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Consensus on core POCUS applications for Korean emergency medicine training: a Delphi study

Ju Young Hong[1], Jin Hee Lee[2*], Young Soon Cho[3], Youngrock Ha[1] and Kisub Sung[4]

Abstract

Background Point-of-care ultrasound (POCUS) is an essential diagnostic and procedural tool in emergency medicine, yet training content and evaluation remain inconsistent across Korean residency programs. To address this gap, the Society of Emergency and Critical Care Imaging (SECCI) sought to develop a consensus-based list of core POCUS applications tailored to the Korean clinical context.

Methods A three-round modified Delphi survey (2022–2023) was conducted with 71 Korean emergency and critical care physicians, all certified POCUS instructors with ≥ 3 years of teaching experience. An initial list of 109 applications across 15 categories was generated from international guidelines and pre-round expert meetings. In each round, panelists rated items on a 9-point Likert scale; consensus was defined as ≥ 80% of ratings in the highest (7–9) or lowest (1–3) tertiles. Items meeting consensus were removed after each round, while unresolved items proceeded to subsequent rounds. Open-ended feedback in Rounds 1 and 2 informed item revisions and additions. This study was not a clinical trial; a trial registration number is therefore not applicable.

Results Response rates were 73.2% (Round 1), 96.2% (Round 2), and 84.0% (Round 3). Across the three rounds, 59 applications achieved consensus: 27 in Round 1, 24 in Round 2, and 8 in Round 3. The final list encompassed resuscitative (e.g., E-FAST, pericardial tamponade, global ventricular function), diagnostic (e.g., biliary disease, femoral DVT, pulmonary edema), and procedural (e.g., vascular access, thoracentesis, pericardiocentesis) domains. Compared with international curricula, the Korean consensus emphasized advanced hemodynamic and cardiac function assessments, reflecting local priorities in resuscitation and shock management, while de-emphasizing certain diagnostic scans (e.g., obstetric, musculoskeletal) due to ready access to alternative imaging.

Conclusions This nationwide Delphi process produced the first consensus-based core POCUS curriculum for emergency medicine residency training in Korea. The framework balances alignment with global best practices and responsiveness to local clinical workflows, providing a structured basis for standardization, competency assessment, and phased implementation across training programs.

Keywords Point-of-care ultrasound, Emergency medicine, Residency training, Delphi survey, Korea medical education

*Correspondence:
Jin Hee Lee
gienee@snubh.org; gienee74@gmail.com; gienee@snu.ac.kr

Full list of author information is available at the end of the article

Introduction

Point-of-care ultrasound (POCUS) has become an indispensable tool in emergency medicine over the past two decades, enabling rapid bedside diagnosis and procedural guidance. Recognizing its critical role, six major organizations—including the American Board of Emergency Medicine (ABEM), American College of Emergency Physicians (ACEP), Council of Emergency Medicine Residency Directors (CORD), Emergency Medicine Residents' Association (EMRA), Residency Review Committee for Emergency Medicine (RC-EM), and the Society for Academic Emergency Medicine (SAEM)—revised the Model of the Clinical Practice of Emergency Medicine in 2022 to expand the scope of ultrasound applications in the field [1]. Despite its widespread adoption, POCUS education varies considerably across residency programs. In response, ACEP and the International Federation for Emergency Medicine (IFEM) published updated guidelines in 2023 [2–4], advocating a competency-based, stepwise training approach encompassing image acquisition, interpretation, and clinical integration.

In South Korea, POCUS has become increasingly important in emergency departments; however, its integration into residency curricula remains inconsistent due to differences in hospital size, resource availability, and faculty expertise. The diagnostic scope and training priorities also differ from those in Western settings, underscoring the need for a standardized curriculum tailored to Korea's clinical environment.

The Society of Emergency and Critical Care Imaging (SECCI) has played a central role in advancing ultrasound education nationwide through structured workshops covering thoracic, abdominal, procedural, and pediatric applications. SECCI also collaborates with national institutions, such as the National Medical Center, and specialty organizations, including the Korean Society of Traumatology and the Korean Society of Pediatric Emergency Medicine, to expand access to PoCUS training.

To establish Korea-specific training standards, SECCI used the Delphi method, a structured approach for achieving expert consensus in medical education. A panel of 71 SECCI-accredited POCUS instructors, each with at least three years of teaching experience, participated in a Delphi process conducted in 2022–2023. This process identified essential POCUS applications for emergency medicine residency training, reflecting both clinical realities and educational needs in Korea.

Methods

Study design

This study employed a modified Delphi method to establish expert consensus on core point-of-care ultrasound (POCUS) applications suitable for emergency medicine residency training in Korea. The Delphi methodology was selected for its structured, iterative approach to synthesizing expert opinion in areas where empirical evidence is limited and educational needs are complex. The study was conducted under the guidance of the Society of Emergency and Critical Care Imaging (SECCI) from 2022 to 2023.

Prior to initiating the Delphi process, the SECCI research committee held several pre-round meetings with 20 board-certified faculty members, each with more than five years of ultrasound teaching experience and dual certification in emergency medicine and critical care. These faculty members reviewed existing international guidelines (e.g., ACEP, IFEM) and adapted relevant frameworks to reflect Korean clinical realities. Through structured discussions, they developed an initial item pool of 109 applications across 15 categories, organized into three overarching domains: Resuscitation, Diagnostic, and Procedural Guidance.

Participants

The Delphi panel consisted of 71 experts in emergency and critical care medicine, all of whom were SECCI-accredited instructors with established experience teaching POCUS in clinical settings. Panelists were nominated by SECCI based on their instructional roles and clinical expertise, and each had at least three years of experience in POCUS education. The demographic characteristics of the participants—including specialty background, geographic distribution, and years of teaching experience—are summarized in Table 1.

Delphi process

A modified Delphi method was conducted over three rounds to achieve expert consensus on core POCUS applications, following structured methodologies widely used in medical education research [5, 6]. In each round, panelists rated the importance of each item on a 9-point Likert scale. Consensus was defined as ≥ 80% of responses

Table 1 Demographics of the expert panel

Characteristics		*n*(%)
Speciality	**Emergency physician**	**46(87)**
	Critical Care Medicine	2(4)
	Trauma	2(4)
	Etc.	3(5)
Region	Seoul	20(38)
	Kyung-ki province	14(26)
	Others	19(36)
Experience teaching focused cardiac ultrasound	1 ~ 5 yrs	5(11)
	6 ~ 10 yrs	27(53)
	11 ~ 15 yrs	11(21)
	16 ~ 20 yrs	7(13)
	21 ~	1(2)

falling within the highest (7–9) or lowest (1–3) tertiles—a threshold consistent with previous Delphi-based ultrasound education studies [7, 8], and selected to ensure a conservative and robust level of agreement. Quantitative analysis involved converting Likert ratings into proportions and reporting the percentages of high (7–9) and low (1–3) scores. Items meeting the ≥ 80% criterion in either direction were categorized as consensus for inclusion or exclusion. Summary statistics from each round were provided to participants in subsequent rounds, as illustrated in Supplementary Fig. 1.

The questionnaire was newly developed for this study, based on a literature review and expert discussions, and the full English version is available in Supplementary Table 1. After each round, items reaching consensus were removed, and only unresolved items were carried forward for reassessment [1]. Open-ended feedback was allowed in Rounds 1 and 2 to capture additional suggestions [6], while the third round relied solely on structured quantitative scoring to finalize the list [7].

Because several POCUS applications may serve different purposes across clinical contexts, some items appeared in more than one category (e.g., resuscitative vs. diagnostic). These items were intentionally treated as separate analytic units rather than duplicates. Participants were explicitly instructed to evaluate each item within the specific clinical domain presented, and the Delphi results therefore reflect domain-dependent decision-making.

Table 2 Distribution of Delphi survey questions by category and subcategory. This table summarizes the number of survey questions presented in each clinical category and its corresponding subcategories during the Delphi process. Some POCUS items were intentionally duplicated across multiple clinical contexts (e.g., trauma, shock, cardiac arrest), resulting in 109 total questions derived from approximately 89 unique items. The number of questions per subcategory is shown. Further details on individual items are provided in Supplementary Table 1

Resuscitative application	Trauma	E-FAST	7
		IVC	1
		Aorta	2
	CPR	Cardiac	4
	Cardiovascular	Heart	7
		GV	6
	Shock	IVC	1
		LVOT	2
		E-FAST	7
		GV	4
Diagnostic application	Hepatobiliary		11
	Lung and pleura		6
	Ocular	Non trauma	6
		trauma	6
	Kidney		5
	Scrotum		2
	OB		5
	Soft tissue		4
	MS		4
	Bowel		4
Procedure	15		

Abbreviations: *E-FAST* extended focused assessment with sonography for trauma, *IVC* inferior vena cava, *GV* great vessels, *LVOT* left ventricular outflow tract, *OB* obstetric, *MS* musculoskeletal

In Round 1, a total of 109 applications derived from 89 unique items across 15 clinical categories were presented to 71 panelists. Because certain items were evaluated in multiple contexts (e.g., trauma, shock, cardiac arrest), the number of survey questions exceeded the number of unique items. The distribution of applications by category is summarized in Table 2, with full details available in Supplementary File 1.

In addition to structured ratings, panelists provided open-ended qualitative feedback in Round 1. These free-text contributions highlighted additional clinical needs not fully captured in the initial list, such as airway verification, vascular access guidance, multi-organ integration, and advanced cardiac assessments (e.g., diastolic function, valvular pathology). All Round 1 suggestions were reviewed and synthesized by the study authors. Conceptually distinct suggestions were incorporated as new applications, whereas suggestions already encompassed within broader items (e.g., TAPSE under "right ventricular systolic function") were not separated into standalone items to avoid redundancy.

Based on this qualitative feedback, 32 new applications were added to the Round 2 survey, resulting in a total of 113 applications. In Round 3, no open-ended feedback was solicited, and only unresolved applications from Round 2 were reassessed, yielding 89 final applications for analysis. A schematic overview of the Delphi process—including panel size, item flow, and feedback incorporation—is presented in Fig. 1.

To promote transparency and reflective reassessment, a color-graded response matrix was also provided in each round. This visual summary displayed the frequency distribution of Likert-scale responses per item, with darker shading indicating higher concentration. This approach was designed to help panelists recognize agreement patterns at a glance (see Supplementary Fig. 1).

Results

To improve clarity and reduce redundancy, detailed item-level results for each round have been consolidated into a single summary table (Table 3), while only the key findings are described narratively below.

Round 1

In the first round, 52 of the 71 invited experts responded (73.2%). The questionnaire included 109 applications derived from 89 unique POCUS items across 15 clinical

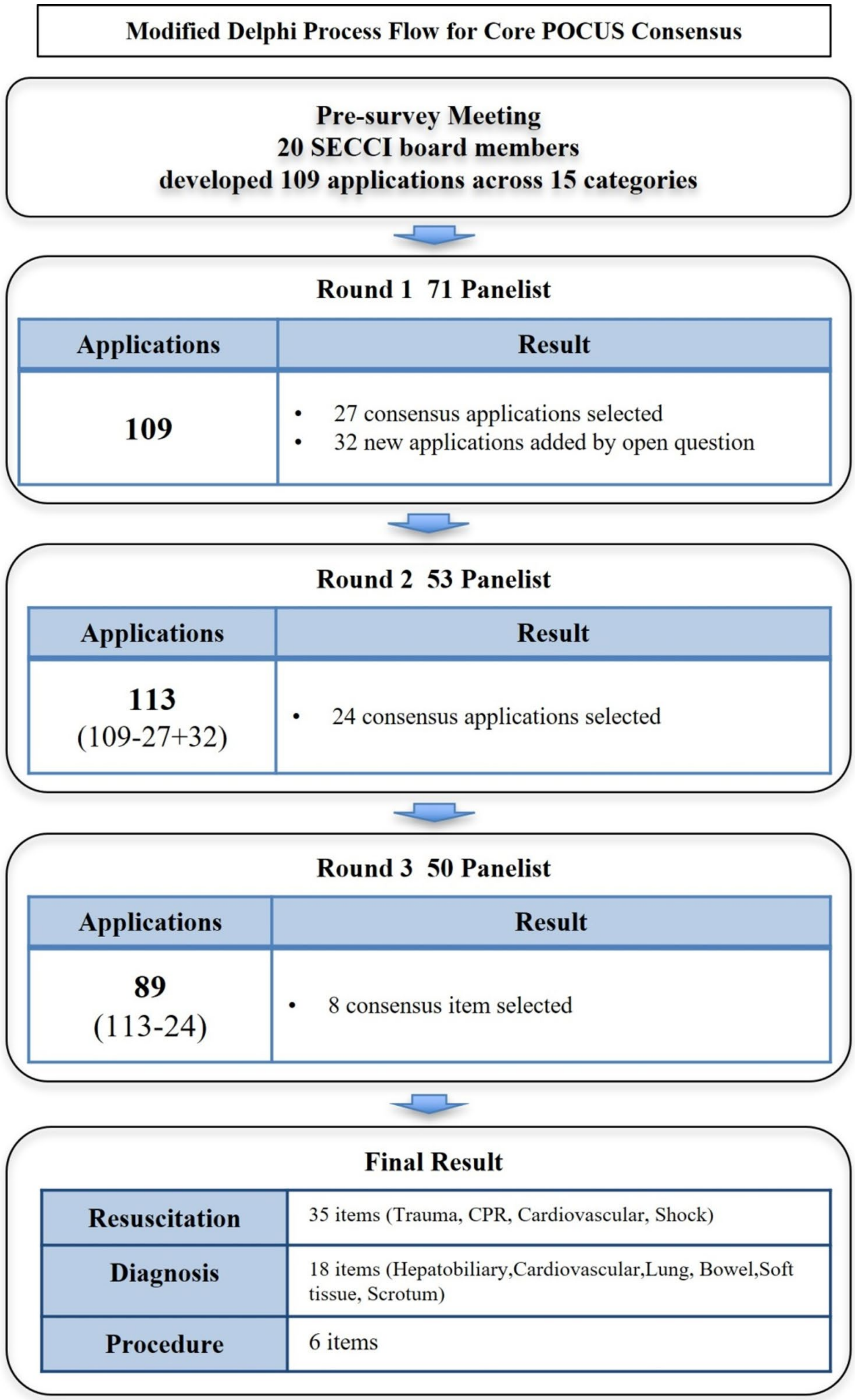

Fig. 1 Modified delphi process flow for consensus on core POCUS applications. A visual summary of the three-round modified Delphi process, showing item inclusion, exclusion, and revision steps across each stage. Open-ended feedback was incorporated in Rounds 1 and 2; Round 3 used structured scoring only

categories. Based on the predefined ≥ 80% consensus threshold, 27 applications were selected in Round 1; none met criteria for exclusion. High-yield diagnostic and procedural applications—such as identification of pericardial fluid, guidance for pericardiocentesis, and major cardiovascular assessments (e.g., left ventricular systolic function and IVC volume estimation)—were among the items selected. The complete list of selected items and agreement rates across all rounds is presented in Table 3.

Panelists also submitted open-ended qualitative feedback in Round 1. These responses highlighted a range of practical needs and emerging priorities within emergency and critical care ultrasound practice. Several panelists emphasized dynamic assessments (e.g., stroke volume variation, serial hemodynamic evaluation) over single-point measurements, whereas others identified underrepresented areas such as airway and endotracheal tube confirmation, vascular access guidance, and integrated multi-organ assessment for rapid decision-making.

Within the resuscitative and cardiac domains, suggestions included TAPSE (not selected), color Doppler assessment of valvular pathology, and distinguishing organized from disorganized cardiac activity during CPR. Diagnostic suggestions included deep vein thrombosis (DVT), intussusception, intrauterine pregnancy and fetal heart rate assessment, infant cranial imaging, and nasal bone evaluation. Procedural suggestions repeatedly included ultrasound-guided regional anesthesia (e.g., fascial plane blocks), PICC insertion, nasogastric tube (L-tube) placement, and joint reduction techniques.

These qualitative insights informed the revision of the Round 2 survey. Based on recurring themes and clinical relevance, 32 additional applications were incorporated, comprising refinements of existing items and 20 entirely new clinical applications. These additions addressed several gaps in both core and advanced competencies, particularly within cardiovascular and procedural domains. Notable new items included lung sliding, endotracheal tube placement, valvular disease assessment (e.g., aortic stenosis, mitral stenosis, acute MR/AR), cardiomyopathies (DCMP, HCMP), and advanced hemodynamic indicators such as velocity time integral (VTI) variation, global right ventricular function, and diastolic function. Diagnostic expansions included pancreatic pathology, femoral and popliteal DVT, and obstetric applications (e.g., intrauterine pregnancy, fetal heartbeat). Procedural additions reflected the increasing use of ultrasound-guided regional anesthesia (e.g., femoral nerve and erector spinae plane blocks).

As detailed in the Methods section, all Round 1 suggestions were reviewed and incorporated into Round 2 when conceptually distinct. Suggestions that represented specific techniques nested within broader domains—such as TAPSE under right ventricular systolic function—were

Table 3 Consensus rates for selected POCUS applications across Delphi Rounds 1–3, organized by domain. This table summarizes the progression of consensus for each POCUS application throughout the three Delphi rounds. Items are grouped by domain (resuscitative, diagnostic, and procedural applications), and consensus rates (percentage agreement) from each round are presented side-by-side for comparison. "New" indicates items introduced in Round 2 based on open-ended suggestions from Round 1. Items that reached the predefined consensus threshold (≥80%) in any round were considered selected for that round, and the total number of selected items per round is displayed in the final row

Selected Items and category			Consensus by round		
Resuscitative application			1	2	3
Trauma	E-FAST	Identify free fluid of Hepatorenal recess	92%		
		Identify free fluid of Splenorenal recess	90%		
		Identify free fluid of Peribladder	85%		
		Identify free fluid of Pericardium	92%		
		Identify pericardial tamponade	90%		
		Identify acute pneumothorax	85%		
		Identify Pleural fluid	75%	96%	
	IVC	Gross estimation of intravascular volume status and cardiac preload.	73%	82%	
	Aorta	Identify Abdominal Aortic Dissection	56%	62%	81%
CPR	Cardiac	Identify free fluid of Pericardium	87%		
		Identify Pericardial tamponade	92%		
		Global left ventricular systolic function	65%	80%	
	lung	Lung sliding	New	80%	
	Abdominal	Identify free fluid of Hepatorenal recess	New	72%	86%
		Identify free fluid of Splenorenal recess	New	68%	81%
Cardiovascular	Heart	Identify free fluid of Pericardium	98%		
		Identify Pericardial tamponade	92%		
		Global left ventricular systolic function	94%		
		Regional Wall motion Abnormality	83%		
		Global Right ventricular systolic function	75%	84%	
		Global Left ventricular diastolic function	65%	82%	
	GV	Identify Abdominal Aortic Aneurysm.	71%	82%	
		Identify Abdominal Aortic Dissection	73%	82%	
Shock	IVC	Gross estimation of intravascular volume status and cardiac preload.	87%		
	Heart	Identify free fluid of Pericardium	87%		
		Identify Pericardial tamponade	90%		
		Global left ventricular systolic function	New	94%	
		Global Right ventricular systolic function	New	84%	
	E-FAST	Identify free fluid of Hepatorenal recess	79%	94%	
		Identify free fluid of Splenorenal recess	77%	94%	
		Identify free fluid of Peribladder	75%	90%	
		Lung sliding	79%	92%	
		Identify Pleural fluid	67%	86%	
	GV	Identify Abdominal Aortic Dissection	77%	78%	86%
		Idetrantify Abdominal Aortic Aneurysm.	63%	74%	89%
Diagnostic application					
Hepatobiliary		Choledocholithiasis	60%	90%	
		Cholelithiasis	85%		
		Cholecystitis	88%		
		ascites	83%		
Cardiovascular		Identify free fluid of Pericardium	New	94%	
		Identify Pericardial tamponade	New	100%	
		Global left ventricular systolic function	New	96%	
		Regional Wall motion Abnormality	New	94%	
		Deep vein thrombosis of Femoral vein	New	84%	
		Global Left ventricular diastolic function	New	76%	84%
Lung and pleura		Identify acute pneumothorax	87%		
		Identify Pleural fluid	87%		
		Pulmonary edema	85%		
Bowel		Appendicitis	73%	90%	
Soft tissue		Identify soft tissue abscess	58%	70%	86%
		Soft tissue foreign body	63%	78%	81%
Scrotum		Scrotal torsion	52%	94%	
		Epididymitis	85%		
Procedure					
Procedural guidance of pericardiocentesis			92%		
Central venous catheter insertion			94%		
Arterial line insertion			90%		
Thoracentesis			94%		
Paracentesis			90%		
Cricothyroid membrane detection			67%	84%	
Total selected items			27	24	8

not added as separate items to maintain conceptual coherence.

Round 2

In Round 2, a follow-up survey was distributed to the same 52 panelists who had responded in Round 1, and 50 experts (96.2%) completed the second round. The questionnaire consisted of 113 applications, which included 81 unresolved items from.

Round 1 as well as 32 newly added applications derived from 20 new items based on open-ended feedback.

Using the same consensus threshold (≥ 80% of panelists rating an item as 7–9), 24 applications achieved consensus in this round and were incorporated into the core item list. No applications were excluded, and all remaining non-consensus items were carried forward to Round 3 for final evaluation.

Open-ended responses in Round 2 did not yield any new applications for inclusion. Most comments repeated previously submitted suggestions or referred to items already incorporated or excluded, and thus were not retained for further analysis. The full list of newly selected applications from Round 2 are shown in Table 3.

Round 3

In Round 3, the final survey was distributed to the 50 experts who had responded in Round 2, and 42 of them completed the questionnaire, yielding a response rate of 84.0%. The survey included 86 items that had not reached consensus in the previous round. To encourage convergence, only structured quantitative ratings were collected, and open-ended responses were not solicited.

Applying the same predefined consensus threshold (≥ 80% of panelists rating an item as 7–9), 8 additional items met the criteria for selection are shown in Table 3. This brought the cumulative total to 59 core POCUS applications identified through the three-round Delphi process.

Although these items did not meet the predefined consensus threshold of ≥ 80%, several questions achieved agreement rates in the 70–79% range, indicating near-consensus. Specifically, 7 items in Round 2 and 6 items in Round 3 fell into this category. Notably, certain items, such as deep vein thrombosis of the popliteal vein, received relatively high support in Round 2 but were rated lower in Round 3, suggesting a divergence in expert opinion. These near-consensus items are summarized in Table 4.

Discussion

This study aimed to define a consensus-based set of core point-of-care ultrasound (POCUS) applications for emergency medicine training in Korea through a structured three-round Delphi process. While multiple international organizations, such as ACEP and IFEM, have published guidelines for POCUS education, few studies have systematically developed a curriculum that reflects national clinical realitie [9, 10]. By engaging a panel of 71 SECCI-accredited instructors with active teaching roles, our study reflects not only expert consensus but also frontline clinical experience. Through this process, a total of 59 POCUS applications were identified as essential components of residency training, offering a structured and context-sensitive foundation for future curriculum development.

The Delphi process ultimately identified 59 applications that achieved expert consensus for inclusion in emergency medicine residency training in Korea. These items, finalized through three rounds of structured evaluation, are summarized in Table 3. A total of 27 items were selected in Round 1, 24 in Round 2, and 8 in Round 3. The final list spans resuscitative, diagnostic, and procedural domains, with high agreement on trauma-related assessments (e.g., detection of free fluid in the hepatorenal recess or pericardial space), procedural guidance (e.g., central venous catheter insertion, thoracentesis), and global left ventricular systolic function.

Notably, the final list includes several advanced cardiac ultrasound parameters, such as global right ventricular systolic function and left ventricular diastolic function,

Table 4 POCUS items with Near-Consensus in round 3 (Agreement rate 70–79%). This table lists the point-of-care ultrasound (POCUS) items that did not meet the predefined consensus threshold (≥80%) in Round 3 but received 70–79% agreement among panelists. Although not selected, these items may represent areas of emerging clinical interest and could be considered for future training modules or tiered curricula

Near consensus item and category		2round Agreement (7 ~ 9)	3round Agreement (7 ~ 9)
Diagnostic application	Deep vein thrombosis of Popliteal vein	78%	68%
	Cause of obstructive uropathy	76%	77%
	ectopic pregnancy	78%	78%
	Intrauterine pregnancy	78%	78%
	Endotracheal tube placement	76%	77%
	Identify Thoracic Aortic dissection	72%	78%
	Liver abscess	76%	78%

indicating a strong emphasis on physiology-based assessment during resuscitation and shock states. Although diastolic function assessment is technically more advanced than other parameters, it is currently taught in both the basic thoracic POCUS course and the advanced cardiac modules offered by SECCI. Because the Delphi panel consisted entirely of SECCI-accredited instructors who regularly teach these competencies, their familiarity with diastolic evaluation and its perceived clinical relevance likely contributed to its advancement through the consensus rounds. Its inclusion should therefore be interpreted as an advanced skill to be introduced within a tiered or staged training framework rather than an expectation of early mastery for trainees.

In contrast, other advanced indicators—such as valvular disease assessments (50–70% agreement) and VTI variation (38% agreement)—were proposed but did not reach consensus, likely reflecting variability in training feasibility or clinical adoption [10].

Importantly, this Delphi process did not evaluate each POCUS application in isolation but rather within specific clinical contexts, including resuscitation, cardiac arrest (CPR), and diagnostic evaluation. For example, identification of peribladder free fluid was considered essential for shock evaluation but was excluded from the CPR category. Similarly, both right and left ventricular systolic function were selected for cardiovascular resuscitation and shock assessment, whereas only systolic function was adopted in the diagnostic category. This pattern aligns with current practice in Korean emergency and critical care medicine, where characterization of circulatory status for tailored resuscitation is highly valued, while purely diagnostic use remains more conservative given the ready availability of alternative imaging modalities [9].

When compared with established international POCUS guidelines and prior Delphi-based curricula, the findings of this study demonstrate both areas of alignment and meaningful divergence. ACEP's 2023 policy statement outlines core applications frequently used in emergency care—such as cardiac, lung, biliary, DVT, FAST, and soft tissue scans—with emphasis on clinical indications and reimbursement context [5]. IFEM's global curriculum further categorizes POCUS applications into core, expanded, and special-interest levels, allowing flexibility for resource variations across countries [3]. Beyond guideline documents, several Delphi studies have aimed to define national or specialty-specific curricula. For example, Shefrin et al. identified 21 core pediatric emergency medicine POCUS applications using a Delphi approach, emphasizing diagnostic domains such as appendicitis, biliary disease, lung pathology, and soft tissue evaluation [5]Similarly, a nationwide Delphi consensus from France prioritized broad diagnostic and procedural applications across emergency practice settings [9].

In contrast, the Korean consensus in this study places greater emphasis on physiologic and hemodynamic applications—particularly advanced cardiac assessments such as diastolic function and right ventricular systolic function—which are often omitted or positioned as optional in international curricula. Meanwhile, several diagnostic applications commonly included elsewhere, such as obstetric, musculoskeletal, or certain soft tissue scans, did not reach consensus in the Korean context. These differences appear to be closely linked to Korea's unique healthcare delivery structure and diagnostic workflows.

This divergence likely reflects differences in Korea's healthcare delivery system. Unlike many countries where imaging access varies substantially by region, Korea maintains highly uniform and rapid CT availability nationwide—even in smaller or rural hospitals—resulting in a healthcare environment where CT often functions as the primary diagnostic modality. National data demonstrate that Korea's CT utilization rate is among the highest in the OECD, with approximately 250 examinations per 1,000 population in 2020 compared with 82.7 in the United States and 113.3 in Spain [11]. In contrast, PoCUS availability and integration into emergency department workflows vary more widely and are often concentrated in larger centers with established training faculty and equipment. Smaller and rural hospitals may have fewer ultrasound-trained emergency physicians and less standardized POCUS education despite having ready access to CT. This asymmetry—CT being uniformly available while PoCUS remains unevenly distributed—helps explain why certain diagnostic POCUS applications were rated lower in priority, as emergency physicians in many regions may rely primarily on CT for time-sensitive diagnosis.

At the same time, bedside ultrasound remains essential for real-time hemodynamic evaluation and resuscitation, particularly in shock or cardiac arrest, where rapid physiological assessment guides immediate interventions. International consensus statements similarly recommend PoCUS as a first-line tool for circulatory or respiratory compromise when immediate imaging access is limited or when patient transport poses risks [12]. Taken together, these patterns indicate that the consensus list reflects not only educational priorities but also the diagnostic pathways and resource distribution characteristics of Korean emergency medicine practice. Given the varying complexity across the consensus items, these findings naturally support a tiered or phased POCUS curriculum. Foundational applications—such as FAST, lung sliding, and global left ventricular systolic function—may be introduced early in residency, while more advanced physiologic assessments, including diastolic function and right ventricular evaluation, may be incorporated into later training stages or advanced elective modules. This framework supports progressive skill acquisition while accommodating institutional variability in expertise and equipment.

In addition to the 59 items that reached formal consensus, several applications achieved near-consensus, with 70–79% of panelists rating them as important or very important. Seven items in Round 2 and six in Round 3 fell within this range. Although these items did not meet the predefined ≥ 80% threshold, they represent clinically relevant domains that merit further consideration.

Near-consensus items included DVT assessment, ectopic and intrauterine pregnancy evaluation, pancreatic pathology, and airway confirmation (e.g., endotracheal tube placement). These items may have fallen short of consensus due to differences in training emphasis, specialty role delineation, or the perceived availability of alternative diagnostic modalities. For example, obstetric evaluation is often deferred to obstetrics in Korea, and DVT imaging is typically performed through formal radiologic studies. Nonetheless, the repeated appearance of these items near the consensus threshold suggests that they may serve as appropriate targets for advanced training modules, optional curriculum components, or institution-specific emphasis. Future work could explore phased implementation of these applications based on resident experience level or local clinical demand.

This study represents the first nationwide Delphi consensus effort to establish core POCUS training content tailored to the Korean emergency medicine environment. By leveraging a diverse panel of experienced educators and clinicians, the process incorporated both evidence-based methodology and real-world teaching perspectives. The resulting list of 59 applications offers a structured foundation for standardizing residency training while preserving flexibility for institutional variation.

However, several limitations should be noted. First, although the panel consisted of certified instructors with broad clinical experience, the responses may not fully represent all institutional contexts or trainee proficiency levels, particularly in smaller or resource-limited centers. Second, the final list includes advanced applications that may be challenging to implement uniformly across programs due to differences in faculty expertise or equipment availability. Third, while the Delphi rounds focused on consensus thresholds, they did not assess relative prioritization or phased learning levels (e.g., basic vs. advanced).

Finally, the central role of SECCI in promoting POCUS training in Korea may have influenced the consensus process. As many panelists serve as SECCI instructors, the results may reflect existing educational emphasis rather than independent clinical demand, introducing potential reinforcement bias. While this alignment supports consistency with current teaching practices, it may limit the identification of less familiar or emerging applications requiring future attention.

Conclusion

In conclusion, this Delphi-based consensus provides a context-sensitive and expert-validated framework for point-of-care ultrasound training in Korean emergency medicine. It offers both a practical curriculum foundation and a platform for further educational development, including the potential for tiered training models, expanded application lists, and future validation through clinical outcomes research.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-08484-x.

Supplementary Material 1.

Supplementary Material 2.

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Clinical trial number

This study was not a clinical trial. Clinical trial number: not applicable.

Authors' contributions

JYH designed the survey, collected data, performed data analysis, and drafted the manuscript. KSS contributed to data collection. JHL conceived and supervised the study, and critically revised the manuscript. YSC and YRH provided expert advice throughout the study process and contributed to manuscript review. All authors read and approved the final manuscript.

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Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of Severance Hospital, Yonsei University Health System (Approval No. 4-2021-1577 ; approval date: January 03, 2022). The IRB reviewed and approved the participant information sheet and determined that written informed consent was not required, as the study involved minimal-risk survey research under applicable national regulations. Accordingly, the IRB-approved information sheet explicitly stated that voluntary completion of the online questionnaire would constitute consent to participate. Based on this protocol, participants who submitted the survey were considered to have provided informed consent. No additional identifiable personal information beyond e-mail contact data was collected. All procedures were performed in accordance with the ethical standards of the institutional and/or national research committee and with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Emergency Medicine, Yonsei University College of Medicine, Seoul, Republic of Korea
[2]Department of Emergency Medicine, Seoul National University Bundang Hospital, Seoul National University College of Medicine, 82 Gumi-ro 173beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do 13620, Republic of Korea
[3]Department of Emergency Medicine, Soonchunhyang University Bucheon Hospital, Bucheon, Republic of Korea
[4]SS-ENG Co., Ltd.,, Bucheon 14449, Republic of Korea

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