

Editor's key points

► Family physicians who have completed point-of-care ultrasound (POCUS) training can safely use it to exclude ectopic pregnancy and document fetal cardiac activity, potentially deferring the need for urgent radiologist-interpreted ultrasound. However, first-trimester POCUS has not been widely adopted by office-based family physicians, possibly due to barriers such as a lack of focused training opportunities.

► Use of POCUS by 12 family doctors was assessed following their participation in a first-trimester POCUS certification course. Among their 56 patients who subsequently underwent POCUS in the first trimester, only 8 (14.3%) had both vaginal bleeding and abdominal pain, the indications for POCUS use outlined in the course. Only 7 (58.3%) of the newly trained providers used POCUS in the 6 months following their course.

► Patterns of use among the trained family physicians suggest a cautious approach to using POCUS. Further research assessing barriers and facilitators to POCUS use, as well as patient and provider preferences, is warranted.

Point-of-care ultrasound for evaluation of vaginal bleeding or abdominal pain in early pregnancy

Use by family physicians following focused training and certification

Catherine E. Varner MD MSc CCFP(EM) Shirley Lee MD CCFP(EM) MHSc(Ed) FCFP
Shelley McLeod MSc PhD Erin Bearss MD CCFP(EM) Amita Singwi MD CCFP
Shirley Hu MD CCFP(EM) Negine Nahiddi MD MHSc CCFP(EM) Bjug Borgundvaag MD PhD

Abstract

Objective To evaluate the use of point-of-care ultrasound (POCUS) for the assessment of patients experiencing first-trimester bleeding or abdominal pain by family physicians working in family medicine clinics following first-trimester POCUS training and certification.

Design Multisite, retrospective chart review.

Setting Two hospital-affiliated academic family medicine clinics in Toronto, Ont.

Participants Twelve family physicians who completed a first-trimester POCUS training and certification course.

Main outcome measures The primary outcome was the proportion of family physicians using POCUS during their evaluations of patients in the first trimester of pregnancy in the 6 months following the FPs' successful completion of the Family Medicine Obstetrical Ultrasound (FaMOUS) course. Secondary outcomes included indications for POCUS use, diagnostic accuracy of POCUS compared with radiologist-interpreted ultrasound, pregnancy outcomes, and emergency department visits within 10 days of the index family medicine clinic visit.

Results Of the 12 certified family physicians, 7 (58.3%) used POCUS during their assessments of first-trimester patients during the study period. The FPs used POCUS with 56 patients for the following indications: 11 (19.6%) had only vaginal bleeding, 5 (8.9%) had only abdominal pain, and 8 (14.3%) had both vaginal bleeding and abdominal pain; the indication for 32 patients (57.1%) was unclear. Forty-six patients (82.1%) underwent a subsequent radiologist-interpreted ultrasound within 10 days of the index POCUS test. Compared with radiologist-interpreted ultrasound, POCUS had a sensitivity of 91.3% (95% CI 79.2% to 97.6%) for documenting intrauterine pregnancy and a sensitivity of 81.4% (95% CI 66.6% to 91.6%) for documenting the presence of fetal cardiac activity.

Conclusion Following a first-trimester POCUS certification course, family physicians used POCUS for the assessment of first-trimester patients with varying frequency and for indications other than vaginal bleeding or abdominal pain. Further study is needed to assess the clinical impact of office-based POCUS, unforeseen barriers and facilitators to its use, and patient and provider preferences.

Échographie au point de service pour l'évaluation des saignements vaginaux ou des douleurs abdominales en début de grossesse

Utilisation par des médecins de famille après une formation ciblée et une certification

Catherine E. Varner MD MSc CCFP(EM) Shirley Lee MD CCFP(EM) MHSc(Ed) FCFP
Shelley McLeod MSc PhD Erin Bearss MD CCFP(EM) Amita Singwi MD CCFP
Shirley Hu MD CCFP(EM) Negine Nahiddi MD MHSc CCFP(EM) Bjug Borgundvaag MD PhD

Résumé

Objectif Examiner l'utilisation de l'échographie au point de service (EPS) pour l'évaluation des patientes qui ont des saignements ou des douleurs abdominales au premier trimestre par des médecins de famille en cliniques de médecine familiale, et ce, à la suite d'une formation et de leur certification en EPS au premier trimestre.

Type d'étude Revue rétrospective et multicentrique de dossiers.

Contexte Deux cliniques universitaires de médecine familiale affiliées à un hôpital à Toronto (Ontario).

Participants Douze médecins de famille qui ont suivi un cours de formation et de certification en EPS au premier trimestre.

Principaux paramètres à l'étude Le premier résultat était la proportion de médecins de famille qui utilisaient l'EPS durant l'évaluation de patientes à leur premier trimestre de grossesse, 6 mois après avoir réussi le cours FaMOUS (sur l'échographie obstétrique en médecine familiale). Au nombre des résultats secondaires figuraient les indications d'utiliser l'EPS, l'exactitude diagnostique de l'EPS par rapport à une échographie interprétée par un radiologiste, les issues de la grossesse et les visites au service d'urgence dans les 10 jours suivant la visite repère à la clinique de médecine familiale.

Résultats Au nombre des 12 médecins de famille certifiés, 7 (58,3 %) ont utilisé l'EPS durant leur évaluation de patientes à leur premier trimestre au cours de la période à l'étude. Ces médecins de famille ont utilisé l'EPS chez 56 patientes pour les indications suivantes : 11 (19,6 %) avaient seulement des saignements vaginaux, 5 (8,9 %) n'avaient que des douleurs abdominales et 8 (14,3 %) avaient à la fois des saignements vaginaux et des douleurs abdominales; dans le cas de 32 patientes (57,1 %), l'indication était imprécise. Parmi les 56 patientes, 46 (82,1 %) ont passé une échographie subséquente, interprétée par un radiologiste, dans les 10 jours suivant l'EPS repère. Par rapport à l'échographie interprétée par un radiologiste, l'EPS avait une sensibilité de 91,3 % (IC à 95 % de 79,2 % c. 97,6 %) pour la documentation de la grossesse intra-utérine et une sensibilité de 81,4 % (IC à 95 % de 66,6 % à 91,6 %) pour la documentation de la présence d'une activité cardiaque fœtale.

Conclusion Après un cours de certification en EPS au premier trimestre, les médecins de famille ont utilisé l'EPS pour l'évaluation de patientes à leur premier trimestre selon une fréquence variable et pour des indications autres que des saignements vaginaux ou des douleurs abdominales. D'autres études sont nécessaires pour évaluer les impacts cliniques des EPS en clinique, les obstacles et les facilitateurs imprévus de son utilisation, de même que les préférences des patientes et des médecins.

Points de repère du rédacteur

- ▶ Les médecins de famille qui ont suivi une formation en échographie au point de service (EPS) peuvent l'utiliser en toute sécurité pour exclure une grossesse ectopique et documenter l'activité cardiaque fœtale, ce qui permettra potentiellement d'éviter la nécessité d'une échographie d'urgence interprétée par un radiologiste. Par ailleurs, les EPS au premier trimestre n'ont pas été largement adoptées par les médecins de famille en clinique, probablement en raison d'obstacles comme le manque de possibilités de formation ciblée.
- ▶ Le recours à l'EPS par 12 médecins de famille à la suite de leur participation à un cours de certification en EPS au premier trimestre a fait l'objet d'une évaluation. Parmi les 56 patientes qui ont subséquemment passé une EPS à leur premier trimestre, seulement 8 (14,3 %) avaient à la fois des saignements vaginaux et des douleurs abdominales, qui sont les problèmes pour lesquels une EPS est indiquée, comme il était précisé dans le cours. Seulement 7 (58,3 %) des médecins nouvellement formés avaient utilisé l'EPS dans les 6 mois suivant leur cours.
- ▶ Les habitudes d'utilisation parmi les médecins de famille qui ont suivi la formation font valoir une approche prudente dans le recours à l'EPS. Il faudrait plus de recherches pour évaluer les éléments qui font obstacle à l'utilisation de l'EPS et la facilitent, de même que les préférences des patientes et des médecins.

Early pregnancy antenatal care is often provided by a patient's family physician.^{1,2} Early pregnancy can be a time of great anticipation, but complications such as miscarriage and ectopic pregnancy can occur.^{3,4} Previous research has described the prevalence of ectopic pregnancy among pregnant patients presenting to a health care provider with vaginal bleeding or abdominal pain as 6% to 16%.⁵ Therefore, excluding ectopic pregnancy and confirming fetal viability with ultrasound are critical when caring for patients presenting with first-trimester vaginal bleeding or abdominal pain.⁶

The use of point-of-care ultrasound (POCUS) might have a substantial impact on first-trimester pregnancy care. A brief transabdominal assessment with bedside ultrasound can easily document a fetal heart-beat and detect a pregnancy inside the uterus, thereby excluding ectopic pregnancy and deferring the need for urgent radiologist-interpreted ultrasound.⁵ Previous studies have suggested the diagnostic accuracy of POCUS is dependent on the quality of training and the experience of the practitioner acquiring the images.^{7,8} Nonradiologist physicians who have completed POCUS training can safely exclude ectopic pregnancy and document fetal cardiac activity (FCA), allowing for patient reassurance and safe discharge with appropriate follow-up.^{7,8} However, first-trimester POCUS has not yet been widely adopted by office-based family physicians, possibly due to barriers such as the cost of ultrasound equipment and the lack of focused training opportunities.⁹

Such barriers are diminishing with the availability of more portable and affordable ultrasound machines and the development of POCUS training programs.^{10,11} Increasingly, POCUS training is being integrated into medical school and postgraduate family medicine curricula, and continuing professional development courses are available to train and certify office-based family physicians to use POCUS.^{10,11} Recent studies describe family physicians' increasing use of POCUS for nonobstetrical indications, including musculoskeletal assessments and screening for abdominal aortic aneurysm,^{12,13} yet there is a paucity of literature reporting its use for first-trimester indications in the family medicine clinic setting.¹⁴

Based on previous literature establishing safety and diagnostic accuracy of POCUS, a first-trimester POCUS training course for family physicians is necessary to ensure this bedside assessment tool is used safely.^{7,8} However, little is known about family physicians' use of office-based POCUS following appropriate training and acquisition of ultrasound equipment.¹⁴ The objective of this study was to evaluate how family physicians who had completed a first-trimester POCUS certification and training program used POCUS in their family medicine clinics for patients experiencing first-trimester bleeding or abdominal pain.

— Methods —

Study design, setting, and population

This was a retrospective observational study of family physicians practising in 2 hospital-affiliated academic family medicine clinics in Toronto, Ont, who were followed for 6 months after successful completion of a first-trimester POCUS training and certification course.

Both family medicine clinics participating in the study are affiliated with tertiary care academic institutions in the same geographical area. Both sites are staffed by family physicians, family medicine residents, nurses, and additional allied health staff, and they have comprehensive maternity care programs that provide care for pregnant patients in all aspects of their pregnancy, including delivery.

Family Medicine Obstetrical Ultrasound (FaMOUS) course

Staff family physicians from both practice sites were invited to participate in the Family Medicine Obstetrical Ultrasound (FaMOUS) course, a training and certification program tailored specifically to family physicians in clinic-based practice and provided at no cost. This course was modeled after the Canadian Emergency Ultrasound Society (CEUS) Emergency Department Echo course and certification process¹⁵ and predated the family physician course offered by the organization under its new name, the Canadian Point of Care Ultrasound Society.

Participating family physicians were instructed and tested on standardized documentation of the presence or absence of intrauterine pregnancy (IUP) and FCA using POCUS terminology (IUP positive, IUP negative, FCA positive, FCA negative). A total of 12 family physicians from the 2 clinic sites successfully completed the certification process. The curriculum consisted of a deliberate practice-mastery model using online learning materials, seminars, and hands-on training, in 3 phases:

- Phase 1: Learners reviewed an e-learning module of core competency material before the course. They were required to achieve a score of 100% on the e-learning module before participating in the workshop and hands-on training.
- Phase 2: The first 2 hours of the workshop seminar oriented learners to the ultrasound machine and specific techniques for image generation. Both portable and hand-held devices were used for training.
- Phase 3: The remaining 10 hours of the workshop were dedicated to hands-on training with CEUS instructor supervision to complete the course certification process. Seven CEUS instructors supervised the 12 participants, ensuring a 2:1 student-to-instructor ratio. Seventy volunteers, including 10 who were pregnant, served as ultrasound models for the certification portion of the course. Course participants each completed at least 60 successful supervised scans.

Following completion of the FaMOUS course, as part of the research program the 2 clinic sites were provided with hand-held ultrasound devices intended for evaluation of patients with first-trimester complaints, including vaginal bleeding, abdominal pain or cramping, or concern about possible miscarriage. Two trained research assistants reviewed the medical records of patients with pregnancies up to 13 weeks' gestational age who had been assessed by any of the POCUS-certified family physicians who completed the FaMOUS course, determined on the basis of obstetrical care billing codes. Medical records were included for any pregnancy-related visit during this time. If a patient had more than 1 POCUS assessment, only the first POCUS was included. Clinical characteristics, POCUS use, and outcome data were collected. Institutional research ethics board approval was received from Mount Sinai Hospital and the University Health Network in Toronto, Ont.

Outcomes

The primary outcome was the proportion of family physicians using POCUS during their evaluations of patients in the first trimester of pregnancy in the 6 months following successful completion of the FaMOUS course. Secondary outcomes included the indications for POCUS use, diagnostic accuracy of POCUS compared with radiologist-interpreted ultrasound, pregnancy outcomes, and emergency department visits within 10 days of the index family medicine clinic visit.

Data analysis

Data were entered directly into a study-specific Microsoft Excel database. Descriptive statistics were summarized using means with standard deviations (SDs). Diagnostic accuracy of the identification of IUP and FCA were assessed using standard techniques to estimate sensitivity, specificity, and positive and negative predictive values, reported with 95% confidence intervals. The reference standard was radiologist-interpreted ultrasound and the index test was POCUS performed by the family physician.

— Results —

In the 6 months following the POCUS training and certification course, 7 of the 12 family physicians (58.3%) used POCUS during their assessments of first-trimester patients, and of those who used POCUS 5 (71.4%) were located at the same family medicine clinic site. Assessments using POCUS were completed for 56 individual first-trimester pregnant patients, who accounted for 11.3% of the 496 pregnant patients seen by these 2 family medicine clinics for pregnancy care or a pregnancy-related concern during the time period. The number of times POCUS was used by individual providers ranged from 2 to 22 patient assessments during the 6-month study period.

For patients undergoing POCUS assessments, mean (SD) patient age and gestational age were 32.6 (3.9) years and 9.5 (2.1) weeks, respectively. Point-of-care ultrasound was used with 56 patients for the following indications: 11 (19.6%) had only vaginal bleeding, 5 (8.9%) had only abdominal pain, and 8 (14.3%) had both vaginal bleeding and abdominal pain; the indication for 32 (57.1%) patients was unclear. Of the 56 patients undergoing first-trimester POCUS, 49 (87.5%) had a viable pregnancy at 20 weeks, 3 (5.4%) had a spontaneous miscarriage, 2 (3.6%) had an induced abortion, and 2 (3.6%) did not have a documented pregnancy outcome. Additional clinical characteristics of these patients are summarized in **Table 1**.

Of the 56 patients undergoing POCUS, 46 (82.1%) went on to have a radiologist-interpreted ultrasound within 10 days of their family medicine clinic visits. Of the remaining 10 patients, 4 underwent radiologist-interpreted ultrasound up to 4 weeks after the visit and 6 did not have radiologist-interpreted ultrasound documented. We report the diagnostic accuracy of IUP and FCA detection in **Figures 1** and **2**, respectively. In cases where patients had radiologist-interpreted US within 10 days of POCUS assessment, all patients who were reported as having IUPs on POCUS were also found to have IUPs on radiologist-interpreted ultrasounds. Similarly, all patients who were reported as having FCA on POCUS and had subsequent radiologist-interpreted ultrasound were again found to have FCA.

— Discussion —

Following a first-trimester POCUS certification process, family physicians used POCUS for the assessment of first-trimester patients with varying frequency and for unclear indications. When the family physicians used POCUS, it demonstrated excellent sensitivity in identifying FCA and IUP in late first-trimester patients.

The recommended indications for POCUS use in the assessment of first-trimester patients include vaginal bleeding or abdominal pain or both to exclude ectopic pregnancy and assess fetal viability.^{8,15,16} The majority of patients who underwent POCUS in this study did not have either vaginal bleeding or abdominal pain reported in their medical record, which were the indications for POCUS use outlined in the FaMOUS course. A Cochrane review advises against routine ultrasound use in pregnancy owing to the possibility of increased health care usage and heightened patient anxiety in the context of unclear early ultrasound results.¹⁷ Routine scans for fetal viability are associated with reductions in adverse outcomes for babies or in health service use by mothers and babies.^{18,19} However, POCUS should not replace early dating ultrasounds (before 24 weeks' gestation), which are shown to improve detection of fetal anomalies and multiple pregnancies and reduce induction of labour for post-term pregnancy.^{18,19}

Table 1. Demographic characteristics of patients who underwent POCUS: N=56.

CHARACTERISTIC	VALUE
Mean (SD) patient age, y	32.6 (3.9)
Mean (SD) gestational age, wk	9.5 (2.1)
Prior pregnancy, n (%)	54 (96.4)
Prior spontaneous miscarriage, n (%)	6 (10.7)
Documented known risk factors of ectopic pregnancy, n (%)	
• Prior ectopic pregnancy	3 (5.4)
• History of IVF	1 (1.8)
• History of smoking	1 (1.8)
• History of PID	0 (0)
• History of STI	2 (3.6)
Clinical presentation, n (%)	
• Vaginal bleeding	19 (33.9)
• Abdominal pain	13 (23.2)
• Abdominal examination performed	6 (10.7)
• Abdominal tenderness	1 (1.8)
• Bimanual examination performed	2 (3.6)
• Bimanual tenderness	0 (0)
POCUS findings, n (%)	
• IUP documented	52 (92.9)
• FCA documented	43 (76.8)
• Radiologist-interpreted ultrasound within 10 d	46 (82.1)
• ED visit within 10 d	3 (5.4)
Pregnancy outcome, n (%)	
• Viable pregnancy at 20 wk	49 (87.5)
• Spontaneous or missed miscarriage	3 (5.4)
• Induced abortion	2 (3.6)
• Unknown	2 (3.6)

ED—emergency department, FCA—fetal cardiac activity, IUP—intrauterine pregnancy, IVF—in vitro fertilization, PID—pelvic inflammatory disease, POCUS—point-of-care ultrasound, STI—sexually transmitted infection.

Figure 1. Diagnostic accuracy of FP POCUS versus radiologist-interpreted US occurring up to 10 days after POCUS documenting IUP: N=46.

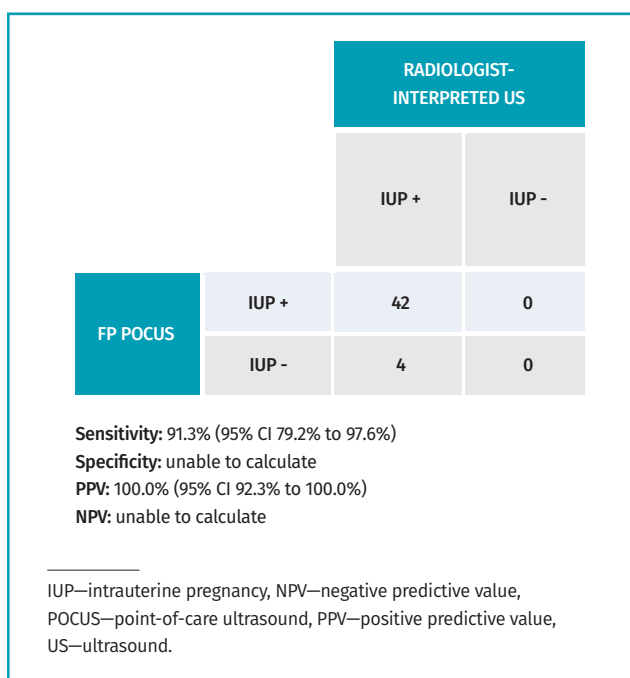
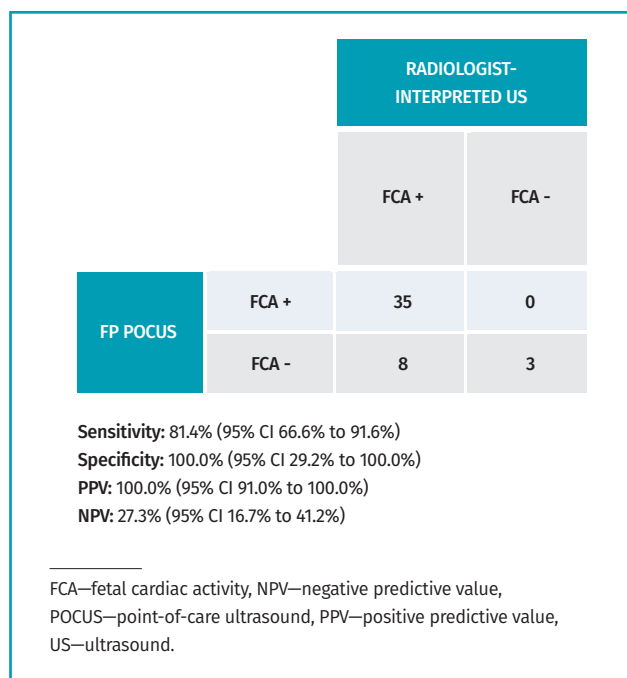


Figure 2. Diagnostic accuracy of FP POCUS versus radiologist-interpreted US occurring up to 10 days after POCUS documenting FCA: N=46.



It is important to note the average gestational age when POCUS was being used was 9 weeks, late in the first trimester. The likelihood of spontaneous abortion, ectopic pregnancy, and indeterminate POCUS scans is lower in late first trimester than at 4 to 6 weeks' gestational age. This pattern of use suggests the FaMOUS-trained family physicians undertook a cautious approach to POCUS use, scanning only in cases where they were likely to see a viable fetus and provide reassurance. Results from this study warrant further investigation, as the FaMOUS curriculum both informed physicians and tested their knowledge of the POCUS indications, yet results suggest unmeasured determinants of use, such as patient and provider preference. Patient-informed research is warranted to determine the different scenarios that patients would find acceptable for the use of POCUS, recognizing its limitations.

Despite the removal of previously acknowledged barriers to POCUS use⁹ by the provision of hand-held ultrasound devices and POCUS training, 5 of the 12 trained providers did not use POCUS in the 6 months following the FaMOUS course. A feasibility study by Bornemann and Bornemann reported that family medicine residents and faculty provided with hand-held ultrasound devices and 16 hours of training found that POCUS was easy to learn and use, and that its use improved diagnostic efficiency, accuracy, and patient satisfaction.²⁰ The authors also reported that 86.7% of family medicine residents and faculty agreed they would continue to use POCUS in their daily practices.¹⁹ This percentage was much higher than the POCUS usage documented in our study, suggesting there might be barriers to clinic-based POCUS use that could inhibit future adoption of this technology in the family medicine clinic setting.

Limitations

This study has several limitations. It was conducted in 2 hospital-based academic family health teams with large obstetrical care practices. Thus, the results might not be generalizable to other health care settings. The assessment of diagnostic accuracy, a secondary outcome of this study, was limited by the timing of the radiologist-interpreted ultrasound, as study participants might have undergone the radiologist-interpreted ultrasound up to 10 days following the POCUS assessment. Recognizing that the accuracy of first-trimester ultrasound is gestational age-dependent, the sensitivity of POCUS to detect IUP and FCA might be underestimated in this study. Additionally, the clinical characteristics of patients who did not have a POCUS assessment for their pregnancy concerns are unknown. Similar to the results of studies of nonradiologists performing focused POCUS,^{7,12} family physicians demonstrated acceptable diagnostic accuracy identifying FCA and IUP. However, the patients assessed with POCUS in this study had pregnancies of a mean gestational age of 9.5 weeks and had a high

proportion of viable pregnancies at 20 weeks. These results suggest that family physicians might have used POCUS in instances where the results were likely to be reassuring, rather than with patients early in the first trimester of their pregnancies, suggesting possible selection bias. Alternatively, physicians seeing patients earlier in the first trimester might not have used obstetrical billing codes, and thus those patients might not have been included in the study. Additionally, POCUS might have been used by providers and not documented in the patient medical record, despite physicians having been instructed to do so as the standard of care for POCUS usage in the FaMOUS course.

Patient and provider preferences and perceived barriers were not documented, which might have affected how and when POCUS was used. Finally, not all patients underwent radiologist-interpreted ultrasound, and those who did have the reference standard did so up to 10 days after the index POCUS test, suggesting partial verification bias. As such, the diagnostic accuracy of POCUS reported in this study should be interpreted with caution.

Conclusion

Following a first-trimester POCUS certification process, family physicians used POCUS for the assessment of first-trimester patients with varying frequency and for unclear indications. Yet, when POCUS was used, there were no false-positive scans for identifying an IUP or fetal viability. Further study is needed to assess the clinical impact of office-based POCUS, unforeseen barriers and facilitators to its use, and patient and provider preferences. 🌿

Dr Catherine E. Varner is Deputy Director and Clinician Scientist with the Schwartz-Reisman Emergency Medicine Institute (SREMI) in the Sinai Health System in Toronto, Ont, an emergency physician with Sinai Health, and Clinician Investigator and Associate Professor in the Department of Family and Community Medicine (DFCM) at the University of Toronto. **Dr Shirley Lee** is Associate Professor in the DFCM at the University of Toronto and Adjunct Professor in the Department of Emergency Medicine at the University of Ottawa in Ontario. **Dr Shelley McLeod** is Research Director of SREMI at Sinai Health and Associate Professor in the DFCM at the University of Toronto. **Dr Erin Bearss** is Chief of the Ray D. Wolfe Department of Family Medicine at Mount Sinai Hospital in Toronto and Assistant Professor in the DFCM at the University of Toronto. **Dr Amita Singwi** is Assistant Professor in the DFCM at the University of Toronto. **Dr Shirley Hu** is Lecturer in the DFCM at the University of Toronto. **Dr Negine Nahiddi** is a family physician with the Prince Edward County Family Health Team in Ontario. **Dr Bjug Borgundvaag** is Director of SREMI in the Sinai Health System, Clinician Scientist in the DFCM at the University of Toronto, and Associate Professor at the University of Toronto.

Contributors

All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

Correspondence

Dr Catherine E. Varner; e-mail Catherine.varner@sinaihealthsystem.ca

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Cet article a fait l'objet d'une révision par des pairs.

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