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COMMENTARY

A case for mandatory ultrasound training for rural general practitioners: a commentary

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ABSTRACT:

Context: Point-of-care ultrasound is a rapidly evolving technology that enables rapid diagnostic imaging to be performed at a patient's bedside, reducing time to diagnosis and minimising the need for patient transfers. This has significant applications for rural emergency and general practice, and could potentially prevent unnecessary transfers of patients from rural communities to more urban centres for the purpose of diagnostic imaging, reducing costs and preventing disruption to patients' lives. Meta-analyses on point-of-care ultrasound have reported extremely high sensitivity and specificity when detecting lung pathology, and the potential applications of the technology are substantial. A significant application of the technology is in the care of rural paediatric patients, where acute lower respiratory pathology is the most common cause of preventable deaths, hospitalisations, and emergency medical retrievals from remote communities for children under five.

Issues: Although widely available, point-of-care ultrasound technology is not widely utilised in Australian emergency departments and general practices. Issues with comprehensive training, maintenance of skills, upskilling and quality assurance programs prevent physicians from feeling confident when utilising the technology. In Canada, point-of-care ultrasound training is part of the core competency training in the Royal College of Physicians of Canada emergency medicine fellowship program. Point-of-care ultrasound is widely used in rural practice, although lack of training, funding, maintenance of skills and quality assurance were still listed as barriers to use.
Lessons learned: Point-of-care ultrasound is a highly sensitive and specific technology with wide potential applications. Issues with quality control and maintenance of skills are preventing widespread use. Coupling point-of-care ultrasound with telemedicine could help increase the usability and accessibility of the technology by reducing the issues associated with maintenance of skills and quality assurance.

Keywords:

Australia, diagnostic imaging, paediatric diagnostic imaging, patient transfers, point-of-care ultrasound, rural medicine, telemedicine, training protocol.

FULL ARTICLE:

Context

Point-of-care ultrasonography (POCUS) is a rapidly evolving technology that allows imaging studies to be performed at a patient's bedside[1]. POCUS can be used to answer focused clinical questions, narrow down differential diagnoses and decide on an appropriate course of action for the patient[1]. POCUS provides numerous benefits, including minimal lag time with clinical correlation, ease of repeat imaging and reduced need for transferring critically unwell patients[1,2]. Studies have found that POCUS usage improved patient satisfaction, physician-patient relationship and physicians' confidence in diagnosis and treatment decisions[3,4]. The technology has rapidly evolved over the last decade to be more affordable, durable, portable, and to have higher image resolution[1,5]. Studies have also shown ultrasound to have greater sensitivity, specificity and accuracy than other imaging modalities for certain pathologies, specifically pneumonia and pneumothoraces[6,7]. POCUS is now routinely used in low- and middle-income countries to provide first-line diagnostic imaging, with applications in numerous fields of medicine[8]. In Australia, POCUS is routinely available in emergency departments and has been found to be a valuable, if underutilised, diagnostic imaging modality, particularly for presentations of acute chest or abdominal pain[9].

Issues

The health disparity between populations in major cities and rural and remote areas is a significant societal problem. In 2018, the Australian Institute of Health and Welfare reported that people living in rural or remote areas have shorter lifespans, higher levels of disease and increased rates of potentially preventable hospitalisations and emergency department presentations[10]. One factor contributing to this health disparity is unequal distribution of health services around Australia. The Australian Government inquiry into the accessibility of diagnostic imaging services and equipment found widespread geographical disparities in access to diagnostic ultrasound, CT, MRI and nuclear medicine imaging around Australia, as well as higher out-of-pocket expenses for regional residents[11]. The findings concur with the 2016 survey by the Australian Institute of Health and Welfare of patients' experience and access to diagnostic imaging services in the past 12 months, where lack of a facility nearby was the given reason why 44% of rural residents surveyed did not access X-ray or other scans despite one being ordered[12]. Additional costs such as travel, accommodation, absence from work and child care may also be pertinent if a remote resident is required to travel a significant distance to access these services. Lack of timely access to diagnostic imaging services within rural and remote communities can mean delayed diagnosis and potential misdiagnosis.

Access to diagnostic imaging services is unequally distributed not only physically and geographically, but also in terms of access to technicians and specialists who are able to operate the equipment and interpret the results[11]. Attracting and retaining radiologists, sonographers and diagnostic imaging technicians in rural or remote areas is a challenge[11]. A submission by the Australasian Society for Ultrasound in Medicine for the Australian Government inquiry highlighted a chronic shortage of trained sonographers[11]; the resultant shortage is felt disproportionately in rural areas, as currently only 14% of radiologists in Australia are based outside of metropolitan areas[13,14]. This results in accessibility issues, and places significant strain on those services that are available within the community[14].

Interviews from rural general practitioners on their satisfaction with their patients' access to diagnostic imaging services reported promptness and reliability of services, equipment and equipment maintenance, access to training and after-hours access as issues relevant to their communities[14]. The study authors reported that lack of available services within rural and remote communities requires medical practitioners to justify pragmatic decisions on whether to advise patients to travel long distances to a major public hospital for after-hours services[14].

A study in the Northern Territory examined the number of patient transfers between Katherine and Darwin based on a lack of CT imaging services in Katherine[15]. This study found that, in a 2-month period, 74 patients were transferred to obtain a CT scan over a distance of 300 km between the Katherine District Hospital and the Royal Darwin Hospital[15]. The need for transfer delayed their timely diagnosis and treatment significantly, with an average wait time from accident to CT scan of 27.7 hours, and median wait time of 18 hours (well past the clinically recommended 8-hour wait

time)[15]. The cost of transfer for these 74 patients amounted to A$213,407, extrapolated to an estimated cost of $1.28 million per year[15]. Transfer for imaging is not unique to Katherine, such scenarios occurring routinely throughout regional and remote Australia where patients have to be transferred out of their communities for diagnostic imaging services not available in their catchments[11,15].

Point-of-care ultrasound for paediatric patients

One significant potential application of POCUS is in the care of rural paediatric patients. The challenges associated with transfers between facilities are particularly relevant for paediatric patients as often parents and families are required to travel with their child to a more urban centre for imaging, disrupting families' lives and potentially placing further financial strain on the family. The need for transfer also delays treatment and deprives the child and their family of a major hallmark of rural clinical practice: continuity of care. Acute lower respiratory infections are the most common cause of preventable deaths, hospitalisations and emergency medical retrievals from remote communities in children under five in Australia, with pneumonia being the leading cause of death worldwide for the same age group[16-20]. Respiratory conditions can be difficult to differentiate clinically, which can lead to misdiagnosis or serious conditions if they remain undetected and untreated[2,21].

Lessons learned

Point-of-care lung ultrasound is emerging as an attractive radiation-free alternative to chest radiography for the diagnosis of paediatric lung conditions in Europe and the USA[2,22], and can be used to confirm chest consolidation or complications such as empyema and abscesses[5-8]. Lung ultrasound as an imaging modality is particularly well suited to paediatric patients, as the anatomy of the thorax in young children provides many acoustic windows into the chest[23]. Incomplete ossification of the sternum allows for analysis of the anterior thorax and mediastinum, providing a more complete picture of the lung compared with ultrasound imaging of adult lungs[23].

Meta-analyses have found the sensitivity and specificity of lung ultrasound to be very high, and have suggested that lung ultrasound be the first-line imaging technique for children with suspected pneumonia[2,21,22,24]. Heuvelings et al (2018) performed a meta-analysis of 18 studies totalling 2031 paediatric patients, and found lung ultrasound to have a sensitivity of 95% and specificity of 96.1%[2]. Balk et al (2018) analysed 12 studies totalling 1510 children, finding lung ultrasound to have a sensitivity of 95.5% and specificity of 95.3%[21]. Similar analyses reported similar sensitivity and specificity for the detection of pneumonia[24,25].

Aside from detecting lung consolidation, ultrasound can be used to differentiate between bronchiolitis and reactive airway disease, diagnose pneumothorax, pleural effusion, atelectasis, exacerbations of chronic obstructive pulmonary disease, and as a screening method for early diagnosis of respiratory distress syndrome[26-29]. The multiple potential uses, high diagnostic sensitivity and specificity, and portability make POCUS well suited to use in rural general practice and emergency department settings.

Barriers and enablers to POCUS

Given the benefits and multiple applications, the question becomes about why POCUS is not more widely used in resource-limited settings in Australia. It was estimated that in Melbourne emergency departments POCUS could be beneficial in 32.2% of presentations, yet was only performed on 2.1% of patients[9]. The researchers attributed the low utility to limited clinical expertise[9]. In Canada, POCUS is widely used in emergency departments, and POCUS training is part of the core competency training in the Royal College of Physicians of Canada emergency medicine fellowship program[3,4,30,31]. Almost all emergency departments in rural Quebec have access to portable ultrasound devices, with the majority of physicians reporting use of the technology[32]. The most common reason given (73%) for Canadian physicians not using POCUS was a lack of training, with 12% reporting difficulty in maintaining skills[32]. Physicians reported concerns about liability due to lack of formal quality assurance programs to evaluate the images produced[31]. Other barriers limiting use in Canada were identified as lack of funding, equipment and maintenance of skills[30,31]. Similar issues could be extrapolated to POCUS use in Australia.

Although the cost of a portable ultrasound machine can be less than A$4500, costs are also associated with training practitioners in the production of high-quality images and interpretation of results. The Australian Institute of Ultrasound offers a 2-day course in point-of-care lung ultrasound for $2150; however, the maintenance of skills and upskilling must also be considered if POCUS is to be introduced more broadly into rural practice. There is also no consensus on the level of training required for practitioners to safely operate and interpret POCUS. Reports on the diagnostic accuracy of experts compared with novice sonographers using POCUS are varied, with some reviews finding novice operators could obtain sufficient diagnostic results after only a short training period[21,25], while others find a significant difference in the diagnostic accuracy between advanced and novice sonographers[2,24].

Telemedicine

One possible solution to issues of quality assurance and maintenance of skills is to couple POCUS with telemedicine[33]. Telemedicine can combat obstacles of geographic distance, as it enables a novice practitioner to consult with an expert in a tertiary centre in real time[33]. The expert sonographer is able to guide the novice to produce high-quality images and interpreting the results, and guide further patient care, thus functionally expanding rural access to clinical support[31,33]. The Australian College of Rural and Remote Medicine reported that telemedicine has been increasing accessibility and healthcare equity in regions where it is difficult to recruit and retain diagnostic imaging technicians[11]. Images of high quality can be transmitted via audiovisual technology, with studies notably finding that minimally trained physicians or healthcare workers can acquire high-quality ultrasound images under the

guidance of a remote physician[34-36]. Zennaro et al (2016) investigated the accuracy of diagnostic POCUS for paediatric emergency patients when performed by paediatricians under remote guidance of radiologists[34]. Of 170 ultrasound findings, sensitivity was found to be 93.8% and specificity 99.7%, with this method producing reliable and timely diagnoses[34].

Limitations for telemedicine include availability of high-bandwidth internet or cellular connections to enable high image quality, availability of an expert to consult with, and technical issues resulting in poor quality images[31]. Additionally, the Australian Society of Medical Imaging and Radiation Therapy highlighted that often images coupled with telemedicine were not added to patient electronic health records, which makes comparison with earlier scans difficult[11]. A new technology developed by Philips that represents a significant development in tele-ultrasound is Lumify, a portable ultrasound transducer coupled to an app via USB connection port, which can be used for acute care and internal medicine[37]. Another recent advancement is using artificial intelligence-based tools to improve the speed and ease of POCUS by aiding the user in achieving excellent image optimisation, potentially minimising quality assurance issues for novice sonographers[38]. Advances such as these are increasing the usability and accessibility to POCUS, and have significant applications in resource-limited locations where they can help support physicians, reduce costs associated with unnecessary patient transfers, and decrease wait times from presentation to diagnosis and definitive treatment[39].

Conclusion

Provision of equitable healthcare services for rural and remote communities should be a priority. Access to timely diagnostic imaging services, particularly in regards to access to experienced specialists and technicians, is a challenge uniquely experienced by rural communities due to geographic spread and low population density. POCUS provides a solution to minimise unnecessary patient transfers for diagnostic imaging. Based on studies in Canada, mandatory training in POCUS should be considered for rural practitioners[3,4,30,31]. Considering the possibility of coupling POCUS with telemedicine, training rural physicians in the use of POCUS and implementing quality control and skills maintenance programs could prevent the unnecessary transfer of patients and the associated disruption to families and communities, decrease time to diagnosis and treatment, and maintain continuity of care, thus preserving one of the core principles of rural practice.

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