COMMENTARY

Feasibility of project ECHO telementoring to build capacity among non-specialist emergency care providers

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A B S T R A C T

The COVID-19 pandemic has led to global disruptions in emergency medicine (EM) teaching and training and highlighted the need to strengthen virtual learning platforms. This disruption coincides with essential efforts to scale up training of the emergency healthcare workforce, particularly in low-resource settings where the specialty is not well developed. Thus, there is growing interest in strengthening virtual platforms that can be used to support emergency medicine educational initiatives globally. These platforms must be robust, context specific and sustainable in low-resource environments. This report describes the implementation of Project ECHO (Extension for Community Healthcare Outcomes), a telementoring platform originally designed to extend specialist support to health care workers in rural and underserved areas in New Mexico. This platform has now been implemented successfully across the globe. We describe the challenges and benefits of the Project ECHO model to support a Point-of-Care Ultrasound (POCUS) training program for health care providers in Kenya who do not have specialty training in emergency medicine. Our experience using this platform suggests it is amenable to capacity building for non-specialist emergency care providers in low-resource settings, but key challenges to implementation exist. These include unreliable and costly internet access and lack of institutional buy-in.

Background

The COVID-19 pandemic has placed significant strain on healthcare systems and disrupted medical education. Simultaneously, there is growing attention to the looming crisis of health care workforce limitations in low-resource settings. The WHO predicts that the world will be short of 12.9 million healthcare workers by 2035, and these shortages will be felt more acutely in Sub-Saharan Africa [1]. In this environment, virtual education has gained increased prominence and proved essential to supporting medical education, building the healthcare workforce and supporting equitable health systems [2].

The global flow of ideas and knowledge is crucial to the development of a skilled healthcare workforce [3]. Even prior to the COVID-19 pandemic, virtual training programs created opportunities to democratize knowledge, particularly in low-resource settings. Within emergency medicine, virtual education and training has become more prevalent in recent years [4,5]. Evidence from the African region shows that emergency healthcare professionals are increasingly looking online for free and open access medical education (FOAM) resources to augment their training and support patient care [6]. Internationally, the growing demand for online, structured emergency medicine content to support remote learning has become even more pressing in the setting of significant travel restrictions during the pandemic [7].

In this push for virtual learning, telementoring stands out as a modality for structured, equitable and collaborative learning within institutions, regions and across borders. It is also an effective tool for healthcare worker capacity building. Telementoring seeks to build a community in which specialists can successfully guide and support primary healthcare workers in remote and underserved areas [8]. This remote training and support leads to improvements in quality of patient care, accuracy of patient diagnosis, and reduction in medical costs [9–12].

Project ECHO: A telementoring platform for multidirectional education and remote collaboration

Project ECHO was developed at the University of New Mexico Health Sciences Center with the goal of expanding specialist Hepatitis C management into underserved regions within the state [13]. This model was invented to address the needs of primary health care providers with limited specialist training who were working in rural clinics treating patients with Hepatitis C.

The Project ECHO model is distinct from telemedicine, which is described as “the use of medical information from one site to another via
electronic communications to improve a patient’s clinical health status” [14]. Telemedicine allows a healthcare provider to connect directly to a patient through different modalities such as video calls, video conferencing, secure telephone calls, emails, web portals and mobile health applications (m-health) [15]. Telemedicine can further be divided into synchronous interactions which occur in real time, versus asynchronous interaction where data is obtained, transmitted and stored for later review. Telementoring on the other hand involves the use of telecommunication technology to enable a mentor/expert to provide remote guidance to a trainee. Telementoring has been used successfully in different settings, including on-time specialist guidance to a trainee performing a surgical procedure [16]. Teleultrasound is an example of a synchronous telementoring interaction where an expert provides real time guidance to a trainee [17].

Project ECHO telementoring is distinct in that it brings together a group of experts to support teams of healthcare workers in underserved rural or isolated regions. The model works through regularly planned videoconferences known as Tele-ECHO clinics, where primary health care providers or trainees present patient cases using a standardized case format, and specialists at academic health centres provide feedback about best practices. This flipped classroom model allows the primary providers to discuss cases that are relevant to their daily work and receive guidance on best practices and evidence-based care. Thus, the providers from isolated and underserved healthcare facilities can care for patients at their medical clinics without the need for referrals that would previously take months to complete.

The Project ECHO platform uses a ‘Hub’ and ‘Spoke’ model where experts/trainers at a central Hub location connect with healthcare providers at multiple spoke sites through regular Tele-ECHO video conferencing sessions (Fig. 1). The platform also incorporates a management tool called IECCHO that allows program managers to organize and collect data on trainee participation.

Since its inception, Project ECHO has expanded to create hundreds of training programs in a variety of fields in the U.S. and around the world [18–20]. Recent applications include training teams of frontline healthcare workers from 55 countries on patient care principles e.g. infection prevention and control, patient screening and triage during the COVID-19 pandemic [21]. Other uses include overcoming barriers to geriatric post-acute and long term care due to COVID-19 [22]. Project ECHO stands out as a virtual training model since it makes use of structured, regularly scheduled sessions (Tele-ECHO clinics), and emphasizes the use of a set curriculum that is developed and updated based on trainee needs.

Rationale for the use of Project ECHO model for POCUS training in rural Kenya

There is a growing recognition for the value of POCUS use in acute and critical care practice in low-resource settings. Many aspects of POCUS such as portability and increasing affordability make it uniquely suited to low-resource settings. The WHO essential package of emergency care now includes availability of POCUS as an important tool to be made available in LMIC emergency centres [23]. Thus the demand for POCUS education has increased, both within emergency medicine training programs and for non-specialist health care workers providing emergency care.

In 2013, we developed a POCUS training program for healthcare workers in rural areas and small towns in Kenya [24]. The training was focused on the Extended Focused Assessment with Sonography in Trauma (E-FAST) and focused obstetrics. Trainees were medical officers (graduates from medical school who have completed 1-year internship), clinical officers (mid-level providers with a 3-year diploma in clinical practice), nurses and radiographers without specific training in emergency medicine. Trainees received a pre-course multimedia manual and pre-course testing prior to presenting for hands-on training. After the training, they received an ultrasound machine to continue POCUS practice at their facilities. Follow-up re-evaluation and re-training was scheduled 3-4 months afterwards, and the process was repeated until the trainee was deemed competent. There were 3 core POCUS trainers in this program who worked with a rotating group of visiting specialists during hands-on training sessions. Through this program, approximately 150 primary health care providers from 60 health facilities across the country were trained.

However, we found that trainees required closer supervision and ongoing guidance outside of the regularly scheduled facility visits 3-4 months post-training. These circumstances led us to consider a telementoring platform while working to increase our pool of trainers. Since our trainees were located in different facilities across the country, it was necessary to consider a platform that brought together multiple geographically isolated teams in a single learning environment. This led our team to trial project ECHO.

Development process

The first step involved selecting a local organization that was focused on the development of emergency medicine in Kenya and that had a national reach. We chose to work with Emergency Medicine Kenya Foun-
dation (EMKF), a non-governmental organization that was formed in 2015 and that has been actively promoting emergency medicine through education, research, and advocacy. Second, the POCUS training group underwent Project ECHO training at the ECHO institute in New Mexico. This training consisted of 2 parts: A 90-minute introduction via videoconference and a 3-day on-site training. Upon successful completion of the training, EMKF was signed on as a project ECHO collaborating partner.

Implementation phase

In 2018, we undertook a 16-week pilot study to investigate the feasibility of Project ECHO as a telementoring model. Fourteen trainees (3 doctors, 3 clinical officers, 4 nurses and 4 radiographers) from 11 healthcare facilities (Fig. 2) who had recently received hands-on training in E-FAST and focused obstetrics were chosen to participate. The study participants received funds to purchase 3G-network access from their mobile phone service provider, and to download zoom onto their smartphones. Every 2 weeks, study participants received a link via WhatsApp to log-on for a 2-hour Tele-ECHO session on Zoom (Fig. 3). The curriculum for the 16 weeks was based on topics covered during the POCUS training program, and is outlined on Table 1. The telementoring sessions were structured to primarily focus on discussing the cases submitted by the trainees, followed by a didactic on the topic outlined on the curriculum. The cases that trainees submitted for discussion are also outlined on Table 1. At the end of the pilot, a qualtrics survey was used to collect participant feedback. The link to the survey was sent to the participants via WhatsApp.

Outcomes

The RE-AIM framework (Reach, Effectiveness, Adoption Implementation and Maintenance) was used to evaluate the feasibility of Project ECHO telementoring in this pilot study [25]. These outcomes are based on the qualtrics survey that was sent to the trainees, and also based on observations and adaptations made during the implementation of the study.

Reach

When approached, all 14 POCUS trainees were willing to participate in the telementoring study. In addition, all the trainees had smartphones which are the primary mode of Internet access in Kenya. Smartphone penetration continues to accelerate in Sub-Saharan Africa, and with it, access to 3G and 4G broadband networks through mobile phone operators [26]. Thus, all the trainees, including those in the very remote clinics, had the ability to connect to zoom on their phone. However, the strength of the internet connection varied, and up to 50% of the trainees reported that at times their connection was poor and would drop off during telementoring sessions. Additional challenges included the phone powering off due to lack of electricity.

Effectiveness

The majority of the trainees (83%) felt that the material presented to them was relevant for their practice, and 100% felt that the cases were clear and well presented. When asked if the sessions increased their confidence in ultrasound scanning, 40% replied Strongly agree, and 40% replied Agree.

Adoption

In assessing adoption, we considered the setting in which the trainees work, the nature of their work environment and how that impacted the ability to participate in POCUS telementoring. The significant challenging factor here was competing clinical obligations. Up to 67% of the trainees reported that work obligations kept them from participating in the sessions. It was difficult to find a day and time when all the trainees...
were available, and they settled on Fridays from 5pm to 7pm. This time slot proved difficult since trainees had to rush to complete clinic activities, commute to their homes and care for their families.

**Implementation**

When the pilot study started, trainees attempted to use their hospital or personal computers to log onto zoom. In addition, weekly notifications were initially sent to their emails. This approach did not work and the option preferred by the trainees was to use their smartphones for internet access and the WhatsApp messaging application for weekly notifications. However, internet access through the smartphone is expensive and financially prohibitive. Therefore, we had to provide financial support to offset this cost (10 USD per trainee per month to enable participation in 2-hour video conferences twice a month).

**Maintenance**

Maintenance was not evaluated on this pilot study. However, the outcomes so far indicate that telementoring through Project ECHO provided desired ongoing education and would be feasible if key infrastructural and institutional barriers are addressed ahead of implementation.

**Discussion**

Our experiences using Project ECHO telementoring to support POCUS training in rural Kenya is an instructive case study on the opportunities and challenges in the use of virtual platforms to support collaborative emergency medical education in low-resource settings. The goal of Project ECHO is to create learning networks and foster a community of learners who share evidence and best practices to improve patient care. This platform is amenable to emergency medicine training due to its structured nature, the ability to utilize a case-based curriculum during regularly scheduled sessions, and built-in tools to evaluate trainee outcomes concurrent with implementation.

However, significant challenges still exist in the effort to create sustainable virtual emergency medicine training platforms in rural Kenya and other similar low-resource environments. A 2018 review of the barriers to virtual medical education cited poor infrastructure and lack of institutional plans for implementation [27]. Our experiences highlight that while internet quality and access is improving, many places still face significant issues with bandwidth and reliability. Most people in Kenya access the Internet through their phones, which can be expensive and create barriers to widespread integration.

Institutional buy-in is important when it comes to investing in Internet connectivity and releasing health-care workers at scheduled times to
participate in online instruction. To support trainee buy-in, telementor-
ing modules can be packaged to provide Continuing Medical Education (CME) points in order to stimulate and reward participation [28]. Im-
portantly there needs to be a thorough evaluation of institutional and individual readiness to participate in such a program. This would en-
sure that the institution is prepared to make the investments to support telementoring infrastructure and that trainees are willing to participate and engage in the program.

Telementoring via project ECHO is well suited for emergency medicine training programs that already have dedicated time for med-
cal education. This is different from our pilot, where trainees from rural facil-
ties did not have scheduled educational sessions. POCUS training is a key milestone in post-graduate emergency medicine training. Many POCUS training models involve a “boot camp” style introduction with hands-on supervised scanning, followed by routine follow-up training, image review for quality assurance and feedback. The follow-up pro-
cess can be challenging in low-resource settings with few POCUS ed-
curators. Under these circumstances, virtual ultrasound instruction has shown promising potential to improve provider knowledge and patient outcomes [29–31]. Since EM trainees have protected time for edu-
cation, it is feasible to hold regular image review and case discussions via
videoconference. POCUS trainers from large academic centres can cre-
ate a “Hub” that allows them to hold virtual image review and teach
learners in multiple “spoke sites” locally or internationally. They can also evaluate trainee outcomes by performing remote image review and
provide online pre and post tests. However, this still requires stable
internet and the ability to de-identify, store and forward ultrasound im-
ages and clips for review during the telementoring session.

This study is limited in that it is a very small pilot study carried out in rural areas in a low-resource country. Thus, our results may not be
generalizable across different low-resource settings due to variations in
telecommunications infrastructure. However, since our trainees were lo-
cated in different facilities across the country, our outcomes are a better
indicator of the challenges involved in creating a telementoring network
as opposed to studies involving one or two facilities. Telecommunica-
tions continue to improve and ultrasound technology is simultaneously
evolving to include smart-phone connected devices that simplify the
process of image transmission for remote review. Some of the newer ul-
strasound devices also have in-built teleultrasound capability. This will
facilitate future implementation of larger scale POCUS telementoring
programs that include robust image review and feedback mechanisms.

Conclusion

Structured virtual education has significant potential to boost emer-
gen care education, especially during the disruptions imposed by the
COVID-19 pandemic. The Project ECHO platform is well suited to ex-
tend specialist knowledge into underserved areas, and to build a com-
munity of practice among specialist and non-specialist emergency care
providers. Our experiences using the Project ECHO telementoring plat-
form for POCUS education in rural Kenya demonstrated its potential, but
significant challenges still exist. There is a need for investment into inter-
net access, and the provision of protected time for healthcare providers
to participate in scheduled tele-ECHO clinics. There is also a need for
further research into telementoring platforms in low-resource settings
to find out which ones work best and why, and what the cost implica-
tions are. This will continue to further the goal of sustainably engaging
emergency care learners in a structured, context specific virtual training
environment.

Dissemination of results

This commentary aims to present our experiences with the Project
ECHO telementoring platform within the context of emergency medicine
education in the African region. We present the opportunities and chal-
lenes of its use, and tools to guide educators in the region who may
wish to implement it.

Authors contribution

Authors contributed as follows to the conception or design of the
work; the acquisition, analysis, or interpretation of data for the work;
and drafting the work or revising it critically for important intellectual
content: GW contributed 50%, LD contributed 25%, GB and BW con-
dributed 12.5% each. All authors approved the version to be published
and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interest.

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References

[1] WHO. A Universal Truth: No Health Without a Workforce [Internet].WHO. World Health Organization; 2022. [cited 2022 Mar 18]. Available from:
https://www.who.int/workforcealliance/knowledge/resources/hrhreport2013/en/

[2] TABATAI A S. COVID-19 impact and virtual medical education. J Adv Med Educ
Prof 2020;8(3):1–40.

[3] Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health profession-
als for a new century: transforming education to strengthen health systems in an
interdependent world. Lancet 2010;376(9756):1923–58.

[4] Leszczyński P, Golić J, Kopáčík Z, Wejnarski A, Święzarski S, Gałążkowski R. Anal-
ysis of Web-based learning methods in emergency medicine: randomized controlled
trial. Arch Med Sci 2018;14(3):887–94.

[5] Windish R, Stuart P, de la Cruz R, Murray A. Enhancing intern emergency medicine
education using a combined didactic and web-based learning curriculum: The EDGE
programme. Emerg Med Australas EMA 2019;31(5):837–42.

[6] Palliam S, Mahomed Z, Hoffman D, Labor AE. Learning in the digital era – awareness
and usage of free open access medical education among emergency department doctors.
Cureus 2022;11(1):e6223.

[7] Cevik AA, Cakal ED, Kawan J. From the pandemic’s front lines: a social responsibility
initiative to develop an international free online emergency medicine course for
medical students. Afr J Emerg Med Afr Emerg Med 2021;11(1):1–2.

[8] McConnell KA, Krisher LK, Lenssen M, Bunik M, Bunge Montes S, Domek GJ. Tele-
health to expand community health nurse education in Rural Guatemala: a pilot
feasibility and acceptability evaluation. Front Public Health 2017;5:60.

[9] Lopez-Bushnell FK. Increasing communication with healthcare providers for patients
with limited English proficiency through interpreter language services education.
Medsurg Nurs 2020;29(2):89–95.

[10] Matimba A, Woodward R, Tambo E, Ramuy J, Gwanuzu L, Guramatshu S. Tele-
ophthalmology: opportunities for improving diabetes eye care in re-
source- and specialist-limited Sub-Saharan African countries. J Telemed Telecare
2016;22(5):311–16 Jul.

[11] Qadoura I, Mansour A, Musharbash A, Drake J, Swaidan M, Tihan T, et al. Impact
to telemedicine on pediatric neuro-oncology in a developing country: the Jordani-
an-Canadian experience. Pediatr Blood Cancer 2007;48(1):39–43.

[12] Bagayoko CO, Traoré D, Theurez L, Diabaté S, Pecoul D, Niang M, et al. Medical and
economic-benefits of teleheath in low- and middle-income countries: results of a
study in four district hospitals in Mali. BMC Health Serv Res 2014;14(1):59 Suppl.

[13] Arora S, Thornton K, Jenkusky SM, Parish B, Scaletti JV. Project ECHO: linking uni-
versity specialists with rural and prison-based clinicians to improve care for peo-
ple with chronic hepatitis C in New Mexico. Public Health Rep Wash DC 1974
2007;122(2):74–7 Suppl.

[14] Schlachte CM, Nguyen NT, Ponsky T, Dunkin B. Project 6 Summit: SAGES telemen-
toring initiative. Surg Endosc: 2016;30(9):3665–72.

[15] Shanbehzadeh M, Kazemi-Arpazhi H, Kalkhajegh SB, Basati G. Systematic review
on telemedicine platforms in lockdown periods: lessons learned from the COVID-19
pandemic. J Educ Health Promot 2021;10:211.

[16] Bravette S, Yeung DKT, Patel HRH, Purskayasta S. Telementoring of Surgeons: A
Systematic Review. Surg Innov 2019;26(2):95–111.

[17] Becker F, Höhne E, Damjanovic D, Schäfer VS. Ultrasound in Telemedicine. A Brief
Overview. Appl Sci. 2022;12(3):33958.

[18] Matimba MO, Parker RA, Chen J, Kibibhu K, Sohl K, for the ECHO Autism Collab-
orative. Effectiveness of the extension for community health outcomes model as
applied to primary care for autism: a partial stepped-wedge randomized clinical trial.
JAMA Pediatr 2020;174(5):e196306.
