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Consensus Recommendations from a Modified Delphi Study on Specific Point of Care Ultrasound Examinations' Utility and Feasibility for North American Primary Care Physicians

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Abstract

Background

Point-of-care ultrasound (POCUS) is increasingly recognized as a valuable diagnostic tool in outpatient medicine. However, adoption in primary care remains low, with perceived wide variability in clinical utility and diagnostic yield. This study aimed to develop expert consensus for point-of-care ultrasound (POCUS) examinations that should be clinically used in adult primary care.

Methods

A list of POCUS examinations was collated based on a literature review for POCUS use in adult primary care. Expert participants completed five rounds of a modified Delphi process to determine consensus on utility for primary care for each POCUS examination. Participants included 37 physicians, including a mix of primary care physicians (PCPs) and subspecialists representing diverse geographic areas within North America, identified for their POCUS expertise via outpatient clinical experience, teaching experience, and recognition through at least one peer-reviewed publication, national or international conference presentation, or POCUS leadership roles. Consensus for each item was defined as greater than 80% of participants agreeing on their selection.

Results

Through this Delphi process, experts reached consensus on 18 POCUS examinations to be useful for all PCPs, 12 examinations to be useful for select PCPs with advanced POCUS training, and 20 examinations as not useful in primary care. Another 23 examinations did not achieve consensus. Examinations useful for all PCP's were deemed better suited to both rule in and rule out a finding, whereas examinations useful for select PCP's were suited to only rule in a finding.

Conclusion

Using the modified Delphi method, we reached consensus on a list of POCUS examinations that are considered useful for PCPs. These expert consensus recommendations may guide POCUS education and clinical use in primary care.

BACKGROUND

Point-of-care ultrasound (POCUS) is increasingly recognized as a valuable diagnostic tool in outpatient medicine, offering immediate information that can improve diagnostic accuracy, expedite decision-making, and enhance patient satisfaction and trust.[1–5] Studies show that POCUS may alter management

plans in up to 50% of cases in some settings, increasing clinician confidence while reducing unnecessary referrals and healthcare costs.[1–2,4]

Despite primary care physicians (PCPs) increasing recognition of the value of POCUS and strong interest in acquiring the skill, actual adoption rates remain low.[6–8] Among the key barriers commonly cited are the time and opportunity required to acquire skills, anticipated workflow disruption, and concern for diagnostic errors.[1–2,4,9–11] Training requirements for POCUS vary widely, as some focused exams can be learned quickly while others demand more extensive practice to achieve and maintain competence.[1,12–15] The diagnostic utility of POCUS exams are also highly exam-dependent. Some focused scans offer strong accuracy and reliability while others carry a higher risk of misinterpretation or clinical pitfalls, especially when used as stand-alone tests or by less experienced operators.[1,12–15] Such risks for diagnostic errors understandably lead to POCUS hesitancy. This highlights the need to identify high-yield, primary care–appropriate POCUS examinations in order to focus training and clinical time on studies that maximize benefit while minimizing risk in practice.[1,10,12–16]

Identification of such POCUS exams can be challenging as the role of POCUS in primary care is context-dependent and supported by an evolving and incomplete evidence base. Expert consensus can be particularly suited to identify areas of clinical practice agreement, heterogeneity, and uncertainty. While consensus efforts on POCUS utilizations in inpatient care and outpatient primary care in other countries have been performed, to date, there remains no consensus efforts focusing on American primary care physicians.[1,10–11,17–18]

This study addresses this need by developing expert consensus on which POCUS exams are both clinically useful and feasible for primary care in the North American setting. By explicitly defining clinical appropriateness and diagnostic value, this work aims to provide actionable recommendations that can guide clinicians, educators, and healthcare systems in advancing the integration of POCUS into primary care practice.

METHODS

POCUS Examination List Creation

The list of potential POCUS examinations for use in the primary care setting was developed by the study authors, all of whom have clinical, teaching, and research experience in general medicine POCUS. A PubMed search for articles on POCUS utilized in primary care and general practice excluding obstetrics and pediatrics was performed in August 2025 (see supplemental materials #1). The resulting 135 articles were separately reviewed by two authors (A.M., S.M.), and 44 relevant articles were identified. All POCUS assessments reported in these articles were compiled into a list of examinations. Two other authors (I.M., B.F.) then reviewed and made additions to this list based on common practices. This process produced a list of 62 POCUS examinations.

Expert Participant Recruitment

Potential experts were identified by purposive sampling reviewing listed authors of peer-reviewed articles generated from a PubMed search performed in August 2025. Additionally, publicly available webpages for the Society of General Internal Medicine and American College of Physicians were reviewed to identify listed POCUS experts. Additional experts known to the study authors and consenting experts through their national and regional POCUS education activities were also identified via snowball sampling. Eligibility criteria required expert participants to have at least five years of clinical practice, outpatient clinical experience, POCUS teaching experience, and demonstrated expertise in POCUS through at least one peer-reviewed publication, national or international conference presentation, or POCUS leadership roles. Outpatient clinical experience and duration of POCUS teaching experience were not specified. A mix of primary care physicians and subspecialists were recruited to provide a broader scope of expertise in outpatient POCUS. Experts were also recruited to represent diverse geographic areas within North America. Participant expertise was prioritized over large numbers.[19] Thirty-seven expert participants were invited via email and provided consent to participate.

Survey Design

Surveys were administered via REDCap (see supplemental materials #2). Surveys presented a list of POCUS examinations and asked experts if each examination is 1) “Useful for all PCPs,” 2) “Useful for some PCPs with advanced POCUS training,” or 3) “Not useful for primary care,” based on the clinical utility of the examination in primary care. For POCUS examinations that were selected as useful to all or some PCP’s, the survey used branching logic to ask experts to select if the examination should be used to rule in the diagnosis, rule out the diagnosis, or both, based on the diagnostic feasibility and accuracy of the examination. For POCUS examinations that were selected as not useful for primary care, experts selected from a list of options for why the examination would not be useful or appropriate. The survey also allowed comments via written text to present rationale and evidence.[20] Experts could elect not to provide a response for examinations that did not fall under their expertise. The survey also allowed experts to suggest additional POCUS examinations in an open textbox. The survey was piloted with five faculty members at Beth Israel Deaconess Medical Center involved in medical education scholarship. The five faculty members provided feedback on the survey content, flow, clarity, and ease of comprehension. The survey instructions and branching logic workflow were modified based on feedback received from this pilot. The surveys were distributed to participants via REDCap, which produced individualized links for each participant. REDCap additionally emailed participants automated repeat reminders to improve survey response rate. The study was approved by the Beth Israel Deaconess Medical Center Institutional Review Board (IRB # 2025P000470).

Consensus Process

The ACCORD guideline was used to standardize the Delphi methodology.[21] The consensus process consisted of using a modified Delphi process, with multiple rounds of asynchronous, anonymous online surveys in which expert participants rated the usefulness and diagnostic role of each POCUS examination. Consensus was defined as more than 80% agreement on a single response option. Items not reaching consensus advanced to the next round, accompanied by anonymized prior results, including percent of agreement and representative comments. This process continued until results showed statistical stability and consensus asymptote.

Study Termination

Stability of expert opinion was prioritized over exhaustive consensus to determine conclusion of the study.[22–23] Stability across survey rounds was assessed by evaluating the number of POCUS examinations that changed from no consensus to consensus. Lack of significant change and high agreement between two subsequent survey rounds indicated stability.[24] POCUS examinations were numericized to “no consensus” = 0 and “consensus” = 1 for each survey round. Significant change between two subsequent survey rounds were assessed via Wilcoxon signed-rank test, and agreement between two subsequent survey rounds were assessed via kappa statistic. Significant change and agreement were assessed between each survey round. The study was terminated when there was no significant change ($p > 0.05$) and high agreement (kappa value > 0.80) between two subsequent survey rounds. Study termination strategy was defined a priori.

Statistical Analysis

Descriptive statistics were used to calculate percent agreement. Wilcoxon signed-rank test was used to determine stability of itemized nonparametric data between survey rounds. Kappa statistic was used to determine agreement between survey rounds. Chi square analysis was used to determine associations between clinical utility (useful for all PCPs versus useful for select PCPs) and diagnostic utility (rule in only versus rule in and rule out). Descriptive statistics and percent agreement were calculated using Microsoft Excel. All other analyses were conducted using Stata, version 18 BE.

RESULTS

Experts Demographics and Participation

A total of 37 expert participants were included in the study. Participant specialties and geographic locations are summarized in Table 1. Five rounds of surveys took place between August and November 2025. Thirty-five (94.6%) participants completed round 1 of the survey, 31 (83.8%) completed round 2, 28 (75.7%) completed round 3, 28 (75.7%) completed round 4, and 30 (81.1%) completed round 5. The median number of surveys completed per participant was 5 (interquartile range 1), and 76% of participants (n = 28) completed at least 4 out of 5 surveys: 22 participants (59.5%) completed all 5

surveys, 6 (16.2%) completed 4 surveys, 3 (8.1%) completed 3 surveys, 2 (5.4%) completed 2 surveys, and 4 (10.8%) completed 1 survey.

Table 1
Baseline Characteristics of Participants

Specialty	**Number (n)**	**%**
Internal Medicine Primary Care	13	35%
Internal Medicine Hospitalist	7	19%
Family Medicine	6	16%
Med Peds	2	5%
Pulmonology	2	5%
Cardiology	1	3%
Nephrology	1	3%
Infectious Disease	1	3%
Emergency Medicine	1	3%
Palliative Care	1	3%
Rheumatology	1	3%
Oncology	1	3%
Total	37	100%
Location		
Massachusetts	8	22%
California	6	16%
South Carolina	5	14%
Minnesota	4	11%
Alberta	2	5%
Washington	2	5%
Oregon	2	5%
Florida	1	3%
Colorado	1	3%

Percentage of POCUS exams reaching consensus on expert recommendations each round are shown. Wilcoxon sign rank test was used to calculate significant difference in consensus results between each survey round and its previous round. No statistically significant change is seen in the fifth and final round.

Specialty	Number (n)	%
Texas	1	3%
Pennsylvania	1	3%
Maryland	1	3%
Nebraska	1	3%
North Carolina	1	3%
New Mexico	1	3%
Total	37	100%

Percentage of POCUS exams reaching consensus on expert recommendations each round are shown. Wilcoxon sign rank test was used to calculate significant difference in consensus results between each survey round and its previous round. No statistically significant change is seen in the fifth and final round.

Consensus on Examinations

In the first survey round, participants added 11 POCUS examinations to the initial list of 62 examinations, totaling 73 examinations to be reviewed. After five rounds of surveys, 18 (25%) examinations reached consensus to be useful for all PCPs, 12 (16%) reached consensus to be useful for select PCPs with advanced POCUS training, 20 (27%) reached consensus to be not useful in primary care, and 23 (32%) did not reach consensus. All 18 examinations that reached consensus to be useful for all PCPs also reached consensus for diagnostic utility to both rule in and rule out the target pathology. Of the 12 examinations that reached consensus to be useful for select PCPs with advanced POCUS training, 5 reached consensus to both rule in and rule out the target pathology, 5 reached consensus to rule in the pathology only, and 2 did not reach consensus for diagnostic utility. Examinations that can only rule in pathology strongly correlated with recommended use only for select PCPs with advanced POCUS training by Chi square analysis ($p = 0.001$). Details on consensus for each POCUS examination's clinical utility and diagnostic utility are shown in Table 2. Of the 20 examinations that reached consensus to be not useful in primary care, reasons selected by experts as being not useful are shown in Table 3 and supplemental materials #3.

Table 2
Results after Five Rounds of the Modified Delphi Process

Point-of Care Ultrasound Examination		Primary Care Utility (Round consensus achieved, Percent agreement)	Diagnostic Utility (Round consensus achieved, Percent agreement)
Ocular POCUS	Increased intracranial pressure	Useful for some PCPs (3, 80%)	Rule in and out (3, 81%)
	Vitreous hemorrhage	No consensus	
	Lens dislocation	Not useful (2, 80%)	
	Retinal detachment	No consensus	
Transcranial doppler	Ischemic cerebrovascular accident secondary to large vessel occlusion	Not useful (1, 88%)	
Temporal artery POCUS	Temporal arteritis	Not useful (4, 84%)	
Sinus POCUS	Rhinosinusitis	No consensus	
Peritonsillar POCUS	Peritonsillar abscess	Not useful (4, 83%)	
Thyroid POCUS	Thyroid nodule/mass	Useful for some PCPs (3, 92%)	No consensus
Carotid POCUS	Intima-media thickness for cardiac risk evaluation	Not useful (3, 83%)	
Cardiac POCUS	Pericardial effusion	Useful for all PCPs (3, 81%)	Rule in and out (2, 87%)
	Gross LV systolic dysfunction	Useful for all PCPs (2, 87%)	Rule in and out (2, 93%)
	Gross LV diastolic dysfunction	No consensus	
	Left ventricular hypertrophy	No consensus	
	Right ventricular strain	Useful for some PCPs	Rule in

Point-of Care Ultrasound Examination		Primary Care Utility (Round consensus achieved, Percent agreement)	Diagnostic Utility (Round consensus achieved, Percent agreement)
		(3, 80%)	(4, 81%)
	McConnell's sign for pulmonary embolism	No consensus	
	Left atrium pressure	Not useful (4, 81%)	
	Left atrium enlargement	No consensus	
	Severe valvular pathology	No consensus	
Internal Jugular Vein POCUS	Central venous pressure	Useful for all PCPs (4, 81%)	Rule in and out (2, 84%)
Inferior Vena Cava POCUS	Central venous pressure	No consensus	
Lung	Pneumonia	Useful for all PCPs (3, 80%)	Rule in and out (4, 81%)
	Pulmonary edema	Useful for all PCPs (1, 83%)	Rule in and out (2, 94%)
	Pleural effusion	Useful for all PCPs (1, 85%)	Rule in and out (1, 88%)
	Pneumothorax	No consensus	
	Interstitial lung disease	Not useful (4, 82%)	
Diaphragm POCUS	Diaphragm paralysis	Not useful (2, 90%)	
Breast POCUS	Breast mass	Not useful (3, 87%)	
Gastric POCUS	Gastropathy	Not useful (2, 100%)	

Point-of Care Ultrasound Examination		Primary Care Utility (Round consensus achieved, Percent agreement)	Diagnostic Utility (Round consensus achieved, Percent agreement)
Liver	Hepatomegaly	Useful for all PCPs (5, 80%)	Rule in and out (3, 84%)
	Nodular/cirrhotic features	No consensus	
	Fatty liver disease	No consensus	
Gallbladder POCUS	Cholelithiasis	Useful for all PCPs (3, 88%)	Rule in and out (2, 80%)
	Cholecystitis	No consensus	
Spleen POCUS	Splenomegaly	No consensus	
Abdominal POCUS	Intra-abdominal free fluid	Useful for all PCPs (2, 87%)	Rule in and out (2, 90%)
	Abdominal aortic aneurysm	Useful for all PCPs (2, 80%)	Rule in and out (2, 85%)
	Small bowel obstruction	Not useful (2, 83%)	
	Inflammatory bowel disease	Not useful (1, 89%)	
	Diverticulitis	Not useful (2, 85%)	
	Abdominal and inguinal hernia	Useful for some PCPs (4, 92%)	Rule in (5, 83%)
Kidney POCUS	Hydronephrosis	Useful for all PCPs (1, 82%)	Rule in and out (1, 81%)
	Nephrolithiasis	Useful for some PCPs (4, 82%)	Rule in (2, 85%)

Point-of Care Ultrasound Examination		Primary Care Utility (Round consensus achieved, Percent agreement)	Diagnostic Utility (Round consensus achieved, Percent agreement)
	Chronic kidney disease	Not useful (4, 81%)	
Bladder POCUS	Post-void urinary retention	Useful for all PCPs (1, 91%)	Rule in and out (2, 97%)
	Bladder mass	No consensus	
	Prostamegaly	No consensus	
Scrotum POCUS	Testicular torsion	No consensus	
	Epididymitis	Not useful (4, 85%)	
Trans-abdominal uterine POCUS	Ovarian mass	Not useful (2, 89%)	
	Ovarian torsion	Not useful (1, 82%)	
	Uterine mass	Not useful (4, 80%)	
	Intrauterine device displacement	No consensus	
Shoulder POCUS	Effusion	Useful for some PCPs (3, 88%)	Rule in and out (3, 80%)
	Rotator cuff injury	Useful for some PCPs (3, 87%)	No consensus
	Bursitis	Useful for some PCPs (5, 83%)	Rule in and out (4, 90%)
	Bicep tendinitis/tendinopathy	No consensus	
Elbow POCUS	Olecranon bursitis	No consensus	

Point-of Care Ultrasound Examination		Primary Care Utility (Round consensus achieved, Percent agreement)	Diagnostic Utility (Round consensus achieved, Percent agreement)
Median nerve POCUS	Carpel tunnel syndrome	Useful for some PCPs (4, 88%)	Rule in and out (1, 90%)
Knee POCUS	Effusion	Useful for all PCPs (3, 92%)	Rule in and out (1, 80%)
	Synovitis	Useful for some PCPs (3, 83%)	Rule in (3, 86%)
	Baker's cyst	Useful for all PCPs (2, 86%)	Rule in and out (1, 81%)
	Prepatellar bursitis	Useful for all PCPs (4, 85%)	Rule in and out (2, 83%)
Achilles tendon POCUS	Tendinopathy/rupture	No consensus	
Plantar fascia POCUS	Plantar fasciitis	Useful for some PCPs (5, 89%)	Rule in and out (4, 90%)
Small joint POCUS	Synovitis	No consensus	
Other joint POCUS	Acute gout flare	Useful for some PCPs (4, 88%)	Rule in (3, 94%)
Long bone POCUS	Long bone fracture	Not useful (4, 81%)	
Muscle POCUS	Sarcopenia	Not useful (2, 88%)	
Vascular POCUS	Deep vein thrombosis	No consensus	
Skin/soft tissue POCUS	Cellulitis vs abscess	Useful for all PCPs (1, 82%)	Rule in and out (1, 87%)

Point-of Care Ultrasound Examination		Primary Care Utility (Round consensus achieved, Percent agreement)	Diagnostic Utility (Round consensus achieved, Percent agreement)
	Foreign body	Useful for all PCPs (3, 96%)	Rule in and out (2, 84%)
	Lymphadenopathy versus lipoma versus cyst	Useful for all PCPs (3, 88%)	Rule in and out (2, 90%)

Table 3
Reason Selected for Not Recommending POCUS Examinations in Primary Care

Reasons	Number of times reason was selected by experts (%)
The pathology should require radiology evaluation.	644 (18.13%)
The POCUS exam is too difficult to perform.	402 (11.31%)
The POCUS exam should be performed by a specialist.	387 (10.89%)
The POCUS exam will not change management.	320 (9.01%)
The pathology should be evaluated in the emergency room or inpatient setting.	318 (8.95%)
The pathology can be easily assessed by physical exam without POCUS.	312 (8.78%)
The pathology is rare.	305 (8.58%)
The POCUS exam has too many pittfalls.	271 (7.63%)
The sensitivity of the POCUS exam is too low.	236 (6.64%)
The specificity of the POCUS exam is too low.	127 (3.57%)
The POCUS exam is too time-consuming.	122 (3.43%)
The POCUS exam requires equipment/presets that may not be available.	80 (2.25%)
Other	29 (0.82%)
Total	3553

Expert participants were also surveyed if each POCUS exam would be useful to incorporate into the physical examination of the adult annual health visit. Of the 73 examinations, none reached consensus to include into the annual physical examination, 65 (89%) reached consensus to not be included into the annual physical examination, and 8 (11%) did not reach consensus.

Termination of Survey Rounds

Wilcoxon sign-rank test showed significantly changing results from rounds one through four. No significant difference was observed between the fourth and fifth survey results, with less than 5% of items gaining new consensus. Additionally, the kappa values for agreement with the prior round was 0.50, 0.60, 0.63, and 0.91 respectively for rounds 2 through 5. These findings suggested stability after five survey rounds (Fig. 1). The study concluded after five rounds of surveys.

DISCUSSION

We used a modified Delphi method to develop expert consensus on POCUS examinations that are considered useful for all PCPs, useful for select PCPs with advanced training in POCUS, and not useful for adult primary care (Table 4). This study extends prior consensus efforts. Building on recent work focused broadly on internal medicine,[18] our recommendations define more specifically which POCUS examinations are relevant to adult primary care outpatient setting, where the scope of practice, time constraints, diagnostic thresholds, and downstream decision-making differ from inpatient and subspecialty settings. In light of a recent European consensus study on POCUS applications,[25] our work offers recommendations for POCUS utilization particularly within the North American primary care context, where regional differences in patient populations, disease prevalence, referral pathways, and healthcare resources may differentially impact the value of individual POCUS examinations.

Table 4
Final Expert Consensus Recommendations on POCUS Examinations in Primary Care

Useful for All Primary Care Physicians
JVP POCUS to rule in and rule out elevated central venous pressure
Cardiac POCUS to rule in and rule out pericardial effusion
Cardiac POCUS to rule in and rule out LV systolic dysfunction
Lung POCUS to rule in and rule out pneumonia
Lung POCUS to rule in and rule out pulmonary edema
Lung POCUS to rule in and rule out pleural effusion
Liver POCUS to rule in and rule out hepatomegaly
Gallbladder POCUS to rule in and rule out cholelithiasis
Abdominal POCUS to rule in and rule out intra-abdominal free fluid
Abdominal POCUS to rule in and rule out abdominal aortic aneurysm
Kidney POCUS to rule in and rule out hydronephrosis
Bladder POCUS to rule in and rule out post-void urinary retention
Knee POCUS to rule in and rule out knee effusion
Knee POCUS to rule in and rule out Baker's cyst
Knee POCUS to rule in and rule out prepatellar bursitis
Skin/soft tissue POCUS to rule in and rule out skin/soft tissue abscess
Skin/soft tissue POCUS to rule in and rule out presence of foreign body
Skin/soft tissue POCUS to rule in and rule out lymphadenopathy versus lipoma versus cyst
Useful for Some Primary Care Physicians with Advanced POCUS Training
Ocular POCUS to rule in and rule out increased intracranial pressure
Thyroid POCUS for the evaluation of thyroid nodule/mass *
Cardiac POCUS to rule in right heart strain
Abdominal POCUS to rule in abdominal/inguinal hernia
Kidney POCUS to rule in nephrolithiasis
* POCUS examination achieved consensus for clinical utility in Primary Care, but did not achieve consensus for diagnostic utility.
** >80% of participants selected "Useful for All PCPs" or "Useful for PCPs with Advanced POCUS Training," but did not achieve > 80% agreement for either option.

Useful for All Primary Care Physicians
Shoulder POCUS to rule in and rule out effusion
Shoulder POCUS for the evaluation of rotator cuff injury *
Shoulder POCUS to rule in and rule out bursitis
Median nerve POCUS to rule in and rule out carpel tunnel syndrome
Knee POCUS to rule in and synovitis
Plantar fascia POCUS to rule in and rule out plantar fasciitis
Other joint POCUS to rule in acute gout flare
Not Useful for Primary Care Physicians
Ocular POCUS for the evaluation of lens dislocation
Transcranial doppler for the evaluation for ischemic cerebrovascular accident secondary to large vessel occlusion
Temporal artery POCUS for the evaluation of temporal arteritis
Peritonsillar POCUS for the evaluation of peritonsillar abscess
Carotid POCUS for the evaluation of intima-media thickness for cardiac risk evaluation
Cardiac POCUS for the evaluation of left atrium pressure
Lung POCUS for the evaluation of interstitial lung disease (screening and/or monitoring)
Diaphragm POCUS for the evaluation of diaphragm paralysis
Breast POCUS for the evaluation of breast mass
Gastric POCUS for the evaluation of gastropathy
Abdominal POCUS for the evaluation of small bowel obstruction
Abdominal POCUS for the evaluation of inflammatory bowel disease (monitoring)
Abdominal POCUS for the evaluation of diverticulitis
Kidney POCUS for the evaluation of chronic kidney disease
Trans-abdominal uterine POCUS for the evaluation of ovarian mass
Trans-abdominal uterine POCUS for the evaluation of ovarian torsion
* POCUS examination achieved consensus for clinical utility in Primary Care, but did not achieve consensus for diagnostic utility.
** >80% of participants selected “Useful for All PCPs” or “Useful for PCPs with Advanced POCUS Training,” but did not achieve > 80% agreement for either option.

Useful for All Primary Care Physicians
Trans-abdominal uterine POCUS for the evaluation of uterine mass
Scrotum POCUS for the evaluation of epididymitis
Long bone POCUS for the evaluation of long bone fracture
Muscle POCUS for the evaluation of sarcopenia
No Consensus
Ocular POCUS for the evaluation of vitreous hemorrhage
Ocular POCUS for the evaluation of retinal detachment
Sinus POCUS for the evaluation of rhinosinusitis
Cardiac POCUS for the evaluation of gross LV diastolic dysfunction
Cardiac POCUS for the evaluation of left ventricle hypertrophy
Cardiac POCUS for the evaluation of McConnell's sign for pulmonary embolism
Cardiac POCUS for the evaluation of left atrium enlargement
Cardiac POCUS for the evaluation of severe valvular pathology
Bladder POCUS for the evaluation of bladder mass
Prostate POCUS for the evaluation of prostatomegaly
Scrotum POCUS for the evaluation of testicular torsion
Elbow POCUS for the evaluation of olecranon bursitis
Small joint POCUS for the evaluation of small joint synovitis
IVC POCUS for the evaluation of central venous pressure **
Lung POCUS for the evaluation of pneumothorax **
Liver POCUS for the evaluation of nodular/cirrhotic features **
Liver POCUS for the evaluation of fatty liver disease **
Gallbladder POCUS for the evaluation of cholecystitis **
Spleen POCUS for the evaluation of splenomegaly **
Trans-abdominal uterine POCUS for the evaluation of intrauterine device displacement **
* POCUS examination achieved consensus for clinical utility in Primary Care, but did not achieve consensus for diagnostic utility.
** >80% of participants selected "Useful for All PCPs" or "Useful for PCPs with Advanced POCUS Training," but did not achieve > 80% agreement for either option.

Useful for All Primary Care Physicians
Shoulder POCUS for the evaluation of bicep tendinitis/tendinopathy **
Achilles tendon POCUS for the evaluation of tendinopathy/rupture **
Vascular POCUS for the evaluation of deep vein thrombosis **
* POCUS examination achieved consensus for clinical utility in Primary Care, but did not achieve consensus for diagnostic utility.
** >80% of participants selected “Useful for All PCPs” or “Useful for PCPs with Advanced POCUS Training,” but did not achieve > 80% agreement for either option.

Additionally, our findings move beyond broad organ-based recommendations (e.g., “Cardiac POCUS”) to provide exam-level, question-specific guidance (e.g., “pericardial effusion”). By clarifying whether examinations are best suited to rule in, rule out, or both, and by distinguishing which examinations are appropriate for all PCPs versus those requiring advanced training and unique practice settings, this work offers more granular guidance for clinical and educational prioritization. Lastly, this study also explored not only “which” POCUS examinations are appropriate for primary care, but also “why” others are not. By systematically capturing expert rationale for examinations deemed not useful, this study offers an understanding into the utility, feasibility, and scope-of-care limitations that constrain POCUS use in primary care. Examinations were most commonly viewed as inappropriate when they required radiologic or specialty evaluation, were technically challenging to perform reliably, or were unlikely to meaningfully influence management in the primary care setting (Table 3). Furthermore, all examinations viewed as appropriate for all PCPs had high diagnostic accuracy in both ruling in and ruling out pathology, whereas examinations that can only rule in pathology strongly correlated with recommended use only for select PCPs with advanced POCUS training. Understanding which examinations require advanced training can help support safer and more targeted POCUS implementation by clarifying examinations that may introduce more risk than benefit.

Not all examinations achieved consensus, reflecting the strong contextual dependence of many ultrasound applications in primary care. Several examinations were viewed by more than 80% of experts as useful for all or some but did not reach formal consensus (Table 4), suggesting nuanced roles that may depend on clinician experience, practice setting, or patient population. Other examinations generated discussion amongst experts regarding possible inclusion into routine annual visits – particularly multiple assessments of the heart, liver, spleen, and screening for abdominal aortic aneurysm – but no agreement was reached. These areas of uncertainty highlight important opportunities for future research to clarify appropriate indications, training thresholds, and clinical impact. Actual implementation, education, clinical outcomes, and system-level impact will also need to be evaluated.

There are inherent limitations to expert consensus-based inquiry.[19] Certain inclusion criteria for expert participants in this study, such as outpatient clinical experience and POCUS teaching experience, were

not quantitatively defined. While the majority of our experts participated in all 5 rounds of surveys, the impact of variable participation could not be assessed via sensitivity analysis due to participant response anonymity. Lastly, for examinations deemed appropriate for some PCPs, how much advanced training required and the feasibility of such training was not described. Future studies should address this gap.

CONCLUSIONS

In conclusion, we recommend adoption of POCUS examinations identified in this study (Table 4) into adult primary care. Reasons for inclusions, exclusions, and diagnostic utility of each examination are also reported. These recommendations can inform safe, effective, and sustainable integration of POCUS into primary care practice.

Abbreviations

Point
of-care ultrasound (POCUS)

Declarations

Ethics approval and consent to participate

The study was approved by the Beth Israel Deaconess Medical Center Institutional Review Board (IRB # 2025P000470). All participant provided consent, and participants' information remains anonymized. This study does not involve human, tissue, and or animal data. All surveys and analysis of responses were performed in accordance with relevant guidelines and regulations.

Consent for publication

This study does not contain data from any individual person.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AM and SM performed the literature review and compiled the list of POCUS examinations which can be used in primary care. IM and BF reviewed and made additions to this list. AM and SM created the RedCap survey and performed the statistical analysis. All authors helped with expert recruitment, participated in the Delphi process, reviewed results, contributed significantly to the writing of the manuscript, and approved the final manuscript.

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Figures

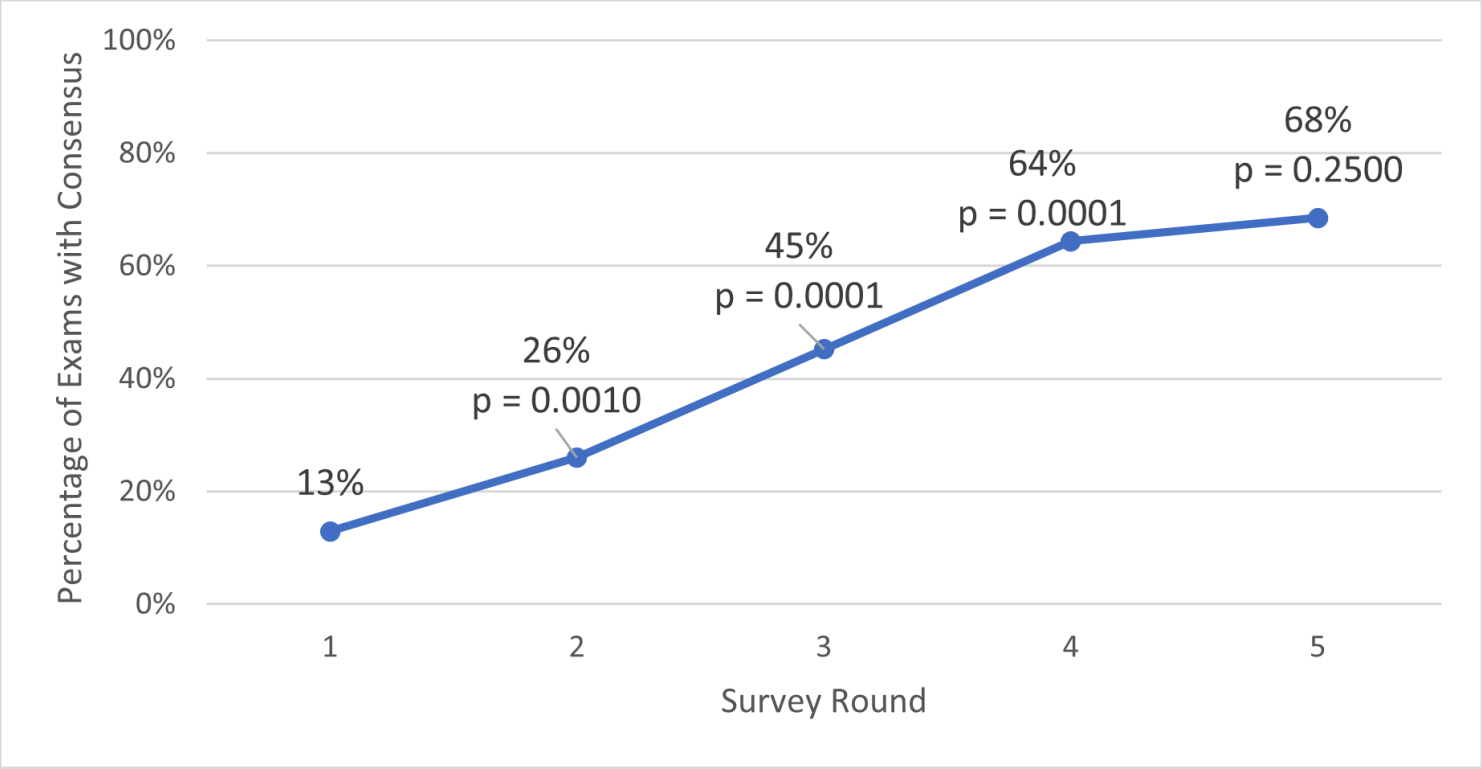


Figure 1

Building Consensus over Five Survey Rounds.

Percentage of POCUS exams reaching consensus on expert recommendations each round are shown. Wilcoxon sign rank test was used to calculate significant difference in consensus results between each survey round and its previous round. No statistically significant change is seen in the fifth and final round.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AdditionalFile1forSurveyRound1.pdf
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