

# Barriers to point-of-care ultrasound use in rural emergency departments

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## ABSTRACT

Over the past few decades, point-of-care ultrasound (PoCUS) has come to play a major role in the practice of emergency medicine. Despite its numerous benefits, there has been a slow uptake of PoCUS use in rural emergency departments. Surveys conducted across Canada and the United States have identified a lack of equipment, training, funding, quality assurance, and an inability to maintain skills as major barriers to PoCUS use. Potential solutions include expanding residency training in ultrasound skills, extending funding for PoCUS training to rural physicians in practice, moving PoCUS training courses to rural sites, and creating teleultrasonography training for rural physicians. With these barriers identified and solutions proposed, corrective measures must be taken so that the benefits of PoCUS are extended to patients in rural Canada where, arguably, it has the greatest potential for benefit when access to advanced imaging is not readily available.

## RÉSUMÉ

Le rôle de l'échographie au point de service (EPS) a gagné beaucoup d'importance en médecine d'urgence au cours des dernières décennies. Malgré ses nombreux avantages, son utilisation dans les services des urgences en milieu rural se fait lentement. Des enquêtes menées partout au Canada et aux États-Unis ont révélé des obstacles importants à son utilisation, soit le manque d'appareils médicaux, de formation, de financement et d'assurance de la qualité ainsi que l'incapacité de garder à jour les compétences acquises. Différentes solutions possibles ont été envisagées, en particulier l'enrichissement de la formation au niveau de la résidence en ce qui concerne les compétences en échographie, l'élargissement

du financement de la formation en EPS aux médecins qui pratiquent déjà en milieu rural, la possibilité d'offrir des cours de formation en milieu rural et l'élaboration de cours en télé-échographie à l'intention des médecins qui travaillent en milieu rural. Maintenant que les obstacles à l'utilisation de l'EPS ont été cernés et que des solutions ont été proposées, des mesures correctrices s'imposent afin que les malades en milieu rural, au Canada, puissent profiter, eux aussi, de ce type d'examen, là où il est permis de penser que la technologie offre le plus d'avantages et où les examens évolués par imagerie ne sont pas rapidement et facilement utilisables.

## INTRODUCTION

Approximately 20% of Canadians live in rural or remote regions of the country.<sup>1</sup> Despite the accessibility clause of the Canada Health Act, major disparities in access to diagnostic imaging exist across the country in rural emergency departments (EDs).<sup>2</sup> In a survey of Canadian rural EDs, 97% have access to X-ray, but only 20% have access to a CT scanner and only 28% have access to formal ultrasound services. If advanced imaging is required, 44% of these rural EDs would need to transfer their patients upwards of 300 km to a nearby trauma centre resulting in significant delays to definitive care.<sup>3</sup> This is even more concerning in the context of rural residents having a higher prevalence of acute and chronic illness as well as greater risk for trauma and trauma death compared to their urban counterparts.<sup>4,5</sup> A potential solution may exist with an imaging modality that is cost-effective, noninvasive, easily accessible, contrast-free, requires no special preparation of the patient, decreases time to diagnosis,<sup>6</sup> decreases patient ED length of stay,<sup>7</sup>

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decreases time to operative care,<sup>8</sup> and improves acute care outcomes<sup>9</sup>—that is, point-of-care ultrasound (PoCUS).

In 2005, Lyon et al. demonstrated the beneficial effects that PoCUS has on rural ED decision-making in that it clarified the clinical situation by reducing the number of differential diagnoses, altering patient management in 74% of cases. In nearly 10% of cases, PoCUS suggested diagnoses that were not originally considered and led to more definitive diagnoses, which avoided the need to transfer patients to larger centres for further imaging in 53% of cases. This also avoided the unnecessary use of ambulances required to transfer these patients in communities where ambulance services are limited.<sup>10</sup> Furthermore, numerous international studies illustrate the benefits of PoCUS in rural and remote settings, which could parallel the situation in rural Canada.<sup>11-13</sup> Clearly there are multiple advantages to performing PoCUS in the rural ED; moreover, the Canadian Association of Emergency Physicians (CAEP), in their 2012 Position Statement, has encouraged access to PoCUS 24/7/365 in the ED.<sup>14</sup> However, despite the numerous benefits offered by PoCUS in the rural ED setting, several barriers to its use remain.

#### **LACK OF EQUIPMENT**

A survey of rural Ontario physicians conducted by Flynn et al. in 2012 (with a low response rate of 28%) reported that approximately 40% did not have an ultrasound machine available in the ED.<sup>15</sup> Of the Ontario physicians surveyed, a majority (66%) believed that the ultrasound machine should be paid for by the hospital (66%), followed by the Ministry of Health and Long-Term Care (24%), and the community (8%). A needs assessment of PoCUS in rural Newfoundland conducted by Warren et al. at Memorial University in 2013 identified that 73% of category A (rural with 24-hour access) EDs had ultrasonography available, whereas category B (call back) EDs only had 4% availability.<sup>16</sup> In stark contrast to Ontario and Newfoundland, a survey of rural ED physicians in Quebec by Léger et al. in 2014 revealed that PoCUS was available in 95% of rural EDs.<sup>17</sup> Variable access to bedside ultrasound in rural EDs also exists in the United States. One survey of ED directors in Colorado, Georgia, Massachusetts, and Oregon reported that only 39% of rural EDs had access to bedside ultrasound.<sup>18</sup> However, another survey of American rural emergency physicians (with a low response rate of 18%) in the

WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) region conducted by Bellows et al. in 2015 discovered that 96% had access to an ultrasound machine in the ED.<sup>19</sup>

#### **LACK OF TRAINING**

Flynn et al. revealed that 71.5% of rural Ontario emergency physicians agreed or agreed strongly that PoCUS is a skill that rural emergency medicine physicians should possess, but less than half (44.4%) knew how to perform ultrasonography, with 77.3% of these physicians stating they had inadequate training.<sup>15</sup> Warren et al. identified that 98.8% of physicians in rural Newfoundland and Labrador believed that PoCUS was very or somewhat important to the practice of emergency medicine, but only 24% of those physicians in category A rural EDs and 0% in category B had formal training in PoCUS with 94% of them being very or somewhat interested in additional training.<sup>16</sup> Léger et al. discovered that 95% of respondents believed that PoCUS was essential for rural ED practice, but 24% of physicians did not use PoCUS on a regular basis with the most common reason for lack of use being limited access to training programs.<sup>17</sup> In the WWAMI region of the United States, 62% of surveyed rural physicians identified a lack of training as a barrier to PoCUS use, with 35% having difficulty with image interpretation. A majority of these physicians (80%) were interested in a PoCUS course if offered at their site with many (64%) also being interested in a distance learning program.<sup>19</sup>

#### **LACK OF FUNDING**

Currently, physicians must pay to complete training courses such as Emergency Department Targeted Ultrasound (EDTU), Emergency Department Echo (EDE), or Emergency and Critical Care Ultrasound (ECCU). These courses can be costly (Table 1). Of the Ontario physicians surveyed, 11.8% identified cost as a barrier to training, whereas Bellows et al. discovered cost to be an issue for nearly 20% of the surveyed physicians in the WWAMI region.<sup>19</sup> More than two-thirds of the Ontario survey respondents believed that funding for PoCUS training should come from a source other than the physician, including the Ministry of Health and Long-Term Care, hospital, Ontario Medical Association, community, or other sources.

**Table 1. Approximate cost of point-of-care ultrasound training courses**

Point-of-care ultrasound course	Cost (approx.)
EDE	\$1,600
EDE Bootcamp*	\$4,400
EDE 2	\$2,475
EDE 3	\$2,147
EDTU*	\$3,500
ECCU 1	\$950
ECCU 2	\$1,950
ECCU IP School	\$850

\*EDE Bootcamp and EDTU allow participants to complete all 200 scans required for PoCUS competency. EDE Bootcamp also allows for completion of the required practical, visual, and written examinations for CEUS IP certification.

Of the physicians who paid for training out of their own pockets, 59% received training from EDE, 15% received training from CAEP, and 20% received training from other sources.<sup>15</sup> The numbers identified by Léger et al. were similar, with 64% receiving training from the Canadian Emergency Ultrasound Society (CEUS), 13% receiving training from CAEP, and 23% receiving training from other courses. Interestingly, only 40% of rural PoCUS users received training within their medical curriculum.<sup>17</sup>

### INABILITY TO MAINTAIN SKILLS

Another major hurdle was the maintenance of skills in PoCUS after rural physicians completed their initial training and returned to their respective practices. With lower patient volume, rural physicians may not have the opportunity to obtain competency in the learned skills or maintain them over time.<sup>20</sup> CEUS and other PoCUS certifying courses, such as EDTU and ECCU, require at least 50 determinate scans in each of the four domains of focused assessment with sonography in trauma (FAST), subxiphoid cardiac view for pericardial effusion, trans-abdominal scan for abdominal aortic aneurysm, and pelvic scan for confirming intrauterine pregnancy. Physicians must then complete visual, written, and practical exams to achieve independent practitioner (IP) status. Flynn et al. discovered that 44% of the rural ED physicians surveyed did not perform PoCUS because of the difficulty maintaining skills. Only 12% of physicians used PoCUS more than once per week, with 31% using it less than once per week and 21% at least once per shift.<sup>15</sup> Warren et al. identified that 73.9% of physicians performed less than 10 scans per month, whereas only 3.4% performed more than

30 scans.<sup>16</sup> Similarly, Léger et al. discovered only 76% of physicians reported using PoCUS regularly.<sup>17</sup>

### LACK OF QUALITY ASSURANCE

It has been noted in the literature that physicians may avoid using PoCUS due to a fear of litigation.<sup>21</sup> This may be partly due to the lack of quality assurance programs available in EDs using PoCUS where physicians are not able to receive feedback with the quality of scans produced and the integration of findings into clinical decision-making. This issue was addressed in the CAEP 2006 Position Paper, but many rural EDs continue to lack any formal quality assurance programs.<sup>22</sup> Concerns about liability were identified as a major barrier to PoCUS use for 33% of American rural ED physicians in the WWAMI region, with 63% reporting no formal quality assurance process for image review.<sup>19</sup> This has been a major concern for radiologists who cite a possible lack of appropriate training, assessment, and quality image generation with the widespread use of PoCUS resulting in compromised patient safety.<sup>23,24</sup> Interestingly, two studies spanning over 25 years of American legal cases did not report a single case against an emergency physician who failed to interpret or made a misdiagnosis using PoCUS but did report six successful cases against physicians who failed to perform PoCUS when it was within their scope of practice, leading to the delayed diagnoses and patient demise.<sup>25,26</sup> Although it is inevitable that a physician error will eventually occur with the use of ultrasound by inexperienced physicians, it is also clear that the benefits seem to greatly outweigh the purported harm. Physicians are encouraged to use PoCUS with the standards set by CEUS, CAEP, and other local associations to minimize the risk of error.

### CORRECTIVE MEASURES

As of 2012, 100% of Royal College and 88% of College of Family Physicians emergency medicine programs have included formal PoCUS training as part of their curriculum.<sup>27</sup> As emergency medicine residents graduate from these programs and become champions for PoCUS in their respective rural EDs, this is likely to increase the availability of PoCUS in rural hospitals. Furthermore, of the emergency physicians surveyed nationwide by Woo et al., more than 80% predicted future use of PoCUS.<sup>20</sup>

An area that needs to be addressed is the training of rural family medicine residents in PoCUS. Of the Quebec physicians working in rural EDs responding to Léger et al., 93% were family physicians.<sup>17</sup> The American Academy of Family Physicians (AAFP) released a statement in 2013 addressing ultrasound use as an area of competency for rural family physicians, but the College of Family Physicians of Canada has yet to make a similar statement for Canadian family physicians.<sup>28</sup> Despite the statement made by the AAFP, in 2014 the Council of Academic Family Medicine Educational Research Alliance surveyed family medicine residency program directors to discover that only 2% of residency programs reported an established ultrasound curriculum. However, it is promising that 29% of the programs reported establishing a curriculum within the past year with a further 11% in the process of developing ultrasound training.<sup>29</sup> As of October 2014, the Memorial University of Newfoundland (MUN) began to integrate a formal PoCUS curriculum into the family medicine residency program with positive outcomes for rural patients already being realized.<sup>30</sup>

In addition to training new family medicine graduates in PoCUS, there should also be a concerted effort by various entities, from rural communities/hospitals to health authorities to residency training programs, to encourage existing rural physicians to receive training in PoCUS. This can include subsidies for physicians to attend PoCUS courses as well as moving these courses from tertiary centres to rural sites. These costs can be justified by the savings seen when PoCUS is used. Although financial data is lacking for the ED setting, Testa et al. (2015) performed an economic analysis of bedside ultrasonography use in the internal medicine department that demonstrated overall cost savings after 734 ultrasound examinations had been performed, which occurred after 406 days of use.<sup>31</sup>

Another possible solution is the implementation of telesonography, whereby a rural health care provider untrained in ultrasound is coached remotely in real-time by a trained physician to produce images and guide patient care. This was first piloted by the National Aeronautics and Space Agency (NASA) at the International Space Station before being tested terrestrially.<sup>32</sup> Assuming instant availability of a trained physician at any time to “tele-mentor,” this method could be both accurate and feasible.<sup>33-39</sup> However, limitations include mentor availability, a need for high-bandwidth Internet or cellular connections to maintain image quality, and technical

problems such as image freezing.<sup>39,40</sup> Its effectiveness in clinical use has not yet been studied in rural Canada. In fact, one of our authors (KS) can confirm that in Nunavut, neither high-bandwidth Internet nor data-capable cellular connections are available.

## CONCLUSION

Despite the numerous benefits of PoCUS, there have been many challenges in translating its use to rural EDs. Recent surveys highlight multiple reasons for this, including a lack of available hardware, lack of physician training, lack of funding, an inability to maintain learned skills, and lack of quality assurance. Potential solutions include expanding residency training in ultrasound skills, extending funding for PoCUS training to rural physicians already in practice, and creating telesonography training for rural physicians. With these barriers identified and solutions proposed, corrective measures must be taken to ensure that the benefits of PoCUS are extended to patients in rural Canada where, arguably, it has the greatest potential for benefit when access to advanced imaging is not readily available.

**Keywords:** ultrasound, point-of-care, PoCUS, rural, emergency department

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