

# Recommendations for Cardiac Point-of-Care Ultrasound Nomenclature



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Point-of-care ultrasound (POCUS) involves the acquisition, interpretation, and immediate clinical integration of ultrasonographic imaging performed by a treating clinician. The current state of cardiac POCUS terminology is heterogeneous and ambiguous, in part because it evolved through siloed specialty practices. In particular, the medical literature and colloquial medical conversation contain a wide variety of terms that equate to cardiac POCUS. While diverse terminology aided in the development and dissemination of cardiac POCUS throughout multiple specialties, it also contributes to confusion and raises patient safety concerns. This statement is the product of a diverse and inclusive Writing Group from multiple specialties, including medical linguistics, that employed an iterative process to contextualize and standardize a nomenclature for cardiac POCUS. We sought to establish a deliberate vocabulary that is sufficiently unrelated to any specialty, ultrasound equipment, or clinical setting to enhance consistency throughout the academic literature and patient care settings. This statement (1) reviews the evolution of cardiac POCUS-related terms; (2) outlines specific recommendations, distinguishing between intrinsic and practical differences in terminology; (3) addresses the implications of these recommendations for current practice; and (4) discusses the implications for novel technologies and future research. (*J Am Soc Echocardiogr* 2024;37:809-19.)

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## BACKGROUND AND RATIONALE

Every clinician, regardless of specialty, scope of practice, training, or medical practice setting, has a shared responsibility to deliver safe, evidence-based, and equitable patient-centered care. Effective communication is a key aspect of this care. Our communication must be intentional, clear, and objective. Standardization of nomenclature is essential for the accurate and efficient transfer of medical knowledge among healthcare professionals, educators, administrators, insurance providers, credentialing bodies, and, most importantly, patients. The words we choose matter.

The current state of point-of-care ultrasound (POCUS) terminology is heterogeneous and ambiguous, in part because it evolved through siloed specialty practices. This statement was developed in collaboration with representatives of various medical societies (American College of Chest Physicians (CHEST), American College of Emergency Physicians (ACEP), American Institute of Ultrasound in Medicine (AIUM), American Society of Anesthesiologists (ASA), American Thoracic Society (ATS), Society of Cardiovascular Anesthesiologists (SCA), Society of Critical Care Medicine (SCCM), World Interactive Network Focused on Critical Ultrasound (WINFOCUS)) and built consensus on “applied terminology” through an iterative process for car-

diac applications of POCUS. The Writing Group consisted of a diverse and inclusive panel of healthcare professionals with representation from multiple stakeholder medical practices and included a specialist in medical linguistics. Our aim was for multispecialty and interprofessional collaboration to contextualize and standardize the nomenclature around cardiac POCUS to reduce confusion and enhance patient safety. We sought to establish a deliberate vocabulary to extend agreement throughout the academic literature and patient care settings. The Writing Group agreed that POCUS terminology must be sufficiently unrelated to any specialty, ultrasound equipment, or clinical setting so as to reflect the priority of a patient-centric approach. We also sought to avoid suppressing variations that might be appropriate in specific settings and to generate a document applicable to the world community, including low-resource settings. To that end, we specifically did not extensively address billing, credentialing, legal liability, and other inherently region-specific elements involved in the practice of cardiac POCUS. That said, we intend for this cardiac POCUS nomenclature to be a starting point for future work in more specific areas.

This scientific statement aims to

1. Review the evolution of cardiac POCUS-related terms.
2. Outline specific recommendations, distinguishing between intrinsic and practical differences in “basic cardiac POCUS/FoCUS,” “advanced cardiac POCUS,” “consultative echocardiography,” and “ultrasound assisted physical examination.”
3. Address implications of these recommendations for current practice.
4. Discuss the implications for novel technologies and future research.

## HISTORICAL DEVELOPMENT AND IMPACT OF DIVERSE TERMINOLOGIES

After a decade of practice by frontline clinicians,<sup>1,2</sup> the American Medical Association (AMA) policy H-230.960<sup>3</sup> affirmed in 1999 that ultrasound imaging is within the scope of practice of appropriately trained physicians. The AMA policy further specified that privileging of physicians to perform ultrasound imaging procedures in a hospital setting should be a function of hospital medical staff and should be specifically outlined on departmental forms that delineate privileges. Recognizing that ultrasound is not the intellectual property of a specialty was vital for the widespread dissemination of POCUS in healthcare, including its spread to low-resource settings.<sup>4</sup> The AMA statement uncoupled POCUS practice from any overarching regulatory body.<sup>5</sup>

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Abbreviations	
<b>AI</b>	= Artificial intelligence
<b>AMA</b>	= American Medical Association
<b>ASE</b>	= American Society of Echocardiography
<b>CCE</b>	= Critical care echocardiography
<b>FAST</b>	= Focused Assessment With Sonography in Trauma
<b>FoCUS</b>	= Focused cardiac ultrasound
<b>IVC</b>	= inferior vena cava
<b>POCUS</b>	= Point-of-care ultrasound
<b>TNE</b>	= Targeted neonatal echocardiography
<b>UAPE</b>	= Ultrasound-assisted physical examination
<b>WINFOCUS</b>	= World Interactive Network Focused on Critical Ultrasound

Consequently, POCUS nomenclature, training, scope, standards, workflow, and documentation practices have been developed in the silos of specialties and subspecialties. This environment proved useful in the early phases of adoption in facilitating the tailoring of protocols and scope of the exams to different users in different clinical settings, including those in developing nations. However, over the years, decentralized and democratized practice has created profoundly heterogeneous groups of POCUS practitioners. This aided dissemination of POCUS but prevented standardization.

Absence of standardization contributes to confusion and misunderstanding, with valid concerns raised regarding safeguards.<sup>6</sup> Patients, clinicians, payors, and others should know what they are getting when they hear the term “cardiac POCUS.” Lack of a common nomenclature in a rapidly devel-

oping field creates problems in interservice coordination, scopes of practice, credentialing processes, documentation in electronic medical records, image archiving, quality assurance, billing practices, training protocols, and research.<sup>7</sup>

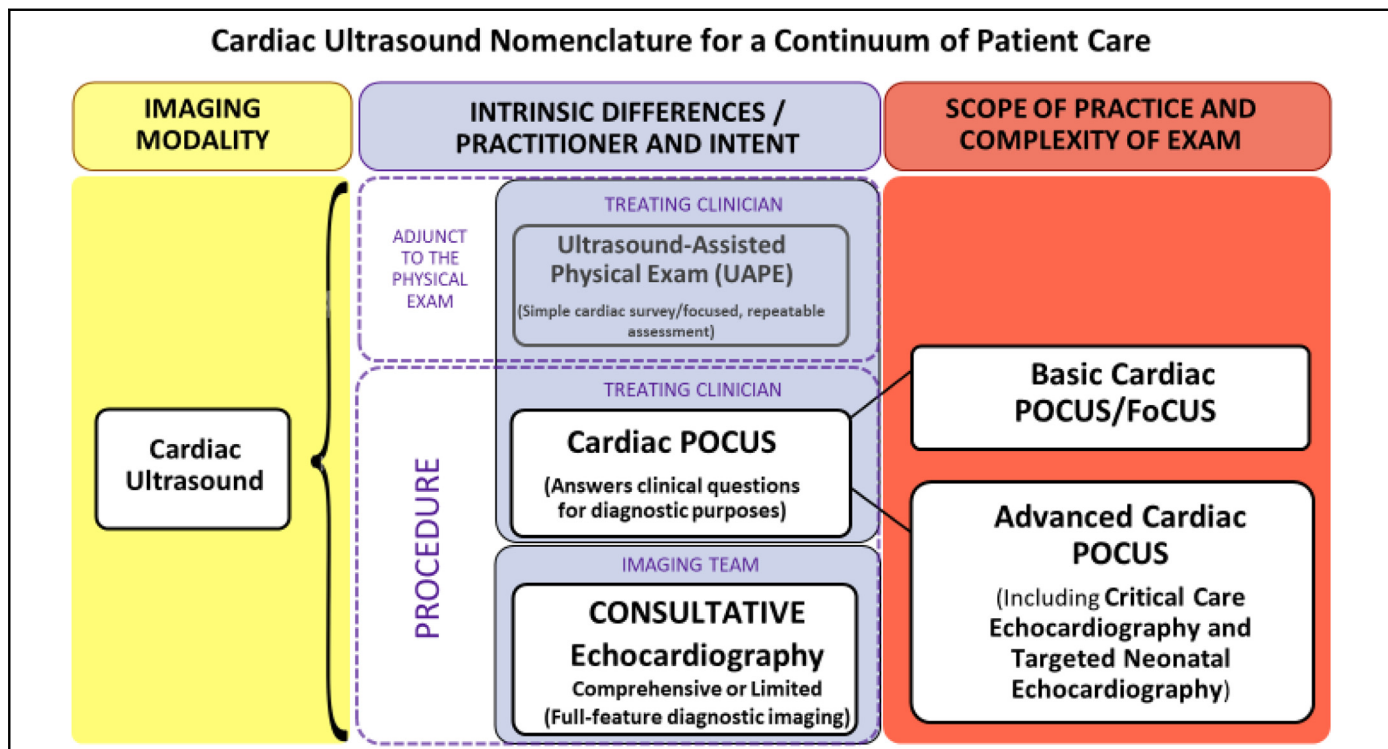
### Multiplicity of Cardiac POCUS-Related Terminology

The medical literature and colloquial medical conversations are rife with terms used to describe cardiac POCUS: “focus-assessed transthoracic echocardiography (TTE),” “cardiopulmonary limited ultrasound,” “informal/unofficial TTE,” “limited TTE,” “bedside TTE,” and “basic echocardiography,” to name a few.<sup>8-12</sup>

In 2014, 17 national and international professional medical organizations came together under the auspices of the World Interactive Network Focused on Critical Ultrasound (WINFOCUS) and developed the term “focused cardiac ultrasound” (FoCUS),<sup>13</sup> which was deemed neutral enough to be widely applied and sufficiently unrelated to any specialty, ultrasound machine, or specific clinical scenario. A deliberate choice was made not to use the term “echocardiography” to avoid confusion.<sup>14</sup> Multiple professional medical societies endorsed “FoCUS,” along with much of the cardiology community,<sup>13-17</sup> but adoption has not been universal.

Alternative terminology emerged from different professional organizations (Table 1). These and other terms represent the multiple applications of cardiac POCUS but also highlight the lack of a gold standard for terminology.<sup>18,19</sup> While advocating for a more standardized nomenclature, this Writing Group gratefully acknowledges the significant contributions that each of these terms and their contributors have made to the field. However, these terms, particularly those that are specialty specific, can sow confusion across disciplines, do not match current cardiac POCUS practice, and create challenges for future growth.

In addition, the multiplicity of terms has generated inconsistencies and ambiguity. For example, the term “informal” (as in “informal echocardiography”) is used in contemporary English to mean “casual,” “not performed according to the usual or prescribed manner,” or “irregular.” However, this term does not apply to cardiac POCUS performed formally and systematically, according to widely accepted norms of image acquisition and interpretation.<sup>20</sup> The term “unofficial” suggests that conclusive findings cannot be obtained or that they



Central Illustration

should not be trusted. It would be inappropriately applied to cardiac POCUS that yields immediate information for patient management through rigorous, in-context interpretation of an exam performed within a recognized scope of practice.

Using the term “limited echocardiography” to describe both cardiac POCUS and echocardiography performed by sonographers or physicians in an echocardiography laboratory can generate confusion. Reports and images from these different exams can be stored in different locations, making them difficult to locate. The dual application of the term can generate misunderstandings over what was performed. If a cardiac POCUS exam report fails to mention a specific diagnosis, it may falsely reassure clinicians and patients that the diagnosis is excluded when it was simply not assessed.<sup>21</sup> Patients may assume that a cardiac POCUS exam obviates the need for a full-feature echocardiogram ordered previously. Furthermore, the scope and capabilities of the 2 examinations can be significantly different. Even when properly differentiated from an echocardiogram, a cardiac POCUS exam should not be considered a “substandard” or “incomplete” echocardiogram. Instead, it is a different sort of exam.

Furthermore, the adoption and integration of the cardiac POCUS exam will continue to evolve in response to technological developments that will improve the image quality and functionality of cardiac ultrasound machines used by bedside clinicians.<sup>22-24</sup> Therefore, cardiac POCUS should not be defined by the capabilities of the machines used to perform it. Finally, professional societies’ terminologies often reflect specific applications, indications, or locations. Most of these terms do not encompass the full spectrum of cardiac POCUS. A more nuanced nomenclature is needed, one that transcends specialties.

## NOMENCLATURE RECOMMENDATIONS

In this section, the Writing Group outlines recommendations for a standardized, pragmatic, and consistent nomenclature to describe different forms of cardiac ultrasound, including “cardiac POCUS,” “consultative echocardiography,” and “ultrasound-assisted physical examination” (Central Illustration).

## Key Points

- The environment of specialty-/subspecialty-specific POCUS practice was useful in the early phases of adoption.
- Lack of a common nomenclature in a rapidly developing field creates problems in interservice coordination, scopes of practice, credentialing processes, documentation in electronic medical records, image archiving, quality assurance, billing practices, training protocols, and research.
- Specialty-specific terms do not reflect the current spectrum of cardiac POCUS or allow for future growth.
- Overlapping terms, specifically those involving cardiac POCUS and echocardiography, generate confusion.
- Because technological developments continue to improve image quality and functionality of cardiac ultrasound machines, the spectrum of machine capabilities cannot appropriately define cardiac POCUS.

## Basic Cardiac POCUS/FoCUS and Advanced Cardiac POCUS

The term “POCUS” can be defined broadly as “the acquisition, interpretation, and immediate clinical integration of ultrasonographic imaging performed by a treating clinician.”<sup>25,26</sup> Importantly, the general term is not defined by the location where the exam is performed, the capability of the imaging device, or the practitioner’s specialty.

The Writing Group employs “cardiac POCUS” because of its widespread use and descriptive clarity and use in adult and pediatric patient groups.<sup>12</sup> The term does not limit itself to any specific specialty, protocol, setting, or ultrasound machine. We view “basic cardiac POCUS” and “FoCUS” to be interchangeable. The term “FoCUS” has widespread international acceptance, particularly outside of North America. In addition, the terms “basic cardiac POCUS” and “FoCUS” both convey the point that this exam uses certain techniques/modalities to answer specific questions. We distinguish between “basic/focused” and “advanced” to reflect the difference between exams in terms of scope and complexity. The Writing Group therefore

**Table 1** Terminology historically used by different professional organizations

Term	Professional organization
Basic CCE	American College of Chest Physicians (ACCP)/CHEST
Basic point-of-care echocardiography in critical care	Small Projects, Audits and Research Projects-Australia/New Zealand (SPARTAN) Collaborative
Cardiac POCUS	Pediatric Emergency Medicine (PEM) Workgroup
Emergent cardiac imaging	Council of Emergency Medicine Residency Directors (CORD)
Focused echocardiography	Danish Society for Emergency Medicine
Echo in life support	International Federation for Emergency Medicine (IFEM)
Emergency echo	Early term from The World Interactive Network Focused on Critical UltraSound (WINFOCUS), prior to adoption of FoCUS
Focused transthoracic echocardiogram	Society of Critical Care Anesthesiologists (SOCCA) Working Group
Focused echocardiography in life support	American College of Emergency Medicine (ACEM)
Transthoracic focused cardiac ultrasound	American College of Emergency Physicians (ACEP)
Thoracic (heart) POCUS	European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB)

**Table 2** Comparisons between cardiac ultrasound exam types

	Ultrasound -assisted physical exam	Basic cardiac POCUS/FoCUS	Advanced cardiac POCUS (including CCE and TNE)	Consultative transthoracic echocardiogram (comprehensive and limited)
Clinician performing the exam (intrinsic differences)	Patient's treating clinician	Patient's treating clinician	Patient's treating clinician	Separate consultative team
Documentation of findings (intrinsic differences)	Progress note	Procedure note or procedure section of progress note		Formal structured report
Ultrasound imaging modalities used in each exam (practical differences)	B-mode (grayscale) imaging	B-mode (grayscale) imaging ± M mode ± Color Doppler	B-mode (grayscale) imaging Color/spectral Doppler ± Speckle-tracking strain ± Three-dimensional ± Agitated saline ± Ultrasound-enhancing agent imaging	
Suggested wording for documentation (practical differences)	Ultrasound was used at the discretion of the treating clinician to augment the physical examination. Findings included____	A basic cardiac POCUS exam was performed for the indication of ____by a trained clinician following a dedicated protocol (parasternal long- and short-axis, apical 4-chamber, subcostal views, and volume assessment (e.g. IVC size and collapsibility/distensibility)) using the following modalities: <input type="checkbox"/> B mode (grayscale) <input type="checkbox"/> M mode <input type="checkbox"/> Color Doppler Image quality was <input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor Procedural findings____ Conclusions_____	An advanced cardiac POCUS exam/ CCE/TNE was performed for the indication of ____by a trained clinician following a dedicated protocol (parasternal long- and short-axis, apical 4-chamber, subcostal views, and volume assessment (e.g. IVC size and collapsibility/distensibility)) using the following modalities: <input type="checkbox"/> B mode (grayscale) <input type="checkbox"/> M mode <input type="checkbox"/> Color Doppler <input type="checkbox"/> Pulsed-wave Doppler <input type="checkbox"/> Continuous-wave Doppler <input type="checkbox"/> Three-dimensional <input type="checkbox"/> Speckle-tracking <input type="checkbox"/> Agitated saline <input type="checkbox"/> Ultrasound-enhancing agent Image quality was <input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor Procedural findings____ Conclusions_____	Per ASE Recommendations for Quality Echocardiography Laboratory Operations, reports must include: • Demographics • Reason for the examination • Statement of image quality • Echocardiographic findings (measurements and qualitative findings) • A summary statement (salient findings and abnormalities correlated to exam indication and compared to prior studies)
Examples of additional ultrasound exams, documented separately	Lung ultrasound Lower extremity vein ultrasound Abdominal aorta ultrasound FAST			
Routine image archiving (intrinsic differences)	Not required except for quality assurance	Required except when not feasible due to resource limitations		

recommends a distinction between basic cardiac POCUS/FoCUS and advanced cardiac POCUS.

A basic cardiac POCUS/FoCUS exam involves the following characteristics, as modified from the original definition of FoCUS:<sup>13</sup>

1. Machine functionality includes at least B-mode (grayscale) imaging.
2. An attempt is made to obtain at least the following views: parasternal long axis, parasternal short axis, apical 4 chamber, subcostal.
3. Clinical questions (in particular those pertaining to left and right ventricular size and function, intracardiac volume status, and the presence of pericardial fluid) are assessed qualitatively.
4. Structured documentation of the procedure and findings is entered into the patient's medical record.
5. The treating clinician routinely archives images (unless an archiving system is unavailable).

An advanced cardiac POCUS exam includes the following elements.

1. Machine functionality includes modalities in addition to B-mode (grayscale) imaging (e.g., color and spectral Doppler, M mode).
2. Clinicians are able to acquire advanced views and employ and interpret modalities besides B-mode (grayscale) and color Doppler imaging (e.g., spectral Doppler).
3. Clinical questions are answered qualitatively and quantitatively.
4. Structured documentation of the procedure and findings is entered into the patient's medical record.
5. The treating clinician routinely archives images (unless an archiving system is unavailable).

Basic cardiac POCUS/FoCUS and advanced cardiac POCUS differ in regard to the scope of the exam, including modalities employed and the complexity of imaging and interpretation performed (e.g., advanced cardiac POCUS involves the use of spectral Doppler to evaluate intracardiac hemodynamics; Table 2). Training also plays a role, as the practitioner's proficiency must be commensurate with the modalities employed and the complexity of the exam. Of course, depending on the clinical questions to be addressed, a practitioner trained to use and interpret advanced modalities can use advanced machines to perform a basic cardiac POCUS/FoCUS exam.

Critical care echocardiography (CCE) is a form of advanced cardiac POCUS. The definition of CCE involves a clinician who treats critically ill patients, regardless of the hospital setting (e.g., emergency department, perioperative setting, operating room, or intensive care unit), performing and interpreting an advanced cardiac ultrasound exam at the point of care to enhance diagnostic accuracy, facilitate management, and/or guide bedside invasive procedures.<sup>27,28</sup> The National Board of Echocardiography has characterized CCE as including elements of Doppler quantification, assessment of complex heart/lung interactions, and hemodynamic measurements in the critically ill.<sup>29</sup> Critical care echocardiography may be restricted in scope compared to other applications of cardiac ultrasound since it is focused on pathology encountered in critical care settings. However, CCE integrates examinations of extracardiac structures (see below) that are not always part of basic cardiac POCUS/FoCUS, other forms of advanced cardiac POCUS, or echocardiography performed by sonographers and/or physicians in an echocardiography laboratory. For all forms of cardiac POCUS, archiving is strongly recommended, but it may be especially crucial for advanced cardiac POCUS, as comparisons of quantitative measures between scans are particularly important.

Targeted neonatal echocardiography (TNE) is another form of advanced cardiac POCUS. TNE employs advanced cardiac ultrasound techniques, including quantitative evaluation of spectral Doppler, to evaluate ventricular function and hemodynamics in the neonatal intensive care unit. There are standardized training pathways and a formal guideline statement detailing indications, standard views, and required measurements.<sup>30</sup> However, more limited evaluation in neonates (such as qualitative evaluation of catheter position, effusions or ventricular function), described as "cPOCUS" in that guideline statement and as "cardiac POCUS" in a broader pediatric guideline,<sup>12</sup> would represent a form of basic cardiac POCUS/FoCUS.

### Consultative Echocardiography

The Writing Group differentiates cardiac POCUS from "consultative echocardiography." Consultative echocardiography takes the form of either "comprehensive consultative echocardiography" or "limited consultative echocardiography," which are terms established in the 2011 American Society of Echocardiography (ASE) Recommendations for Quality Echocardiography Laboratory Operations and found in the AMA Current Procedural Terminology coding books (specifically codes 93306 and 93308) to describe what is included in an exam.<sup>31</sup> These distinctions involve both "*intrinsic*" differences (those that are essential to the definition) and "*practical*" differences (those that occur frequently in clinical practice, depending on situational factors, but are not essential to the definition). The Writing Group follows the previously established distinction between cardiac POCUS and consultative echocardiography based primarily on the role in patient management of the healthcare professional who performs the exam, which is an intrinsic difference.<sup>26</sup> A cardiac POCUS exam is performed and interpreted by the patient's treating clinician. In contrast, a consultative echocardiogram is performed and interpreted by a separate team (sonographer or physician), usually from the echocardiography laboratory. Notably, this distinction does not designate a cardiac POCUS exam as substandard to a consultative echocardiogram. While performed by different kinds of healthcare professionals, both exams have an important role in patient care. Equally importantly, the term "consultative" should not be conflated with "comprehensive".

In addition to understanding the intrinsic differences, practitioners should understand the *practical* differences of each exam in different contexts. Cardiac POCUS and consultative echocardiography usually answer different questions or answer the same question in different ways, and they are often complementary. Machine capabilities may differ (e.g., availability of M mode, spectral Doppler, speckle-tracking, three-dimensional imaging). The scope-of-practice differences between most cardiac POCUS users and echocardiography consultants usually arise in the degree and breadth as well as depth of training and type of certification. Sonographers and/or physicians performing consultative exams must demonstrate and maintain expertise in the full suite of cardiac ultrasound modalities after having completed requisite training. The extent of the exam may not always differ intrinsically between consultative echocardiography and cardiac POCUS. Practically, however, most comprehensive echocardiograms performed by echocardiography laboratories will include more views of more structures with more in-depth interrogation, with greater quantitation involving more modalities than most cardiac POCUS exams. Congenital heart disease evaluation, in particular, should involve consultative echocardiography by specialist sonographer/physician operators and physician interpreters.<sup>12</sup>

In brief, cardiac POCUS and consultative echocardiography differ *intrinsically* in workflow (performed by treating clinicians vs performed by consultative teams at the request of treating clinicians). They usually differ *practically* in purpose/indication, relative scope, modalities used, and speciality and training level of operators.

## Cardiac Ultrasound–Assisted Physical Examination

Ultrasound-assisted physical examination (UAPE) has been defined in different ways, including as the “amalgamation of physical and ultrasound examinations”<sup>32</sup> and as “augmentation of the physical examination.”<sup>33,34</sup> Several protocols have been established and investigated (e.g., cardiopulmonary limited ultrasound examination).<sup>11</sup> Although cardiac UAPE shares elements with basic cardiac POCUS/FoCUS, including similar machines and limited number of views, there is a need to distinguish the two (Table 2). The *intrinsic* difference is that cardiac POCUS is a procedure and UAPE is not. The intent of UAPE is the same as a physical examination—to survey the heart rapidly with a simple, explorative tool that adds confidence to other physical exam maneuvers or to perform a limited assessment of a specific structure (e.g., the inferior vena cava) that can be easily repeated as part of the physical exam.<sup>35</sup> In contrast, a basic cardiac POCUS/FoCUS is a diagnostic procedure performed to address a clinical question using a specific technique. This question usually involves establishing or excluding a diagnosis. Basic cardiac POCUS/FoCUS may serve as a stand-alone modality, although confirmatory testing may be necessary.

On a *practical* level, compared to basic cardiac POCUS/FoCUS, UAPE may require less intensive training. Although findings should be documented, there is no standard requirement for routine image archiving. Ultrasound-assisted physical examination may be used serially, for example, to augment visual assessment of jugular venous pressure in a patient undergoing diuresis. In this case, as a physical examination maneuver, there is no specific need to archive images except for quality assurance. On the other hand, if basic cardiac POCUS/FoCUS is used to identify a pericardial effusion with chamber compression, which is then followed by pericardiocentesis, archiving is important for future comparison to exams performed to assess for the reaccumulation of fluid.<sup>13,36,37</sup> Importantly, cardiac POCUS exams should not be defined as UAPE in order to avoid archiving requirements.

## Key Points

- “POCUS” can be defined broadly as “the acquisition, interpretation, and immediate clinical integration of ultrasonographic imaging performed by a treating clinician.”
- Importantly, the general term is not defined by the location where the exam is performed, the capability of the imaging device, or the practitioner’s specialty.
- Nomenclature Recommendation: Basic cardiac POCUS/FoCUS employs B-mode imaging to address a defined set of pathologies in focused views.
- Nomenclature Recommendation: Advanced cardiac POCUS is performed by properly trained clinicians using advanced modalities and views to investigate complex pathologies.
- Nomenclature Recommendation: CCE is a form of advanced cardiac POCUS that is applied in the critical care context.
- Nomenclature Recommendation: TNE is a form of advanced cardiac POCUS that is applied in the neonatal intensive care unit.
- Nomenclature Recommendation: The intrinsic workflow difference between cardiac POCUS and consultative echocardiography is that the former is performed and interpreted by treating clinicians and the latter is performed and interpreted by a separate consultative team, usually from the echocardiography laboratory.
- Nomenclature Recommendation: Key distinctions are “point of care” vs. “consultative” and “comprehensive” vs. “limited”. Specif-

ically, a “consultative” exam may be either “comprehensive” or “limited”. “Consultative” should not be conflated with “comprehensive”.

- Nomenclature Recommendation: UAPE differs intrinsically from cardiac POCUS in its intent—to augment the physical examination as opposed to performing a diagnostic procedure.
- Recommendation: Archiving of images should be standard for cardiac POCUS but is not universally required for UAPE.

## PRACTICAL APPLICATIONS

The Writing Group believes that the recommended nomenclature has several practical implications. It should be noted that no nomenclature is perfect, and there are situations in clinical practice that challenge the definitions we have outlined. In Box (see below), we describe and apply the nomenclature to some of these challenging scenarios, and we recognize there may be others.

### Clinical Integration

The evolution of POCUS has resulted in its integration into clinical pathways, and it should function as part of an overall diagnostic approach.<sup>38,39</sup> For instance, in a patient presenting in shock, cardiac POCUS can have an important role in the initial evaluation, diagnosing shock etiology and guiding initial care. Initial findings can then be used for determining the timing and need for additional diagnostic tests such as comprehensive consultative echocardiography, right heart catheterization, invasive coronary angiography, computed tomography, or other imaging procedures. Findings from these additional tests can dictate the indication and timing of follow-up cardiac POCUS exams, which can assess response to therapy, identify complications, or monitor coexisting pathologies.

Similarly, in a patient presenting with a subacute history of dyspnea on exertion in the outpatient setting, performance of UAPE to augment physical exam assessment of right-sided congestion may guide referral for comprehensive consultative echocardiography as an outpatient or in the emergency department.

### Documentation and Archiving

Healthcare professionals should document findings from all cardiac ultrasound procedures and archive images according to local requirements and capabilities. Table 2 provides sample language for documentation. The Writing Group recommends that cardiac POCUS documentation clearly identify whether the procedure is a basic cardiac POCUS/FoCUS exam, an advanced cardiac POCUS exam, or a CCE or a TNE exam. Ultrasound-assisted physical examination should be documented in a progress note, as findings on physical exam would be, and not in a procedure note. Archiving images allows review for detection of changes in cardiac structure and function over time. Images and the structured report should be accessible in the electronic medical record except in limited-resource settings where this is not possible. Ultrasound-assisted physical examination images, especially if requiring validation by experienced clinicians or if useful for comparison to subsequent UAPE or other forms of cardiac ultrasound, should be recorded and stored locally on a machine or a secure drive. Periodic review for quality assurance is recommended.

In many resource-limited settings, routine archiving in an electronic image storage system is not possible. In these settings, the clinician should follow local standard practices regarding comparison and

## Box

**EXAMPLES OF CARDIAC POCUS NOMENCLATURE APPLIED TO DIVERSE SCENARIOS:****Same practitioner, multiple exam types**

1. A properly trained cardiologist who maintains scanning skills performs a cardiac ultrasound exam involving color and advanced spectral Doppler on that cardiologist's own patient while on rounds in the inpatient setting, and then performs the same exam on another clinician's patient as part of a consultative team from the echocardiography laboratory. The cardiologist then goes to the clinic and performs an ultrasound exam to augment the physical exam in surveying the heart, involving only B-mode (grayscale) imaging. Images from the latter exam are not saved, but the findings are documented in a clinic progress note.
  - According to the nomenclature in this document, the cardiologist would be performing an advanced cardiac POCUS exam in the first instance, a consultative echocardiogram in the second, and a UAPE in the third. The key is the capacity in which the cardiologist performs the exam—as the patient's physician at the point of care vs. as part of a consultative team from the echocardiography laboratory. It is possible that a cardiologist may serve both functions for the same patient in different scenarios. Similarly, a cardiologist interpreting a sonographer-performed, consultative echocardiogram will be acting in the role of an echocardiography lab team member.

**Same machine, different exam types**

2. A properly trained cardiac POCUS practitioner using a machine with B-mode, and pulsed- and continuous-wave spectral Doppler capabilities performs an exam with B-mode (grayscale) imaging in 4 to 5 standard views. Another practitioner with the same level of training uses the same machine to acquire the same images but adds interrogation of valves and measurement of the tricuspid regurgitant jet velocity to estimate pulmonary artery systolic pressure.
  - According to this document's nomenclature, the first practitioner performed a basic cardiac POCUS/FoCUS exam, and the second performed an advanced cardiac POCUS exam. If the exam is performed in the critical care context, and especially if it includes other measurements such as cardiac output using pulsed-wave Doppler in the left ventricular outflow tract and left ventricular outflow tract diameter or pulmonary vascular resistance, it would be considered a CCE exam.
3. A properly trained neonatal intensive care specialist uses a machine with B-mode (grayscale) imaging, color Doppler, and pulsed- and continuous-wave spectral Doppler capabilities to perform a limited evaluation of effusions, ventricular filling, and qualitative ventricular function as a first exam. The following day, a different practitioner with more advanced training performs a similar exam using the same machine but with the addition of hemodynamic assessment.

- The first exam constitutes a basic cardiac POCUS, and the second a TNE exam.

**Resource-limited settings**

4. A properly trained treating clinician in a resource-limited setting performs a cardiac ultrasound exam using B-mode (grayscale) imaging in 4 to 5 standard views. The clinician lacks the capabilities to archive all of the images but does save a representative clip displaying key abnormalities on a password-protected external drive. Results are recorded in a procedure note.
  - This is a basic cardiac POCUS/FoCUS exam. Inability to archive images in a resource-limited setting does not change the intent and nature of the exam.

quality improvement. These practices may include saving selected images to encrypted external drives, archiving images on machines until they can be reviewed by experts, or even printing still-frame images.

**Training**

Although ultrasound education has become an integral part of medical training in several countries,<sup>40-44</sup> there are no universally accepted standards for cardiac POCUS curriculum and training. Several statements have addressed this issue,<sup>45,46</sup> and the National Board of Echocardiography has defined the knowledge base required for special competence in CCE in its exam content outline.<sup>30</sup> While harmonizing specific protocols is beyond the scope of the current document, the Writing Group believes that standard nomenclature is mandatory for standard imaging and training protocols. That said, for the sake of patient safety and appropriate use of information gained during these exams, the Writing Group endorses the requirement that UAPE, along with cardiac POCUS, should be subject to training programs and quality improvement.

**Extracardiac POCUS Nomenclature**

POCUS of other organ systems plays a significant complimentary role in some cardiac POCUS protocols. Lung ultrasound, in particular, became a prominent feature for hospitalized patients during the COVID pandemic, but its indications continue to expand.<sup>47</sup> Other protocols focus on splanchnic venous congestion and the abdominal aorta. The FAST exam (Focused Assessment With Sonography in Trauma)<sup>48</sup> assesses for blood in the peritoneal, pelvic, pleural, and pericardial spaces. The Writing Group considers these exams to be outside the scope of cardiac POCUS and not part of the intrinsic or practical definition of cardiac POCUS. Such an exam would be characterized as a cardiac POCUS exam *with* an exam of the other system (e.g., "basic cardiac POCUS with lung ultrasound" or "FoCUS with lower extremity vein ultrasound" or "FoCUS with FAST"). Depending on the clinical setting and practice

**Key Points**

- Documentation Recommendation: Cardiac POCUS exams should be documented with a structured report in the medical record and clearly identify whether the procedure is a basic cardiac POCUS/FoCUS exam or an advanced exam or a CCE exam.



- Documentation Recommendation: Extracardiac POCUS exams may be documented and archived separately or together, but noncardiac elements should be clearly identified.
- Documentation Recommendation: UAPE requires training in image acquisition and interpretation appropriate for the scope of practice, and some images should be saved (with proper data safeguards) for quality assurance purposes, unless it is impossible to do so.
- Documentation Recommendation: UAPE findings should be clearly labeled as such in a progress note.

pattern, these exams may be documented and archived separately or together, but noncardiac elements should be clearly identified. Competence in CCE and TNE requires expertise in certain forms of extracardiac POCUS.

## IMPLICATIONS FOR NOVEL TECHNOLOGIES

### Artificial Intelligence

Deep learning algorithms offer real-time, prescriptive guidance, assisting practitioners in obtaining cardiac imaging planes and interpreting images.<sup>49-53</sup> Artificial intelligence (AI) in POCUS may become standard and especially important in low-resource settings,<sup>54</sup> particularly by helping users with minimal training to apply a probe in the right location with the appropriate orientation, providing immediate guidance, and gathering information to provide an accurate interpretation. “Smarter” devices could empower patients to conduct scans.<sup>55</sup>

Cardiac POCUS nomenclature becomes relevant when considering the integration of AI in several ways. The lack of standardization makes it challenging to develop AI algorithms that can seamlessly integrate with different POCUS systems.<sup>56</sup> Inconsistencies in labeling can result in misinterpretations by AI algorithms, leading to errors in quality assessment. In addition, AI models require large and diverse datasets for training. Without standardized nomenclature and definitions, it becomes difficult to aggregate and annotate data from various sources, limiting the development of robust AI solutions for cardiac POCUS. To effectively utilize AI, it is crucial to ensure that the terminology aligns with the language and definitions accepted by healthcare practitioners. This consistency facilitates effective communication between AI systems and end users. Cardiac POCUS devices with AI capabilities need user interfaces that present AI-generated information clearly, concisely, and in a standardized format.

Standardized nomenclature and definitions can help establish a clear framework for assigning responsibility in AI-assisted diagnoses. The Writing Group recommends that, for the time being, the use of AI in cardiac POCUS be described as “AI-assisted cardiac POCUS.” Patient-conducted scanning is considered by the Writing Group to be outside of the scope of POCUS at this time.

### Wearable Ultrasound

Wearable ultrasound patches contain ultrasound transducers that transmit medical grade images. These devices can be useful for continuous remote monitoring of cardiac function, for remote imaging during telemedicine visits, and for use during resuscitation.<sup>57-60</sup> Devices incorporate AI and deep learning algorithms for continuous analysis.

How wearable ultrasound will fit into the clinical application of cardiac ultrasound imaging remains to be seen and may depend on the indications for which they prove most useful. Wearable ultrasound currently functions in a manner akin to wearable or implanted electrophysiological devices or implanted hemodynamic monitors. In the technical sense of the word, wearables are not “point of care,” as healthcare professionals are not usually administering clinical services at the time of acquisition (which may be continuous). The Writing Group considers them outside the scope of cardiac POCUS at this time.

### Remote-Controlled Scanning

Use of cardiac POCUS in resource-constrained settings faces barriers prevalent in low-resource or underserved healthcare settings. These may include lack of training and difficulty maintaining competency.<sup>61</sup> Several authors have investigated “hub and spoke” networks using remote and AI-guided POCUS by novice practitioners in low-resource settings under the auspices of centers that can provide technical support, remote interpretation, and clinical expertise, as well as assistance with quality assurance.<sup>62-64</sup> In addition, this model can involve remote-controlled scanning by which an operator remotely controls a robotic scanning arm (similar to robotic surgery). Robotic scanning is currently performed by remote specialists and technically is not “point of care.” The Writing Group therefore considers it outside the definition of cardiac POCUS.

### Key Points

- Nomenclature Recommendation: The use of AI in cardiac POCUS should be identified by the term “AI-assisted cardiac POCUS.”
- Nomenclature Recommendation: Wearable ultrasound machines and robotic scanning are currently outside the definition of cardiac POCUS.

## CONCLUSION

This collaborative scientific statement represents a distinct approach to nomenclature standardization in cardiac POCUS—one made iteratively by a large, diverse, and inclusive panel of healthcare professionals and a medical linguist seeking to build consensus. A standard nomenclature can promote patient safety and facilitate standardization of practice, a necessary next step in the evolution of quality assurance. Furthermore, a standard nomenclature sets the stage for future consensus building around coordination of imaging studies, credentialing processes, billing practices, liability considerations, training protocols, and research.<sup>7</sup> As technology and patient care evolve, future collaboration, facilitated by a standard nomenclature, will be essential to maximize the benefits of this remarkable diagnostic tool.

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## REVIEWERS

This document was reviewed by members of the 2023-24 ASE Guidelines and Standards Committee, ASE Board of Directors, ASE Executive Committee, and designated reviewers (Piers Barker, MD, David Dudzinski, MD, Noreen Kelly, MD, David Orsinelli, MD, Anitha Parthiban, MD, Alan Pearlman, MD, Andrew Pellet, PhD, RDCS).

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The following authors reported relationships with one or more commercial interests: Srikar Adhikari, MD, participated as Consultant, GE Healthcare and EXO ultrasound; Sara Damewood, MD, participated in producing educational materials for MedMastery; Madeline Jankowski, BS ACS, RDCS, participated as a consultant for Caption Health, Bristol Myers Squibb, and Echo IQ; Smadar Kort, MD, served on the Advisory Board for Medtronics; Sharon L. Mulvagh, MD is a member of the Steering Committee for a Novo Nordisk clinical trial; Nova Panebianco, MD, received research funding from ButterflyNetworkInc.

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