Review Article

In situ clinical education of frontline healthcare providers in under-resourced areas: A rapid review

Michael Seabrooke, MD, AEMCA, BSc, Adrienne Seabrooke, J, RN, BScN, MEd

School of Medicine, University of Limerick, Ireland

Correspondence to: Adrienne Seabrooke, adrienneseabrooke@gmail.com

This article has been peer reviewed.

Abstract

Rural communities are geographically isolated from large urban areas, affecting access to definitive care, specialists and other health services that only service urban areas. Rural decision-makers are often faced with numerous challenges regarding the availability, capacity, sustainability and performance of health systems in rural and remote areas. We evaluated the current body of literature on educational initiatives being used in under-resourced areas to increase the knowledge or skills of healthcare workers. This rapid review followed the methods laid out by the Cochrane Rapid Reviews Methods Group and included published articles from any of three databases that described and evaluated an educational intervention, in which healthcare workers were the learners and which took place in an under-resourced area. Papers were excluded if they were deemed to be too resource intensive, were an opinion or concept paper or took place in an urban area. Results were synthesised descriptively. Ten studies were identified that contained information on educational initiatives in a variety of countries. The healthcare workers targeted in the studies varied from physicians, nurses and midwives to community health workers and students. The quality of studies also varied and included randomised control trials, systematic reviews and both prospective and retrospective studies. Initiatives involving simulation or point-of-care ultrasound were most common and showed the most benefit to a learner's knowledge and skill development. A limited body of literature exists on educational initiatives for healthcare workers in under-resourced areas. While simulation and hands-on learning showed positive results, the opportunity remains for a low-cost, high-yield educational initiative tailored to the unique needs of healthcare workers in under-resourced areas.

Keywords: Education, frontline, healthcare provider, remote, rural, training, under-resourced

Résumé

Les communautés rurales sont géographiquement isolées des grandes zones urbaines, ce qui affecte l'accès à des soins définitifs, à des spécialistes et à d'autres services de santé qui ne desservent que les zones urbaines. Les décideurs ruraux sont souvent confrontés à de nombreux défis concernant la disponibilité, la capacité, la durabilité et la performance des systèmes de santé dans les zones rurales et

Access this article online

Quick Response Code:

Website: https://journals.lww.com/cjrm

DOI: 10.4103/cjrm.cjrm_95_22

Received: 22-12-2022 **Revised:** 10-02-2023 **Accepted:** 15-02-2023 **Published:** 20-02-2024

How to cite this article: Seabrooke M, Seabrooke A. *In situ* clinical education of frontline healthcare providers in under-resourced areas: A rapid review. Can J Rural Med 2024;29:20-9.

éloignées. Nous avons évalué l'ensemble de la littérature actuelle sur les initiatives éducatives utilisées dans les zones sous-dotées pour améliorer les connaissances ou les compétences des travailleuses et travailleurs de la santé. Cette examen rapide a suivi les méthodes définies par le Cochrane Rapid Reviews Methods Group et a inclus des articles publiés dans l'une des trois bases de données qui décrivaient et évaluaient une intervention éducative dans laquelle les travailleuses et travailleurs de la santé étaient les apprenants et qui SE déroulait dans une zone manquant de ressources. Des articles jugés trop gourmands en ressources, des opinions, des documents conceptuels ou en lien avec des zones urbaines, ont été exclus. Les résultats ont été synthétisés de manière descriptive. 10 études ont été identifiées, contenant des informations sur des initiatives éducatives dans divers pays. Les travailleurs de la santé ciblés dans les études variaient des médecins, des infirmières et des sages-femmes aux travailleurs de la santé communautaire et aux étudiants. La qualité des études était également variable et comprenait des essais contrôlés randomisés, des revues systématiques et des études prospectives et rétrospectives. Les initiatives impliquant la simulation ou le POCUS étaient les plus courantes et présentaient le plus d'avantages pour le développement des connaissances et des compétences de l'apprenant. Il existe un nombre limité de documents sur les initiatives éducatives destinées aux travailleurs de la santé dans les zones sous-dotées. Bien que la simulation et l'apprentissage pratique aient donné des résultats positifs, il est toujours possible de mettre en place une initiative éducative peu coûteuse et à haut rendement, adaptée aux besoins spécifiques des travailleuses et travailleurs de la santé dans les zones sous-dotées.

Mots-clés: Formation, éducation, rural, éloigné, manque de ressources, première ligne, prestataire de soins de santé

INTRODUCTION

A globally recognised challenge is the geographical maldistribution of the health workforce between rural and urban areas. A multipronged approach is needed to address this complex problem, and understanding the impact of interventions is key to being able to scale them up.[1] Rural communities are geographically isolated from large urban areas, affecting access to definitive care, specialists and an array of health services that only service urban areas.[2] The 2010 global policy guideline produced by the World Health Organization (WHO) issued recommendations for increasing access to health workers in rural and remote areas through four main areas – education, regulations, financial incentives and personal/professional support. Although most data come from high-income countries, it does suggest that interventions that target these areas can influence the retention and the effectiveness of healthcare workers in rural and remote areas.[1]

Conventionally, staff shortages and gaps in access to care are addressed by increasing recruitment of healthcare workers; however, the comprehensive costs of this practice are often underestimated and encompass not only the visible costs of advertising, orientation and training but also the hidden costs of temporary staffing and the damage to staff morale and stability. Retention has many benefits aside from cost-effectiveness, including increased opportunity for mentoring, increased institutional memory amongst staff and a knowledge base that grows at a faster pace with experienced, long-term employees.[3] Multiple sources cite access to continuing education and organisational support for on-the-job learning and skill building as a key contributor to job satisfaction ratings amongst health workers and to higher patient satisfaction.[1,3,4]

This rapid review sought to evaluate the current body of literature on what educational initiatives may be being used in under-resourced areas to increase the knowledge or skill sets of the health workers in those communities.

METHODS

Rapid reviews are becoming increasingly popular and influential within the health sector. Policymakers require evidence to inform decisions and those decisions often need to be made quickly and with limited resources. More recent studies have shown that decision-makers want answers to their questions to be completed quickly, in days or weeks rather than months or years, and to be accurate and affordable.[5] Recently, a set of methods for conducting rapid reviews has been agreed upon by the Cochrane Rapid Reviews Methods Group, primarily in response to the

need for fast and accurate information during the COVID-19 pandemic.[5] When conducting this review, the recommendations from the Cochrane Rapid Review Group were followed – refining of the research question, setting eligibility criteria, searching and study selection, data extraction and synthesis.[6] The inclusion and exclusion criteria and the search strings were developed and agreed on by two reviewers.

Inclusion criteria included English language results, human learning, papers that describe and evaluate a specific educational intervention and healthcare providers as learners. Exclusion criteria included opinion or concept papers, programmes that were too resource intensive or a population that was not under-resourced.

The following search strings were entered into the Cochrane, PubMed and Embase databases: ('*in situ*' OR mobile OR 'point of care') AND (simulation OR training OR education) AND (rural OR remote OR 'under resourced') AND (frontline OR 'health care provider' OR nurse OR doctor). A date limit of 20 years was put on the search. This time frame was chosen specifically to account for the approximated implementation gap of 17 years in health research.[7] The 20 year date limit allowed the search to capture any research that was done, implemented, and evaluated while taking into consideration the time lags that occur within the research translation process.

Abstracts were screened by both reviewers, to yield articles for data extraction and synthesis which were done by one reviewer, and using the approach consistent with rapid reviews, a descriptive synthesis was completed without additional meta-analysis.[5]

RESULTS

Our searches returned 331 hits [Figure 1], and we identified ten relevant studies [Table 1], which came from several different countries, many of which are low and middle income.[8] The healthcare workers targeted in the studies varied from physicians, nurses and midwives to community health workers (CHW) and students. The quality of studies also varied and included randomised control trials, systematic reviews and both prospective and retrospective studies.

The educational interventions that were studied ranged in type, length and topic area. The majority of the included papers focussed on point-of-care ultrasound (POCUS) and simulation training as the intervention, with a similar variety of evaluation methods.

Simulation training

Two of the included articles centred on simulation training, specifically for medical students and student doctors (medical residents), and both used an Objective Structured Clinical Examination (OSCE) style evaluation method. In both papers, the intervention group who received the simulation training scored higher on their OSCEs than the control group.

Bhattacharyya *et al*.[9] discuss interactive simulation with junior orthopaedic surgery residents in the UK. Participants were assessed in a mobile simulation operating theatre with high-fidelity femur models and nailing instruments. Residents were assessed after simulation training through an OSCE format, which showed significantly better scores in the simulation group. Morato *et al*.[10] trained final-year medical students on their paediatric rotation in Brazil. All trainees received Choosing Wisely training – an initiative launched by the American Board of Internal Medicine to encourage dialogue about the costs and benefits of medical care. Some students then received *in situ*, role-playing simulation followed by an OSCE evaluation. As with Bhattacharyya *et al*.,[9] the simulation group scored significantly higher than the control group.

Point-of-care ultrasound training

Four of the ten papers discussed POCUS training, with a variety of specific foci – prenatal, abdominal, chest and Focused Assessment with Sonography in Trauma. Three were studies that took place in low- or middle-income countries, and one was a systematic review. All four papers showed positive results, though one focussed solely on the increased uptake of the procedure by the learners over the quality of the images or the diagnostic capabilities of the healthcare providers. The training ranged from 3 h to several years in the review paper and 30 days, 12 months and two years in the other three papers. In the case of Stolz *et al*.,[11] the intervention was part of an upskilling programme that covered background knowledge, anatomy and technique,

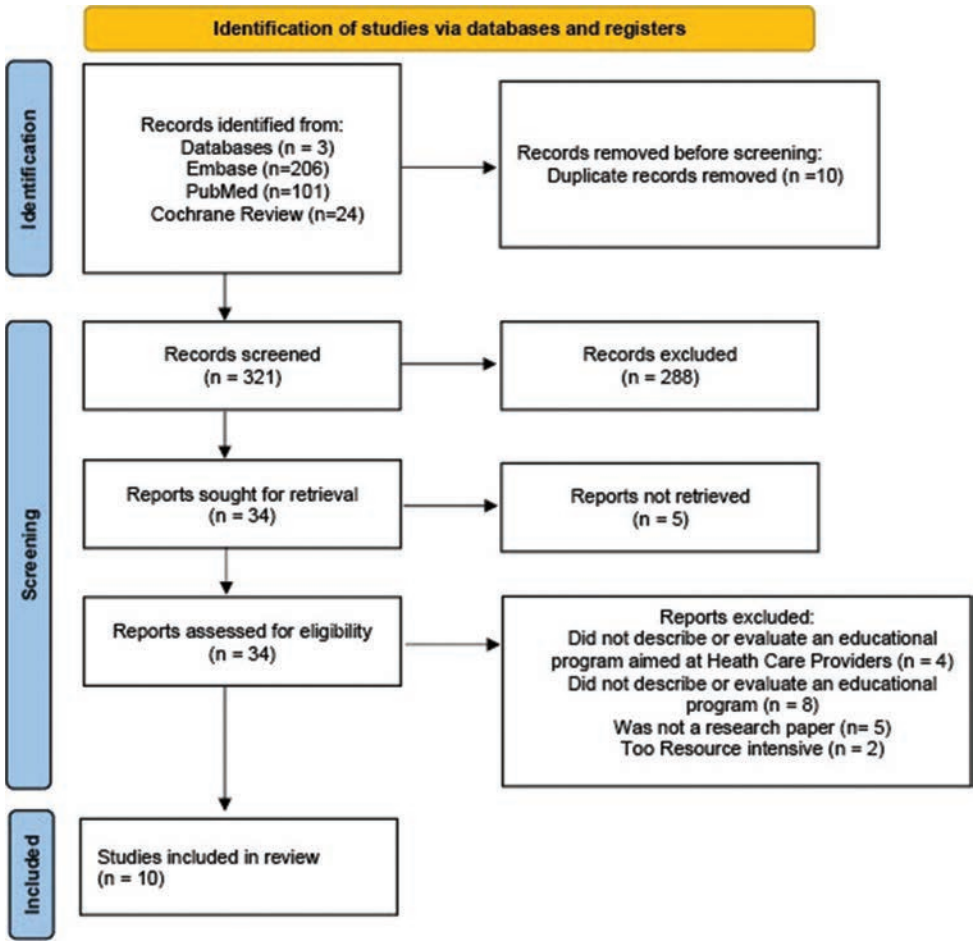

Figure 1: PRISMA flow diagram.

using lectures, hands-on demonstration, mentoring and examinations to nurses in Uganda. This paper reported on uptake instead of the quality of images or accuracy of diagnosis; however, this particular setting had extremely low healthcare provider to population ratios and highlighted the difference between POCUS examinations (2185) and radiological examinations (750) during the study timeframe. This was seen as a positive step to improved patient care and the authors noted that the examination results were positive in 46% of the cases, likely due to the high acuity of the patients, further highlighting the need for an accessible imaging modality.

Sabatino *et al.*,[12] similarly, trained CHW in Sierra Leone through a Nongovernment Organization (NGO) that offered voluntary medical assistance to train the CHWs. They noted success in both identification of anatomy, general knowledge scores and inter-observer agreement with physicians. They further pointed out that only 220 million people out of a population of 5 billion in developing nations have access to basic radiological services and highlighted the convenience, portability and relative ease of use of POCUS in the developing world.

Rominger *et al.*[13] conducted their study in Mexico with physicians, based on rural health clinics that were part of a regional collective. Ultrasound is the only imaging modality available in this region of Mexico, with the nearest radiological centre anywhere from 2 to 6 h away. The instructors who trained them in POCUS were faculty from the University of Louisville and Harvard University in the United States. This programme also demonstrated success, with only 4.3% of the scans resulting in a disagreement in findings, and in 34% of the patient encounters, POCUS changed the clinical diagnosis which, according to authors, likely expedited care without having to wait for additional imaging.

Finally, the review article[14] analysed articles that included mostly multidisciplinary groups of trainees. Training programmes varied in length, were intended for bedside application on prenatal patients, and trainees were evaluated using a

Table 1: Papers meeting inclusion criteria (*n*=10)

Study ID	Country	Study type	Healthcare provider targeted	Number of participants	Educational intervention	Outcome
Bhattacharyya *et al*., 2021[9]	UK	Double-blinded RCT	Orthopaedic surgeons (junior residents)	14	Simulation training Cognitive task analysis/ distributed interactive simulation (a real-time interactive simulation) Participants were assessed in a simulation mobile operating theatre with high-fidelity femur models and nailing instruments	Significantly better scores for the intervention group (49 vs. 17)
Bidner *et al*., 2022[14]	N/A	Review	33% medical physicians, 19% nurses and midwives, 52% multidisciplinary	903 across 27 studies	POCUS Ultrasound training programme intended for point-of-care or bedside application on prenatal patients Could have been part of a broader training curriculum Programme duration varied significantly (3 h to several years) Evaluation methods included pre- and post-training tests, knowledge assessments, written tests before practical training, OSCE assessments, expert image review	Half the studies lacked the follow-up support/ training important to the safe ongoing practice of PoCUS Findings were generally positive, reporting improved knowledge and competence
Gill *et al*., 2016[15]	Australia	Three-armed RCT (control vs. 2 different mCME intervention)	Community-based physician assistants	592 (completed)	SMS messaging SMS bullet point knowledge (Group 2) and SMS multiple choice question with response (Group 3)	High satisfaction from participants, but no improvement in follow-up tests or job satisfaction
Eddy *et al*., 2016[16]	Australia	Systematic review		7 papers included	Teamwork programmes Data synthesis of qualitative studies regarding health professional's experience of teamwork education programmes	A range of factors that influence experience Key takeaway: Go beyond the focus on specific teamwork education programmes and view them instead as part of a more complex environment The six synthesised findings included: Organisational culture and expectations understanding the functioning of successful teams; the experience of the education is influenced by their starting point; teamwork education is highly valued; high fidelity

Contd...

Table 1: Contd...

Study ID	Country	Study type	Healthcare provider targeted	Number of participants	Educational intervention	Outcome
						simulation provides a powerful learning opportunity, and this education provided increased confidence and motivation
Morato *et al*., 2022[10]	Brazil	Prospective	Final-year medical students in paediatric rotation/clerkship	50	Simulation training in paediatrics Remote video class versus *in situ* simulation training. Outcome tested in an OSCE	Simulation group was significantly higher scoring than the control group
Rominger *et al*., 2018[13]	Mexico	Longitudinal	Rural clinic physicians	Not specified - 10 clinics, with 584 ultrasounds completed and evaluated	POCUS training 12 months curriculum, 4 teaching sessions (lecture and hands-on), practising on healthy volunteers and patients	34% of patients had a change in diagnosis, and 30% had a change in management – taken to mean POCUS training was helpful
Sabatino *et al*., 2020[12]	Sierra Leone	Prospective	CHWs	2	POCUS training Trainees were evaluated on performing E-FAST and POCUS (chest and abdominal) correctly Training course lasted 30 days	Trainees were able to recognise the abdominal organs (with minor difficulties) Highest scores obtained in the hepatic spaces and pelvis
Sabin *et al*., 2017[17]	Vietnam	RCT	Community-based physicians assistants	638 participated in the intervention and 70 participated in the in-depth evaluation	SMS messaging Daily SMS text message that contained either a simple message related to primary care or a four-option multiple choice question which required a reply. Those in the latter group got an immediate response indicating whether the message was correct or not Both groups received messages that covered six topic areas: Surgery, internal medicine, paediatrics, infectious diseases, sexually transmitted infection and family planning Messages were sent in random order Intervention lasted 6 months and was evaluated through focus groups discussions and in-depth interviews with some participants (70)	Qualitative descriptors of the intervention Pros included convenience, relevant content, desire to continue and perceived improvement in knowledge/skills Cons included lack of depth or detail in the messages, irrelevant or difficult content, lack of interactivity and technology challenges

Contd...

Table 1: Contd...

Study ID	Country	Study type	Healthcare provider targeted	Number of participants	Educational intervention	Outcome
Sagi *et al.*, 2018[18]	India	Prospective	Primary care physicians	38	Varied Phase 1: 10 days of in-person training, including patient interviewing skills, drug dependence knowledge, and assessment and treatment of drug disorders Phase 2: Both synchronous tele-conference training sessions and smartphone app e-learning (providing knowledge and skills) Finally, participants were tested and given various questionnaires	They found a significant improvement over time Self-confidence improved in 32%, whereas the rest felt the same as before Satisfaction: 22% improved from baseline, 51% reported the same level of satisfaction (and were *above* 5 on a 1–10 Likert Scale), and 16% reported the same level of satisfaction (and were *below* 5 on a 1–10 Likert Scale) Authors determined that telementoring could be helpful for future training of primary care physicians in mental health/addiction management
Stolz *et al.*, 2015[11]	Uganda	Retrospective review	Nurses	13	POCUS Lectures were delivered as part of a 2 years up-skilling programme, covering background knowledge, technique, anatomy, pathology, etc., Some hands-on, demonstration, proctored exams, etc., were supplied. Further support was provided by mentoring from experienced nurses and visiting physicians	Report on uptake of procedure, rather than focussing on improvement in skill. A total of 2185 POCUS assessments were completed, with a gradual increase in usage shown over the course of the nurse's training

RCT: Randomised control trial, OSCE: Objective structured clinical examination, mCME: Mobile continuing medical education, E-FAST: Extended focused assessment with sonography in trauma simulation training, POCUS: Point-of-care ultrasound, N/A: Not available, CHWs: Community health workers

variety of methods, including pre- and post-tests, knowledge assessments, OSCE assessments and image reviews by experts. Although the authors found that half the studies lacked the follow-up support that was critical for the safe, ongoing practice of POCUS, results were generally positive, with studies reporting improved knowledge and competence.

The final four studies included two randomised controlled trials using SMS text messages, a systematic review of teamwork programmes and a varied programme that combined in-person training on a variety of interviewing, assessment and treatment skills and teleconference and e-learning app training. Gill *et al.*[15] and Sabin *et al.*[17] both assessed the efficacy of SMS text messages that contained medical information on a variety of topics, to community-based physician assistants in Australia and Vietnam, respectively. Both studies showed high satisfaction with the intervention, with participants citing convenience, relevant content and perceived improvement in knowledge and skills. However, there was no actual improvement noted in follow-up tests or job satisfaction.

Sagi *et al.*[18] reported on a tele-mentoring programme in India targeting Primary Care Physicians and consisting of both synchronous and asynchronous components. The topic focus was

the detection and early intervention of substance misuse disorders. Authors found a significant improvement over time in self-confidence and satisfaction and determined that tele-mentoring could be helpful for future training.

Eddy *et al*.[16] reviewed teamwork programmes by analysing seven qualitative studies that looked at health professional's experience with teamwork education programmes. In healthcare, teamwork is essential to delivering high-quality patient care, and as no one professional can deliver all the healthcare that a patient needs, those with specific expertise must work together. This review focussed on the experiences of health professionals in acute hospital settings in Australia who participated in teamwork education programmes. Results of the review highlighted six key findings that influence the experience of teamwork education, including organisational culture, understanding team dynamics, the value of education, simulation as a learning opportunity, the influence of educational starting points and increased confidence and motivation with education. The key takeaway from this review was the need to move away from focussing on specific teamwork educational programmes and view them instead as part of a more complex environment.

Of special note was a paper from the Society for Academic Emergency Medicine Virtual Meeting in 2021. The paper by Wetzel[19] discussed The Bridge to Emergency Medicine curriculum, an open-access, flipped classroom curriculum targeting fourth-year medical students planning to enter an emergency medicine residency, to prepare them with essential knowledge and skills in the field. Although this paper did not evaluate the educational outcomes of the learners, nor was it specific to under-resourced areas and so was not included in this review, the programme remains ongoing and could be used as a model for online medical education, particularly in rural and remote environments where expert-led, in-person training could be more difficult to facilitate.

DISCUSSION

Educational programmes from a variety of countries show that there is some effort to increase the body of knowledge and skill acquisition of rural and remote healthcare providers. Most of the interventions in our review centred on POCUS, which is known to be increasing in use in many areas of healthcare,[20] and from as far back as 1985, the WHO was recommending its use in developing countries, citing improved patient management where ultrasound may represent the sole radiologic service.[21] Simulation and hands-on practice were similarly popular ways of educating, and in our review, they were used both as the sole intervention and as part of a larger programme. Simulation training has been shown to be beneficial for many professions, including military personnel and pilots, and is often used by personnel from various health disciplines.[8] It is considered an effective training method with improvements usually noted in knowledge, skills and behaviours.[10]

Significant differences exist between rural and urban populations and rural decision-makers are often faced with numerous challenges regarding the availability, capacity, sustainability and performance of health systems in rural and remote areas.[22] For the past 30 years, there has been an increasing emphasis on basing clinical practice on the best available evidence to ensure the best possible outcomes for patients. Several landmark reports and studies in the early 2000s called attention to patient safety and quality care and a key component that came from these reports is the understanding that quality care is knowledge based. National databases such as the Canadian Institute for Health Information contain many examples of inadequate or unnecessary practices in Canada and studies from the US, the Netherlands and Australia have shown that up to 50% of patients may be getting ineffective care.[23] In low- and middle-income countries, more than 8 million deaths are attributed to poor quality of care – something that can be improved by healthcare workers who are able to work at their optimal capacity, within strong, knowledgeable teams. Safe staffing and education, both pre-service and ongoing, correlate with patients' reduced length of stay and lower incidence of adverse events and overall mortality.[1]

It is worth noting as well that the COVID-19 pandemic forced either the cancellation of continuing medical education or the fast move into the virtual sphere. Although this was necessary, the drawbacks in terms of networking, time zone differences and technical difficulties were felt across all sectors. Nonetheless, a poll conducted

by Nature of over 900 of their readers indicated that virtual educational opportunities such as meetings and conferences were valued, citing the increased access to information regardless of physical location, decreasing travel costs and lowering the carbon footprint of the attendee.[24] As climate change is unquestionably linked to health, particularly in under-resourced areas,[25] the move to virtual could facilitate both increased access to information for those working in under-resourced areas as well as help lessen the environmental impact of continuing education.

The COVID-19 pandemic has provided the healthcare community with a unique opportunity to rethink pre-pandemic educational practices. The early success of peer-to-peer support programmes developed in Ontario and British Columbia, which allow practitioners in rural and remote environments to connect with specialists or more experienced providers for support and assistance, indicate an eagerness to engage in programmes that are practical, patient-centred and accessible.[26]

While our results are valuable, there is a lack of generalisable models that could be used to develop an educational curriculum for rural and remote healthcare providers. Much of the literature in our review reported on initiatives based in low- and middle-income countries and included smaller sample sizes and used NGOs or volunteers as the instructors of the interventions. The delivery of healthcare is complicated by increasing numbers of patients who present with complex conditions, increasing numbers of patients with chronic diseases and constant organisational or structural changes to healthcare systems,[16] all of which have been exacerbated by the COVID-19 pandemic, in addition to global shortages of nearly all healthcare professions.[27]

To match the current and upcoming needs of all health systems, particularly vulnerable under-resourced systems, significant investment in continuing education and training is required. The WHO is clear – investment in education is key to building leadership and management capacity, optimising return on investment and accelerating and sustaining jobs.[1]

According to data extracted from the WHO's National Health Workforce Accounts, in 2020, there were 65.1 million health workers, tallied from numbers of doctors, pharmacists, dentists, midwives, nurses and others. Of these available health workers, one-fifth of the world's population has access to nearly half of these health professionals, with an estimated current global shortage of 15.4 million and an estimated global shortage projected for 2030 of 10.2 million.[28] This highlights the need for investments in the healthcare workforce, particularly in under-resourced areas, especially given the effects of the COVID-19 pandemic on health workers across the globe.

The COVID-19 pandemic forced innovation in shifting some face-to-face patient care encounters to a virtual delivery model, with emerging evidence that this was effective. There is a similar opportunity now for continuing medical education and the development of low-cost, high-impact educational interventions that can be tailored to the unique needs of the rural, remote and under-resourced healthcare providers. Increasing the educational opportunities of these healthcare providers will work to increase a collective knowledge base specific to these areas, contribute to job satisfaction and retention and ultimately improve patient care.

Limitations

As with all Rapid Reviews, speed was prioritised over comprehensiveness. The lack of involvement of stakeholders in developing a protocol was a clear limitation and was done in the interest of time and resources. Topic refinement and protocol development were guided by topic literature and background information. In this review, using three databases and including articles from the previous 20 years was intentionally chosen to be as thorough as possible within the limits of a rapid review. Limiting to English language studies only could have led to missed articles, especially given the high number of included studies that took place in countries where English is not the primary spoken language. Due to the ongoing nature of the COVID-19 pandemic, it is likely that there are educational initiatives that would be accessible to practitioners in under-resourced areas that were not included in this review. These were all limitations that were balanced with the timely need for a review of this topic, and the limited resources that are afforded to rural and remote areas globally.

CONCLUSION

Despite an extensive search over a long period, the body of literature on educational initiatives in under-resourced areas is remarkably small and incomplete. This is more likely due to the focus being on the rural and remote environment where resources, both human and financial, are much lower than in urban areas, rather than indifference on the part of researchers. This review suggests that hands-on or simulation-style learning is generally well received and produces positive results in both knowledge and skills.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

REFERENCES

1. Increasing Access to Health Workers in Remote and Rural Areas through Improved Retention. World Health Organization; 2010. Available from: https://www.who.int/publications/i/item/increasing-access-to-health-workers-in-remote-and-rural-areas-through-improved-retention. [Last accessed on 2023 Feb 10].
2. Services NACORHAH. Social Determinants of Health. National Advisory Committee on Rural Health and Human Services; 2017. Available from: https://www.hrsa.gov/sites/default/files/hrsa/advisory-committees/rural/2017-social-determinants.pdf. [Last accessed on 2023 Feb 05].
3. Levett-Jones TL. Continuing education for nurses: A necessity or a nicety? J Contin Educ Nurs 2005;36:229-33.
4. Kramer M, Schmalenberg C. Development and evaluation of essentials of magnetism tool. J Nurs Adm 2004;34:365-78.
5. King VJ, Stevens A, Nussbaumer-Streit B, Kamel C, Garritty C. Paper 2: Performing rapid reviews. Syst Rev 2022;11:151.
6. Garritty C, Gartlehner G, Nussbaumer-Streit B, King VJ, Hamel C, Kamel C, *et al*. Cochrane rapid reviews methods group offers evidence-informed guidance to conduct rapid reviews. J Clin Epidemiol 2021;130:13-22.
7. Morris ZS, Wooding S, Grant J. The answer is 17 years, what is the question: Understanding time lags in translational research. J R Soc Med 2011;104:510-20.
8. Wellcome. Low and Middle Income Countries; 2022. Available from: https://wellcome.org/grant-funding/guidance/low-and-middle-income-countries. [Last accessed on 2023 Feb 05].
9. Bhattacharyya R, Al-Obaidi B, Sugand K, Bhattacharya R, Gupte CM. Evaluating the effectiveness of the Imperial Femoral Intramedullary Nailing Cognitive Task Analysis (IFINCTA) tool in a real-time simulation setting (distributed interactive simulation): A randomized controlled trial. Injury 2021;52:3420-6.
10. Morato TM, Mendes PH, Ghosn DS, Couto TB, Mai PV, Farhat SC, *et al*. Teaching medical students to choose wisely through simulation. Eur J Pediatr 2022;181:1125-31.
11. Stolz LA, Muruganandan KM, Bisanzo MC, Sebikali MJ, Dreifuss BA, Hammerstedt HS, *et al*. Point-of-care ultrasound education for non-physician clinicians in a resource-limited emergency department. Trop Med Int Health 2015;20:1067-72.
12. Sabatino V, Caramia MR, Curatola A, Vassallo F, Deidda A, Cinicola B, *et al*. Point-of-care ultrasound (POCUS) in a remote area of Sierra Leone: Impact on patient management and training program for community health officers. J Ultrasound 2020;23:521-7.
13. Rominger AH, Gomez GA, Elliott P. The implementation of a longitudinal POCUS curriculum for physicians working at rural outpatient clinics in Chiapas, Mexico. Crit Ultrasound J 2018;10:19.
14. Bidner A, Bezak E, Parange N. Evaluation of antenatal point-of-care ultrasound (POCUS) training: A systematic review. Med Educ Online 2022;27:2041366.
15. Gill CJ, Le Ngoc B, Halim N, Nguyen Viet H, Larson Williams A, Nguyen Van T, *et al*. The mCME project: A randomized controlled trial of an SMS-based continuing medical education intervention for improving medical knowledge among Vietnamese community based physicians' assistants. PLoS One 2016;11:e0166293.
16. Eddy K, Jordan Z, Stephenson M. Health professionals' experience of teamwork education in acute hospital settings: A systematic review of qualitative literature. JBI Database System Rev Implement Rep 2016;14:96-137.
17. Sabin LL, Larson Williams A, Le BN, Herman AR, Viet Nguyen H, Albanese RR, *et al*. Benefits and limitations of text messages to stimulate higher learning among community providers: Participants' views of an mHealth intervention to support continuing medical education in Vietnam. Glob Health Sci Pract 2017;5:261-73.
18. Sagi MR, Aurobind G, Chand P, Ashfak A, Karthick C, Kubenthiran N, *et al*. Innovative telementoring for addiction management for remote primary care physicians: A feasibility study. Indian J Psychiatry 2018;60:461-6.
19. Wetzel TV. Bridge to emergency medicine: A virtual medical student curriculum for flipped classroom learning during the COVID-19 pandemic. Acad Emerg Med 2021;28 (SUPPL 1): S399.
20. Hashim A, Tahir MJ, Ullah I, Asghar MS, Siddiqi H, Yousaf Z. The utility of point of care ultrasonography (POCUS). Ann Med Surg (Lond) 2021;71:102982.
21. Future us of New Imaging Technologies in Developing Countries. World Health Organization; 1985. Available from: https://iris.who.int/handle/10665/40297? and locale-attribute=de. [Last accessed on 2023 Feb 10].
22. Canadian Institute for Health Information (CIHI). Rural health care in Canada. 2022. Available from: https://www.cihi.ca/en/topics/rural-health-care-in-canada. [Last accessed on 2023 Feb 12].
23. Harrison M, Graham ID. Knowledge Translation in Nursing and Healthcare. A Roadmap to Evidence-Informed Practice. 1st ed. Hoboken: John Wiley and Sons Inc; 2021.
24. Remmel A. Scientists want virtual meetings to stay after the COVID pandemic. Nature 2021;591:185-6.
25. Ebi KL, Vanos J, Baldwin JW, Bell JE, Hondula DM, Errett NA, *et al*. Extreme weather and climate change: Population health and health system implications. Annu Rev Public Health 2021;42:293-315.
26. Dubois S. Rural ER Docs are Struggling to Do it All. Peer Support Programs Try to Lessen the Load CBC News; 2023.
27. Health Workforce. World Health Organisation. Available from: https://www.who.int/health-topics/health-workforce#tab=tab_1. [Last accessed on 2023 Feb 10].
28. Boniol M, Kunjumen T, Nair TS, Siyam A, Campbell J, Diallo K. The global health workforce stock and distribution in 2020 and 2030: A threat to equity and 'universal' health coverage? BMJ Glob Health 2022;7:e009316.