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Study objective: Nearly all emergency medicine residency programs provide some training in emergency physician–performed ultrasonography, but the extent of emergency physician–performed ultrasonography in community emergency departments (EDs) is not known. We seek to determine the state of ultrasonography in community EDs in terms of access to ultrasonography by other specialists and performance of ultrasonography by emergency physicians.

Methods: A 6-page survey that addressed access to ultrasonography performed by other specialists and emergency physician–performed ultrasonography was designed and pilot tested. A list of all US ED directors was obtained from the American College of Emergency Physicians. Twelve hundred of 5264 EDs were randomly selected to receive the anonymous survey, with responses tracked by separate postcard. There were 3 mailings from Fall 2003 to Spring 2004.

Results: Overall response rate was 61% (684/1130). Respondents who self-reported as being academic with emergency medicine residents were excluded from further analysis (n=35). A sensitivity analysis (reported in parentheses) was performed on the key outcome question to adjust for response bias. As reported by ED directors, ultrasonography was available in the ED for use by emergency physicians at all times in 19% of EDs (12% to 28%), with an additional 15% (9% to 21%) reporting a machine available for use by emergency physicians in some capacity and 66% (51% to 80%) reporting that there was no access to a machine for emergency physician use. ED directors reported being requested or required to limit ultrasonography orders performed by radiology in 41% of EDs, with less timely access to radiology-performed ultrasonography in off hours. Of EDs with emergency physician–performed ultrasonography, the most common applications were Focused Assessment with Sonography for Trauma (FAST) examination (85%), code situation (72%), and check for pericardial effusion (67%). Of physicians performing ultrasonography, 16% stated they were currently requesting reimbursement (billing). The primary reason cited for not implementing emergency physician–performed ultrasonography was lack of emergency physician training. For the statement ‘emergency medicine residents now starting residency should be trained to perform and interpret focused bedside ultrasonography,’ 84% of ED directors agreed, 14% were neutral, and less than 2% disagreed.

Conclusion: Community ED directors continue to report barriers to obtaining ultrasonography from consultants, especially in off hours. Nineteen percent of community ED directors report having a machine available for emergency physician use at all times; however, two thirds of EDs report no access to ultrasonography for emergency physician use. A majority of community ED directors support residency training in emergency physician–performed ultrasonography. [Ann Emerg Med. 2006;47:147-153.]
INTRODUCTION

Emergency physician–performed ultrasonography first appeared in the emergency medicine literature in the 1980s, and has since become widely incorporated into emergency medicine residency training programs. Training in bedside ultrasonography is a Residency Review Committee requirement, and in 2002 nearly all emergency medicine residency programs reported providing some training in emergency physician–performed ultrasonography, up from 50% in 1997. Although a longitudinal survey of board-certified emergency physicians has suggested a parallel trend in emergency physician–performed ultrasonography, up from 50% in 1997, actual ultrasonography use by community emergency departments (EDs) across the United States is unknown. In 1997, data about reimbursement for emergency physician–performed ultrasonography from Medicare was used to argue that emergency physicians were not performing a sufficient number of examinations to maintain competency, based on data that found only 0.7% of all reimbursements for ultrasonography were performed by emergency physicians. The degree to which emergency physicians who are performing ultrasonography in community EDs are requesting reimbursement is unknown.

In addition, despite an American College of Emergency Physicians (ACEP) resolution calling for 24-hour availability of ultrasonography for ED patients, access to ultrasonography performed by other specialists continues to be problematic, especially in off hours. As of 1995, this goal was rarely met in large teaching hospitals and practically never met in smaller community hospitals, even as reported by radiology directors. Since then, shortages of radiologists and ancillary personnel, especially in community hospitals, may have worsened.

We sought to examine to what extent ultrasonography is available in community EDs in the United States as performed by emergency physicians and as available from other specialists. For those EDs using emergency physician–performed ultrasonography, we sought to delineate how this is occurring, including issues about privileging, quality assurance, and reimbursement.

MATERIALS AND METHODS

Study Design

This was a cross-sectional anonymous mail survey designed to determine access to consultant performed ultrasonography imaging and performance of ultrasonography by emergency physicians in community EDs as reported by ED directors. Data were collected from Fall 2003 to Spring 2004.

Setting

In the fall of 2003, a list of all ED directors in the United States (n=5264) was obtained in spreadsheet format from the ACEP. This survey was considered exempt from informed consent by the Human Investigation Committee at the Yale University School of Medicine.

Selection of Participants

One thousand two hundred ED directors were selected at random from the list using the Excel random number generator (Microsoft, Redmond, WA).

Methods of Measurement

A 6-page survey consisting of 40 questions (Appendix E1, available online at http://www.annemergmed.com) was developed by the authors with input from the ACEP Ultrasound Section. This survey was pilot tested by a small group of emergency physicians with experience in ultrasonography before mailing to determine clarity of the questions, with modifications made based on comments.

EDs selected to participate received a cover letter, an unmarked survey, a stamped and addressed return envelope, and a separate stamped and addressed postcard. The postcard identified the respondent, which allowed respondents to be tracked while keeping the survey anonymous. Any envelopes returned unopened were excluded from the study, and there were a total of 3 mailings between the fall of 2003 and the spring of 2004.

Editor's Capsule Summary

What is already known on this topic

Although many emergency physicians perform bedside ultrasonography, the penetration of this technology into emergency department (ED) practice is unknown.

What question this study addresses

This survey of a random sample of 1200 ED directors characterizes the availability of emergency physician–performed ultrasonography and standard ultrasonography in the ED and the ways that emergency physicians are using this technology.

What this study adds to our knowledge

Roughly one fifth of ED directors indicated that their department had 24-hour emergency physician–performed ultrasonography, whereas two thirds indicated emergency physicians never performed ultrasonography. Many directors reported difficulty obtaining ultrasonographs, particularly in off hours. The most common emergency physician–performed ultrasonography procedures were Focused Assessment with Sonography for Trauma (FAST) examination (85%), code situation (72%), and check for pericardial effusion (67%).

How this might change clinical practice

Although these data will not change practice, the fact that 36% of directors who do not have emergency physician ultrasonography have plans to institute this service suggests that the prevalence of emergency physician–performed ultrasonography is increasing and may soon be present in the majority of EDs.
Table 1. Characteristics of EDs, as reported by ED directors, percentage of respondents, overall and grouped by EDs with and without emergency physician–performed ultrasonography (EPPUS).

<table>
<thead>
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<th>Percentage</th>
<th>Overall</th>
<th>With EPPUS</th>
<th>No EPPUS</th>
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<td><strong>ED patient visits per year</strong></td>
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<td>26</td>
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<td>18</td>
<td>10</td>
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<tr>
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<td>5</td>
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<tr>
<td>&gt;80,000</td>
<td>2</td>
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<td>0</td>
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<tr>
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**Figure 1.** Typical time required to obtain ultrasonography from radiology as reported by ED directors, from time order is entered to time report is made, stratified by time of day.

**Characteristics of Study Subjects**

Of the 649 responses, 580 directors reported their EDs as being “primarily community” with no emergency medicine residents, 39 reported being “primarily community” but did have emergency medicine residents, 25 reported being “equally mixed” but did not have emergency medicine residents, and 5 reported being “primarily academic” but did not have emergency medicine residents.

The majority of EDs were reported to have fewer than 40,000 visits per year, fewer than 10 full-time emergency physicians, and no trauma designation (Table 1). More than half of ED directors reported that less than a quarter of their emergency physicians were emergency-medicine-residency trained.

Ultrasonographs “ordered per week” from consultants were reported as less than 10 per week in 33% of EDs, 10 to 20 per week in 32% of EDs, 21 to 40 per week in 22% of EDs, and more than 40 per week in the remainder.

For providers of ultrasonography in specific situations, questions were asked about who provided services for pregnant patients, echocardiography, and deep venous thrombosis. For pregnant patients, ultrasonography was reported to be provided by radiology in 74% of cases, by obstetrics/gynecology in 19% of cases, and by emergency physicians in 7% of cases. Echocardiography was reported to be provided by cardiology in 66% of cases, by radiology in 30% of cases, and by emergency physicians in 3% of cases. Ultrasonography for deep venous thrombosis was reported to be provided by radiology in 77% of cases, by the vascular service in 16% of cases, by cardiology in 6% of cases, and by emergency physicians in 1.4% of cases.

Availability of ultrasonography performed by radiology was variable and differed from daytime to nighttime hours (Figure 1). Thirty-four percent of ED directors reported being required to limit ultrasonography orders by radiology, with 7% of directors reporting being required to do so, whereas 59% of directors reported no limits on ordering.

**Primary Data Analysis**

Results were entered into Microsoft Access (Microsoft) and exported to Excel for initial manipulation, with statistics done using SPSS version 11.0 (Apache Software, Chicago, IL). Results to question responses are descriptive and are reported as the percentage of respondents. Correlations by rank were done using Pearson’s correlation coefficient with SPSS.

To account for response bias, we repeated our calculations for questions about the use of ED ultrasonography first assuming that nonresponders have no ED ultrasonography and then assuming that nonresponders had twice the availability of responders. This sensitivity analysis produces intervals that are wider than standard confidence intervals and conservatively estimate the range of true values for these variables.

**RESULTS**

There were 684 completed responses from 1130 completed mailings, yielding a response rate of 61%. Respondents who self-reported that their ED had emergency medicine residents and was “primarily academic” or “equally mixed” (community and academic) were excluded from further analysis, leaving 649 responses that are reported in this article.
ultrasonography through radiology. Transthoracic cardiac ultrasonography (echocardiography) was reported as “always” available by 29% of ED directors, “usually available” by 27% of directors, “rarely available” by 18% of directors, and “not available” by 26% of directors.

Nineteen percent (sensitivity analysis range 12% to 28%) of ED directors reported that a machine was available for use by emergency physicians at all times, with another 15% (9% to 21%) of directors reporting some machine availability, typically a machine borrowed from radiology. The remaining 66% (51% to 80%) of directors reported that emergency physicians had no access to an ultrasonography machine.

Of those with no current emergency physician ultrasonography access, 36% of directors reported plans to obtain emergency physician ultrasonography, 8% within the next year. Of ED directors reporting any emergency physician access to ultrasonography, 24% reported having access for less than 1 year, 34% for 1 to 2 years, 25% for 3 to 5 years, 8% for 6 to 10 years, and 9% for more than 10 years.

Lack of training, resistance from radiology, and adequate ultrasonography coverage were the most common reasons cited by ED directors for not implementing emergency physician–performed ultrasonography (Figure 2). Focused Assessment with Sonography for Trauma (FAST) scanning was the most commonly reported use of emergency physician–performed ultrasonography (Figure 3). When considering physicians for employment, 8% of community ED directors rated training in ultrasonography as “very important,” 17% as “somewhat important,” 16% as “slightly important,” and 59% as “not important.” For the statement “emergency medicine residents now starting residency should be trained to perform and interpret focused bedside ultrasonography,” 54% of ED directors strongly agreed, 30% agreed, 14% were neutral, 1% disagreed, and 0.6% strongly disagreed.

There were 155 responses to the second portion of the survey (24% of community ED respondents), addressing community EDs actively using emergency physician–performed ultrasonography (Table 2). Of EDs using emergency physician–performed ultrasonography, 16% stated that they were requesting reimbursement. Of those not requesting reimbursement, 47% stated that they intended to do so.

When cross-referenced by ED environment (ranked responses), the reported presence of emergency physician–performed
ultrasonography is correlated with higher reported annual ED volume, larger physician groups, presence of a trauma designation, overall use of ultrasonography, and larger proportion of emergency medicine residency–trained physicians in a group. Presence of emergency physician–performed ultrasonography was weakly and negatively correlated with longer reported time to obtain daytime ultrasonography from radiology but did not correlate with reported time required to obtain ultrasonography from radiology at night or to reported radiology limits on ultrasonography. The details of these analyses are contained in Appendix E2 (available online at http://www.annemergmed.com).

**LIMITATIONS**

The major limitation of this study is potential response bias caused by the 61% response rate. However, the sensitivity analysis demonstrates that, although our estimate of the percentage of EDs that has emergency physician–performed ultrasonography may be imprecise, the qualitative conclusions of our study remain robust.

The respondents of this survey were intended to be ED directors. Although it was supposed that these persons would be in the best position to assess actual and future use of ultrasonography, there is no guarantee that the responses were accurate or that the respondents were in fact the directors. In addition, although we believe that the ACEP list is the most comprehensive list of US ED directors available, it may not be complete. Although anonymous, ED directors may have inherent bias or incomplete information about emergency physician–performed ultrasonography in their departments. Although the survey was pilot tested for clarity of the questions, this was not specifically done on ED directors, and test-retest reliability assessment was not performed, potentially limiting the validity of the survey instrument.

Because the prevalence of ultrasonography in “academic EDs” (ie, emergency medicine residency programs) has already been well delineated,7,9 we sought to exclude these programs. To do this, we excluded any programs that self-reported as “primarily academic” or “equally mixed” in addition to having emergency medicine residents. This exclusion resulted in the removal of 35 responses of 1130 total (3.1%), which is close to what might be expected, given the presence of 124 emergency medicine residencies in the United States (2.4% of 5264 EDs in the initial list) as listed by the Accreditation Council on Graduate Medical Education. However, not all EDs that reported themselves as “primarily academic” or “equally mixed” were removed (ie, those without emergency medicine residents), nor were “primarily community” EDs with emergency medicine residents removed. Although we believe this accurately reflects community EDs not previously addressed by surveys about ultrasonography use, there may be differences of opinion about what composes a “community” ED.

Regional differences in the penetration of emergency physician–performed ultrasonography in the United States may exist. In retrospect, including a question about general ED location in this anonymous survey may have helped to reveal some of these differences, but this was not done.

**DISCUSSION**

There is increasing evidence that focused ultrasonography performed by emergency physicians can be performed accurately and cost-effectively, resulting in improved and expedited care.2,14,18-32 Although most emergency medicine residencies include emergency physician ultrasonography to some degree, training and privileging in ultrasonography remain contentious issues.5,33-48 This study provides a baseline for the state of emergency physician–performed ultrasonography in the community.

It is evident that barriers still exist to obtaining timely access to ultrasonography performed by other consultants, especially during nighttime hours, when nearly a quarter of ED directors reported that ultrasonography was not available at all. Echocardiography may be particularly problematic, with nearly half of ED directors reporting difficulties in obtaining this study from a consultant. The environment in many community EDs still appears to be far from meeting the ACEP policy about access to ultrasonography in the ED, published first in 1991 and
revised in 2001, which states: “Bedside ultrasonography evaluation, including examination, interpretation, and equipment, should be immediately available 24 hours a day for ED patients.”

An ultrasonographic machine available for use by emergency physicians at all times is present in about a fifth of community EDs, though approximately two thirds of community EDs have no emergency physician access to ultrasonography. However, 69% of EDs that have emergency physician–performed ultrasonography obtained it in the last 5 years, with more than a third of EDs reporting plans to implement emergency physician–performed ultrasonography soon. Presence of an ultrasonographic machine in an ED does not necessarily mean that ultrasonography is being used extensively. Among EDs with emergency physician–performed ultrasonography, there is variation in image archival, quality assurance, and documentation. Reimbursement for emergency physician–performed ultrasonography is requested in a minority of cases, although nearly half of ED directors with emergency physician–performed ultrasonography report plans to request reimbursement.

Emergency physician–performed ultrasonography appears to be more feasible in larger, busier EDs. By far the largest barrier to implementation of emergency physician–performed ultrasonography appears to be training of emergency physicians. The majority of ED directors strongly support residency training in bedside ultrasonography. As residency training in emergency physician–performed ultrasonography continues to mature, especially with the recent expansion in ultrasonography fellowships and designated ultrasonography faculty within emergency medicine residency programs, it is likely this barrier will be addressed more completely as recent emergency medicine graduates populate the workforce. Although this study establishes a baseline for emergency physician–performed ultrasonography, it appears to be in a period of rapid expansion. Reassessment in several years is warranted.

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REFERENCES


