Getting It Right the First Time: Defining Regionally Relevant Training Curricula and Provider Core Competencies for Point-of-Care Ultrasound Education on the African Continent

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Significant evidence identifies point-of-care ultrasound (PoCUS) as an important diagnostic and therapeutic tool in resource-limited settings. Despite this evidence, local health care providers on the African continent continue to have limited access to and use of ultrasound, even in potentially high-impact fields such as obstetrics and trauma. Dedicated postgraduate emergency medicine residency training programs now exist in 8 countries, yet no current consensus exists in regard to core PoCUS competencies. The current practice of transferring resource-rich PoCUS curricula and delivery methods to resource-limited health systems fails to acknowledge the unique challenges, needs, and disease burdens of recipient systems. As emergency medicine leaders from 8 African countries, we introduce a practical algorithmic approach, based on the local epidemiology and resource constraints, to curriculum development and implementation. We describe an organizational structure composed of nexus learning centers for PoCUS learners and champions on the continent to keep credentialing rigorous and standardized. Finally, we put forth 5 key strategic considerations: to link training programs to hospital systems, to prioritize longitudinal learning models, to share resources to promote health equity, to maximize access, and to develop a regional consensus on training standards and credentialing. [Ann Emerg Med. 2017;69:218-226.]

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BACKGROUND

Many countries on the African continent have well-known high burdens of trauma and unacceptably high all-cause mortality among emergency department (ED) patients (2.2% to 12.3%).[1-4] This occurs, in part, because of limited access to basic and advanced laboratory facilities, along with limited diagnostic imaging equipment availability, including radiographs and computerized tomography (CT). As a result, point-of-care ultrasound (PoCUS) has gained increasing recognition as an important tool for these clinical environs.

Despite this recognition, there remains limited use of PoCUS by local emergency medicine providers on the African continent. Reasons for this vary, but lack of portable ultrasound machines, poor access to reliable electrical power, limited consumable supplies (gel), and lack of adequate training with rigorous standards and credentialing are certainly primary constraints. Additionally, locally initiated educational programs often lack necessary resources and technical expertise, whereas externally (high-income countries) initiated programs often lack coordination between learners and teachers, longitudinal mentorship, and context appropriateness pertaining to local disease patterns. These limitations preclude program longevity and local sustainability.[5-7]

Quality training programs in Africa's emergency care settings hold immense potential to affect preventable morbidity and mortality, to improve diagnostic capability, and improve health equity. As leaders in emergency medicine from 8 African countries and local stakeholders, we initiate this dialogue to lay the groundwork for developing high-quality sustainable and collaborative emergency medicine PoCUS educational programs. Toward this end, we propose a novel PoCUS curriculum, developed by expert consensus, to establish core competencies grounded in functionality and contextualized to local epidemiology and resources. Furthermore, we propose a continent-wide coordinating structure to ensure

quality training, credentialing, and revalidation of skills throughout the region. We also present 5 key strategies as a foundation to enhance collaborative best practices for PoCUS development on the African continent.

DEFINING RELEVANT PoCUS CORE COMPETENCIES

This conversation is timely and imperative because interest and engagement in emergency medicine on the African continent has significantly increased during the past decade. Dedicated postgraduate emergency medicine residency training programs now exist in 8 countries (Figure 1). Individuals involved in each of these programs report educational initiatives in PoCUS, but training appears to vary greatly, and there have been minimal efforts to coordinate educational resources within and between countries. South Africa is a notable exception, with 5 domestic programs (all members of the College of Emergency Medicine of South Africa), each of which follows a curriculum of the Emergency Medicine Society of South Africa, accredited by the College of Emergency Medicine of South Africa. An extensive review of the literature identified only summaries of other PoCUS use, with descriptive reports from EDs in Rwanda, South Africa, Democratic Republic of Congo, and Ethiopia.[8-10]

ALGORITHMIC APPROACH

To start, we recommend that programs adopt core competencies based on local disease and illness within infrastructure and training limitations. We suggest PoCUS be used early in a patient's presentation, with algorithm-, organ-, and procedural-based scans triggered by presenting signs and symptoms.[11] Throughout settings as varied as the slum areas of Kibera, conflict zones of the Democratic Republic of Congo, or relatively affluent areas of Dar Es Salaam, a majority of the population lacks access to primary care, sufficient laboratory testing, radiographs, and CT scan imaging modalities. The lack of imaging modalities can be profound; North Kivu Province, Democratic Republic of Congo (population of 6 million), has no functional CT scanners and only 25 inconsistently functional radiograph machines, the Mozambique public health system (serving 20 million) has only 3 CT scanners, and the South African

Emergency Medicine Residency Programs
Ethiopia
Addis Ababa University
South Africa
University of Cape Town
Stellenbosch University
University of KwaZulu-Natal
Pretoria University
University of the Witwatersrand
Republic of Tanzania
Muhimbili University National Hospital MUHAS
Sudan
Omdurman Teaching Hospital
University of Bahri
Egypt
Egyptian Fellowship - MOHP
Botswana
Princess Marina Hospital
Ghana
Komfo Anokye Teaching Hospital
Uganda
Makerere University

Post-graduate EM Training Programs
Rwanda
University of Rwanda College of Medicine and Health Sciences
Kenya
Aga Kahn University Hospital
Democratic Republic of Congo
HEAL Africa Hospital
Kindu General Hospital

Figure 1. Emergency medicine training programs on the African continent. Postgraduate training programs were defined as local Ministry of Health–recognized emergency medicine residency programs, fellowship programs (post–medical school), and emergency medicine technical officer training programs. The authors requested the assistance of the African Federation of Emergency Medicine to compile this list. It is possible we missed a program.

public health system (serving 4 million) has only 15 CT scanners. This lack of access often contributes to a delay in diagnosis that then results in advanced illness, complex complications from congenital illness, smoldering infections, or multiorgan involvement by the time patients present to an emergency setting. We deliberately emphasize "algorithmic" because approaches to the undifferentiated patient are likely to involve several different organ scans, many of which can be conducted in a functional order to help reach a more rapid diagnosis.

Because of these expected complexities in presentation, the number of core algorithmic scans will need to expand from those typically used in more resourced settings. The context demands that approaches to the patient with undifferentiated shortness of breath, for example, would need to incorporate an immediate lung and cardiac PoCUS examination, given the potential for pericardial and pleural effusion from untreated infectious disease, pulmonary emboli, undiagnosed congenital heart abnormalities, and cardiomyopathies. We also suggest that a general abdominal assessment for undifferentiated abdominal pain or distension be added, which anecdotal evidence suggests is currently performed in many EDs without formal recognition. Ultrasound logs from EDs in Ethiopia, Tanzania, and the Democratic Republic of Congo often have the word *abdominal* as the scan performed and *abdominal pain* presumed to be undifferentiated as the indication.[12] This scan includes examination of the urinary tract system (for urinary retention or hydronephrosis), the intra-abdominal or pelvic cavity for free fluid (from hemoperitoneum, perforations from typhoid infection, and other bowel pathology or ascites), liver interrogation (for abscesses or cysts), and biliary system evaluation (for cholelithiasis versus cholecystitis).[13] We also recommend developing an algorithm for assessment of dehydration in the patient with diarrheal illness.[8] Fluid resuscitation is difficult to manage in many locations, given lack of or expense of intravenous fluids. Furthermore, it is often unclear in what stage of dehydration patients would benefit from intravenous fluids, given a high burden of concurrent malarial disease and recent literature suggesting increased mortality from routine fluid boluses in the Sub-Saharan Africa pediatric population.[14] We anticipate that many more algorithms will be designed and validated and enthusiastically invite this research.

ALTERNATIVE CORE COMPETENCIES

Procedures critical to individual patient management are also identified that are not traditionally considered core PoCUS competencies in more resourced areas, such as ultrasound guided regional anesthesia,[15] because many countries lack narcotic-purchasing power[16] and have limited access to patient monitoring for conscious sedation outside major capital cities.[17] Further suggestions for future curricula include obstetric scanning for second- and third-trimester patients. Many providers in emergency care settings are expected to care for obstetric patients in all trimesters because separate obstetric units are few outside large academic centers in capital cities (personal communication, Nerys Benfield, MD, MPH, Albert Einstein College of Medicine, March 2016).[6] We consider the procedure of ultrasound guided central line placement as nonessential. Central venous catheters are rarely placed, if ever, in the EDs that our authors are associated with (representing some of the most resourced in Africa). There is also minimal ability to monitor central venous pressure, limited access to vasopressors and other medications that traditionally require a central line, and little access to consistent cardiac monitoring. Lack of surgical expertise for aorta repair or stenting limits the importance of the aorta scan, which is rarely conducted and not considered essential[18] (Figure 2).

The sheer number of PoCUS scans may be greater than in more resourced departments. This will necessitate planning for more extensive machine maintenance because of heavier use and for departments to develop plans to integrate scan results into a wider range of patient presentations. A 2016 review of ultrasound logs from Black Lion Hospital's ED in Addis Ababa, Ethiopia revealed a daily average of 30 scans for a patient census of 60 to 80, using 2 first-generation Sonosite/Fuji 180 machines. Muhimbili National Hospital in Dar Es Salaam, Tanzania has greater than 50 scans per day on average with a Sonosite/Fuji Nano for a patient census of 170 per day. Finally, many sites exist with scanning limited to 1 abdominal probe because of lack of resources. This raises a few interesting issues, such as there being no published competencies or guidelines acknowledging how to maximize use of a single abdominal (5-MHz) probe, to our knowledge.

The development of PoCUS curricula will need to be presented in novel ways, and educators should consider transport of paper-based articles and provision of laptop computers or tablets. Curricula will need to be prepared in French, Portuguese, Arabic, and Kiswahili, depending on the local language. Education of nonemergency physicians may be considered in some locations for lack of alternative practitioner cohorts (eg, family medicine physicians or nurses). PoCUS training in hostile environments that are not conducive to standard educational practices may be required, including limited access to translators, sites with no electricity, chaotic environments, and even conflict zones.

Algorithm Based

1. ****E-FAST (Extended Focused Assessment with Sonography in Trauma –** This is an ultrasound examination used to detect the presence of hemopericardium, hemoperitoneum, hemothorax and pneumothorax.

1. ****RUSH (Rapid Ultrasound evaluation for Shock and Hypotension) –** This consists of cardiac and inferior vena cava ultrasound to rapidly evaluate patients with shock and/or hypotension.

1. ****FASH (Focused Assessment with Sonography for HIV-associated tuberculosis) –** While evidence shows the basic FASH has limited clinical value due to low sensitivity and specificity, a full FASH (organ pathology and lymph nodes) generates a higher odds ratio. Unfortunately the extended exam is technically difficult and may be best for more advanced practice/programs.

1. ****ABUE (ABdominal Assessment for the Undifferentiated abdominal pain or distention) –** This is an ultrasound examination of the urinary tract system (eg, urinary retention or hydronephrosis), intra-abdominal/pelvic cavity for free fluid (from hemoperitoneum, perforations or ascites), liver interrogation (abscesses or cysts) and biliary system evaluation (gallstone disease vs. cholecystitis).

2. ****SOCL (Sonography Of Cardiac and Lung) -** This is an ultrasound examination indicated when patients present with shortness of breath. Examination of the lung for evidence of pneumothorax, pleural effusion, pleural edema, pneumonia and a cardiac scan to evaluate for pericardial effusion, heart failure, evidence of right-sided heart strain from pulmonary embolism and gross valvular dysfunction.

Organ Based

3. **DVT assessment –** Two-point compression evaluation of the proximal veins of the lower limbs. The deep veins of the lower limb are evaluated for compressibility at the level of the popliteal vein and the common femoral vein to evaluate for deep venous thrombosis.

4. ****Obstetrics –** Evaluation of the uterus during all trimesters.
   - *1st trimester –* Confirm the presence of intra-uterine pregnancy
   - *2nd trimester –* Evaluation of the uterus to evaluate for fetal viability, fetal growth, r/o multiple pregnancies, placental location.
   - *3rd trimester –* Evaluation of the uterus to evaluation for fetal presentation and viability, r/o multiple pregnancies, placental location.

5. **Soft tissue, muscle –** Evaluate for abscess, edema, and/or foreign body.

6. **Ocular –** Evaluation of vision loss (retinal detachment, vitreous hemorrhage) and increased intracranial pressure.

7. **Long bone fractures –** Evaluation of both fracture location as well as vascular integrity with Doppler.

Procedure Based

8. **Regional anesthesia –** The use of real-time ultrasound to identify regional nerves to block for acute pain management.

9. ****Thoracentesis –** Guidance aspiration of the pleural cavity.

10. ****Paracentesis –** Guidance aspiration of the abdominal cavity.

11. ****Pericardiocentesis –** Aspiration of the pericardium.

12. **Peripheral vascular access –** For rapid access in shock patients and those with difficult to access veins.

Regional potential applications – Not considered core

1. **CVC insertion –** Ultrasound as an adjunct to internal jugular vein or femoral vein catheterization, using either the in-plane or out-of-plane approach. It has been shown to increase the success rate and decrease the complication rate when compared with traditional landmark techniques.

**Indicates scan can be done with an abdominal 5 mHZ probe

Figure 2. Suggested initial curriculum for 1- and 2-probe sites. Scans listed as regional are suggested for regions with high malaria burden or central line access. Scans marked with double asterisk (**) are recommendations for single-probe sites (usually a 5-MHz abdominal probe).

LIMITATIONS OF ADAPTING HIGH-INCOME CURRICULA

The current practice of adapting and transferring resource-rich PoCUS curricula and delivery methods to resource-limited health systems is not recommended.[9,19-20] This is based on the observation that transferred curricula do not match local disease epidemiology, nor do they consider a lack of other imaging modalities. These observations are supported in the study by van Hoving et al[19] that reported South African disease burden did not match the epidemiology of PoCUS curriculum content adopted from the United Kingdom. Similarly, Stachura et al[20] reported that PoCUS, as taught by Canadian faculty in Ethiopia, was clinically useful in 94.6% of patients who presented to the Black Lion Hospital ED in Addis Ababa, Ethiopia, but that predominant scans were markedly different than those observed commonly in their Canadian institutions. Muller et al[9] reported that 41% of PoCUS scans performed in an ED with a high trauma burden in an eastern province of the Democratic Republic of Congo were for emergency provision of ultrasound guided regional anesthesia.

TRAINING AND ORGANIZATIONAL STRUCTURE

Proposed Phases of Training

All PoCUS providers must reach and maintain competency to add value to their medical systems, even more so in resource-limited medical systems. Lack of access to formal radiologic investigations and other laboratory investigations inherently increases the responsibility of the PoCUS provider to ensure competency. Concurrent responsibilities for the expert teacher to ensure competency is greatly increased. We recommend a continent-wide means of training and support of ongoing skill maintenance. To start, PoCUS curricula delivery usually consists of 4 phases[18]:

1. Introduction phase: Introductory course, workshop, or training sessions
2. Experience-gaining phase: PoCUS trainees gain initial competence by scanning real patients under trainer supervision (directly or indirectly) until their skills are optimal to progress to phase 3
3. Competency assessment phase: To ensure that PoCUS trainees reach an established required competency level
4. Revalidation phase: To ensure that PoCUS trainees maintain and update their competency throughout their career

We suggest that health care leaders in the African region consider these 4 phases of curricula delivery as a criterion standard in PoCUS training and that guidelines be standardized, published, and made widely available. In addition, we propose the creation of a phase 5, the education/champion phase:

5. Education/teacher phase: To ensure that educators have the required skills and understanding of differential diagnoses to effectively teach ultrasound curricula in this specified resource-limited setting

Only successful trainees, who complete the first 3 or 4 phases of the credentialing process, should receive proof that they have reached the required core competencies and thus may be certified as "competent" ultrasonographers. We further suggest that providers emerging from phase 3 be referred, when possible, to a nidus site to train for the phase 5 education or teacher phase, and on completion they will be referred to as a PoCUS "champion." This phase will signify a transition from a competent ultrasonographer to an PoCUS educator, who has acquired skills to teach ultrasound curricula and guide trainees from phases 1 through 3 or certainly phase 4: revalidation. Specific guidelines for phase 5 have yet to be determined, and creation of an objective assessment tool is currently under way with the Delphi method.

Successful delivery of PoCUS curricula will be influenced by many local factors in established and newly initiated training programs (eg, trainer capacity, distance between training centers, Internet access). We suggest that future research identify and synthesize the unique barriers to curricula delivery within the context of these local factors. Only then will novel practical interventions stand a chance to succeed, leading to improved credentialing success. Furthermore, validity and evaluation studies of these novel interventions within their own contexts will add extra credibility.

If an adaptable core curriculum can be developed through regional partnerships and best practices shared across countries, new PoCUS training programs (eg, Kindu General Hospital, Democratic Republic of Congo) can learn from more established ones (eg, Muhimbili National Hospital, Dar Es Salaam, Tanzania), allowing them to launch more quickly, reducing start-up and opportunity costs. Well-established PoCUS training programs would also benefit by leveraging experience and expertise, and these programs can grow into regional centers of excellence (eg, Black Lion Hospital, Addis Ababa, Ethiopia). As training program opportunities in the region build capacity and expertise among junior and future faculty members, emerging PoCUS champions can and will further increase the reputation of established programs, thus establishing a positive cycle of increased student interest, as well as greater research and funding opportunities.

ORGANIZATIONAL STRUCTURE

In 2014, at the African Conference on Emergency Medicine, the African Ultrasound Committee became operational. Committee members include national directors of emergency medicine residency programs that formally incorporate PoCUS training in their curriculum and regional ultrasound experts. The aim of the committee is to provide support, including shared materials, curricula, training methods, and advisory services, to potential champions who pioneer PoCUS training on the African continent.

Working with or within the African Ultrasound Committee, we suggest an organizing institution as a framework by which existing ultrasound training programs on the supply side have the opportunity to formally share their knowledge capital. This could include items such as successful ultrasound course models from PURE Rwanda, recipes on how to manufacture low-cost cassava ultrasound gel from InnovationsCZ, and image control review systems from Mt. Sinai/St. Roosevelt/St. Luke's. Each of these organizations, and many more, is equipped to share lessons learned and new systems and products with the remaining nidi. We suggest that this institution actively engage to provide work in English, French, Portuguese, and Arabic. Although each site would start with the same curriculum, we anticipate that through time and research efforts the curricula will become tailored. We do not anticipate their being tailored according to geography, however, but rather a differentiation clustered by language or resource level (Figure 3).

BUILDING ON EXPERIENCE: LEARNING FROM AFRICAN REGIONAL PARTNERSHIPS

Improving the culture of collaboration in the African region in PoCUS training and enabling regional experts will further drive other relevant regional agendas. South-South collaborations are likely to be more balanced than North-South partnerships, require reduced implementation costs, allow greater program ownership, and decrease cross-cultural barriers.[21-23] Regional cooperation in PoCUS education and practice would also encourage and build a local marketplace, potentiating collective buying power to decrease equipment and repair costs while cultivating local expertise in maintenance and repairs.

STRATEGIC PROGRAM DEVELOPMENT CONSIDERATIONS

We identified 5 strategic program development considerations that will enhance the intended collaborative best practices, core competencies, and oversight in the African region for PoCUS training and use in emergency care in the African region:

1. Prioritizing PoCUS training in emergency medicine training programs linked to hospital-based systems

We recommend an initial focus on creating nidi of concentrated champions, embedded in emergency medicine training programs in hospital-based systems, to support long-term sustainability. By leveraging local competencies within established and supported emergency medicine training programs, we believe that local champions will more easily be developed and emerge to carry on training to a new, broader array of potential end users. Initiation of a continent-wide distribution of PoCUS too early, although admirable, could tax an already constrained supply chain of skill, equipment, and equipment maintenance, which in turn might delay a more functional longer-term adaptation of the technology because of system failure for lack of skills.

2. Prioritizing longitudinal and sustainable models for PoCUS training

We identify that PoCUS is a skill demanding expert training, supervised learning, and ongoing maintenance for competency. Although the initial skills of PoCUS can be taught over a few days to many different kinds of emergency care providers, short-course trainings without adequate planning for system integration and ongoing supervision or skill maintenance should be avoided. Rather, we recommend that resources be invested thoughtfully to provide ongoing support and collaboration in PoCUS training with active continuing medical education components. Drop-in courses by externally trained PoCUS experts could then evolve into more sophisticated, reciprocal educational exchanges. As the community of PoCUS-trained experts grows, the long-term educational goal would ideally be to develop mentorship networks of local PoCUS experts to train and supervise future learners, longitudinally, negating the current need for drop-in courses led by externally trained PoCUS experts.

3. Recognizing an imperative to share regional and global resources to promote health equity for all populations with and within the African region

We believe that negotiating a means to share educational materials and faculty development opportunities regionally would benefit all partner countries. Resources include educational materials, curriculum research and development, training expertise, and, finally, the means to access and maintain ultrasound machines.

We recognize the importance for all stakeholders (low and high resourced) to engage with often-marginalized yet important actors (recipient populations) in this discussion. First, we believe that we must strive to include postconflict

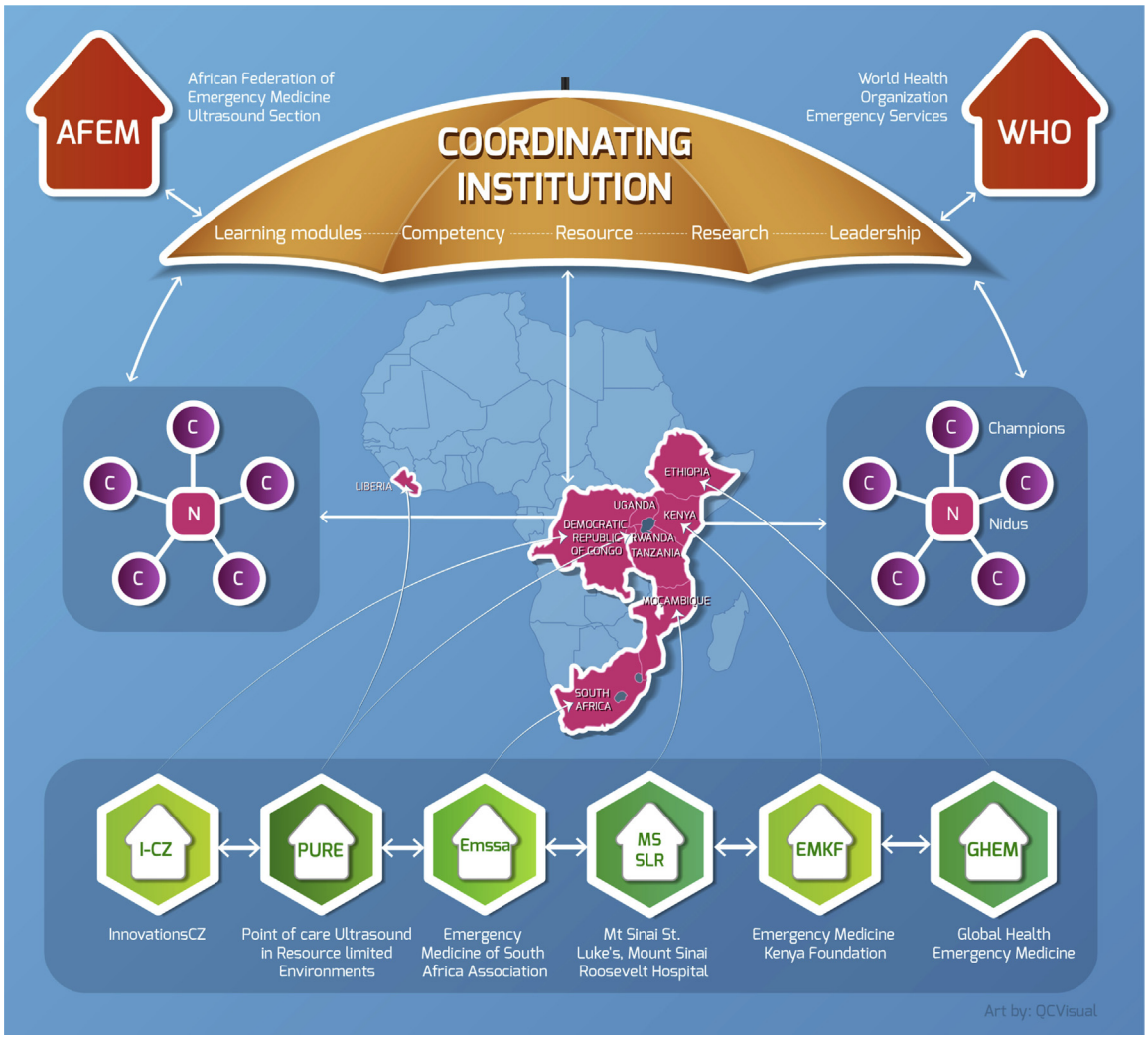

Figure 3. Future ecology of African continent ulstrasound learning. Current countries with programs are represented in red, with arrows from supporting organizations. Each country is encouraged to develop at least 1 nidus center of learning. These nidi will then work with local institutions through PoCUS champions to develop training programs. Champions will also work with one another to support programs across regions and countries withoutnidi to promote PoCUS education and use, and share resources. Normative organizations, such as AFEM and WHO, will provide support in the form of resources, guidelines, and technology. Nidus reciprocally will provide data for research and best practice development. *AFEM*, African Federation of Emergency Medicine; *WHO*, World Health Organization; *C*, champions; *N*, nidus; *I-CZ,* InnovationsCZ; *PURE*, Point-of-care ultrasound in resource-limited environments (PURE); *EMMSA*, Emergency Medicine Society of South Africa; *MSSLR*, Mount Sinai Saint Luke's Mount Sinai West; *EMKF*, Emergency Medicine Kenya Foundation; *GHEM*, Global Health Emergency Medicine.

states. If the lessons of the failed health care systems in the Democratic Republic of Congo, Sierra Leone, and Liberia are to be learned, it is that postconflict states cannot be left out of health care infrastructure building and educational initiatives. Second, we need to include countries often excluded by language, including French, Portuguese, and Arabic, for which multilingual discussions, training curricula, and research should be considered. Third, we recognize ongoing tensions involved in providing care for diverse populations such as urban, rural, and marginalized urban populations such as those in slum households (37% of the urban population in Sub-Saharan Africa, anticipated to increase to more than 70% in countries such as Egypt by 2030).[24] Regional collaborations should actively seek and strive to identify innovative solutions to support training and technology use among often invisible populations in more challenging settings that are frequently ignored by the formal health sector.

4. Maximizing patient access to PoCUS technology

PoCUS technology is becoming increasingly affordable, yet funding the purchase and maintenance of machines remains challenging in resource-limited settings. Further discussion is required in regard to the development of effective business models to sustainably integrate PoCUS

technology into resource-limited EDs. Strategic thinking around access to technology should focus on human-centered solutions and engage providers, policymakers, and the private sector, including manufacturers of ultrasound equipment.

Given the reality of resource limitations in many settings introducing PoCUS, we caution against using it in the ED on a fee-for-service basis. This is an uncomfortable discussion often not addressed; however, given the emergency indications for PoCUS in regard to both diagnostic and therapeutic uses, we submit that the strategy of charging a fee for this service must be discouraged. Rather, ultrasound machines should be considered an extension of the care provider that is no different from the provider's stethoscope or other similar equipment, rather than as a revenue generator. A policy of no fee for service for emergency PoCUS is therefore recommended to maximize the potential of PoCUS, to decrease morbidity and mortality, and to keep trained providers' skills intact.

5. Developing regional consensus for PoCUS training standards and credentialing

The implementation of PoCUS training standards and curricula in local contexts will be best guided by regionally determined policies in regard to some key implementation issues.

First, we posit that the African Federation for Emergency Medicine, as a recognized professional body of emergency providers, is in the best position to design and implement these standards. Second, we recommend not credentialing learners with general PoCUS certifications until a governing body such as the African Ultrasound Committee can recommend a certification process based on evidence and sound policy. The alternative to a regional credentialing program would be to keep certification designations within the context of a specific emergency medicine training program or residency curriculum, thus minimizing the misrepresentation of PoCUS skills as a stand-alone skill set rather than an essential skill within the particular context of emergency medicine training.

CONCLUSIONS

This article is a clarion call for coordinated action to foster collaboration around resource and knowledge sharing, to effectively disseminate and sustain PoCUS training initiatives in emergency medicine programs, and improve patient outcomes across the African continent. As the number of African emergency medicine training programs steadily grows, it will become increasingly important to have a thoughtful, regional approach to scaling up and introducing PoCUS technology and training into fledgling programs. The challenges of ultrasound machine provision and maintenance and the sustainability of longitudinal PoCUS education programs within established emergency medicine training programs must be addressed now to ensure a promising future in PoCUS education in Africa. This will reduce time to effective PoCUS uptake and provide greater equity with respect to education and technology access. PoCUS champions are emerging now and can continue to do so at great pace with the coordinated guidance and support of the African Federation for Emergency Medicine Ultrasound Committee coordinating regional and international partnerships.

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Authors of this commentary are directors of emergency medicine residencies, ultrasound educational programs, or leaders of developing emergency medicine in the countries identified on the author institution list with the exception of Salmon, C. who is a specialist in building health systems in low resource settings. The conversation was initiated at the African Federation of Emergency Medicine Conference in Ghana (2012), continued at the S. African conference (2014) which then resulted in an email based group devoted to this subject. The initial discussion was among program leaders based in the Sub-Saharan region, after which authors from Egypt were recruited for comment to ensure a more-resourced (and Northern) perspective and Mozambique to ensure those with Portugese language. The corresponding author (Salmon, M.) directs programs in Democratic Republic of Congo where she is based 3-5 months per year and senior author (Lampretch, H.) is the chair of the African Federation of Emergency Medicine Ultrasound Section and directs an Ultrasound Fellowship in South Africa. French authors were included from Democratic Republic of Congo (Malemo, L. and Paluku, J.). Given the manuscript was submitted to an English language based journal, second and third authors (Landes, M., and Hunchak, C.) by default contributed most to the actual writing of the manuscript with English as their first language. Author order was based on who contributed most to the actual writing of the manuscript per World Health Organization recommendations but all authors listed had an active role in the writing and review of the manuscript and meet the 4 criteria for authorship described by the International Committee of Medical Journal Editors (ICJME).

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