



Point of Care Ultrasound in Family Medicine Residency Programs:

A CERA Study

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BACKGROUND AND OBJECTIVES: Point-of-care (POC) ultrasound is increasingly used by clinicians across multiple medical specialties. Current perceptions and prevalence of POC ultrasound practice and training in family medicine residency programs has not been described.

METHODS: Questions were included in the 2014 Council of Academic Family Medicine Educational Research Alliance (CERA) survey of family medicine residency directors. The survey included questions regarding current use and current curricula regarding POC ultrasound. It also asked rank order questions of perceived benefits and perceived barriers to expanding such training.

RESULTS: Fifty percent (n=224) of residency program directors completed the 2014 CERA survey. Few programs (2.2%) reported an established ultrasound curriculum. However, 29% indicated they have started a program within the past year, and 11.2% reported starting the process of establishing such training. Ultrasound assistance for procedural guidance was the most commonly reported (44%) use out of seven POC examples. The three leading perceived benefits of POC ultrasound were: making a more rapid diagnosis, the potential to save health care costs, and the potential to improve patient outcomes. The three leading barriers to expanding training were a lack of appropriately trained faculty, limited access to ultrasound equipment, and a lack of comfort in interpreting images without radiologist review.

CONCLUSIONS: A small, but rapidly growing, number of family medicine residencies currently use POC ultrasound. Further research is needed to explore how POC ultrasound can improve patient outcomes in the ambulatory setting and to develop appropriate training methods for this technology.

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In recent years, ultrasound use has broadened into multiple medical specialties and into medical school training.¹⁻⁴ Point-of-care (POC) ultrasound, or bedside ultrasound,

involves limited, defined protocols developed for busy clinicians to use as part of their routine practice in various settings.⁵⁻⁹ Educational institutions have recognized this trend,

and medical schools have been increasingly integrating POC ultrasound training into their curricula. According to the American Institute of Ultrasound in Medicine (AIUM), over 20 US medical schools currently report having focused ultrasound training curricula in place for medical students,¹⁰ and each year this number increases. Several of these schools have published data on the success of these curricula.^{11,12} Published reports on resident interest also generally demonstrate a desire to continue such training.¹⁹

As these trends in medical education continue, larger numbers of students will graduate medical school with ultrasound training. Ongoing innovations in technology make ultrasound devices smaller, less expensive, and increasingly available for primary care physicians. Examples of validated protocols that family physicians might find useful include: screening for abdominal aortic aneurysms, screening for left ventricular hypertrophy, differentiating cellulitis from abscesses, and identifying

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a deep venous thrombosis.¹³⁻¹⁸ Family medicine residency programs will need to expand upon any training initiated in medical school to ensure and document professional competency for new physicians to use ultrasound in these capacities. Competency-based curricula in POC ultrasound have already been implemented in emergency medicine²¹ and have been proposed for other graduate medical training programs such as critical care.²⁰ It is not currently known how many family medicine residencies have established POC ultrasound curricula. We wanted to investigate the current status of ultrasound training in family medicine residencies and also wanted to explore what program directors perceived the role of POC ultrasound could be in their graduates' future practices. Finally, we hoped to evaluate possible resources and barriers to expanding POC ultrasound education within family medicine residency programs.

Methods

We developed a series of questions investigating current practice, curricula, attitudes, and opinions regarding the use of ultrasound in primary care offices. Most questions were evaluated using a 5-point Likert scale, ranging from 5=strongly agree to 1=strongly disagree or 5=very likely to be used to 1=very unlikely to be used depending on the nature of the question. There were also two "rank sum" questions where

respondents were asked to rank their first, second, and third choices that were designed to ascertain barriers and benefits for training of residents in POC ultrasound. These questions were developed by consensus among the authors at our three institutions. They were included in the 2014 Council of Academic Family Medicine (CAFM) Educational Research Alliance (CERA) survey. The survey was sent out electronically to the 451 family medicine residency program directors who are CAFM members with a link to the questions submitted on the Survey Monkey website in the spring of 2014. Program directors who did not respond to the initial survey request were sent up to two follow-up email reminders with the attached survey links at 2-week intervals. The CERA studies have been reviewed by the American Academy of Family Physicians federally approved institutional review board.

Analysis

Survey responses were aggregated and coded using SAS 9.3. For each question using a 5-point Likert scale, the proportion answering each category was calculated. For some responses, categories were collapsed into very/somewhat likely, neutral, and unlikely/very unlikely. Proportions were further subset by variables of interest, including interest in training, perceptions of usefulness, and prevalence of practice and curricula. For perceived barriers and

identified resources, respondents were able to rank their top three responses. The first ranked response received a score of 3, the second ranked response received a rank of 2, and the third ranked response received a score of 1. We then summed these weighted scores and displayed from highest to lowest, with the highest scores indicating those responses more commonly cited and ranked highly by the respondents.

Results

Of 451 surveys sent through the CERA Program Directors survey, responses were received from 224, for an overall response rate of 50%. Questions examining baseline interest in POC ultrasound training are listed in Table 1. Overall, half of the respondents indicated there was not significant interest in incorporating POC ultrasound into their programs. Separating out programs by community size did not demonstrate substantial changes in this level of interest. Similarly, differentiating programs based on whether their residents were already "well trained" in obstetrical ultrasound versus not failed to translate into significant differences in interest for POC ultrasound (37.5% of 56 programs versus 41.1% of 160 programs).

Current Prevalence of Practice and Curricula

Only 2.2% of respondents reported an established curriculum at the time of this survey (Table 2).

Table 1: Interest and Background

| Question | Strongly Agree/ Agree n (%) | Neutral n (%) | Disagree/ Strongly Disagree n (%) | No Response n (%) |
|---|-----------------------------------|------------------|--|----------------------|
| My residents are currently well trained in obstetrical ultrasound. | 67 (29.9%) | 44 (19.6%) | 105 (46.9%) | 8 (3.6%) |
| I am familiar with the literature that supports the use of point-of-care ultrasound (performed by the physician at the bedside) for applications other than obstetrical ultrasound. | 27 (12.1%) | 53 (23.7%) | 137 (61.1%) | 7 (3.1%) |
| Currently, there is interest in my program to train residents in point-of-care ultrasound for applications other than obstetrical ultrasound. | 57 (25.5%) | 48 (21.4%) | 112 (50.0%) | 7 (3.1%) |

Table 2: Current Status of Training

| Which Best Describes the Current Status of Point-of-Care Ultrasound Training (Beyond OB Ultrasound) at Your Program? | Percent of Respondents Answering "Yes" n (%) |
|--|--|
| a. We have no plans to establish ultrasound training. | 89 (39.7%) |
| b. We are considering the addition of ultrasound training to our program. | 25 (11.2%) |
| c. We have elective opportunities in point-of-care ultrasound for our residents. | 6 (2.7%) |
| d. We are in the process of establishing a core ultrasound curriculum or training. | 25 (11.2%) |
| e. We have recently (last year) established a core ultrasound curriculum or training. | 65 (29.0%) |
| f. We have an established core ultrasound curriculum or training. | 5 (2.2%) |
| g. No response | 9 (4.0%) |

However, 29% indicated that they have started a program within the past year, with another 11.2% in the process of establishing such training. In contrast, nearly 40% indicated they had no plans at this time. Programs with strong obstetrical ultrasound were slightly less likely to have an established curriculum for other modalities (1.5% of 57 versus 2.5% of 160), but the presence of such curriculum was very rare across all program types. Residencies with obstetrical ultrasound were also less likely to have added POC ultrasound training within the last year (16.4% versus 34.4%) but more likely to be considering POC ultrasound curricula (16.4% versus 8.9%). None of these differences were statistically significant. There was a statistically significant association with program directors reporting familiarity with literature, who were more likely to be making changes in the POC ultrasound curriculum (64.4% versus 34.4%).

University-affiliated programs were less likely to have adopted POC ultrasound training when compared with their non-affiliated counterparts. They were more likely to report "no plans" to incorporate POC ultrasound (41.8% of 184 versus 20.7% of 29) and less likely to have added a POC curriculum within the last year compared with their university-based counterparts (25.5% versus 55.2%).

Community size of the program demonstrated an insignificant trend. Comparing programs in the smallest communities (<75,000, n=56) with mid-sized communities (75,000–500,000, n=102) to large cities (>500,000, n=62) indicated that established core curricula were rare in all programs (3.6% versus 2.9% versus 0.0%) and that roughly similar proportions had initiated curricula within the last year (37.5% versus 25.5% versus 29.0%).

Current Perceptions of Usefulness
Exactly half (112) of the program directors indicated that their program used ultrasound in at least one of the seven modalities used as examples listed in Table 3. The most common current use reported was for procedural guidance, at 44.6% of respondents. Only two modalities were thought by a majority of respondents to be likely or very likely to be used in their graduates' future practices, including procedural guidance (73.7%) and musculoskeletal (MSK) evaluation for tendinopathy (51.3%). The directors' perception of usefulness generally correlates with their reported current practices; the two modalities most reported as being currently used were procedural guidance and MSK evaluation.

Perceived Barriers and Benefits
Over 95% of programs report faculty lacking appropriate training as one of their top three barriers (Table 4).

Lacking access to ultrasound equipment was a barrier for 48% of programs. The leading benefit of making more rapid diagnoses was identified by 80% of programs, with potentially reducing health costs noted by 60% and improving patient outcomes listed by 45%. The order of the leading barriers did not change when comparing programs using ultrasound in any capacity with those who did not. This comparison also made little change to the rank list of benefits and no changes at all to the top three. Evaluating by residency type or by community size resulted in minimal adjustments to the rank order.

Identified Resources

A total of 46.9% of programs report access to an available ultrasound machine (Table 5) with little difference noted between residency types or community size. The spectrum of identified potential teachers of POC ultrasound varies from program to program. Curricula specific to the family medicine residency and collaboration of curricula with a medical school were infrequently reported. Emergency medicine physicians interested in teaching ultrasound could be identified by 33.5% of family medicine programs overall, but they were more common in university-affiliated programs compared with the non-affiliated programs (35.3% of 184 versus 13.8% of 29). The university programs were less

Table 3: Current Use Versus Perceived Usefulness

| Modality | Training Programs Currently Using This Application n (%) | Believe Application Is Very Likely or Somewhat Likely to Be Useful in Graduates' Future Practice n (%) | Programs Using the Application Who Believe It Is Likely to Be Useful in Future Practice n (%) | Programs Not Currently Using the Application Who Believe It Is Likely to Be Useful in Future Practice n (%) |
|--|---|---|--|--|
| Screening for abdominal aortic aneurysm | 10 (4.5%) | 51 (22.7%) | 14 (29.8%) | 36 (27.1%) |
| Procedural guidance (joint injection, paracentesis, central venous line placement) | 100 (44.6%) | 165 (73.7%) | 50 (89.3%) | 113 (71.5%) |
| Focused Assessment With Sonography for Trauma: FAST exam | 18 (8.0%) | 57 (25.4%) | 23 (41.1%) | 34 (21.7%) |
| Lower extremity Doppler for deep venous thrombosis | 9 (4.0%) | 73 (32.6%) | 19 (34.5%) | 54 (34.6%) |
| Right upper quadrant abdominal ultrasound for biliary colic | 12 (5.4%) | 83 (37.1%) | 23 (41.8%) | 58 (36.9%) |
| Limited echocardiogram for ejection fraction determination | 5 (2.2%) | 52 (23.2%) | 11 (19.6%) | 41 (25.9%) |
| Musculoskeletal ultrasound evaluation for tendinopathy | 41 (18.3%) | 115 (51.3%) | 32 (58.2%) | 81 (51.3%) |

Percentage responding "yes" to: "Physicians in my residency training program currently use ultrasound to perform:"

Percentage of respondents answering "very or somewhat likely" to "which of the following applications of point-of-care ultrasound (performed by the family physician at the bedside) do you believe would be likely to be useful in your graduates future practices?"

likely to identify interested teachers among the radiologists (7.1% versus 20.7%) or among ultrasound technicians (6.5% versus 17.2%).

Discussion

Ultrasound curricula are not entrenched in most family medicine residencies but seem to be growing rapidly. While a very small number of programs (2.2%) report established curricula, and a majority of programs indicate there is not an interest in developing such training, a notable number of programs indicate curricula are under development or just recently started in the past year (29%). Only a minority of programs (39.7%) reported no plans at all to establish POC ultrasound training. We did not find many substantial associations between POC ultrasound use for more recently described POC examinations and training in the more traditional use of ultrasound

in obstetrics. There was, however, a significant association in training programs between program directors who identified familiarity with POC ultrasound literature and those who did not. Most POC ultrasound literature comes out of emergency medicine programs, and many program directors may feel these activities do not translate well into family medicine ambulatory practice. Studies of POC ultrasound specific to practice in the primary care setting are very sparse, but those that have been published indicate good correlation of POC exams to formal studies by expert sonographers.^{23,24}

Procedural guidance and musculoskeletal evaluation are currently the most used POC ultrasound modalities. Also, these two modalities are the only two currently affirmed by a majority of respondents as likely to be useful in their graduates' future practice. However, programs

currently using ultrasound in a particular purpose almost always report with a much higher frequency that their physicians will continue to find it useful after graduation. Several potential modalities, however, are only being taught by a small minority (<10%) of programs.

Other barriers include lack of faculty training, lack of equipment, and lack of specialist oversight. This is important because it highlights a disconnect between the increasing number of medical schools training students in POC ultrasound and the need for family physicians who will be able to mold the students' foundation into a clinically useful tool during residency. Collaborations between family physicians and other specialties practicing POC ultrasound will need to be developed. These partnerships can identify the appropriate uses for POC ultrasound in family medicine and

Table 4: Ranking Perceived Barriers and Benefits to Point-of-Care Ultrasounds

| Perceived Barriers | Rank Sum for All Programs |
|---|---------------------------|
| My faculty lacks appropriate training in performing point-of-care ultrasound. | 487 |
| Our program does not have adequate access to ultrasound equipment. | 212 |
| Physicians feel uncomfortable interpreting ultrasound images without having a radiologist available to over-read them. | 113 |
| Clinic or hospital system policies do not permit family physicians to use ultrasound in a meaningful way. | 96 |
| The time physicians spend performing ultrasound examinations may not be reimbursed by insurance. | 90 |
| There is no time in our current curriculum to add ultrasound training. | 86 |
| Our program does not see a need for family doctors trained in point-of-care ultrasound. | 44 |
| Ultrasound examinations are too time consuming to be done in a busy clinic. | 36 |
| There are insufficient data to prove that point-of-care ultrasound improves patient outcomes in the ambulatory setting. | 34 |
| Students and residents are uninterested in learning point-of-care ultrasound. | 15 |
| Patients prefer ultrasounds to be done by radiology departments rather than by their primary physician. | 0 |
| Perceived Benefits | |
| A diagnosis is made more rapidly when the physician performs the examination at the point of care. | 462 |
| Point-of-care ultrasound use by family physicians has the potential to save substantial health care costs. | 229 |
| Point-of-care ultrasound use by family physicians has the potential to significantly improve patient outcomes. | 206 |
| Patients prefer having the examination done by their own physician. | 134 |
| Medical students and residents are eager to further their skills in point-of-care ultrasound. | 107 |
| Addition of point-of-care ultrasound can provide additional revenue to a family physician's practice. | 58 |
| Other | 146 |

obtain benchmarks for clinical competence in performing and teaching this technology. If POC ultrasound becomes a more widely used technology in family medicine, then a consistent set of program requirements will need to be developed.

Another significant barrier for the practical implementation of ultrasound in the clinical setting is uncertainty regarding payment for focused POC examinations. Reimbursement is a critical issue, both to help justify the purchase of equipment as well as to compensate the physician for the time spent performing the exam. Criteria for reimbursements for ultrasound guidance with procedures have been developed by many

payers, and this may contribute to its high acceptance compared with other modalities listed in our survey.

The response rate to our survey was just under 50% and is a limitation of this study, although responses from 224 program directors still represent a substantial number of family medicine training programs throughout the country. Perhaps a more significant limitation in the study is that we did not have the ability to assess the quality of curricula used by programs. While our data do rely exclusively on self-reporting from the program directors, rather than a direct evaluation of their training programs, we believe program directors to be the

best source of survey data on current residency education practices. Our survey is also limited in that we do not have data on whether incorporation of POC training has been able to bring physicians to a level of competency needed to improve clinical decision-making or patient outcomes.

To our knowledge, this study is the first national survey of family medicine educators on the current practice of POC ultrasound within family medicine residencies. POC ultrasound is clearly not the norm in family medicine, and many programs report that there is no current interest in POC ultrasound training. However, other programs report substantial new interest and have newly

Table 5: Available Resources

| Resources We Have to Assist in the Implementation of Point-of-Care Ultrasound Training Include (Mark All That Apply): | Percent of Respondents Answering "Yes" |
|---|--|
| a. A reasonably accessible and usable ultrasound in our residency clinic | 105 (46.9%) |
| b. An available curriculum for training residents in point-of-care ultrasound | 33 (14.7%) |
| c. An affiliated medical school that collaborates with us on our ultrasound curriculum | 16 (7.1%) |
| d. Emergency physicians that are trained in point-of-care ultrasound | 75 (33.5%) |
| e. Radiologists that are interested in teaching point-of-care ultrasound | 21 (9.4%) |
| f. Ultrasound technicians that are interested in teaching point-of-care ultrasound | 19 (8.5%) |
| g. Other (please specify): _____ | 16 (7.1%) |

incorporated it into their curricula within the last few years. University-affiliated programs were notably less likely to be among the new adopters.

Since current expertise of faculty is the most universally acknowledged barrier to implementing ultrasound, it will be important to find ways to develop faculty POC ultrasound skills, including technical expertise, familiarity with ultrasound literature, and even practical concerns such as billing practices. The American Institute of Ultrasound in Medicine¹⁰ created a registry of medical schools to track the current status of ultrasound training among medical students. It may be helpful to create a similar registry or interest group of family medicine residency programs that offer POC ultrasound training. Such a group would be an excellent resource for sharing educational tools, collaborating on curricular development, and investigating the best uses for POC ultrasound in the primary care setting.

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