ORIGINAL ARTICLE

Utilisation and barriers of PoCUS in a rural emergency department – A quality improvement project

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Abstract

Introduction: Point-of-care ultrasound (PoCUS) has been recognised as a tool that leads to more definitive diagnoses and enhances clinical decision-making in rural emergency departments (EDs) where diagnostic imaging is limited. We aimed to determine the current utilisation, barriers and solutions to using PoCUS in this rural Saskatchewan ED.

Methods: Physicians working in the ED participated in a semi-structured interview. An online survey, administered via SurveyMonkey post-interview to provide further context, was used to support qualitative approaches. Interviews were recorded, transcribed and then analysed using inductive interpretation.

Results: Seven physicians completed the quantitative survey with a response rate of 70%. Ten physicians were interviewed with a response rate of 100%. Themes identified were that physicians in this community's ED perceived their skill level as determining whether a scan was diagnostic or not, rather than the specific PoCUS application itself. In addition, they performed scans primarily for the purpose of triage. Inadequate training, *Core IP certification* certification requirement and intradepartmental logistics were barriers to PoCUS utilisation.

Conclusion: This study showed that ED physicians in this community perceived PoCUS as a clinical adjunct and as a tool to triage patients for further imaging. Results highlight the need to have accessible training for rural physicians to increase PoCUS utilisation, awareness of current Saskatchewan PoCUS guidelines and education on diagnostic applications of PoCUS. Increased use of PoCUS for specific scans could decrease the need for formal imaging and the associated healthcare system resources.

Keywords: Access to training, emergency medicine, point-of-care ultrasound, rural

Résumé

Introduction: L'échographie au point d'intervention (ÉPI) est reconnue comme un outil permettant d'établir des diagnostics plus définitifs et d'améliorer la prise de décision clinique dans les services d'urgence ruraux où l'imagerie diagnostique est limitée. Nous avons cherché à déterminer l'utilisation actuelle, les obstacles et les solutions à l'utilisation de l'ÉPI dans ce service d'urgence rural de la Saskatchewan.

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Méthodes: Les médecins travaillant aux urgences ont participé à un entretien semi-structuré. Une enquête en ligne, administrée via SurveyMonkey après l'entretien pour fournir un contexte supplémentaire, a été utilisée pour soutenir les approches qualitatives. Les entretiens ont été enregistrés, transcrits puis analysés à l'aide d'une interprétation inductive.
Résultats: Sept médecins ont répondu à l'enquête quantitative, soit un taux de réponse de 70%. Dix médecins ont été interrogés avec un taux de réponse de 100%. Les thèmes identifiés sont les suivants: les médecins du service d'urgence de cette communauté considèrent que leur niveau de compétence détermine le caractère diagnostique ou non d'un examen, plutôt que l'application spécifique de l'ÉPI. En outre, ils effectuaient des scanners principalement à des fins de triage. Une formation inadéquate, l'exigence d'une certification de *praticien indépendant de base* et la logistique interne au service étaient des obstacles à l'utilisation de l'ÉPI.
Conclusion: Cette étude a montré que les médecins des services d'urgence de cette communauté percevaient l'ÉPI comme un complément clinique et un outil de triage des patients en vue d'un examen d'imagerie plus approfondi. Les résultats soulignent la nécessité d'une formation accessible aux médecins ruraux pour accroître l'utilisation de l'ÉPI, la connaissance des lignes directrices actuelles de l'ÉPI de la Saskatchewan et l'éducation sur les applications diagnostiques de l'ÉPI. L'utilisation accrue de l'ÉPI pour des examens spécifiques pourrait réduire le besoin d'imagerie formelle et les ressources du système de santé qui y sont associées.

Mots-clés: Accès à la formation, échographie au point d'intervention, médecine d'urgence, milieu rural

INTRODUCTION

Rural Canadians have lower life expectancy, higher mortality and higher rates of many acute and chronic illnesses than their urban counterparts.[1,2] They also have higher trauma and trauma-related death rates, with 22.5% of Canadians residing more than 1 h away from a level I or level II trauma centre.[2,3] In Canada, it has been acknowledged that there are major disparities in access to diagnostic imaging between rural and urban centres.[1,3] Twenty per cent of rural emergency departments (EDs) have access to computed tomography (CT) scanners and 28% to ultrasound services.[2,4] This results in the use of inappropriate imaging modalities, such as X-ray, or transferring patients to larger centres, up to thousands of kilometres away, for appropriate imaging such as consultative ultrasound, CT and MRI.[2,5,6] This inaccessibility and associated travel results in significant direct and indirect financial burdens on the healthcare system as well as the individual.[4] In addition, transportation delays due to weather or transport availability can also compromise patient care.[5-8] Thus, a significant barrier to accessible healthcare in rural communities is access to urgent diagnostic imaging, creating a significant disparity between urban and rural populations.[3,6]

Point-of-care ultrasound (PoCUS) has been identified as an important tool in rural settings to assist in clinical decision-making.[3,9] PoCUS reduces time to diagnosis, contributes to definitive diagnoses, alters patient management, improves acute care outcomes and reduces the need for immediate transfer of patients to larger centres for further imaging.[2,5,10] Furthermore, PoCUS is inexpensive, non-invasive and does not require potentially harmful contrast and radiation.[2,11]

In Canada, many physicians providing care in rural EDs are family medicine-trained physicians. Despite the benefits for rural physicians to use PoCUS, and these physicians believing PoCUS to be critical to ED practice, there continue to be disparities in PoCUS use between rural and urban acute care environments. As of 2012, less than half of the physicians working in rural EDs used PoCUS, with lack of training followed by time and departmental flow requirements cited as the primary barriers.[2,12,13] In a survey of Canadian ED physicians, Leschyna *et al*. (2019) demonstrated a strong association between PoCUS utilisation and level of training.[12] Most physicians surveyed (56.6%) received training solely outside of residency, while only 14.8% had received training in residency, with many family medicine residency programmes not having an established PoCUS curriculum.[12,14] Cost of training, scan requirements to receive formal PoCUS qualification and accessibility to training courses are significant barriers to becoming trained.[3,13,15,16] Others have identified challenges with skill maintenance, lack of quality assurance and poor access to equipment (i.e., ultrasound

machine), as barriers to PoCUS utilisation in the rural setting.[2,3,15-19]

To date, there has been 1 published abstract investigating the barriers to adopting PoCUS into practice in rural Saskatchewan EDs.[16] We expanded on their findings by eliciting the voices of physicians working in a specific rural ED, exploring how they utilise PoCUS, perceived barriers to such and possible solutions to overcome those barriers.

METHODS

Methodology

For this quality improvement study, a mixed-methods approach was used with an exploratory sequential research design. Participants first participated in an interview followed by an online survey via SurveyMonkey.[20] Data from both research components were analysed.

Setting

This study was completed in a community hospital in rural Saskatchewan serving 5000–6000 residents, as well as the catchment area population of ~15 000, including Indigenous and farming communities. The 24-h ED is staffed by 1 physician and 1–2 registered nurses per shift. This ED has daytime access to in-house X-ray and laboratory services, and on-call services during the night. In-house formal emergency ultrasound is available from 8 am to 4 pm approximately 3 days per week. The nearest community to access non-emergent formal ultrasound and CT is 158 km by road.

Study participants

Eligible study participants were permanent physicians (i.e., non-locum) who worked in this rural community's ED. Purposive sampling took place due to the small sample size of eligible physicians. The community has been kept anonymous to maintain the anonymity of the research participants.

All participants provided written informed consent for participation in the study. The study was submitted to the University of Saskatchewan Research Ethics Board and was exempted from an ethics review due to quality improvement intent. Despite the obtained ethics exemption, ethical guidelines for conducting research were observed.

Data collection: Qualitative

With consideration of the research questions and pertinence to each objective, interview questions were developed by the primary researchers to help guide the semi-structured interviews. These questions were then reviewed by a qualitative research and knowledge translation specialist to ensure that questions were appropriate and would elicit adequate response. The questions were not piloted due to small sample size.

Interviews took place in a private room in a medical clinic or at the local hospital, and were audio recorded and transcribed using an online artificial intelligence software, Otter.ai.[21] Transcripts were manually edited by the primary investigator to remove repetitive words, filler words, and reviewed for accuracy. Member checking was employed; participants had the opportunity to edit, delete, rephrase or add to their interview transcript.

Data analysis was conducted after all interviews were completed. All physicians consented via written consent to participate. After 10 interviews were completed, no new information or experiences were shared, and enough data were generated to address the objectives of this study.

Data analysis qualitative

Qualitative data analysis was performed by 2 reviewers using inductive interpretation in 5 concise steps, illustrated by Figure 1, to ensure trustworthiness.

Data collection: Quantitative

After completing the interview, all participants were E-mailed a secure link to complete a survey via SurveyMonkey. Participants inputted a unique participant ID to link their survey responses to their interview responses while maintaining anonymity to the researchers. Participants were given 21 days to complete the survey. Two E-mails reminding participants to complete the survey were sent at 7 and 17 days following the

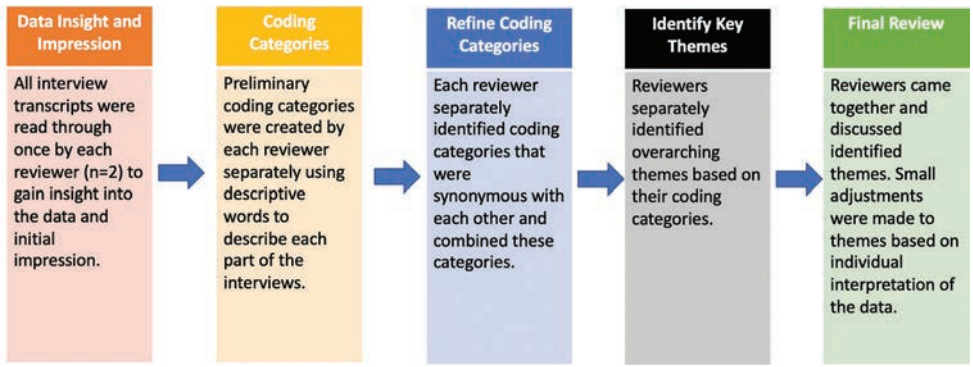


Figure 1: Qualitative analytic process using inductive interpretation.

interview. The survey was comprised of a total of 15 questions, including a mix of open- and close-ended questions. The survey was included in the study design to provide data on participant demographics and gather quantitative data to help support themes elicited through the interviews.

Data analysis: Quantitative

The individual responses from the online survey were compiled and reported as absolute values. Due to the small number of respondents, no statistical analysis was performed.

Researcher characteristics

The research team consisted of 2 medical students immersed in this rural community for 10 months of medical training. They brought with them perspectives influenced by recent clinical experiences in urban centres as well as new knowledge of the barriers that exist in this rural community ED. Each medical student reflected on lived experiences throughout the data analysis. Each had a diverse upbringing in rural and urban settings alike, providing a range of perspectives and insight into the complexity of rural healthcare.

RESULTS

Total participants

Eleven physicians who were permanently working in the ED in this community were approached and 10 of those individuals were interviewed. Of these 10 physicians, 7 of the 10 participated in the online survey.

Participant demographics

Tables 1 and 2 report the participant demographics of interviewed and surveyed participants, respectively.

Themes

Three themes were developed from the semi-structured interviews that address the research objectives – current utility, barriers to utilisation and solutions – and are listed in Table 3.

Objective 1: Current utility

Clinical adjunct

Many participants identified PoCUS as an adjuvant to their clinical examination – 'Almost always as an adjunct. I don't use it as a diagnostic tool. So it's the same as how I use my stethoscope, as part of the clinical examination' (P03). Other physicians stated that they were hesitant to use PoCUS as more than a supportive clinical skill due to lack of qualifications. The consensus was that if someone did not have PoCUS training and certification, they should use PoCUS as a clinical adjunct rather than a diagnostic tool.

Diagnostic tool

Although many physicians were hesitant to identify PoCUS as a diagnostic tool, some indicated they used it as such. Six out of 7 surveyed physicians were comfortable using it to rule in/out particular pathologies that were identified by free fluid or air, such as intra-abdominal bleeding, abscesses, pleural effusions, pericardial effusions and pneumothoraces. Four of the

Table 1: Demographics of participants who were interviewed

Years	Number of interviewed participants (*n*=10)		
	Practising as a physician	Practising in an emergency department	Practising in this community's emergency department
0–5	2	4	6
6–10	2	4	2
11–15	2	-	-
16–20	2	1	2
21–25	-	-	-
26+	2	1	-
Mean (range)	14 (2–28)	9 (2–28)	7 (2–20)

Male:female=5:5

Table 2: Demographics of participants who completed the survey

Years	Number of survey participants (*n*=7)		
	Practising as a physician	Practising in an emergency department	Practising in this community's emergency department
0–5	2	2	3
6–10	2	3	2
11–15	1	-	-
16–20	1	1	2
21–25	-	-	-
26+	1	1	-
Mean (range)	12 (2–28)	11 (2–28)	8 (2–20)

Male:female=4:3

Table 3: Objectives and subsequent themes

Current utility	Barriers to utilisation	Solutions
Clinical adjunct	Inadequate training	Addressing travel, time and cost of training opportunities
Diagnostic tool	Inaccessible training courses	Lateral skill transfer
Triaging patients for urgent tertiary medical management	*Core IP certification* certification requirements and clinical relevance	
	Intradepartmental logistics	

interviewed participants stated that they would use PoCUS as a diagnostic tool if they were more comfortable with PoCUS scans. All 7 participants who completed the online survey indicated that they had encountered scans – recommended by the Canadian Association of Emergency Physicians (CAEP) as essential to practise in an ED – that they wished to perform but did not feel comfortable doing so.

Triaging patients for urgent tertiary medical management

Amongst those who used PoCUS, all could identify an experience where PoCUS allowed for a timely diagnosis of a high-risk presentation and expedited management. They also indicated that it helped triage patients in terms of urgent CT imaging or transport to a larger centre. A participant explained, 'when I look at a gallbladder in the emerg (with PoCUS) and say, 'Oh, this person's got stones and signs of cholecystitis,' then I might be able to expedite that a little bit and be more likely to say, 'I'm going to send this person tonight instead of in four days' (P01). Another participant conferred that PoCUS helps determine, 'how soon this person needs care and what level of care they need' (P10).

Objective 2: Barriers to utilisation

Inadequate training

Six of the interview participants indicated that insufficient training prevented them from using PoCUS and being confident in their findings. This was echoed in the survey results, with 5 of 7 surveyed physicians indicating that a lack of training limited the use of PoCUS in the ED, making it the most frequently cited barrier. One physician indicated that they felt significantly restrained by their lack of knowledge regarding PoCUS, 'Because I haven't had any training, or I am not very comfortable to use (PoCUS)… it's just a matter of user. It's not just a matter of facility or equipment. It's our (lack of) experience' (P08).

Inaccessible training courses

Despite a recognised need for training amongst participants, all cited inadequate access to PoCUS training opportunities as barriers to participate in further training. These were characterised by the high cost of courses, limited course availability and time away from practice resulting in lost income, less availability for patients and increasing workload for colleagues. One physician said, 'Time-because they are 4-day courses, and most of them have happened in Regina. And that's a 5-h drive from here. So, I have to take the full day before off to get there…So it's 5 days that I have to take to do the training' (P01). Another interviewed physician outlined how the cost of the course and time away from practice is a barrier to further training; 'It would have cost me $5,000 for a week, and I wouldn't be able to work. So I lost income plus I paid $5,000 to be able to say I have this qualification, which I couldn't bill for' (P04).

Core IP certification certification requirements and clinical relevance

Many of the physicians had completed the ED Echo (EDE) One course but did not receive certification, citing difficulty achieving the required number of supervised scans. While 1 interviewed physician repeated the EDE One course to achieve the number of necessary supervised scans and receive their certification, they found this to be a costly endeavour. Another participant echoed this sentiment, 'I think it's really hard for people to go back (to complete scans)…to have a provider come here, it was very expensive. To have somebody come and watch scans… it was like thousands of dollars' (P05). Eight of the interviewed physicians cited completing the number of supervised scans to receive certification as difficult and very expensive. Furthermore, all physicians stated that they did not receive formal ultrasound training in residency. Of those who were exposed to PoCUS during residency, it was completed informally by preceptors during clinical rotations.

Three interviewed physicians were hesitant to say obtaining core IP certification, a cerfitication which is provided by Candian Point of Care Ultrasound Society to facilitate independet use of PoCUS in practice, would alter how they used PoCUS in the rural ED. One physician stated, 'I think there needs to be more clarification regarding - does (Core IP certification) ultimately change the way we practise and (make decisions)? Because that's what it comes down to. I think a lot of people are holding back on doing this extra training' (P09). Furthermore, participants expressed that specialists in the city still request formal imaging of the described pathology before accepting the patient, regardless of Core IP certification, thus exemplifying the diminished benefit of acquiring the PoCUS skill set. Many physicians identified the inability to save images or videos of their scans and upload them to PACS, the provincial online imaging viewing system, as a significant contributor to this.

Intradepartmental logistics

Physicians also highlighted the time requirement of using PoCUS in the rural community ED. As 1 physician stated, 'I don't have enough time and I'm the only (physician) in the ED, so I find that when things are slower,.. I'll use ultrasound a lot more. Whereas..if it's too busy, then I will rely on other means to get my answers and I won't spend as much time using ultrasound' (P05).

Three of the interviewed physicians also regarded the current COVID-19 precautions in the ED as a barrier to utilisation due to the enhanced sanitisation protocol of the machine. Some also stated that the low volume of specific scans limited their ability to maintain their skills.

Objective 3: Solutions

Addressing travel, time and cost of training opportunities

All physicians who completed the survey either agreed (1/7) or strongly agreed (6/7) that if opportunities for PoCUS training and skill maintenance were made more accessible, they would be more likely to engage in activities to further their PoCUS skills. The travel requirement was the most frequently cited barrier that, if removed, would increase the likelihood of the participants participating in further PoCUS training (7/7). This was followed closely by eliminating the out-of-pocket cost (5/7) and reducing time requirements (5/7). This was echoed during the interviews:

'Offering it in rural centres. I think that would actually solve a lot of the problems… That if a course was actually taking place in your community, I think you'll get a lot of people signing up… that would reduce time away from practice and potential costs associated with the course…' (P09).

Capitalising on lateral skill transfer

Lateral skill transfer via peer-to-peer teaching was also identified as a possible solution, with 6 of 10 interviewed participants identifying it as such. They highlighted that it would help eliminate travel and cost requirements while improving congeniality;

'You can learn this by being taught by colleagues as well….If we have some training here that leaks out… (resulting in) everyone knowing a little bit more. There's definitely a lateral skill transfer that occurs when you've got people that are qualified in ultrasound..' (P03).

Most surveyed respondents (5/7) believed that there is a role for using telemedicine with PoCUS in this ED. However, 5/7 expressed that those significant logistical challenges, such as the time burden associated with consulting another physician, would be a barrier to using PoCUS telemedicine.

DISCUSSION

Physicians in this rural ED currently use PoCUS mostly as a clinical adjuvant and triage tool, even for scans with a diagnostic application. Many barriers, including training accessibility, cost, time away from family and practice and fulfilling scan requirements for Core IP cerficiation, limit opportunities for further training, preventing PoCUS from being utilised to its full potential in this ED.

Currently, CAEP indicates that PoCUS should be used based on clinical context as a diagnostic or procedural tool to help guide the management and treatment of patients in the ED and that all physicians working in an ED should be comfortable with specific scans.[22] Based on these guidelines, the diagnostic application can be further divided into 3 categories – resuscitative, advanced diagnostic and therapeutic – and the utility of a PoCUS scan should not be based on the provider's skill level.[22] While the physicians in this rural ED used PoCUS via a diagnostic application in specific situations, they were hesitant to identify their scans as diagnostic under most circumstances, attributing this to their perceived skill level and their limited knowledge of current Saskatchewan PoCUS guidelines. These guidelines state 'that all providers should have a clear induction to the ultrasound application followed by supervised apprenticeship'.[23] This emphasises the need to continue to promote systems to connect emergency medicine providers throughout the province with networks such as the Saskatchewan Emergency Medicine Collective.[24]

In this rural ED, some physicians felt uncomfortable using PoCUS due to a lack of training. Those physicians using PoCUS only did so for specific scans with which they felt confident. This too seemed to be associated with a lack of necessary training and experience. Our results were consistent with Flynn *et al.*, who reported that 77.8% of rural physicians surveyed cited training as a barrier to PoCUS use.[15] Level of training in PoCUS also correlated with PoCUS utilisation and the likelihood that a physician would consider their scans as diagnostic, which, as stated previously, should not be associated with the skill level of the provider. A Canadian survey study by Leschyna *et al.* elicited similar results, in that those physicians who had formal training in PoCUS were using it more regularly in the ED.[12]

Rural physicians have indicated accessing training as per Saskatchewan PoCUS guidelines is costly, and achieving scan requirements to

become certified is tedious.[12] Participants echoed Flynn *et al*'s results and concurred that the time commitment and poor accessibility to courses were deterrents to using PoCUS.[15] Participants noted that most EDE courses were in major centres hours away with limited spots that fill quickly. This did not give them adequate time to rearrange their clinic and practice responsibilities. Despite this, participants recognised PoCUS as a beneficial ED tool and skillset.

This study provided insight into the potential system benefits of increased formal PoCUS training for rural ED physicians. In this rural ED, PoCUS is currently being applied as a triage tool, reducing the need for urgent imaging and the associated ambulance transports hours away to major centres. As outlined by Arnold *et al*., further training to build on the current use of PoCUS in rural centres can further aid in the reduction of healthcare utilisation and costs.[19]

Participants were eager to learn and suggest solutions to training barriers. A proposed solution was lateral skill transfer via peer-to-peer teaching, which has been suggested in the current Saskatchewan PoCUS guidelines.[25] This is an effective learning medium, with knowledge transmission that is like an experienced teacher.[26] It also provides a more comfortable learning environment that encourages collaboration and collegiality.[26] Second, increasing the availability of courses in rural communities in Saskatchewan would decrease training barriers and increase the uptake of training of rural physicians while providing education on current Saskatchewan PoCUS guidelines.[2,16] Finally, increasing the formal PoCUS training within medical school and residency programmes could decrease the need for PoCUS training post-residency, reducing the barriers reflected upon by participants.[14]

Strengths

Reviewers had different worldviews resulting in a thorough interpretation of the data, from a rural and urban perspective. Supportive data from the survey and precise qualitative analysis completed by 2 reviewers enhanced the trustworthiness of this study. Furthermore, 10 of the 11 total physicians permanently working in this ED were interviewed, corresponding to a high participation rate.

Limitations

The participants interviewed in this study were working closely with the researchers at the time, resulting in possible bias. In addition, this study was limited to a small sample size attributable to the size of the community. Finally, this study was focused on a specific ED in rural Saskatchewan with the intent of quality improvement. Thus, caution should be taken when generalising the results to other rural communities. Further research should be completed in assessing whether the results of this study are representative of physicians working in other rural Saskatchewan EDs.

CONCLUSION

In this rural ED, physicians use PoCUS as a clinical adjuvant and triage tool due to perceived skill level. This is exacerbated by the fact that these physicians need to travel great distances to seek out formal PoCUS training which requires time and money. Furthermore, many do not seek out the opportunity due to a perceived lack of impact on current practice. To overcome these barriers, physicians suggested that formal PoCUS courses be offered in the community to make them more accessible which would increase diagnostic efficiency and help decrease transportation healthcare costs for urgent imaging. This study further highlights the need to connect with rural communities throughout the province to provide continued and current updates on Saskatchewan PoCUS guidelines.

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REFERENCES

1. Adhikari S, Fiorello A. Emergency ultrasound fellowship training: A novel team-based approach. J Ultrasound Med 2014;33:1821-6.

2. Micks T, Sue K, Rogers P. Barriers to point-of-care ultrasound use in rural emergency departments. CJEM 2016;18:475-9.
3. Fleet R, Archambault P, Plant J, Poitras J. Access to emergency care in rural Canada: Should we be concerned? CJEM 2013;15:191-3.
4. Bergeron C, Fleet R, Tounkara FK, Lavallée-Bourget I, Turgeon-Pelchat C. Lack of CT scanner in a rural emergency department increases inter-facility transfers: A pilot study. BMC Res Notes 2017;10:772.
5. Lyon M, Sturgis L, Lendermon D, Kuchinski AM, Mueller T, Loeffler P, *et al*. Rural ED transfers due to lack of radiology services. Am J Emerg Med 2015;33:1630-4.
6. Adams SJ, Babyn P, Burbridge B, Tang R, Mendez I. Access to ultrasound imaging: A qualitative study in two Northern, remote, indigenous communities in Canada. Int J Circumpolar Health 2021;80:1961392.
7. Rourke JT, Kennard M. Emergency patient transfers from rural hospitals: A regional study. CJEM 2001;3:296-301.
8. Watchorn A, Curran J, Evans Z, Wong V. Evaluating delays for emergent CT scans from a rural British Columbia hospital. CJEM 2021;23:641-5.
9. Lyon M, Blaivas M, Brannam L. Use of emergency ultrasound in a rural ED with limited radiology services. Am J Emerg Med 2005;23:212-4.
10. Weile J, Frederiksen CA, Laursen CB, Graumann O, Sloth E, Kirkegaard H. Point-of-care ultrasound induced changes in management of unselected patients in the emergency department – A prospective single-blinded observational trial. Scand J Trauma Resusc Emerg Med 2020;28:47.
11. Barchiesi M, Bulgheroni M, Federici C, Casella F, Medico MD, Torzillo D, *et al*. Impact of point of care ultrasound on the number of diagnostic examinations in elderly patients admitted to an internal medicine ward. Eur J Intern Med 2020;79:88-92.
12. Leschyna M, Hatam E, Britton S, Myslik F, Thompson D, Sedran R, *et al*. Current state of point-of-care ultrasound usage in Canadian emergency departments. Cureus 2019;11:e4246.
13. Léger P, Fleet R, Maltais-Giguère J, Plant J, Piette É, Légaré F, *et al*. A majority of rural emergency departments in the province of Quebec use point-of-care ultrasound: A cross-sectional survey. BMC Emerg Med 2015;15:36.
14. Micks T, Braganza D, Peng S, McCarthy P, Sue K, Doran P, *et al*. Canadian national survey of point-of-care ultrasound training in family medicine residency programs. Can Fam Physician 2018;64:e462-7.
15. Flynn CJ, Weppler A, Theodoro D, Haney E, Milne WK. Emergency medicine ultrasonography in rural communities. Can J Rural Med 2012;17:99-104.
16. Moshynskyy A, Kapusta M, McGonigle R, Miller L, O'Brien JM, Thoma B, *et al*. P093: Sound check: Quality in point of care ultrasound in rural and regional Saskatchewan through participatory action research. Can J Emerg Med 2017;19:S109-10.
17. Smalley CM. Exposure to point-of-care ultrasound in PA programs before employment. JAAPA 2021;34:42-5.
18. Young K, Moon N, Wilkinson T. Building point-of-care ultrasound capacity in rural emergency departments: An educational innovation. Can J Rural Med 2021;26:169-75.
19. Arnold AC, Fleet R, Lim D. A case for mandatory ultrasound training for rural general practitioners: A commentary. Rural Remote Health 2021;21:6328.
20. Momentiveinc. SurveyMonkey. San Mateo, California, USA. Available from: https://www.momentive.ai. [Last accessed on 2022 May 15].
21. Otter Artificial Intelligence. Available from: https://otter.ai/?utm_content=brand&utm_source=google_ads&utm_medium=search&utm_campaign=search-core-prospecting-consumer-non_edu-web-brand&utm_term=otterai&gclid=CjwKCAjw-8qVBhANEiwAfjXLrkGPuyLpTujIqFHyNBj_1wgokvk2G1HxbgPEoVEOY7Lidm27z9l83hoCwFMQAvD_BwE. [Last accessed on 2022 May 20].
22. Lewis D, Rang L, Kim D, Robichaud L, Kwan C, Pham C, *et al*. Recommendations for the use of point-of-care ultrasound (POCUS) by emergency physicians in Canada. CJEM 2019;21:721-6.
23. Olszynski P, Allie B, Davies A, Delport C, Kapur P, Lynds D, *et al*. Standards for Emergency Ultrasound in Saskatchewan. 2019. p. 1-25. Available from: https://skemcollective.ca/wp-content/uploads/2023/01/SK-ED-Ultrasound-Standards.pdf. [Last accessed on 2023 Apr 03].
24. Stampien J, Kapur P, Batta R. Saskatchewan Emergency Medicine Collective [internet]. 2022. Available from https://skemcollective.ca/about/. [Last accessed on 2023 Apr 03].
25. Olszynski P, Kim DJ, Ma IW, Clunie M, Lambos P, Guzowski T, *et al*. The development of a provincial multidisciplinary framework of consensus-based standards for point of care ultrasound at the University of Saskatchewan. Ultrasound J 2019;11:28.
26. Khoury M, Sethuraman S, Wilson S. Peer-led point-of-care ultrasound; a potential ally to rural medicine. Univ Ottawa J Med 2019;9:38-45.

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