XXVI Congresso Brasileiro de Engenharia Biomédica

Armação de Búzios – RJ – Brasil

October 21st to 25th, 2018

Point of care ultrasound in low resource arenas: applied appropriate technology

E R Greene[1, 4], G Gunther[2], C J Hunter[2], B Gonik[3], S John[4]

[1]University of New Mexico Schools of Engineering and Medicine, Albuquerque, NM, USA

[2]University of Namibia School of Medicine, Windhoek, Namibia

[3]Wayne State University of Medicine, Detroit, Michigan, USA

[4]Namibia University of Science and Technology, Windhoek, Namibia

dickgreene7@gmail.com

Background, Motivation, and Objective. Point of care ultrasound (POCUS) provides low cost, robust, handheld, noninvasive medical imaging that extends the clinical exam (Ann Emerg Med 2014; 64:277-285). Resulting from technological and digital advances, POCUS is transforming medical imaging into a more direct, universal, utilitarian, and pragmatic tool by physicians, nurses, and other clinical practitioners. Telemedicine and artificial intelligence (AI) can be used with POCUS to expand its use by taking the diagnostic imaging and interpretation to the patient, often remote and rural. Many medical schools and residency programs in high resource countries are now requiring that POCUS be implemented within their training. The small, portable device is replacing the traditional stethoscope. This product of biomedical engineering can be transformational within health care delivery. Nevertheless, cost effective and sustainable POCUS programs in low resource counties and arenas have been slow in developing. Clearly, this application is where POCUS is most needed. Reasons of this delayed implementation are many, but generally are due to voids of awareness, equipment, and most importantly, training. Our objective is to create an experiential model of how to reduce these barriers of POCUS in the developing countries like Namibia.

Methods. During parts of 2015-2018 we have undertaken a POCUS awareness campaign in Namibia. Numerous public and professional seminars and television media appearances have been given. Meetings with national medical societies and members of the Namibia Ministry of Health outlined the advantages and limitations of POCUS in low resource arenas. Limited portable or handheld devices were made available by donation or minimal cost contributions from POCUS manufacturers. The faculty members of the University of Namibia School of Medicine were consulted and training seminars were integrated into the curriculum and general medical rounds. Recently, practical training programs have been extended into the district hospitals and small rural clinics. Importantly, with the help of other POCUS implementers, we will fund and plan a trans African randomized, controlled trial (RCT) to validate the apparent cost effectiveness, improved triage, and outcomes of POCUS in low resource arenas. This RCT will take at a minimum 3 years and is necessary for the proper evolution of POCUS in developing countries.

Results. Local and national awareness levels of POCUS in Namibia have significantly increased with support coming from all sectors of the medical systems. As expected, some individual private

sector physicians have complained, both formally and informally, about the introduction of POCUS as threat to their practices. Faculty, medical students and other medical practitioners have generally embraced this appropriate technology and its required training. Most users become comfortable and relatively proficient after an adequate training period (~23 weeks) and a variety of applications (>50 cases). Some rural providers are cautious of their use of POCUS without the direct oversight of a responsible physician to make the final clinical decision. Unfortunately and often in rural clinics, a physician is available only 1-2 days/month. Telemedicine and AI may help solve this problem. Equipment availability is an ongoing challenge. We are asking the Namibian Ministry of Health to provide each well trained graduating medical student, district physician, and rural clinic provider to have a device at a cost of <$500USD each. Integrating smart phone technology into a POCUS device is becoming available (butterflynetwork.com) and should continue to reduce costs and increase robustness.

Discussion and Conclusions. Clearly, POCUS will be an important and integral part of diagnostic medicine in the future. This appropriate technology is a result of the rational evolution and maturity of ultrasound imaging which is now limited only by the physical laws of acoustic signal creation and transduction. How medical practice adapts to this new tool will depend on its implementation and validations. In low resource arenas such as Africa and South America, its utility seems self-evident. Nevertheless, many economic, cultural, educational, and practical challenges remain. Front line practitioners will need to be well trained and critically confident in the use of the method. Radiologists and other specialists will need to adapt to others being diagnostic with this technology that extends the clinical exam and it used throughout the medical disciplines. Importantly, therapeutics and treatments need to improve to finalize the positive results that were begun more efficiently by the improved, low cost diagnostics. These important caveats are certainly salient in developing countries and low resource arenas where options are limited. If properly implemented, POCUS should have a significant impact on health care throughout the world and is truly a biomedical engineering gem.

Acknowledgement. We thank the NMHU Foundation, NUST, Namibian Ministry of Health, UNSOM, and USAID for their support. Students M Menenbach, Z Diener, J Foster, and T Hangula provided POCUS training and public media awareness.

Keywords. ultrasound; imaging; developing countries, POCUS, diagnostics, appropriate technology