

POCUS IN A RURAL COMMUNITY OF MANITOBA

Point-of-Care Ultrasound in a Small Rural Community of Manitoba, Canada

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## POCUS IN A RURAL COMMUNITY OF MANITOBA

### **Introduction**

Ultrasound is reshaping modern medicine. Point-of-care ultrasound (POCUS) is an emerging methodology in which the primary care or emergency physician utilizes bedside ultrasound to aid in diagnosis. POCUS enables physicians to diagnose a plethora of conditions at the bedside such as pleural effusions, pericardial effusions, valvular diseases, cholelithiasis, renal calculus, bladder stones, abdominal aortic aneurisms, testicular torsion, deep vein thrombosis, fractures, tendinopathies and many more.<sup>1</sup> This advancement in technology provides physicians with an imaging modality that is highly accurate and has uniquely low energy, space and cost requirements.<sup>2,1</sup> Access to advanced imaging in rural medical centers is limited - a problem of increasing importance.<sup>3</sup> In a survey of Canadian Rural Emergency Departments (EDs), it was found that only 20% have access to a CT scanner and 28% to ultrasound services.<sup>4</sup> In cases that call for imaging more advanced than x-ray, 44% of rural EDs must transfer patients more than 300kms away.<sup>4</sup> Transfers are costly to the healthcare system, the patient and result in delay of patient treatment.<sup>5</sup> Point-of-care ultrasound may be part of the solution. Point-of-care ultrasound (POCUS) has been shown to clarify the diagnostic picture, narrow differential diagnoses and change the patient management plan in 74% of cases.<sup>4,6,7,8</sup> Point-of-care ultrasound has been shown to reduce the number of transfers required by 53%.<sup>4</sup> Overall, point-of-care ultrasound (POCUS) has the potential to significantly impact patient satisfaction and management, therefore influencing Quebec and Ontario rural physicians to consider its use in rural EDs as essential.<sup>9,5</sup>

In Quebec and Ontario, ultrasound services are readily available in rural EDs but their use has been limited by the number of physicians on site who are trained in POCUS.<sup>10,5</sup> Currently, already licensed rural physicians must commit to a costly and time consuming ultrasound course in order to become competent.<sup>10</sup> In Ontario, only 44% of physicians who work

## POCUS IN A RURAL COMMUNITY OF MANITOBA

in rural EDs have the training required to take advantage POCUS.<sup>10</sup> This lack of uptake persists regardless of the available evidence that suggests POCUS is essential to rural practice.<sup>5,11,12,10,4</sup>

The utility of POCUS in emergency departments is well established.<sup>8</sup> The role of POCUS in general practice in Canada has only been described in one small survey performed in Whitehorse, Yukon.<sup>7,13</sup> Despite this lack of literature, Memorial University in Newfoundland incorporated formal ultrasound training in their family medicine residency program – the first of its kind in Canada.<sup>6</sup> A survey of Canadian medical schools conducted in 2018 found that nearly all directors of family medicine residency programs believe the incorporation of official ultrasound training is essential.<sup>14</sup> Medical schools in the United States have begun incorporating ultrasound curricula into family medicine residency programs.<sup>14</sup> One such program was developed using Kern's 6 step approach to medical curriculum development which involves understanding the needs of the population before developing learning objectives.<sup>15,16</sup> To understand the needs of the population with respect to ultrasound in family medicine, investigation into its current use in this field is needed. Furthermore, the utilization of POCUS may vary geographically; region to region and urban to rural. In the United States, the most common indications for POCUS use in primary care were procedural guidance and musculoskeletal evaluations.<sup>17</sup> In Whitehorse, Yukon the most common indications were gynecological/obstetric in nature and abdominal evaluations.<sup>13</sup>

Emergency POCUS applications may also vary geographically. In rural Quebec, the most common indication for POCUS use was to rule out abdominal aortic aneurism followed by fluid analysis in trauma and intrauterine pregnancy.<sup>5</sup> The indications for use in rural Ontario were similar, but included pericardial effusion analysis and noted POCUS's application in directing central venous catheter placement.<sup>10</sup> A study on rural ultrasound use in New Zealand found

## POCUS IN A RURAL COMMUNITY OF MANITOBA

cardiac scans to be the most commonly sited scan type, followed by gallbladder, kidney, fluid analysis in trauma, bladder, leg veins and lungs.<sup>12</sup>

There are currently no studies on the uptake or use of POCUS in rural Manitoba. For physicians considering ultrasound training, an analysis of ultrasound use in Manitoba may be helpful in aiding their decision to become competent. For program directors of family medicine residency programs, local studies that include data on POCUS use in general practice is essential in developing an ultrasound curriculum.

### **Methods**

This study had two main objectives. The first was to document the scope of point-of-care ultrasound use in a small rural community in Manitoba. The second was to determine if POCUS use in this community showed similar utility in diagnostic certainty and patient management as has been documented in international studies. To accomplish these objectives within the time constraint of four weeks, a prospective descriptive study design was used. The structure of this study was modeled after Blaivas et al., a study with similar objectives performed in a remote location.<sup>9</sup>

This study took place in Pinawa and Lac du Bonnet, two towns located within the Eastern region of Manitoba separated by 28 kilometers. Of five total physicians working at two main medical sites, two were trained in point-of-care ultrasound and participated in this study. A portion of the ultrasounds performed were in the emergency department (10 scans) of the Pinawa Hospital and the majority (18 scans) were performed in a general practice clinic. The physicians involved in this study are family physicians who have a private practice and help run the emergency department by taking weekly shifts. Pinawa, Manitoba is the main hospital for this

## POCUS IN A RURAL COMMUNITY OF MANITOBA

region and has no emergency specialist. The aim of this study was not to examine POCUS in emergency medicine or general practice, but rather to examine its use in a rural setting where family physicians have a large scope of practice.<sup>18</sup>

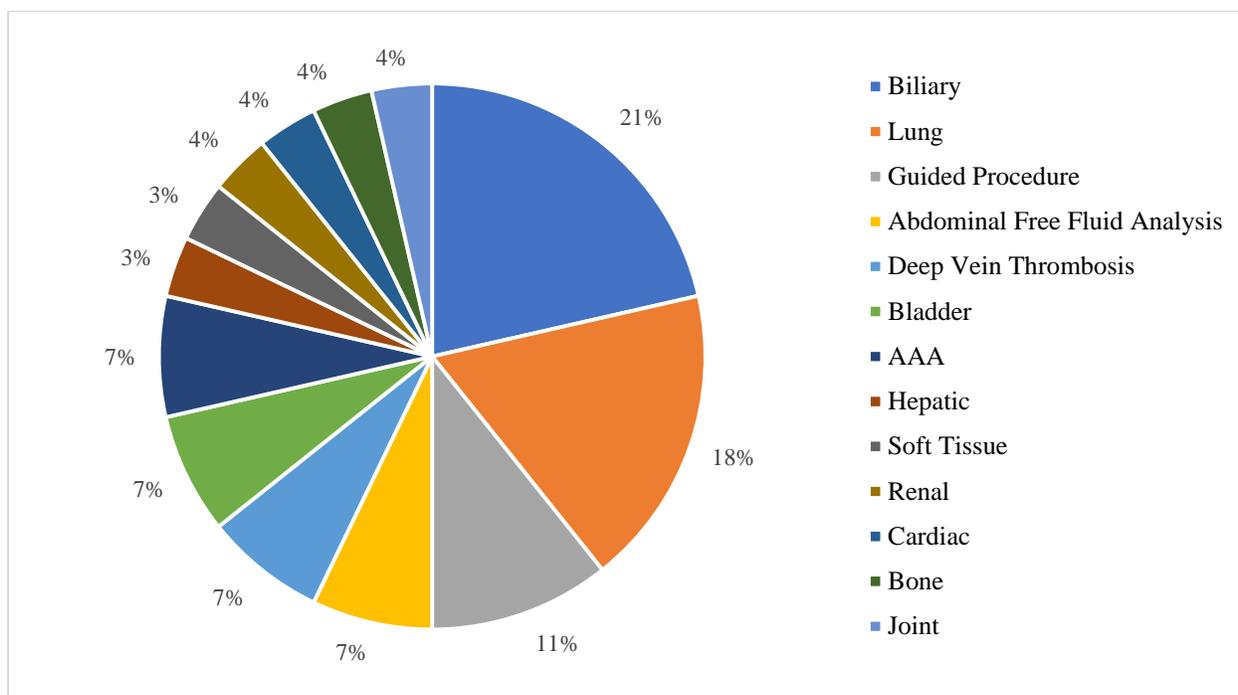
These physicians were provided with a questionnaire to complete before and after using ultrasound. Before the ultrasound, the physician filled out the initial part of the questionnaire, outlining their preliminary differential diagnosis and the type of ultrasound to be performed. After the ultrasound, the physician indicated the result of the scan and the post-ultrasound differential diagnosis. The final section of the questionnaire addressed the effect on diagnostic certainty and the effect on patient management. To reflect diagnostic certainty, the physician was asked to indicate if the scan had narrowed, widened, defined the diagnosis or had no effect. To analyze change in patient management, the physician indicated if the scan avoided a referral, indicated a referral or had no effect on this decision. Finally, the physician indicated if a condition requiring emergent care was uncovered using the ultrasound. The cases were reviewed with a physician to determine how ultrasound altered the course of diagnostics and patient management.

Data from the questionnaire and review were tabulated and interpreted. Many patient examinations involved more than one type of scan. The types of scans performed were gathered from the pre-ultrasound and post-ultrasound sections in addition to the review. Retrospectively, the result of the scan was defined as either negative or positive where positive was a pathological finding. This information was graphically represented along with each variable listed in the questionnaire – diagnostic certainty and patient management.

## **Results**

## POCUS IN A RURAL COMMUNITY OF MANITOBA

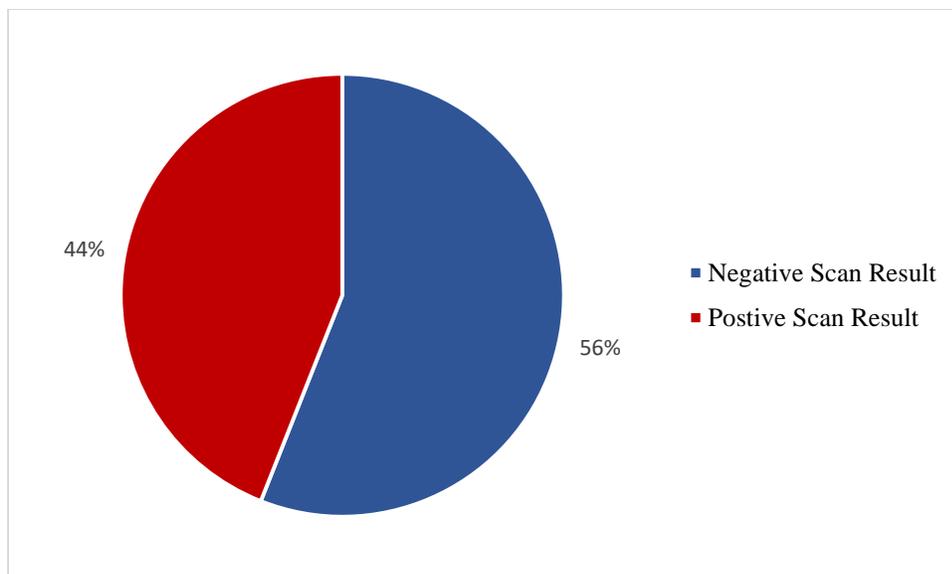
A total of 21 patient encounters were documented with a total of 28 ultrasound scans performed. Ultrasound scan assessments performed were biliary studies (6), lung scans (5), abdominal free fluid analyses (2), deep vein thrombosis investigations (2), bladder scans (2), abdominal aortic aneurism studies (2), soft tissue scans (1), hepatic studies (1), bone scans (1), joint scans (1), and imaging for guided procedures (3) (figure 1).



*Figure 1. Graphical representation of types of scans performed over a 4-week period by 2 point-of-care trained physicians in the Pinawa and Lac du Bonnet area of Manitoba. Scans are represented by a percentage of 27 total scans performed.*

Three scans were used for the purpose of guiding a procedure. Of the remaining investigative scans (25), 44% had positive findings (figure 2).

## POCUS IN A RURAL COMMUNITY OF MANITOBA

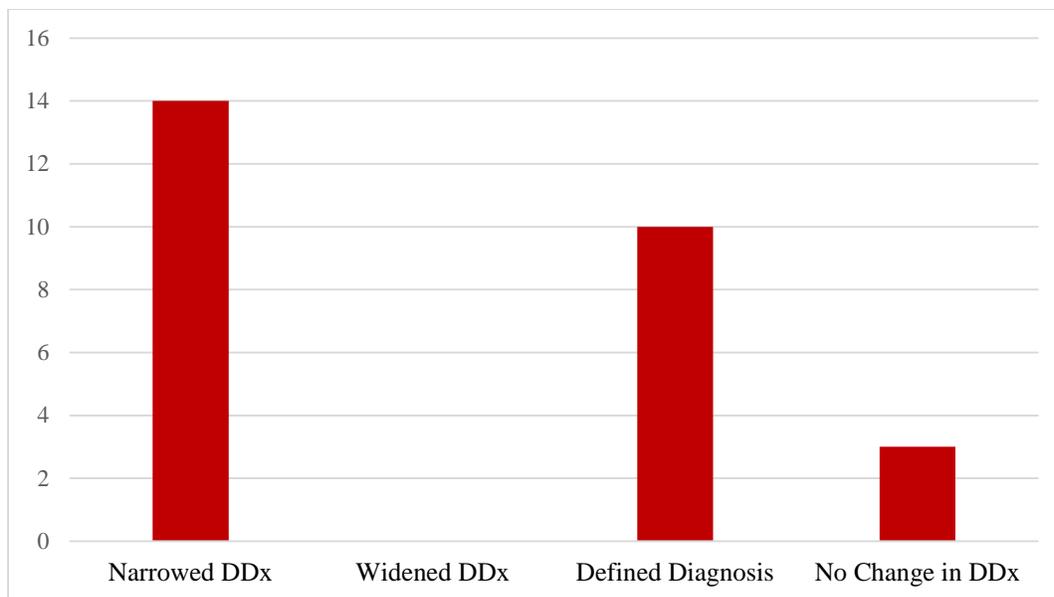


*Figure 2. The proportion of positive and negative findings among the 25 investigative ultrasound scans performed.*

*A positive finding was defined as any pathological condition identified by ultrasound.*

Every investigative scan performed influenced the differential diagnosis either by narrowing it or by uncovering a definitive diagnosis. The three scans used for guided procedures had no effect on the differential diagnosis (figure 3).

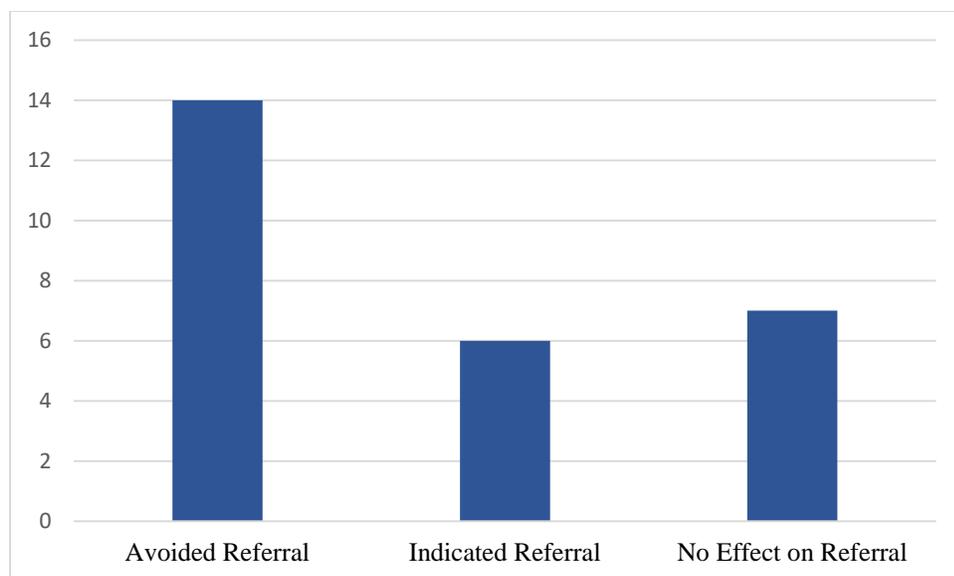
## POCUS IN A RURAL COMMUNITY OF MANITOBA



*Figure 3. All investigative scans increased diagnostic certainty by either narrowing the differential diagnosis (DDx) or defining the condition. There was no change in the differential diagnoses for ultrasound guided procedures (3 scans).*

As displayed in figure 4, 56% (14 of 25) of investigative scans avoided referral to a larger center and 24% of investigative scans (6 of 25) indicated the need for referral. Overall, investigative scans changed the patient management plan in 80% of cases. The three scans performed to guide procedures were included in the “no effect on referral” category of figure 4 since these procedures could be performed without US.

## POCUS IN A RURAL COMMUNITY OF MANITOBA



*Figure 4. The effect of point-of-care ultrasound on patient management as defined by the need to refer the patient to a larger center for more advanced imaging. Three scans used for guided procedures had no effect on the need to refer the patient.*

### Discussion

The scope of POCUS in a rural area of Manitoba over four weeks with two participating doctors included 13 different types of scans. Scans with higher frequency were biliary studies and lung scans. This large breadth of applications for POCUS in rural areas is a finding in keeping with other investigations.<sup>12,19,9,13,20</sup> These studies found at least 6 scan types to be common in rural settings.<sup>20,9</sup> In contrast, this survey found the most common application for POCUS to be biliary studies while Siu, et al, found obstetrical/gynecological scans to be the most common in Whitehorse, Yukon. In rural New Zealand, cardiac scans were the most common application.<sup>20</sup> The large New Zealand study found that there was significant variation in the frequency of scan types between hospitals that could not be explained by differences in physician training.<sup>20</sup> This suggests geographical variation in population needs with respect to POCUS examination in general practice, a finding that should be further investigated and taken

## POCUS IN A RURAL COMMUNITY OF MANITOBA

into account for family medicine residency programs planning include formal ultrasound training. This study is a starting point for the investigation into the application of POCUS in rural Manitoba, but studies that cover a larger geographical area over a longer period are needed in order to draw a conclusion about this population's needs.

This study found similar results as in Nixon et al., Anderson et al., and Blaivas et al. with respect to the second objective - to determine the effect of POCUS on diagnostic certainty and patient management. Diagnostic certainty was improved in 56% of cases and the diagnosis was solidified using POCUS in 40% of cases. Overall this means that every investigative scan had a positive effect on diagnostic certainty. The only cases in which ultrasound had no effect on diagnostic certainty were those that were used for guided procedures. Over the duration of this study, point-of-care ultrasound changed the patient management in 80% of cases. In 14 of 25 of cases, referral to a larger center was avoided. While these findings parallel the aforementioned studies on point-of-care ultrasound, this study had important limitations. These limitations include a short four-week study period, a small sample size of 28 scans performed by two physicians and lack evaluation of the safety or accuracy of the scans. A study that overcomes these limitations is needed to confirm the results of this study. These findings suggest that point-of-care ultrasound in rural locations where formal ultrasound services are not readily available will improve patient care by preventing delay of treatment and may reduce healthcare costs by avoiding unnecessary consults. The utility of POCUS in emergency care is well established in literature, however its use in general practice has limited evidence. In rural general practice, physicians are often required to expand their skillset to accommodate the need for a larger scope of practice than in urban settings.<sup>18</sup> Rural family physicians regularly incorporate emergency coverage in their practice.<sup>18</sup> This, in addition to the lack of access to advanced imaging in rural

## POCUS IN A RURAL COMMUNITY OF MANITOBA

communities, means it is essential that rural general practitioners' become competent in POCUS to help solve the problem of access to care in rural Canada.<sup>4,21</sup>

Rural general practice differs from urban general practice in important ways. Rural general practice demands a broader scope of practice and larger range of clinical procedural skills.<sup>18</sup> 53% of rural physicians provide services in community hospitals compared to 19% of urban family physicians.<sup>18</sup> Rural physicians often must provide primary, secondary and tertiary care.<sup>18</sup> 49% of rural family physicians provide care in the emergency setting compared to 13% of urban family physicians.<sup>18</sup> The Canadian Association of Emergency Physicians published a position statement on point-of-care ultrasound, recognizing its utility in emergency medicine and recommending steps to advance POCUS development in emergency medicine.<sup>8</sup> If rural family physicians are the emergency care providers in rural settings where access to imaging and care is limited, where transfers and referrals are more costly, and where their scope of practice is broad then it follows that point-of-care ultrasound should be emphasized in their training as well. This study is the first look at point-of-care ultrasound use in rural Manitoba and the findings suggest POCUS has potential to enhance rural medicine by aiding in diagnostics and reducing the number of required transfers in such a way that will enhance continuity of care and reduce healthcare costs.

### References

1. Soni NJ, Arntfield R, Kory P. *Point-of-Care Ultrasound*. Philadelphia: Elsevier Saunders; 2015.
2. Tayal VS, Raio CC, Mandavia DP, Nelson BP, Berkowitz R, Bajaj T. Policy Statement. *Ann Emerg Med*. 2017;69(5):27-54. doi:10.1016/j.annemergmed.2016.08.457
3. Bergeron C, Fleet R, Tounkara FK, Bourget IL, Pelchat CT. Lack of CT scanner in a rural emergency department increases inter - facility transfers : a pilot study. *BMC Res Notes*. 2017;10:1-6. doi:10.1186/s13104-017-3071-1
4. Micks T, Sue K, Rogers P. Barriers to point-of-care ultrasound use in rural emergency departments. *Can Assoc Emerg Physicians*. 2019;18(6):475-479. doi:10.1017/cem.2016.337
5. Léger P, Fleet R, Giguère JM-, 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. doi:10.1186/s12873-015-0063-0
6. Micks T, Smith A, Parsons M, Locke T, Rogers P. Point-of-care ultrasonography training for rural family medicine residents — its time has arrived. *Can J Rural Med*. 2016;21(1):28-29.

## POCUS IN A RURAL COMMUNITY OF MANITOBA

7. Andersen CA, Holden S, Vela J, Rathleff MS, Jensen MB. Point-of-Care Ultrasound in General Practice: A Systematic Review. *Ann Fam Med*. 2019;17(1):61-69.
8. Lewis D, Rang L, Kim D, et al. Recommendations for the Use of Point-of-Care Ultrasound ( PoCUS ) by Emergency Physicians in Canada. *Can Assoc Emerg Physicians*. 2018.
9. Blaivas M, Kuhn W, Reynolds B, Brannam L. Change in Differential Diagnosis and Patient Management With the Use of Portable Ultrasound in a Remote Setting. *Wilderness Environ Med*. 2005;16(1):38-41. doi:10.1580/1080-6032(2005)16
10. Flynn CJ, Wepler A, Theodoreo D, Haney E. Article original Emergency medicine ultrasonography in rural communities. *Can J Rural Med*. 2012;17(3):99-104.
11. Epstein D, Petersiel N, Klein E, et al. Pocket-size point-of-care ultrasound in rural Uganda — A unique opportunity “ to see ” , where no imaging facilities are available. *Travel Med Infect Dis*. 2018;23(September 2017):87-93. doi:10.1016/j.tmaid.2018.01.001
12. Mnzmn GN, Blattner K, Nixon G. Rural point-of-care ultrasound of the kidney and bladder : quality and effect on patient management. *J Prim Health Care*. 2018;10(4):324-330. doi:10.1071/HC18034
13. Siu T, Chau H, Myhre D. Bedside ultrasonography performed by family physicians in outpatient medical offices in Whitehorse , Yukon. *Can J Rural Med*. 2013;18(2):43-46.
14. Micks T, Braganza D, Peng S, et al. Canadian national survey of point-of-care ultrasound training in family medicine residency programs. *Can Fam Physician*. 2018;64(10):462-467.

## POCUS IN A RURAL COMMUNITY OF MANITOBA

15. Bornemann P. Assessment of a Novel Point-of-Care Ultrasound Curriculum's Effect on Competency Measures in Family Medicine Graduate Medical Education. *J Ultrasound Med.* 2017;36(6):1205-1211. doi:10.7863/ultra.16.05002
16. Kern D, Thomas P, Hughes M. *Curriculum Development for Medical Education: A Six-Step Approach.* Baltimore, MD; 2009.
17. Hall JWW, Holman H, Bornemann P, et al. Point of Care Ultrasound in Family Medicine Residency Programs : A CERA Study. *Fam Med.* 2014;47(9).
18. Bosco C, Oandasan I. Review of Family Medicine Within Rural and Remote Canada : Education , Practice, and Policy. *Coll Fam Physicians Canada.* 2016.
19. Nixon G, Dist F, Blattner K, Koroheke-rogers M, Muirhead J, Finnie WL. Point-of-care ultrasound in rural New Zealand : Safety , quality and impact on patient management. 2018:342-349. doi:10.1111/ajr.12472
20. Mnzmn GN, Mbchb KB, Comm D, Otago H. Scope of point-of-care ultrasound practice in rural New Zealand. *J Prim Health Care.* 2018;10(3):224-236. doi:10.1071/HC18031
21. *CMA Position Statement : Ensuring Equitable Access to Care : Strategies for Governments , Health System Planners , and the Medical Profession.*