

Competency of Ultrasound Knowledge of Laos Emergency Medicine Residents during International Elective Rotation in Thailand

Kamonwon Ienghong, MD¹, Takaaki Suzuki, MD², Alongkone Phengsavanh, MD³, Titaporn Nasaarn, MD¹

¹ Department of Emergency Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand

² Department of Emergency and Critical Care Medicine, University of Tsukuba Hospital, Tsukuba, Japan

³ Faculty of Medicine, University of Health Sciences, Vientiane, Laos

Background: International rotations for EM residents are becoming increasingly popular. However, there is a dearth of evidence to demonstrate that these rotations can be performed utilizing the POCUS training and that residents have appropriate training, which could assist them in improving their point-of-care ultrasound (POCUS) knowledge.

Objective: The researchers aimed at evaluating the POCUS knowledge of the international EM residents after the POCUS training during an international elective rotation.

Materials and Methods: A curriculum was developed in the form of a 4-week rotation in the Laos EM residency program at the Department of Emergency Medicine at Khon Kaen University's Srinagarind Hospital. It consisted of didactic lectures, bedside ultrasound trainings, the journal club, and the process of reviewing the images. Tools were developed, which included a knowledge exam, which was designed to test the residents' image interpretation abilities and their clinical decision-making processes. The assessments were administered before and after each resident's rotation.

Results: Eight Laos EM residents completed their rotations and the tests. The average Pre-training scores and Post-training scores were 11.13 ± 1.27 and 17.75 ± 1.30 , respectively. The average knowledge test score was found to have significantly improved from 55.63% to 88.75%.

Conclusion: A POCUS training for the Laos EM residency program in the international elective rotation was able to be developed. Through participating in this training, the residents had been able to improve their basic POCUS knowledge, which will aid the emergency physicians to better care for their patients.

Keywords: Ultrasound, POCUS, Emergency medicine, International cooperation

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Laos has been classified as one of the least developed countries⁽¹⁾, and the public health system in Laos still has many problems, such as caring for emergency patients. In 2017, the first training for residents in Emergency Medicine was developed in Laos. This three-year training program has been supported by Health Frontiers and the University of Health Sciences in Vientiane, Lao PDR⁽²⁾. In 2019, collaboration was undertaken among 3 universities in 3 countries: the University of Health Science in Laos.

The University of Tsukuba in Japan, and the

Faculty of Medicine at Khon Kaen University in Thailand. The mission of this collaboration has been to develop trainings for residents in Emergency Medicine and to improve the emergency trauma care and Emergency Medical Services (EMS) in Laos. Funding for this program was supplied by the Japan International Cooperation Agency (JICA), which provides resources for the Laos organization, as well as scholarships to those, who are training in the program.

The international rotations for Emergency Medicine (EM) residents are becoming popular all over the world given the awareness of the global health issues^(3,4). In previous literature about international rotation programs, we discovered that some EM residents in the US had been sent to Argentina⁽⁵⁾ and Rwanda⁽⁶⁾ to observe the global environments of emergency care. Therefore, a 1-month international elective rotation for third-year residents in Emergency Medicine from Lao was arranged at the Department of Emergency Medicine at Khon Kaen University's Srinagarind Hospital in Thailand.

In terms of the curriculum for the Emergency Medicine residents all over the world and in Thailand, Point-of-Care Ultrasound (POCUS) is one of the core competencies for both training and practice in Emergency Medicine. Hence,

Correspondence to:

Nasaarn T.

Department of Emergency Medicine, Khon Kaen University, Khon Kaen 40002, Thailand

Phone: +66-43-366869, **Fax:** +66-43-366870

Email: md221@kku.ac.th

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in this elective rotation, we were able to provide the POCUS training, which included didactic lectures, bedside ultrasound trainings, the journal club, and the process of reviewing the images.

This was the first international elective rotation provided for Laos EM residents. In this study, we aimed to evaluate the POCUS knowledge of the Laos EM residents prior to studying in the international elective rotation in Thailand and after they had completed their training.

Materials and Methods

Study design

This was a retrospective, single-center, observational analytical study conducted in a tertiary university hospital in Thailand. Ethics approval was provided by the Khon Kaen University Ethics Committee for Human Research and was registered with the Thai Clinical Trials Registry (HE631198).

Participants

The Lao EM residents, who studied in the international elective rotation at the Department of Emergency Medicine at Khon Kaen University's Srinagarind Hospital, were enrolled in this study. No monetary incentives were provided to the participants, and prior to enrollment, written informed consent was obtained from each of them.

Sample size

All of the EM residents from Laos, who studied in the international elective rotation during the period from January 2020 to March 2020, were included in this study. The EM residents from Lao, who had not participated in this rotation, were excluded. Hence, that the total number of participants was determined to be 8 EM residents.

Study protocol (The POCUS training in the international elective rotation)

In this international rotation, EM residents from Lao participated in the program. It consisted of a 4-week rotation in the Emergency Department. During this period, bedside ultrasound learning was provided by a supervisor, who was a POCUS specialist (9 hours per week). In addition, there was the journal club (2 times, 3 hours/time), the process of reviewing the ultrasound images (2 times, 3 hours/time), and the didactic lectures (3 hours per week), which consisted of a basic introduction to ultrasound technology (i.e., cardiac, lung, abdomen, inferior vena cava, and aorta) and ultrasound protocols, such as the FAST examination, the RUSH protocol, and the CASA protocol.

The ultrasound equipment

The EM residents from Laos used the standard ultrasound machines (the Mindray M9 and Sonosite M Turbo), which are used in the Emergency Department. In terms of transducers, curvilinear, linear, and phased array probes were provided.

The POCUS training evaluation

At the beginning of the rotation, all of the Laos EM residents were requested to complete the Pre-training test, which consisted of 20 POCUS multiple choice questions that presented ultrasound pictures, video clips, and simple clinical scenarios. The individual students, who took the test, were anonymized, and each student was then de-identified and given a code to use. After 1-month into the international rotation, the anonymized post-course testing (using a de-identified code for each student) was completed by all participants.

Statistical analysis

The quantitative data was presented as means \pm standard deviations, while the qualitative data was presented using proportions and percentages. Differences in the Pre-training and Post-training tests were compared using a paired sample t-test. A two-tailed $p < 0.05$ was considered to be statistically significant. All data analyses were performed using Stata version 10 (StataCorp, College Station, TX).

Results

Our program ran from January 2020 to March 2020. All 8 EM residents from Lao were recruited from this international elective rotation, and all of them completed the test. The average age of the participants was 34 ± 4.30 years, and 62.5% ($n = 5$) of the participants were female.

The average Pre-training scores and Post-training scores were 11.13 ± 1.27 and 17.75 ± 1.30 , respectively. The difference of the average pre- and post-training scores was statistically significant (p -value < 0.001). The Pre-training scores and Post-training scores for each participant are shown in Figure 1. The average scores on the multiple-choice test showed a statistically significant improvement from 55.63% before the rotation to 88.75% after the rotation (p -value < 0.001). The number of correct answers for the Pre-training scores and Post-training tests are shown in Table 1.

Discussion

It was found that in the multiple-choice test, the residents had improved significantly. This suggests that the POCUS training, which had been developed for the international elective rotation had been successful in improving the residents' basic POCUS knowledge. We found the scores improved from 55.63% to 88.75%, which had been consistent with the previous studies⁽⁷⁻¹¹⁾. For example, in a study by Bornemann⁽⁷⁾, seventeen residents from Family Medicine completed a 4-week ultrasound curriculum. It was found that the average knowledge test scores of the residents had significantly improved, from 62 to 84%. A study conducted by Blackstock⁽⁸⁾ showed that on an EM rotation, forty-five medical students had demonstrated an increase in sonographic knowledge given that their overall mean scores had significantly improved from 66.6% ($SD \pm 11.2$) to 85.7% ($SD \pm 10.0$). Another study by Lee⁽⁹⁾ showed that 41

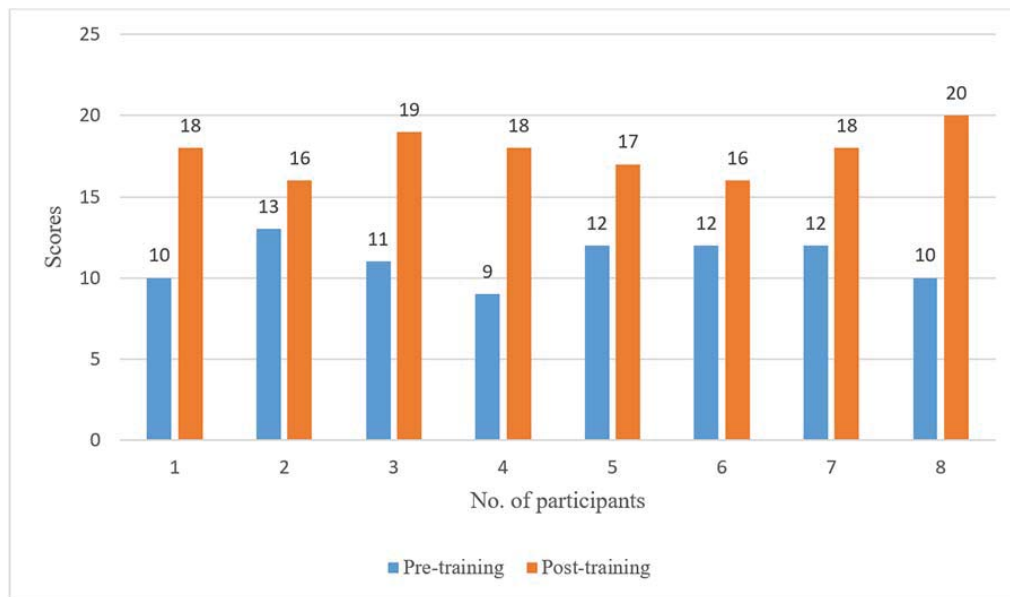


Figure 1. A comparison of the Pre-training and the Post-training scores for each participant

Table 1. A comparison of the number of the right answers between the Pre-, Post-training tests

No. of question	Number of right answer, n (%) (n = 8)		p-values
	Pre-training	Post-training	
1) Cardiology	7 (87.5)	8 (100)	0.351
2) Cardiology	6 (75)	8 (100)	0.170
3) Cardiology	4 (50)	8 (100)	0.033*
4) Cardiology	4 (50)	8 (100)	0.011*
5) Cardiology	3 (37.5)	7 (87.5)	0.104
6) Lungs	5 (62.5)	3 (37.5)	0.351
7) Lungs	3 (37.5)	7 (87.5)	0.104
8) Inferior vena cava (IVC)	4 (50)	6 (75)	0.451
9) FAST exam	6 (75)	6 (75)	>0.999
10) FAST exam	7 (87.5)	7 (87.5)	>0.999
11) RUSH protocol	3 (37.5)	7 (87.5)	0.104
12) CASA protocol	2 (25)	8 (100)	0.003*
13) Hepatobiliary	8 (100)	5 (62.5)	0.080
14) Hepatobiliary	7 (87.5)	7 (87.5)	>0.999
15) Soft tissue and Musculoskeletal	2 (25)	8 (100)	0.003*
16) Soft tissue and Musculoskeletal	3 (37.5)	8 (100)	0.011*
17) Vascular	4 (50)	6 (75)	0.351
18) Knobology	6 (75)	8 (100)	0.170
19) OB-GYN	5 (62.5)	8 (100)	0.080
20) OB-GYN	5 (62.5)	8 (100)	0.080

Indonesian clinicians, who had attended 4-week ultrasound training course, had had average pre-course exam scores at 35.2% with a 2.4% pass rate. In contrast, their average post-course exam scores had been 82.0% with a 92.7% pass rate.

From the results of this study, it was shown that before the training, the EM residents from Lao already possessed a basic knowledge of POCUS in some aspects, such as cardiology, the FAST exam, and the hepatobiliary system. However, it was discovered that they lacked knowledge in the following areas: soft tissue and musculoskeletal, OB-GYN, the vascular system, and in some novel ultrasound protocols, such as the RUSH and the CASA protocols. After receiving the training, the residents' knowledge scores had increased in most aspects. The knowledge scores of cardiology, CASA protocol, Soft tissue and Musculoskeletal in most students were improved statistically significant.

Nevertheless, this study was unable to evaluate the retention of the knowledge they had received and the residents' long-term memory. The factor, which could have affected scoring, was that participants were not graded based on their test scores. Moreover, the method of enrolling the study participants was limited by number of students, who were participating in the rotation.

Previous studies in medical education, which have addressed global health issues, have focused on stand-alone ultrasound courses⁽¹²⁾ or on stand-alone international EM elective rotations^(13,14). However, in this study, we conducted the POCUS training during an international elective rotation. This approach was able to provide benefits by allowing the researchers to assess how incorporating the POCUS training had affected the clinical decision-making processes of the residents in more real-world situations, such as in the Emergency Department and in other environments. For the future, a better way to assess the ability of each participant in the POCUS examination would be to base it on a practice examination⁽¹⁵⁻¹⁹⁾.

Conclusion

This study found that as a result of completing a 4-week POCUS training course, EM residents from Lao had been able to effectively learn the POCUS during the international elective rotation at Srinagarind Hospital. In order to evaluate the residents' POCUS skills and their degree of confidence to perform POCUS in the Emergency Department, as well as to determine the level of satisfaction regarding this course, future studies are needed. Moreover, the participants should be re-evaluated so that their long-term retention can be determined.

What is already known on this topic?

Recent studies have shown that ultrasound training can be carried out for medical students, residents in Emergency Medicine, and for others engaged in sub-specialty training. However, for the EM residents from Laos, their ultrasound learning has just begun.

What this study adds?

This study shows that for the novice Laos EM residents, there had been an increase in the knowledge test scores of the POCUS. This increase had taken place after the residents had received 4 weeks of POCUS training from experts while participating in an international elective rotation in Thailand.

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Conflicts of interest

The authors declare no conflict of interest.

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