Internal Medicine Residents' Perceptions of Point-of-Care Ultrasound in Residency Program: Highlighting the Unmet Needs

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ABSTRAK

Latar belakang: *Point-of-care ultrasound (POCUS) mulai banyak digunakan dalam bidang Ilmu Penyakit Dalam. Pelatihan Ultrasonografi telah menjadi bagian dari Program Pendidikan Dokter Spesialis (PPDS) Ilmu Penyakit Dalam. Tujuan penelitian ini adalah untuk menilai persepsi peserta PPDS mengenai kompetensi dan kebutuhan akan POCUS.* ***Metode****: Peneliti melakukan studi deskriptif potong-lintang dengan menggunakan data sekunder dari survei internal peserta PPDS IPD di Fakultas Kedokteran Universitas Indonesia. Survei tersebut dilakukan untuk evaluasi dan perbaikan pada PPDS.* ***Hasil:*** *175 dari 197 (88,8%) peserta PPDS mengikuti survei. 99,4% subjek setuju POCUS merupakan ketrampilan yang harus dimiliki selama PPDS. Namun hanya 40% subjek menilai mereka mampu melaksanakan POCUS. Enam puluh dua persen peserta PPDS menyatakan durasi pelatihan USG selama PPDS belum cukup. Subjek menilai ketrampilan yang paling penting ialah USG hepatobilier, paru, jantung, ginjal dan tindakan yang dipandu USG.* ***Kesimpulan:*** *Penelitian ini menyatakan bahwa pelatihan POCUS dibutuhkan oleh peserta PPDS IPD karena mayoritas dari subjek menyatakan bahwa mereka tidak mampu melaksanakan USG. Optimalisasi pelatihan yang telah ada harus dilakukan untuk memastikan kecakapan peserta PPDS.*

Kata kunci: *Ilmu penyakit dalam, program pendidikan dokter spesialis, ultrasonografi.*

ABSTRACT

Background**:** *Point-of-care ultrasound (POCUS) is increasingly utilized in internal medicine field. Ultrasound training has been part of the training provided in the Internal Medicine Residency Program (IMRP). The aim of this study is to examine the residents' needs and perceptions regarding their competency and needs of POCUS.* ***Methods:*** *We conducted a cross-sectional descriptive study using secondary data from a survey among internal medicine residents at the Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo National General Hospital. The survey was conducted to evaluate and improve the curriculum in IMRP.* ***Results:*** *A total of 175 out of 197 residents (88.8%) completed the questionnaire. Almost all the residents (99.4%) agreed that POCUS is a beneficial must-have skill during residency. Nevertheless, only 40% of residents identified themselves as competent in POCUS. Sixty-two percent residents reckoned that the training received during the residency program is insufficient.*

They indicated that the most useful skills are US of hepatobiliary, lungs, heart, kidneys, and US-guided procedures. ***Conclusion:*** *This study confirms that there is a need for POCUS training for IM residents, as the majority perceived themselves as unable to perform US. It is necessary to optimize the training provided to ensure proficiency.*

Keywords: *Internal medicine, residency, ultrasonography.*

INTRODUCTION

Point-of-care ultrasound (POCUS) is increasingly used in many specialties, including internal medicine (IM). The interesting aspect of POCUS is its application in point-of-care or bedside settings. This makes POCUS a goal-directed and focused tool in answering brief yet important clinical questions regarding the patients' symptoms.[1] Recent data shows that POCUS improves diagnostic accuracy and timeliness, shortens the time to definitive therapy, and reduces the risk of blind procedures.[1] Furthermore, POCUS can be used in various clinical scenarios, not only in emergency, but also in ward and outpatient clinic settings.

For internists, POCUS is an emerging and relatively new skill in daily clinical practice. Nevertheless, the Indonesian College of Internal Medicine requires internists to be competent in abdominal ultrasounds and various emergency scenarios that would benefit from ultrasound (US) use. To achieve that competence, US training has already become part of the training provided in the Internal Medicine Residency Program (IMRP), Faculty of Medicine Universitas Indonesia and Cipto Mangunkusumo National General Hospital. However, there is limited data about the optimal content and duration of the training program. To date, in Indonesia, no data has been published the IM residents' perception of the need for and competence acquisition of US skills during residency training.

An online survey regarding residents' perception of ultrasonography training was conducted at our institution by the IMRP during February-March 2020. The primary objective of the survey was to evaluate and improve the overall curriculum in IMRP. We carried out a descriptive study presenting secondary data analysis of the survey to further investigate the residents' needs and aspiration regarding ultrasound training. In the future, the results of this study are expected to form the basis for the development and formulation of a POCUS training program, as well as a US curriculum for IM residents at the Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo National General Hospital.

METHODS

We conducted a cross-sectional descriptive study using secondary data from a survey among IM residents at the Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo National General Hospital. The survey was organized in February-March 2020 by the IMRP at the Faculty of Medicine Universitas Indonesia. The survey was part of the evaluation and improvement program for overall curriculum in IMRP. The content of the questionnaire was developed by three researchers: an attending physician from the IM department, and two chief IM residents.

The survey was disseminated on February 18, 2020, using an online survey tool (www.docs.google.com/forms). All IM residents from the Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo National Hospital who had already begun their clinical rotations were invited to fill out the questionnaire. An invitation and regular reminder for this survey was distributed by the Internal Medicine Resident Committee (IMRC) between February 18, 2020 and March 8, 2020.

The questionnaire consisted of 18 questions concerning demographic data, the current US training and practice, and the residents' needs, perceived competence, limitations, and future expectations regarding US training during the residency program. At the beginning of the questionnaire there was also a brief illustration of what POCUS is. In the questionnaire, we divided the applications of POCUS into nine categories: (1) heart (pericardial effusion,

cardiac tamponade, ejection fraction, and tricuspid annular plane systolic excursion), (2) lung (pneumothorax, pleural effusion, lung edema, pneumonia, and lung mass), (3) vena cava (collapsibility index), (4) renal tract (hydronephrosis, urinary tract stones, acute kidney disease, and chronic kidney disease), (5) hepatobiliary (acute hepatitis, chronic liver disease, cirrhosis, splenomegaly, biliary duct dilatation, cholelithiasis, and choledocolithiasis), (6) intestinal and pancreas (acute pancreatitis, pancreatic mass, acute appendicitis, small bowel obstruction, inflammatory bowel disease), (7) deep vein thrombosis, (8) procedures (abdominal paracentesis and thoracocentesis), and (9) musculoskeletal (joint effusion). The full text of the survey can be found in Appendix. We extracted and analyzed the data in June 2020 using Microsoft Excel. The results of the survey were presented as descriptive statistics as frequencies and percentage. The study was approved by the Health Research Ethics Committee of the Faculty of Medicine Universitas Indonesia and Cipto Mangunkusumo National General Hospital (Reference no. KET-734/UN2.F1/ETIK/PPM.00.02/2020).

RESULTS

A total of 175 out of 197 residents completed this survey, yielding a response rate of 88.8%. The survey was voluntary and limited to 1 month period of dissemination. There were 22 residents who did not fill the survey. The demographics of the respondents are shown in **Table 1**.

The first part of the questionnaire consists of the questions concerning the residents' perception of the utility of POCUS. Almost all the residents (99.4%) agreed that POCUS is a must-have skill during residency training. All the residents agreed that POCUS is beneficial for improving the accuracy and timeliness of diagnosis in various conditions. They all agreed that POCUS can be used as a tool to ensure prompt management for various acute conditions, whether in the emergency room, wards, or outpatient clinics. The respondents' perception of which core applications of POCUS are useful for IM residents and internists are shown in **Table 2**.

Table 1. Demographic characteristic of respondents.

Demographics	N (%)
Age (years)	
26-30	122 (69.7)
31-35	46 (26.3)
36-40	7 (4)
Sex	
Male	88 (50.2)
Female	87 (49.8)
Residency (year)	
1	21 (12)
2	45 (25.7)
3	43 (24.6)
4	43 (24.6)
5	20 (11.4)
6	3 (1.7)
Ultrasound training	
Yes	135 (77.1)
No	40 (22.9)
Ultrasound machine available at workplace	
Yes	140 (80)
No	35 (20)
Frequency of exercising POCUS during the last 1 year	
Never	66 (37.7)
< 12 times in 1 year	77 (44)
12-24 times in 1 year	29 (16.6)
> 24 times in 1 year	3 (1.7)

Table 2. The most useful core applications indicated by respondents.

Core applications	Yes N (%)	No N (%)
Musculoskeletal	97 (55.4)	78 (44.6)
Procedures	152 (86.9)	23 (13.1)
Deep vein thrombosis	103 (58.9)	72 (41.1)
Intestinal and pancreas	109 (62.3)	66 (37.7)
Hepatobiliary	165 (94.3)	10 (5.7)
Renal tract	146 (83.4)	29 (16.6)
Vena cava	121 (69.1)	54 (31.9)
Lung	159 (90.9)	16 (1.1)
Heart	149 (85.1)	26 (14.9)

The second part of the questionnaire focused on the current use of US application and the residents' perception of their competence. Less than half of the residents (40%, n=70) identified themselves as competent in POCUS. Only 24 residents from year 4 (55.8%) and 9 residents from year 5 (45%) felt that they were competent to perform POCUS. The perceived competence of the residents for various US applications is shown in **Figure 1**. Out of the 135 respondents who had already received US training, 113

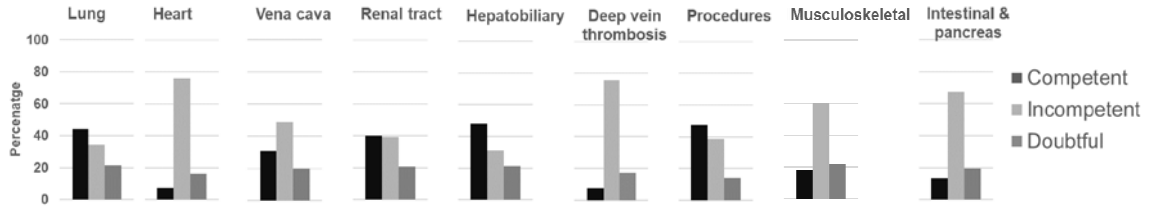

Figure 1. The residents' perceived competence in ultrasound applications.

(83.7%) felt that the training was insufficient. Forty-six percent of fourth-year residents and 40% of fifth-year residents reported that they had performed less than 12 POCUS examinations during the past year. If the residents had indeed performed ultrasounds themselves, the most common applications were hepatobiliary (42%, n=74), lung (40%, n=71), and US-guided procedures (36%, n=63).

The last part of the questionnaire was about limitations in acquiring competence and the residents' future expectations. Eighty percent of the respondents indicated the inadequacy of the US training as a major barrier. Other limitations were insufficient time to practice the skills needed, inadequate supervision from the instructors or attendings and uneven availability of the US machine at each workplace (**Table 3**).

All respondents agreed that POCUS skills might be needed and used in the next five years, when they are expected to be internists. All the respondents agreed that POCUS core applications must be taught during the residency program. The top five core competences they wished to acquire were heart, lung, hepatobiliary, deep vein thrombosis, and procedures (**Table 4**).

Table 3. Perceived barriers for POCUS use.

Limitations	Yes N (%)
Insufficient training module available	140 (80)
Insufficient practice time	110 (62.8)
Insufficient knowledge of ultrasound (POCUS)	95 (54.2)
Unavailability of ultrasound machine at workplace	95 (53.1)
Insufficient supervised practice time	82 (46.9)
Insufficient cases to practice on	25 (14.3)
No limitations	5 (2.9)

Table 4. Core applications the respondents aimed to achieve.

Core applications	Yes N (%)	No N (%)
Musculoskeletal	113 (64.6)	62 (35.4)
Procedures	134 (76.6)	41 (23.4)
Deep vein thrombosis	138 (78.9)	37 (21.1)
Intestinal and pancreas	124 (70.9)	51 (29.1)
Hepatobiliary	139 (79.4)	36 (21.6)
Renal tract	131 (74.9)	44 (25.1)
Vena cava	122 (69.7)	53 (30.3)
Lung	140 (80.0)	35 (20.0)
Heart	161 (92.0)	14 (8.0)

DISCUSSION

To the best of our knowledge, there has not been any study published in Indonesia assessing the needs and usefulness of US training for IM residents. Our study showed that all respondents believed that US skills are a must-have competence during residency training, as well as for internists. All respondents agreed that POCUS could be beneficial in improving diagnostic accuracy and promptness.

A study which was recently published in the Netherlands and carried out by Olgers, et al. also showed similar results.[2] These are consistent with previous studies showing a high level of interest in US training, as well as a generally low level of perceived competence among IM residents.[3–6] The use of POCUS by internists has increased significantly over the past years, due to the accumulating evidence showing that POCUS may assist therapeutic procedures and improve diagnostic performance when used alongside conventional physical examination.[7] The use of POCUS for lung and heart assessment increases accuracy when it comes to diagnosing dyspneic and shock patients.[8] As far as the examination of the abdomen is concerned, the ultrasound has been in widely, both in trauma and

in acute medicine settings. Moreover, it is now known that the use of POCUS in certain bedside procedures decreases the likelihood of errors and complications.[7] Based on those evidence, it is not surprising that POCUS skills are needed by IM residents in daily clinical practices.

Nevertheless, in our study, more than half of the respondents indicated that they had not achieved proficiency in US skills. It is also worth highlighting that only about half of the senior (chief) residents perceived themselves as competent US applications. They reported that the main barriers in acquiring the necessary proficiency are insufficient training modules, insufficient practice time, and a lack of knowledge regarding POCUS. These findings are in line with those of previous studies.[2–5]

During the Internal Medicine Residency Program at the Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo National General Hospital, the second-year residents were provided with three-day training in the US of hepatobiliary and kidney systems. After that, the residents would receive further US training during certain division rotations and would have opportunities to practice during outpatient care and on-call shifts at the emergency room and on inpatient wards. In spite of that, the residents regarded the amount of training and practice as insufficient.

At this moment, it is unclear how many hours of training an IM resident should receive to become competent in each US skills. As the US is a highly operator-dependent imaging modality, it certainly requires substantial time to study and practice. It is also up for debate whether an IM resident should acquire all the core competences of POCUS, since internal medicine consists of many subspecialties. According to the Indonesian College of Internal Medicine, abdominal US is the only US skill that an internist must achieve to the level of competence 4A, which means an internist must be proficient enough to do it without any further supervision.[9] However, the Indonesian College of Internal Medicine also requires internists to diagnose and treat various emergency conditions, such as acute abdominal pain, shock, acute kidney injury, respiratory failure and thrombosis, as well as to carry out procedures, such as abdominal paracentesis, thoracocentesis, and insertion of central vein catheter, which could benefit from the use of POCUS.

We believe that the results of this study reflect a real problem and limitation in our IMRP regarding ultrasound training. Although some of the US trainings are already part of the internal medicine curriculum, to date, there has not been any uniform curriculum of US training for internal medicine in Indonesia. It is necessary to have clear guidelines on the core competences and US skills an internist should acquire, in accordance with the standard competence mandated by the Indonesian College of Internal Medicine. The curriculum should include a description of core US applications and the training process needed to be achieved.[10,11] As the residents already have a clear perspective of the importance of ultrasound skills, an optimized training program is deemed necessary. We believe that the results of this study reflect a real problem and limitation in our IMRP regarding ultrasound training.

This study has some limitations. First, this study used secondary data from a previously conducted survey. Second, the questionnaire used in the survey was not validated due to not having an established gold standard. Third, this study was conducted using a cross-sectional survey performed at a single institution.

CONCLUSION

Our study showed high interest in and a need for US training among IM residents, as US is beneficial for patient care. Despite the training they obtained during the residency program, the majority of residents still perceived themselves as insufficiently trained to perform ultrasound. More than half of the residents reckoned that the training during residency is still lacking and considered this as a major barrier. This study will hopefully serve as a starting point for the optimization of US courses for the IM residency program. Additionally, studies in more center and institutions with larger samples may be needed to develop a uniform and integrated US curriculum for the internal medicine residency program in Indonesia. We believe that US will continue to

be safe, noninvasive, and useful complement to the history and physical examination of patients for the purpose of making accurate diagnoses. Therefore, it is crucial that future internists have sufficient training to take advantage of this powerful tool.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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APPENDIX

POCUS SURVEY FOR INTERNAL MEDICINE RESIDENTS OF UNIVERSITAS INDONESIA – CIPTO MANGUNKUSUMO GENERAL HOSPITAL

Point-of-care ultrasound (POCUS) is increasingly used in many specialties, including internal medicine (IM). It is as goal-directed and focused tool in answering clinical questions regarding patient's symptom or sign. Recent data show that POCUS improves diagnostic accuracy and timeliness, shortens the time to definitive therapy, and reduces the risk of blind procedures in various clinical scenarios, not only in emergency settings, but also in ward and outpatient clinic settings.

POCUS (Point-of-care Ultrasound)	
Clinical settings	Core competencies
- Dyspnea of unknown origin - Chest pain - Patients with shock and periarrest situations - Abdominal pain - Abdominal mass - Jaundice - Renal injury - Lower limb edema	- Free fluid detection (pleural, pericardial, peritoneal) - Wet or dry lung - Dilated heart ventricles - Severe ventricular systolic dysfunction - Diameter and collapsibility inferior vena cava - Palpable or suspected abdominal mass (solid vs liquid) - Splenomegaly - Gallbladder stones - Dilatation of the biliary tract - Hydronephrosis - Small bowel dilatation - Abdominal aortic aneurysm - Bladder outlet obstruction - Ultrasound assisted procedures: thoracocentesis, paracentesis, venipuncture, arterial puncture, central vein catheterization - Proximal deep vein thrombosis by compression evaluation - Catheter into the bladder

Sumber: Torres-Macho J, Aro T, Bruckner I, Cogliati C, Gilja OH, Gurghean A, et al. *Point-of-care ultrasound in internal medicine: A position paper by the ultrasound working group of the European federation of internal medicine. Eur J Intern Med*. 2019

This survey is conducted to know the perception of internal medicine residents regarding their competency and needs of POCUS, as well as regarding the resource available and the barriers. We appreciate your participation in this survey. The results will be analyzed anonymously. The survey consists of 17 questions and will take you about 5 minutes to complete.

1. What is your age?
2. What is your gender?
   a. Male
   b. Female
3. What year did you start residency?
4. In which semester of residency are you?
5. Do you have access to ultrasound machine?
   a. Yes
   b. No
6. Do you agree with this statement? POCUS needs to performed by internal medicine residents in daily clinical practice.
   a. Agree
   b. Disagree
7. Do you agree with this statement? POCUS is a diagnostic modality that could contributes to faster and better diagnosis for several conditions in internal medicine.
   a. Agree
   b. Disagree
8. Do you agree with this statement? POCUS is beneficial for diagnosing and treating patients in various clinical scenarios in emergency room, inpatient ward, procedure room, and outpatient clinics.
   a. Agree
   b. Disagree
9. Which POCUS applications do you think are useful for internal medicine residents and internists? (multiple answers possible)
   a. None
   b. Heart (pericardial effusion, cardiac tamponade, ejection fraction, and tricuspid annular systolic excursion)
   c. Lung (pneumothorax, pleural effusion, lung edema, pneumonia, and lung mass)
   d. Vena cava (collapsibility index)
   e. Renal tract (hydronephrosis, urinary tract stones, acute kidney disease, and chronic kidney disease)
   f. Hepatobiliary (acute hepatitis, chronic liver disease, cirrhosis, splenomegaly, biliary duct dilatation, cholelithiasis, and choledocolithiasis)
   g. Intestinal & pancreas (acute pancreatitis, pancreas mass, acute appendicitis, small bowel obstruction, inflammatory bowel disease)
   h. Deep vein thrombosis
   i. Procedures (abdominal paracentesis and thoracocentesis)
   j. Musculoskeletal (joint effusion)
   k. Others:
11. Was the ultrasound training you obtained during residency program sufficient?
   a. Sufficient
   b. Insufficient
   c. Never obtain any ultrasound training

11. How many times you ever performed POCUS in the last 1 year?
   a. Never
   b. < 12 times in 1 year
   c. 12-24 times in 1 year
   d. > 24 times in 1 year
12. Which POCUS applications you have performed during residency?
   a. Heart (pericardial effusion, cardiac tamponade, ejection fraction, and tricuspid annular systolic excursion)
   b. Lung (pneumothorax, pleural effusion, lung edema, pneumonia, and lung mass)
   c. Vena cava (collapsibility index)
   d. Renal tract (hydronephrosis, urinary tract stones, acute kidney disease, and chronic kidney disease)
   e. Hepatobiliary (acute hepatitis, chronic liver disease, cirrhosis, splenomegaly, biliary duct dilatation, cholelithiasis, and choledocolithiasis)
   f. Intestinal and pancreas (acute pancreatitis, pancreas mass, acute appendicitis, small bowel obstruction, inflammatory bowel disease)
   g. Deep vein thrombosis
   h. Procedures (abdominal paracentesis and thoracocentesis)
   i. Musculoskeletal (joint effusion)
   j. Others:
13. Do you agree with this statement? I feel competent to perform POCUS.
   a. Agree
   b. Disagree

14. Do you agree with this statement? I feel competent to perform these POCUS applications without supervision. (agree, disagree, doubtful)
    a. Heart (pericardial effusion, cardiac tamponade, ejection fraction, and tricuspid annular systolic excursion)
    b. Lung (pneumothorax, pleural effusion, lung edema, pneumonia, and lung mass)
    c. Vena cava (collapsibility index)
    d. Renal tract (hydronephrosis, urinary tract stones, acute kidney disease, and chronic kidney disease)
    e. Hepatobiliary (acute hepatitis, chronic liver disease, cirrhosis, splenomegaly, biliary duct dilatation, cholelithiasis, and choledocolithiasis)
    f. Intestinal and pancreas (acute pancreatitis, pancreas mass, acute appendicitis, small bowel obstruction, inflammatory bowel disease)
    g. Deep vein thrombosis
    h. Procedures (abdominal paracentesis and thoracocentesis)
    i. Musculoskeletal (joint effusion)
    j. Others:
15. What are the biggest limitations or barriers to obtain the competency of and perform POCUS? (multiple answers possible)
    a. Insufficient knowledge of ultrasound (POCUS)
    b. Insufficient training module available
    c. Insufficient practice time
    d. Unavailability of ultrasound machine at workplace
    e. Insufficient supervised practice time
    f. Insufficient cases to practice on
    g. No limitations
    h. Others:
16. Do you agree with this statement? It is very likely that I will use POCUS within 5 years.
    a. Agree
    b. Disagree
17. Do you agree with this statement? Internal medicine residents need to obtain POCUS training.
    a. Agree
    b. Disagree