital ships [18,19]. These missions are a joint effort between the Ministry of Health and Navy to deliver care to communities living along the riverbanks of the Amazon basin [19,20]. Their focus is to provide care to smaller communities with no access to medical facilities. This coordinated effort has been ongoing for 45 years. As part of the Brazilian Navy's effort to build international collaboration, they occasionally invite foreign military medical personnel to participate in these humanitarian missions [18,19,21].

The February 2019 Madeira River hospital assistance mission was a joint mission conducted by the Brazilian 9th Naval District and United States Navy's 4th Fleet, providing primary care along the Madeira River aboard the Carlos Chagas Hospital Assistance Ship (NAsH Carlos Chagas) (Figure 1). This was the first mission of this kind with tele-dermatology and portable POCUS available as a diagnostic tool [22]. This

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paper describes the methods used to teach POCUS in an austere environment.



Figure 1. NASH Carlos Chagas moored to a treatment site along the Madeira River. US Navy photos by Mass Communication Specialist 1st Class Byron C. Linder/Released. Maintained for public use by the Defense Visual Information Distribution Service (dvids) and free for use for non-commercial, educational activities (<https://www.dvidshub.net/about/copyright>). The appearance of U.S. Department of Defense (DoD) visual information does not imply or constitute DoD endorsement.

Materials and Methods

The February 2019 Madeira River hospital assistance mission provided care to 8 communities along the Madeira River. Medical care was provided by general

medicine, family medicine and pediatric physicians, and augmented with general surgery (for minor procedures), dermatology, obstetrics/gynecology, and physical therapy. Fujifilm Sonosite® loaned a portable IVIZ® ultrasound for use during this mission, allowing POCUS evaluation for a focused assessment with sonography for trauma (FAST/limited abdominal), obstetric (OB), pelvic non-OB and soft tissue pathology. Detailed medical and dental, tele-dermatology, and POCUS impact are described elsewhere [4,21,22]. We reviewed pelvic and soft tissue POCUS techniques with interested partner nation physicians, and offered training in the FAST exam to the level of U.S. credentialing.

Challenges to teaching POCUS include an absence of national criteria for credentialing, instructor qualifications, and curriculum. The American College of Emergency Physicians (ACEP) recommends 25-50 quality-reviewed exams and a half to full day of didactic introduction for a particular application [23]. ACEP recognizes that novel didactic structures (i.e., flipped classrooms using online didactics) may be used to achieve the didactic goal. After a one-hour introduction to ultrasound didactic session, we distributed didactics to reinforce learning (Table 1), consistent with training methods that our hospital Naval Hospital Jacksonville (NHJ) uses for credentialing (See NHJ Curriculum, Supplemental Materials).

Table 1. Shipboard Training Schedule

Session	Monday	Wednesday	Friday	Total hours over four week mission
Didactics	1330-1400	1330-1400	1330-1400	6
Live scanning	1400-1500	1400-1500	1400-1500	12

Highly credentialed instructors are fewer in number and hence less likely to be physically present on any given humanitarian assistance mission. To demonstrate a method of overcoming this limitation, we had a Family Medicine resident (PGY-3) provide all the hands-on teaching (Figures 2&3), with asynchronous remote over-reads by our chief ultrasound instructor at NHJ, consistent with ACEP guidelines [23]. Credentialed staff provided direct oversight during the mission, but we wanted to demonstrate that asynchronous oversight was effective and timely.

We used a hybrid curriculum, combining the software training included in the Fujifilm Sonosite® device, printed and internet material [24-30], small group discussion of the printed material, hands on demon-

stration and practical demonstration by learners (Figure 2).



Figure 2. Classroom and teaching locations. Dr. John Sullivan demonstrates POCUS to Dr. Priscila Ribeiro on a mock patient in a treatment bay of NASH Carlos

Chagas.

Interested participants were provided written material reviewing the minimum required ultrasound views with corresponding pictures, and through small group discussion points of confusion were clarified.

This study is a retrospective, observational analysis of teaching POCUS, and was approved by the Naval Medical Center Portsmouth Institutional Review Board.



Figure 3. Dr. John Sullivan, observed by obstetrician Dr. Giselle Oliveira da Costa, demonstrates a dating ultrasound to a very excited family (their first experience with ultrasound visualization of a fetus). U.S. Navy photos by Mass Communication Specialist 1st Class Byron C. Linder/Released. Maintained for public use by the Defense Visual Information Distribution Service (dvids) and free for use for non-commercial, educational activities (<https://www.dvidshub.net/about/copyright>). The appearance of U.S. Department of Defense (DoD) visual information does not imply or constitute DoD endorsement.

Results

Five partner physicians expressed interest in learning POCUS, an intern-level general medical officer, general surgeon, obstetrician, gynecologist and pediatrician. The intern-level general medical officer and general surgeon completed the FAST curriculum, completing 25 documented scans that were reviewed for quality assurance, and six hours of structured didactics. The level of proficiency and expertise they achieved met the credentialing standards of our U.S. hospital. The other three interested physicians joined our mission at its halfway point, and due to that time limitation did not complete the full training. Although the obstetrician did not complete our course, it inspired her to register for a privately offered obstetric ultrasound course, which she completed after the mission.

Discussion

The clinical utility of POCUS during humanitarian assistance missions has been well documented. However, that value ends with the mission unless it is taught to partner nation physicians. Moreover, there is an unmet medical need for a portable imaging modal-

ity in resource poor environments and no modular curriculum to provide this highly desired training. We demonstrate that it is possible to effectively teach POCUS with limited time in an austere setting. In addition to use as a capacity building tool in humanitarian missions, it may offer benefit in extended disaster relief missions as well.

A limitation of our study is that it is a single humanitarian assistance mission teaching a single POCUS technique. Our method may not be generalizable to other missions, and our curriculum method may not be generalizable to other POCUS exams.

We also do not address the cost of POCUS to the partner nation, who must purchase and maintain equipment to unlock the value of our training. However, given its utility and relative value compared to cost, [4] most health systems including those of low and middle-income countries can afford portable US units.

Conclusion

In summary, POCUS is a valuable adjunct to primary care in humanitarian assistance and disaster relief missions. It is possible to teach POCUS to partner nation clinicians in time-limited, austere humanitarian assistance missions. More research is needed to determine the extent to which other techniques may be taught and if teaching POCUS may also be possible during extended disaster relief missions.

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Conflicts of Interest

The authors declare no conflicts. (Note: POCUS device loaned from Fujifilm Sonosite® for this project. Fujifilm Sonosite® was not involved in study design or article creation, and no author receives compensation from Fujifilm Sonosite®.)

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