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# The Effects of an Eight-Hour Six-Step Point-of-Care Ultrasound Training Program: A Pilot Study

Sekiz Saatlik Altı Adımlı Bakım Noktası Ultrasonu Eğitim Programının Etkileri: Pilot Bir Çalışma

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***ABSTRACT***

***Objective:*** *The use of ultrasonography in emergency departments is becoming widespread all over the world. However, the recommendations of the guidelines that form the framework of training may not be suitable for all regions. In this study, we investigated the effect of a targeted eight-hour Point-of-Care Ultrasound (PoCUS) course planned in an emergency medicine clinic with limited facilities on the practical skills of emergency physicians.*

***Materials and Methods:*** *A six-step ultrasonography course was planned for twenty-six emergency physicians. Four hours of theoretical course followed by four hours of practical training was given. Participants were administered a practical exam a week before and a week after the training. Whether sufficient images were provided in the practical exam depended on certain criteria. The time to achieve adequate images by fulfilling all criteria was recorded in seconds.*

***Results:*** *After the training, the success rates of cardiac ultrasound (US), extended focused assessment with sonography in trauma (E-FAST), and the adequacy of hepatobiliary and aortic imaging increased statistically significantly ($p<0.05$).*

***Conclusion:*** *Targeted eight-hour theoretical and practical ultrasonography training, which was provided in line with the demands of emergency physicians, has a significant contribution to the successful imaging time of participating emergency physicians.*

***ÖZET***

***Amaç:*** *Acil servislerde ultrasonografi kullanımı tüm dünyada yaygınlaşmaktadır. Ancak, eğitimin çerçevesini oluşturan kılavuzların önerileri tüm bölgeler için uygun olmayabilir. Bu çalışmada, kısıtlı imkanlara sahip bir acil tıp kliniğinde planlanan hedefe yönelik sekiz saatlik Point-of-Care Ultrasound (PoCUS) kursunun acil hekimlerinin pratik becerileri üzerindeki etkisini araştırdık.*

***Gereç ve Yöntem:*** *Yirmi altı acil tıp hekimi için altı aşamalı bir ultrasonografi kursu planlandı. Dört saatlik teorik dersin ardından dört saatlik pratik eğitim verildi. Katılımcılara eğitimden bir hafta önce ve bir hafta sonra pratik sınav uygulandı. Pratik sınavda yeterli görüntü sağlanıp sağlanmadığı belirli kriterlere bağlıydı. Tüm kriterleri yerine getirerek yeterli görüntü elde etme süresi saniye cinsinden kaydedildi.*

***Sonuçlar:*** *Eğitim sonrasında kardiyak ultrasonografi (US), travmada sonografi ile genişletilmiş odaklı değerlendirme (E-FAST) ve hepatobiliyer ve aort görüntülemenin yeterliliği başarı oranları istatistiksel olarak anlamlı şekilde arttı ($p<0.05$).*

***Sonuç:*** *Acil hekimlerinin talepleri doğrultusunda verilen hedefe yönelik sekiz saatlik teorik ve pratik ultrasonografi eğitiminin, katılımcı acil hekimlerinin başarılı görüntüleme sürelerine önemli bir katkısı vardır.*

***Keywords:***
*Ultrasonography*
*Point-of-care systems*
*Education*

***Anahtar Kelimeler:***
*Ultrasonografi*
*Yatakbaşı teknolojisi*
*Eğitim*

## INTRODUCTION

Many terms are used by emergency physicians for bedside ultrasonography. These include emergency, bedside, focused, and others. However, the most widely accepted term is point-of-care ultrasound (PoCUS). PoCUS is gaining importance in emergency practice. Its use as a diagnostic tool in emergency departments is increasing with its bedside, rapid, non-invasive, and radiation-free features. With the increasing use of emergency ultrasonography, training curricula are also developing every year. In many countries, ultrasonography training has even started to be provided for medical faculty students (1, 2). In these trainings, medical faculty students have benefited from the trainings and their skills in the use of ultrasonography have improved (3).

Ultrasonography can be used in many fields in the emergency medicine practice. In emergency medicine, ultrasonography is used to guide diagnosis, treatment, follow-up, and the resuscitative and procedural procedures. According to the content of ultrasonography training renewed by the American College of Emergency Physicians (ACEP) in 2023, it is recommended to complete a total of 80 hours of training during the speciality training period after a 2-week rotation in the first year (4). However,

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studies have shown that ultrasonography training varies and there are serious differences in qualification assessment methods (5,6). When the emergency point-of-care ultrasound training guideline of the South African Society of Emergency Medicine (SAMJ) is examined, we see that a comprehensive, systematic, and continuous training program similar to the ACEP guideline is recommended (7).

It has been revealed that the biggest problem preventing the widespread use of ultrasound especially in developing countries and the rural areas of developed countries is training (8,9). In Turkey, ultrasonography training of emergency medicine speciality students may vary depending on the region and hospital. Local emergency medicine associations across the country provide paid emergency ultrasonography trainings. In our country, the most common learning methods are learning on one's own or by watching the procedure. These results show that emergency ultrasonography training in our country is not at an adequate level and does not have a certain standardization.

In this study, we planned a targeted basic ultrasonography training in line with the needs of emergency physicians. We investigated the effect of this 8-hour didactic and practical training on emergency physicians.

## MATERIAL AND METHOD

We conducted the study at an Emergency Department (ED) with an annual volume of 600,000 patients, which hosts a four-year Emergency Medicine (EM) residency program. The residency provides training for 35 residents. Residents who did not complete 6 months of residency were excluded. The 26 resident doctors who agreed to participate in the study had not received systematic or certified PoCUS training before. In our study, the path followed in the planning of PoCUS training was the basic 6-step approach suggested by Kern, modified according to local needs (10). The steps of this 6-step approach are given on Table 1.

### Assessment of General Needs and Training Needs

An observational assessment of the overall need for PoCUS showed that the biggest preventing factor for residents to use ultrasound in their daily practice was training. Residents who did not receive adequate training were hesitant to include US in their daily practice.

**Table 1:** A basic 6-step approach modified according to local needs

| | |
|---|---|
| **1** | Identification of the problem and a general needs assessment |
| **2** | Targeted local needs assessment in prospective PoCUS trainees |
| **3** | Setting of goals and objectives for the local curriculum |
| **4** | Selection of educational strategies that match with the resources available and match with the length of longitudinal training opportunities |
| **5** | Implementation of the program |
| **6** | Development of concepts for evaluating the effectiveness of the curriculum again adhering to available resources and ability to measure outcomes to predetermined mastery standards |

To organize the training content, 26 emergency medicine physicians who agreed to participate in the study were asked to choose four of the PoCUS contents they wanted to receive training. The options consisted of ultrasonography courses defined for diagnostic procedures. These options were as follows: Aorta Ultrasound, Bowel, Cardiac, Haemodynamic Assessment, Deep Vein Thrombosis, Hepatobiliary System, Musculoskeletal Ultrasound, Ocular, Pregnancy, Skin and Soft Tissue Ultrasound, Testicular Ultrasound, Trauma, and Urinary Tract ultrasound. Among the options presented, the most preferred four were planned.

### Identifying Learning Objectives for Training

When planning the training content, guidelines of national EM organisations with sections focusing on clinical ultrasound education such as ACEP, EuSEM, and SAMJ were reviewed. A 4-hour didactic training followed by a 4-hour practical training on the same day was planned. In the course planning, targets in cardiac US, E-FAST, hepatobiliary, and aortic imaging were determined. In the first part of the training, a short training was planned about the functions and features of the device in our emergency department. The learning objectives and the allocated time for our 8-hour training course are given on Table 2 below.

Determination of training strategy with local resources

When the guidelines of national EM organisations with departments focusing on ultrasound education were reviewed, it was found that the ACEP and SAMJ guidelines clearly stated the course criteria. Considering the resources of our clinic, we tried to determine the best implementation strategy. Firstly, since we have one M5 Model US device (Mindray, NJ, USA) in our clinic, the practical trainings were performed at a single station. The trainees were divided into small groups in a large room. The trainings were provided by two Associate Professor Doctor of Emergency Medicine and a Specialist Doctor of Emergency Medicine, who were experienced and competent in the ultrasonography field. However, the ratio of 5 trainees to 1 instructor recommended by both guidelines could not be achieved. The following are the course criteria of the ACEP and SAMJ guidelines that we were able to fulfil and the criteria that we could not fulfil due to our local resources (Table 3).

### Implementation of the Training Program and Evaluation of the Training

Trainings on cardiac US, extended focused assessment with sonography in trauma (E-FAST), hepatobiliary, and aortic US, which were selected according to the requests of emergency medicine residents, were performed within the given periods. One week before and one week after the trainings, image acquisition success and image acquisition times were measured. While imaging was performed before and after the training, the observer and a single participant were taken into the room, and after the imaging process was completed, the other participants were taken into the room in turn. Imaging studies exceeding 180 seconds were considered unsuccessful. The pre-training and post-training evaluations were performed with the same US device and the same healthy simulated patient.

**Table 2:** Learning objectives and duration of the training

| Course | Course content and learning goals | Course duration |
|---|---|---|
| **Theoretical Lessons** | | |
| **Course 1.1** | **Basic features of USG device, Basic information on probes** | |
| | 1. Describe the features of the control panel<br>2. To be able to define the function of gains<br>3. To be able to define the function of depth<br>4. To be able to define the function of zooming<br>5. To be able to locate the freeze button on the control panel<br>6. To be able to define measurement and calculation functions<br>7. To be able to recognize linear, sector, and convex probe and understand their functions | 15 min. |
| **Course 1.2** | **Cardiac US** | |
| | 1. To be able to define clinical indications<br>2. To provide Probe-Display orientation<br>3. To be able to identify anatomical regions in the parasternal long axis image<br>4. To be able to define anatomical regions according to the parasternal short axis and levels<br>5. To be able to identify anatomical regions in apical 4-chamber view<br>6. To be able to define the anatomical regions in the subxiphoid window<br>7. To be able to recognize the appearance of pericardial tamponade<br>8. To be able to recognize pulmonary embolism findings on Cardiac US | 90 min. |
| **Course 1.3** | **E-FAST** | |
| | 1. To be able to define clinical indications<br>2. To be able to define the anatomical regions in the perihepatic area<br>3. To be able to describe the anatomical regions in the splenorenal area<br>4. To be able to describe the anatomical regions in the suprapubic area<br>5. To be able to describe the anatomical regions in the subxiphoid area<br>6. To be able to describe the anatomical regions in the anterior thoracic window<br>7. To be able to understand the pitfalls in E-FAST<br>8. To be able to interpret pathological images in E-FAST | 60 min. |
| **Course 1.4** | **Hepatobiliary System** | |
| | 1. To be able to define clinical indications<br>2. To be able to describe the anatomical images of the hepatobiliary system in short and long axis<br>3. To be able to recognize the common bile duct, portal vein, and hepatic artery<br>4. To be able to list the ultrasonographic findings of acute cholecystitis<br>5. To be able to interpret pathological images | 45 min. |
| **Course 1.4** | **Aorta Ultrasound** | |
| | 1. To be able to recognize the abdominal aorta, to define the anatomical structures<br>2. To be able to describe the anatomical images of the celiac trunk, mesenteric artery, and renal arteries<br>3. To be able to state the normal value of the diameter of the abdominal aorta<br>4. To be able to recognize the pathological appearance of aortic aneurysm and aortic dissection | 30 min. |

**Table 2:** Learning objectives and duration of the training (Continue)

| **Practical Applications** | | |
|---|---|---|
| **Course 2.1** | **Cardiac US** | |
| | 1. Parasternal Long Axis image acquisition<br>2. To be able to visualize the LV, LA, RV, MV, AV and Aorta in the parasternal long axis image and identify the structures<br>3. Parasternal Short Axis image acquisition<br>4. To be able to visualize and identify the apical level, papillary muscles, MV and AV in the parasternal short axis image<br>5. Apical 4 chamber image acquisition<br>6. To be able to see and identify LV, RV, LA, RA, RA, MV, TV structures in apical 4-chamber image<br>7. To be able to show pericardial borders in the subxiphoid window<br>8. To understand how to optimize images | 75 min. |
| **Course 2.2** | **E-FAST** | |
| | 1. Visualize and describe the structures in the perihepatic area<br>2. Visualize and describe the structures in the splenorenal area<br>3. Visualize and describe the structures in the suprapubic area<br>4. Visualize and describe the structures in the subxiphoid area<br>5. Visualize and identify structures in the anterior thoracic window | 75 min. |
| **Course 2.3** | **Hepatobiliary System** | |
| | 1. Visualize and scan the hepatic parenchymal tissue<br>2. Visualize the gallbladder and measure the wall thickness<br>3. Visualize and recognize the common bile duct, portal vein, and hepatic artery | 45 min. |
| **Course 2.4** | **Aorta Ultrasound** | |
| | 1. Visualize the abdominal aorta and measure the aortic diameter at appropriate points<br>2. Visualize the celiac trunk, mesenteric artery and renal arteries and describe the structures | 45 min. |

**Table 3:** The fulfillment of the course criteria for PoCUS guidelines in our training

| |
|---|
| Stretcher at every station (Successful) |
| Large/multiple rooms (Successful) |
| Maximum ratio of one instructor to five students (Unsuccessful) |
| Ultrasound gel and paper towels (Successful) |
| Simulated patient with normal anatomy (Successful) |
| Simulated patient with pathological appearance (Unsuccessful) |
| Informed consent of the simulated patient (Successful) |
| Post-course feedback questionnaire (Unsuccessful) |

The criteria for successful imaging are given on Table 4 below.

In summary, on the first day, the needs of emergency medicine residents were determined by a questionnaire. Within 7 days, the learning objectives were created. After 3 days, an exam was applied to the participants. One week later, the training was applied. Finally, the same exam was performed again after the training. The timeline of our study is shown in Figure 1 below.

**Ethical Committee Approval**

This study was approved by the Local Ethics Committee (Date: 06.06.2022, decision no: 139/36). The study was conducted in line with the creiteria of the Helsinki Declaration throughout the research process. A written informed was obtained consent form for each participant.

**Statistical analysis**

The data were analysed with SPSS (Statistical Package for Social Sciences, SPSS Inc., Chicago, Illinois, USA) 25.0 software package. Descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum) were used. The normality of the distribution of the data was checked by Shapiro-Wilk test. The distribution of continuous data was tested by Kolmogorov-Smirnov test. The success rates of the participants in the theoretical and practical exams were evaluated separately for each person. Mann-Whitney U test was used to compare two groups with respect to non-normally distributed data. The significance test of the difference of two matched groups was performed with Wilcoxon test.

**RESULTS**

In our study, 26 emergency medicine residency students working in Training and Research Hospital were included. The votes for the PoCUS courses cast by the 26 emergency

**Table 4:** Criteria for successful visualization

| | Imaging areas | | | |
|---|---|---|---|---|
| | **Cardiac US** | **E-FAST** | **Hepatobiliary System** | **Aorta Ultrasound** |
| **Criteria** | PLAX view LV, RV, MV, AV structures | Demonstration of the perihepatic space | To be able to show the gallbladder and scan the entire gallbladder | To be able to show the abdominal aorta |
| | PSAX view papillary muscle, MV, AV visualization | Demonstration of the splenorenal space | To be able to show the common bile duct, portal vein and hepatic artery | To be able to show celiac trunk, mesenteric artery and renal arteries |
| | Apical 4 chambers LV, RV, LA, RA, MV, TV visualization | Demonstration of the suprapupic space | | |
| | Visualization of pericardial borders in subxiphoid view | Visualization of pericardial borders in subxiphoid view | | |
| | | Demonstration of pleural movement in the anterior thoracic window | | |

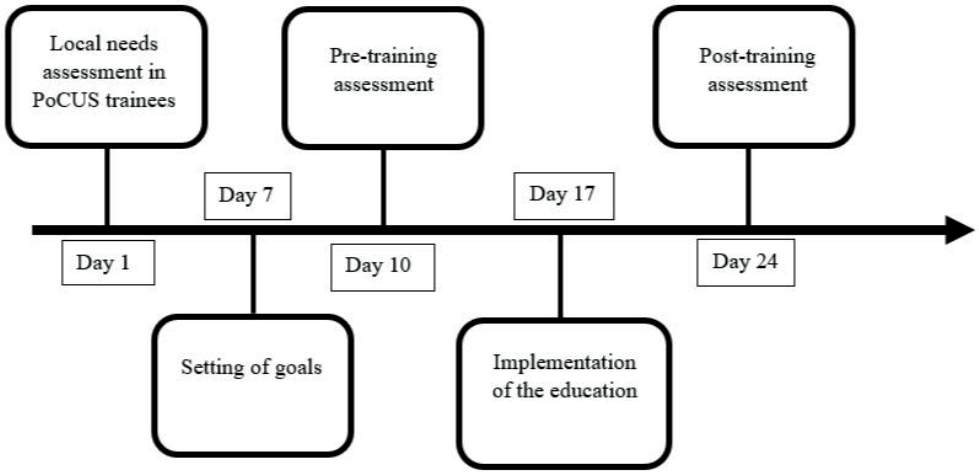


**Figure 1:** The timeline of our study

medicine residency students, who agreed to participate in the study in line with their needs, are shown in Figure 2.

Before the training, the minimum cardiac US imaging time was 29 seconds, maximum 60 seconds, and 42.33±9.20 seconds on average. It was found that the pre-training cardiac US imaging time was normally distributed ($p>\alpha=0.05$). Aortic imaging time before the training was minimum 17 seconds maximum 40 seconds, with a mean duration of 25.00±7.50 seconds. Aortic imaging time before the training was found to be normally distributed ($p>\alpha=0.05$). Hepatobiliary imaging time before training was minimum 23 seconds, maximum 65 seconds, and 41.00±12.49 seconds on average. Hepatobiliary imaging time before the training was found to be normally distributed ($p>\alpha=0.05$). E-FAST imaging time before the training was minimum 45 seconds, maximum 63 seconds, and 54.00±5.19 seconds on average. It was found that the pre-training E-FAST imaging time was normally distributed ($p>\alpha=0.05$).

After the training, it was found that cardiac US imaging time was normally distributed ($p>\alpha=0.05$). Aortic imaging time after the training was minimum 11 seconds, maximum 30 seconds, and 18.67±5.78 seconds on average. After the training, it was found that the aortic imaging time was normally distributed ($p>\alpha=0.05$). After the training, hepatobiliary imaging time was minimum 21 seconds, maximum 52 seconds, and 33.33±9.49 seconds on average. Hepatobiliary imaging time after the training was found to be normally distributed ($p>\alpha=0.05$). After the training, E-FAST imaging time was minimum 11 seconds, maximum 34 seconds, and 22.67±6.64 seconds on average.

The participants included in the study worked in the Emergency Medicine clinic for a minimum of 6 months and a maximum of 48 months. The average duration of Emergency Medicine practice was 23.1 months. The number of residents who successfully performed Cardiac imaging, Aortic imaging, Hepatobiliary imaging, E-FAST before the training was less than half of all participants. After the training, the number of participants

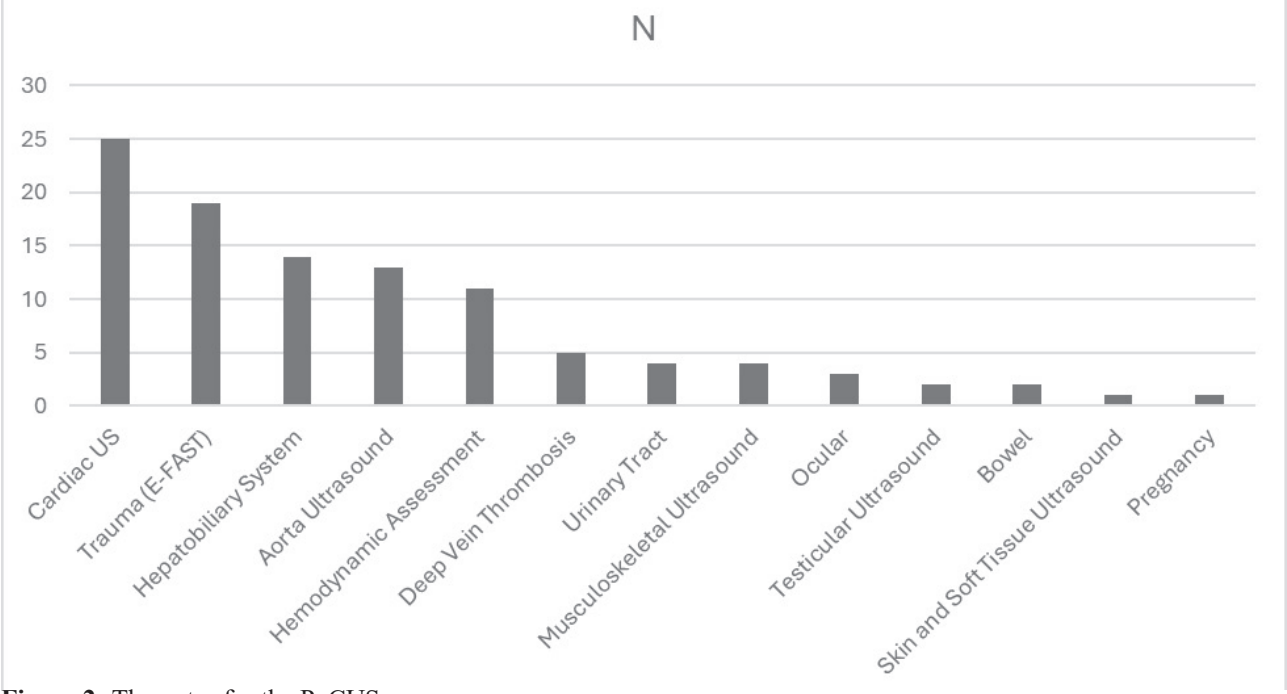


**Figure 2:** The votes for the PoCUS courses

who provided adequate images in all imaging studies increased. Descriptive statistics and distribution tests of the measurements are given on Table 5.

There was no correlation between the duration of working in emergency medicine clinic and pre-training and post-training imaging times, except for a single imaging. There is a highly significant negative correlation (r: -0.783) between the duration of working in the emergency medicine clinic and pre-training E-FAST imaging time.

After the training, created in line with the needs of emergency medicine resident physicians, was completed, the time to provide successful images in all imaging methods (Cardiac imaging, Aortic imaging, Hepatobiliary imaging, E-FAST) significantly decreased. The comparison of the measurements before and after the training is shown on table 6.

**DISCUSSION**

In this study, we applied the PoCUS course curriculum, which was created in line with the needs of emergency medicine residents, in eight hours, and investigated whether it increased the rate of adequate image acquisition and reduced the time of adequate image acquisition. As our results showed, the rate of adequate image acquisition increased, and the time of adequate image acquisition was reduced significantly. Training is important when considering barriers to PoCUS use, and PoCUS course curricula vary (11). With this study, we think that we have shown that certain emergency medicine ultrasound trainings such as the present emergency medicine ultrasound application, which is targeted and provides important information to physicians in a short time can be provided in a period as short as eight hours. The most important point that distinguishes our course curriculum from many other course programs is its six-step training planning. In this planning, determining the needs and shaping the planning with regional facilities constitute the most important steps. This shows that the program can be shaped according to hospital facilities in other regions. With this study, we think that the PoCUS curriculum can be shaped in a region-specific manner rather than a universal structure, which may increase the success of emergency medicine residentsin ultrasound use.

**Table 5:** Descriptive Statistics and Distribution Tests of Measurements

| Variables | N | Min. | Max. | Mean ± SD | Normality Test / p |
|---|---|---|---|---|---|
| Emergency department residency period (Months) | 26 | 6 | 50 | 23.12±13,53 | 0.812/0.144* |
| Pre-training Cardiac imaging (sec) | 6 | 29 | 60 | 42.33±9.20 | 0.945/0.546* |
| Pre-training Aortic imaging (sec) | 11 | 17 | 40 | 25.00±7.50 | 0.783/0,073* |
| Pre-training Hepatobiliary imaging (sec) | 8 | 23 | 65 | 41.00±12.49 | 0.942/0.537* |
| Pre-training E-FAST (sec) | 11 | 45 | 63 | 54.00±5.19 | 1.000/1.000* |
| Post-training Cardiac imaging (sec) | 19 | 10 | 31 | 21.33±6.11 | 0.981/0.739* |
| Post-training Aortic imaging (sec) | 22 | 11 | 30 | 18.67±5.78 | 0.900/0.384* |
| Post-training Hepatobiliary imaging (sec) | 20 | 21 | 52 | 33.33±9.49 | 0.889/0.350* |
| Post-training E-FAST (sec) | 26 | 11 | 34 | 22.67±6.64 | 0.999/0.952* |

**Shapiro-Wilk Normality Test **p>α=0.05 statistical significance*

**Table 6:** Comparisons of Measurements Before and After Training

| | Variables | Mean ± Standard Deviation | T Test | p |
|---|---|---|---|---|
| **Pre - Post training Cardiac US time** | Pre-training Cardiac | 52.83±18.19 | 4.404 | 0.007* |
| | Post-training Cardiac | 20.83±7.75 | | |
| **Pre- Post training Aorta time** | Pre-training Aortic | 66.18±43.13 | 3.603 | 0.005* |
| | Post-training Aortic | 38.64±26.51 | | |
| **Pre- Post training Hepatobiliary time** | Pre-training Hepatobiliary | 64.50±33.44 | 2.649 | 0.033* |
| | Post-training Hepatobiliary | 37.50±14.53 | | |
| **Pre- Post training E-FAST time** | Pre-training E-FAST | 91.82±40.54 | 5.522 | 0.000* |
| | Post-training E-FAST | 22.18±8.30 | | |

**Paired Sample T Test, **Wilcoxon T Test, p<α=0.05 statistical significance*

The unique aspect of our training curriculum is that it is formed in six steps and the first of these steps is shaped in line with the needs of the participants within the capabilities of our clinic. Similarly, there are studies in the literature showing the difficulty of a standardized training in different regions and suggesting the creation of a region-specific training curriculum (12).

In the survey study conducted to determine the PoCUS needs of the participants, the four most requested PoCUS studies were Cardiac US, E-FAST, Hepatobiliary imaging and Aorta US. The three most preferred PoCUS applications in the studies were like the survey results in our study (13,14). This may be due to the rapid and significant contribution of cardiac US, E- FAST, and Aorta US to emergency medicine practice. The three PoCUS applications, which are needed for situations where urgent decisions need to be made for a given patient, were among the most preferred studies by the participants in our study and formed the basis of our training curriculum. When the literature was reviewed, obstetric US was the most performed PoCUS application after cardiac US and E-FAST (15). However, since our hospital does not have an obstetrics clinic, obstetric emergencies may not have been among the first four PoCUS studies since those emergencies are not frequently admitted.

Following the widespread application of emergency ultrasound, emergency ultrasound training has become a necessity. Most emergency medicine residents want to receive training on emergency ultrasound (14). The prevalence of the demand for training among emergency physicians may indicate a lack of knowledge on the subject. At the same time, although ultrasound training curricula are already in place, it is evident that there is no common training system between clinics (16). In our study, imaging success rates of the participants for echocardiography, hepatobiliary, aortic, and E-FAST were lower than 50% before the emergency ultrasound training. The fact that only 23.1% of the participating emergency physicians were able to provide adequate images in cardiac US may explain the inadequacy of the training programs and the demand by emergency physicians for more training on emergency ultrasound. Similar to our study, in a study conducted in Haiti, the success rate increased after a training program on cardiac US compared to the pre-treatment period (17).

There are also data in the literature that contradict our results. In a study conducted in Guyana, the pre-training ultrasound success of emergency medicine physicians was significantly higher than the participants in our study (18). We attribute these different results to achievement assessment scales differing from country to country. There are several structured assessment criteria for the evaluation of ultrasound training (19-22). These guiding evaluation criteria are not widely used.

There was a highly significant negative correlation (r: -0.783) between the duration of working in the emergency department and E-FAST imaging time before training. We think that the routine use of E-FAST in our clinical practice, especially in trauma patients, is influential in this correlation. In the literature, , short-term E-FAST training in students was found beneficial in providing successful images even in pre-clinical medical students (23). It can also be considered that the routine use of E-FAST in our clinic contributes to peer training (24).

In this study, we found that a targeted eight-hour basic ultrasonography training in line with the demands of emergency residents had a positive contribution on the practical examinations performed by emergency physicians. Only after an eight-hour training, the times to successfully acquire an image in emergency echocardiography, aortic imaging, hepatobiliary, and E-FAST imaging were significantly shorter than those recorded before the training. In a study by Mandavia et al., 16 hours of training contributed to the success of the participants (25). Another recent study found that a 9-hour introductory training course improved the participants' skills in using ultrasound and increased the physicians' confidence in using ultrasound (26). In our study, we observed that interest in ultrasound increased with pre- and post-training exams and eight hours of training, and physicians included ultrasound more in their daily practice.

Training curricula on the use of emergency ultrasound are not fully and uniformly implemented in our country. There is still no consensus on the evaluation scales of trainings in the world (27). However, even this eight-hour training we applied in our clinic increased the participants' ability to acquire adequate images in certain PoCUS applications

and shortened the time to provide adequate images. We think that a basic PoCUS training with a systematic approach in 6 steps may be effectively improve the ultrasound utilization skills of emergency physicians.

**Limitations**

Our study has some limitations. In our study, while providing practical training to emergency physicians and applying practical exams, studies were conducted on healthy volunteers. Despite obtaining successful images, physiological images were taken as the basis. No aim was made to detect and interpret pathological images in the practical exams. This is a limitation of our study, but the pathological images were used in the theoretical exams and the participants were asked to interpret them.

In our study, the practical exam was planned by ensuring that each participant was alone with the volunteer mannequin and the proctor. However, we could not determine whether the hyperemic area remaining on the body of the volunteer mannequin after the trainee used ultrasound was used by the next participant as a guiding point.

**CONCLUSION**

More than half of emergency medicine trainees are unable to acquire images in PoCUS. Cardiac US, E-FAST, Hepatobiliary imaging, and Aorta US are the most demanded PoCUS applications. The eight-hour PoCUS training curriculum, created in six steps and shaped by participant needs and clinical resources, increases the image acquisition success of the participants and shortens the image capture time.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Ethics:** The study was approved by the Local Ethics Committee for Dışkapı Dışkapı Yıldırım Beyazit Training and Research Hospital (Date: 06.06.2022, decision no: 139/36)

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**Approval of final manuscript:** All authors.

**REFERENCES**

1. Hoppmann RA, Rao VV, Poston MB, Howe DB, Hunt PS, Fowler SD, et al. An integrated ultrasound curriculum (iUSC) for medical students: 4-year experience. Crit Ultrasound J. 2011;3(1):1-12. Epub 2011/04/26. doi: 10.1007/s13089-011-0052-9. PubMed PMID: 21516137; PubMed Central PMCID: PMC3064888.
2. Hoppmann RA, Rao VV, Bell F, Poston MB, Howe DB, Riffle S, et al. The evolution of an integrated ultrasound curriculum (iUSC) for medical students: 9-year experience. Crit Ultrasound J. 2015;7(1):18. Epub 2015/11/22. doi: 10.1186/s13089-015-0035-3. PubMed PMID: 26589313; PubMed Central PMCID: PMC4654731.
3. Dinh VA, Dukes WS, Prigge J, Avila M. Ultrasound Integration in Undergraduate Medical Education: Comparison of Ultrasound Proficiency Between Trained and Untrained Medical Students. J Ultrasound Med. 2015;34(10):1819-24. Epub 20150902. doi: 10.7863/ultra.14.12045. PubMed PMID: 26333569.
4. Ultrasound Guidelines: Emergency, Point-of-Care, and Clinical Ultrasound Guidelines in Medicine. Ann Emerg Med. 2023;82(3):e115-e55. doi: 10.1016/j.annemergmed.2023.06.005. PubMed PMID: 37596025.
5. Ahern M, Mallin MP, Weitzel S, Madsen T, Hunt P. Variability in Ultrasound Education among Emergency Medicine Residencies. West J Emerg Med. 2010;11(4):314-8. Epub 2010/11/17. PubMed PMID: 21079699; PubMed Central PMCID: PMC2967679.
6. Amini R, Adhikari S, Fiorello A. Ultrasound competency assessment in emergency medicine residency programs. Acad Emerg Med. 2014;21(7):799-801. Epub 2014/07/22. doi: 10.1111/acem.12408. PubMed PMID: 25039680.
7. Wells M, Goldstein LN, Beringer C, Farham B. Emergency Medicine Society of South Africa guidelines for the training and credentialing in emergency point-of-care ultrasound. S Afr Med J. 2021;111(5b):13296. Epub 20210503. doi: 10.7196/SAMJ.2021.v111i5b.15346. PubMed PMID: 33944752.
8. Micks T, Sue K, Rogers P. Barriers to point-of-care ultrasound use in rural emergency departments. CJEM. 2016;18(6):475-9. Epub 2016/07/25. doi: 10.1017/cem.2016.337.
9. Shah S, Bellows BA, Adedipe AA, Totten JE, Backlund BH, Sajed D. Perceived barriers in the use of ultrasound in developing countries. Critical Ultrasound Journal. 2015;7(1):11. doi: 10.1186/s13089-015-0028-2.
10. Kern DE. Curriculum development for medical education: a six step approach: JHU Press; 1998.
11. Smith M, Krishnan SV, Leamon A, Galwankar S, Sinha TP, Kumar VA, et al. Removing Barriers to Emergency Medicine Point-of-Care Ultrasound: Illustrated by a Roadmap for Emergency Medicine Point-of-Care Ultrasound Expansion in India. J Emerg Trauma Shock. 2023;16(3):116-26. Epub 20230929. doi: 10.4103/jets.jets_50_23. PubMed PMID: 38025509; PubMed Central PMCID: PMC10661575.
12. Fourie L, Pather MK, Hendricks G. Point-of-care ultrasound: The new district focus. Afr J Prim Health Care Fam Med. 2023;15(1):e1-e8. Epub 20230614. doi: 10.4102/phcfm.v15i1.3576. PubMed PMID: 37403679; PubMed Central PMCID: PMC10319924.
13. Moore CL, Molina AA, Lin H. Ultrasonography in community emergency departments in the United States: access to ultrasonography performed by consultants and status of emergency physician-performed ultrasonography. Ann Emerg Med. 2006;47(2):147-53. Epub 20051121. doi: 10.1016/j.annemergmed.2005.08.023. PubMed PMID: 16431225.
14. Fischer LM, Woo MY, Lee AC, Wiss R, Socransky S, Frank JR. Emergency medicine point-of-care ultrasonography: a national needs assessment of competencies for general and expert practice. Cjem. 2015;17(1):74-88. doi: 10.2310/8000.2013.131205. PubMed PMID: 25961081.
15. Smalley CM, Simon EL, Muir MR, Fertel BS. A Real-World Experience: Retrospective Review of Point-of-Care Ultrasound Utilization and Quality in Community Emergency Departments. West J Emerg Med. 2023;24(4):685-92. Epub 20230630. doi: 10.5811/westjem.58965. PubMed PMID: 37527388; PubMed Central PMCID: PMC10393449.
16. Kim DJ, Olszynski P, Smith DJW, Lalande E, Woo MY. Point of care ultrasound training in Canadian emergency medicine residency programs. Cjem. 2022;24(3):329-34. Epub 20220303. doi: 10.1007/s43678-022-00269-1. PubMed PMID: 35239169.
17. Rao VV, DellaValle J, Gelin G, Day J. Mission POCUS in Haiti. J Radiol Nurs. 2023;42(1):77-84. Epub 20230201. doi: 10.1016/j.jradnu.2022.12.006. PubMed PMID: 36742420; PubMed Central PMCID: PMC9890376.
18. Jhagru R, Singh R, Rupp J. Evaluation of an emergency medicine point-of-care ultrasound curriculum adapted for a resource-limited setting in Guyana. Int J Emerg Med. 2023;16(1):57. Epub 20230906. doi: 10.1186/s12245-023-00531-y. PubMed PMID: 37674124; PubMed Central PMCID: PMC10481457.
19. Lewiss RE, Pearl M, Nomura JT, Baty G, Bengiamin R, Duprey K, et al. CORD-AEUS: consensus document for the emergency ultrasound milestone project. Acad Emerg Med. 2013;20(7):740-5. doi: 10.1111/acem.12164. PubMed PMID: 23859589.
20. Hofer M, Kamper L, Sadlo M, Sievers K, Heussen N. Evaluation of an OSCE assessment tool for abdominal ultrasound courses. Ultraschall Med. 2011;32(2):184-90. Epub 20110214. doi: 10.1055/s-0029-1246049. PubMed PMID: 21321843.

21. Ma IWY, Desy J, Woo MY, Kirkpatrick AW, Noble VE. Consensus-Based Expert Development of Critical Items for Direct Observation of Point-of-Care Ultrasound Skills. J Grad Med Educ. 2020;12(2):176-84. doi: 10.4300/jgme-d-19-00531.1. PubMed PMID: 32322351; PubMed Central PMCID: PMC7161337.
22. Boniface KS, Ogle K, Aalam A, LeSaux M, Pyle M, Mandoorah S, et al. Direct Observation Assessment of Ultrasound Competency Using a Mobile Standardized Direct Observation Tool Application With Comparison to Asynchronous Quality Assurance Evaluation. AEM Educ Train. 2019;3(2):172-8. Epub 20190219. doi: 10.1002/aet2.10324. PubMed PMID: 31008429; PubMed Central PMCID: PMC6457355.
23. Shokoohi H, Boniface K, Kaviany P, Armstrong P, Calabrese K, Pourmand A. An Experiential Learning Model Facilitates Learning of Bedside Ultrasound by Preclinical Medical Students. J Surg Educ. 2016;73(2):208-14. doi: 10.1016/j.jsurg.2015.10.007. PubMed PMID: 26868311.
24. Ahn JS, French AJ, Thiessen ME, Kendall JL. Training peer instructors for a combined ultrasound/physical exam curriculum. Teach Learn Med. 2014;26(3):292-5. doi: 10.1080/10401334.2014.910464. PubMed PMID: 25010242.
25. Mandavia DP, Aragona J, Chan L, Chan D, Henderson SO. Ultrasound training for emergency physicians--a prospective study. Acad Emerg Med. 2000;7(9):1008-14. doi: 10.1111/j.1553-2712.2000.tb02092.x. PubMed PMID: 11043996.
26. Geis RN, Kavanaugh MJ, Palma J, Speicher M, Kyle A, Croft J. Novel Internal Medicine Residency Ultrasound Curriculum Led by Critical Care and Emergency Medicine Staff. Mil Med. 2023;188(5-6):e936-e41. doi: 10.1093/milmed/usab392. PubMed PMID: 34591116.
27. Damewood SC, Leo M, Bailitz J, Gottlieb M, Liu R, Hoffmann B, et al. Tools for Measuring Clinical Ultrasound Competency: Recommendations From the Ultrasound Competency Work Group. AEM Educ Train. 2020;4(Suppl 1):S106-s12. Epub 20190730. doi: 10.1002/aet2.10368. PubMed PMID: 32072114; PubMed Central PMCID: PMC7011402.