BRITISH JOURNAL OF HOSPITAL MEDICINE

REVIEW

Is Point of Care Ultrasound Worth the Bother?

Laura O'Sullivan[1], Nicholas Smallwood[2,*]

[1]Department of Critical Care Medicine, Guy's and St Thomas' NHS Foundation Trust, London, UK
[2]Department of Acute Medicine, Hampshire Hospitals NHS Foundation Trust, Basingstoke, UK
*Correspondence: nick.smallwood@hhft.nhs.uk (Nicholas Smallwood)

Abstract

There has been an increase in the routine use of point of care ultrasound (POCUS) in the UK over the last decade, which has been reflected by its inclusion in the training curriculum of several specialties. Despite this fact there are still those within medicine who are reluctant to engage with POCUS, remaining sceptical about its benefits. A substantial evidence base exists in support of POCUS use in patient assessment and management. Though there are accepted challenges in achieving competency, these are being acknowledged and work undertaken to overcome them. There is growing enthusiasm amongst the medical workforce for the development of POCUS competencies, and as its use becomes increasingly normalised those still in doubt may see its value. This review aims to highlight the current state of play of POCUS within internal medicine, explore the current barriers to accreditation whilst also suggesting solutions, and discuss the future possible directions for this imaging modality. We conclude that to facilitate the use of POCUS as a routine part of care within internal medicine, there must be collaboration between multiple specialties to facilitate high quality training and sustainable safe practice to the benefit of our patients.

Key words: point of care technology; ultrasound; medical education; diagnosis; interventional ultrasound

Submitted: 13 November 2024 Revised: 6 January 2025 Accepted: 22 January 2025

Introduction

Point of care ultrasound (POCUS) utilises the expanding availability and reducing cost of ultrasound devices to allow immediate bedside imaging assessment of patients. Within medical practice in the UK it is used primarily to aid diagnosis (e.g., pleural effusion vs consolidated lung), or to facilitate a procedure (e.g., thoracic intervention, regional anaesthesia). There has been an increase in the routine use of POCUS in the UK over the last decade, which has been reflected by its inclusion as a mandatory skill in the training curriculum of several specialties including respiratory and emergency medicine. POCUS has also become best practice to facilitate procedural interventions—namely, central line insertion and chest drain insertion.

Despite this, there is no dedicated training process for internal medicine (IM) POCUS within the UK—the closest to this is the Focused Acute Medicine Ultrasound (FAMUS) programme developed within the specialty of acute internal medicine (AIM). The core components of this POCUS programme were driven primarily by survey data from AIM clinicians outlining what skills they would most

How to cite this article:
O'Sullivan L, Smallwood N. Is Point of Care Ultrasound Worth the Bother? Br J Hosp Med. 2025. https://doi.org/10.12968/hmed.2024.0909

Table 1. Core and extended POCUS skills within internal medicine.

Core POCUS skills		Extended POCUS skills	
Diagnostic	Procedural	Diagnostic	Procedural
Pulmonary oedema	Pleural intervention	Haemodynamic assessment/shock	Lumbar puncture
Consolidation	Paracentesis	Liver and biliary assessment	
Pleural effusion	Peripheral vascular access	Advanced echocardiography	
Hydronephrosis	Central venous access	Optic nerve sheath diameter assessment	
Bladder outflow obstruction			
Free fluid assessment			
Basic echocardiography			

POCUS, point of care ultrasound.

value (Smallwood et al, 2015), and includes respiratory failure ultrasound, imaging of the renal tract and assessment of free fluid, and the identification of deep vein thrombosis (Smallwood et al, 2017). As well as this, guidance for pleural and ascitic procedures and peripheral vascular access are included (see Table 1). In 2022 the curriculum for higher specialty training in AIM was updated to address the perceived importance of this evolving discipline by mandating the inclusion of these core POCUS competencies. Prior to the 2022 curriculum, POCUS had been available within AIM training as an optional skill only. It does not currently feature at all in either the internal medicine stage 1 or 2, or Foundation training programmes within the UK. Regardless of this fact some Medical Schools in the UK have chosen to incorporate POCUS into their undergraduate teaching (McCormick et al, 2023), following the trend in the USA (Martin et al, 2023).

There have been anticipated challenges to introducing the POCUS element of the curriculum, which have been demonstrated in other specialties previously (Aggarwal et al, 2023; Reid et al, 2018). Alongside these expected hurdles there remains a lack of enthusiasm from some to engage with POCUS implementation and training, particularly if they have limited experience or education in this modality. In order to try to overcome this reluctance, it is important that any benefits of POCUS are demonstrated objectively and with clarity. Is it possible to show to not only the broader medical community, but also those with doubt within internal medicine that POCUS is worth the bother?

This article aims to outline the current evidence concerning POCUS integration within internal medicine as both a core skill, and also what the future directions of POCUS education in IM may look like. We aim to outline some of the challenges to delivering this education and offer potential solutions. It is hoped this will provide some foundation to help implement IM POCUS education more widely across the UK.

What POCUS Currently Offers for Acute and Internal Medicine

In order to warrant attention within acute and internal medicine, it should be shown that POCUS offers benefits in the timely diagnosis, treatment and manage-

ment of acutely unwell patients, since the majority of UK internal medicine practice happens within the inpatient rather than stable outpatient setting. The primary outcome within the literature, therefore, should be acceptable diagnostic accuracy of POCUS versus traditional diagnostic modalities. In this regard, the evidence base has grown and there is consensus on the sensitivity and specificity of POCUS as a diagnostic tool in many scenarios (Rice et al, 2021). Questions around whether POCUS changes management, influences outcomes or reduces length of stay or costs are often asked, but are not appropriate benchmarks to place on a diagnostic test; these are instead appropriate questions for a management intervention. There are also much harder to assess concepts around 'confidence' in diagnosis and management, for both the operating physician and the patient, that have attracted attention in the literature.

Procedural

Both central and peripheral venous access facilitated by ultrasound exemplify the reward demonstrated by POCUS in practical procedures—that it makes a task easier and safer to do when you can see what you are doing. In 2002, central venous access was the first ultrasound guided skill to have a National Institute for Health and Care Excellence (NICE) guidance recommending its use (NICE Technology appraisal guidance 49), based on analysis of randomised controlled trials that showed that its routine use in comparison to a 'landmark' technique decreased rates of failure and complications. As such, it is now accepted best practice, and the ability to perform ultrasound guided central venous access is included in the internal medicine training curriculum in the UK as a minimum skill demonstrable in the skills lab.

In a similar vein, the demonstration of increased success and improved safety led to the National Patient Safety Agency publication which was instrumental in mandating ultrasound guidance for intercostal drain insertion. This 2008 document demonstrated the benefits of ultrasound use in pleural procedures, with the risks of the 'blind' technique (including failure, insufficient sampling and trauma) summarized in a subsequent British Medical Journal (BMJ) article (Lamont et al, 2009). More recently the British Thoracic Society have published their recommendations on the use of pleural ultrasound for intercostal drain insertion, as well as the definition of training standards in lung ultrasound for specialists in respiratory medicine (Roberts et al, 2023).

Thoracic Ultrasound

Beyond the pleura the use of lung ultrasound is valuable in the diagnosis of the breathless patient, one of the most common presentations to internal medicine. When studies look to compare POCUS to both clinical examination and chest X-ray, ultrasound is consistently more sensitive and specific at detecting consolidation, effusion and interstitial fluid (Lichtenstein et al, 2004). It has also been demonstrated to reduce time to diagnosis and reduce misdiagnosis (Ben-Baruch Golan et al, 2020). The 'BLUE' protocol (Bedside Lung Ultrasound in Emergency) has been adopted

as a useful strategy for systematically identifying the most likely cause of respiratory failure (Lichtenstein and Meziere, 2008), and forms the basis of the approach in both FAMUS and Focused Ultrasound in Intensive Care (FUSIC) lung modules.

During the coronavirus disease 2019 (COVID-19) pandemic, and before widespread rapid testing was available, the increased use of lung ultrasound (LUS) demonstrated the value of a rapid diagnostic tool in the hands of medical doctors (Cogliati et al, 2021). It also aided decision making around probability of clinical deterioration, to the extent that the World Health Organization (WHO) included its use in their recommendations (WHO, 2020). This raises the possibility of standardised approaches of POCUS having prognostication benefits in certain disease states, particularly respiratory infections. The use of bedside ultrasound also helped with the logistical challenges during this time when the need to reduce exposure to other clinicians was paramount.

Example pathologies are shown in Fig. 1.

Focused Echocardiography

Point of care echocardiography is probably the POCUS skill with the greatest evidence base in support of its use, and it has been adopted with enthusiasm across critical care and emergency medicine during the last decade; perhaps less so within internal medicine so far. It involves rapid focused interrogation to produce a qualitative assessment of cardiac structure and function that can support clinical diagnosis. There are several accreditations that cover the acquisition of a limited dataset that comprises basic echo, including British Society of Echocardiography (BSE) 'level one' and the FUSIC heart module. Focused echo can aid the assessment of medical patients with presenting conditions for which there is a cardiac differential, and point of care echo demonstrates benefits including more rapid diagnosis and risk stratification compared to traditional examination techniques (Hothi et al, 2014); it also has value in time critical procedures such as emergency pericardiocentesis. In cases of undifferentiated shock that required critical care admission, a national audit study recently showed that the use of point of care echo changed treatment in 54% of cases (Flower et al, 2024). It also has a role in cardiac arrest, where the presence of sonographic cardiac activity has been shown to correlate with an increased chance of return of spontaneous circulation, and so may contribute to decision making around termination of resuscitation attempts (Blyth et al, 2012).

Renal Tract

The incidence of acute kidney injury (AKI) is common in hospital patients. Its presence indicates an increased risk of developing chronic kidney disease, as well as being a reliable indicator of increased in-hospital mortality and morbidity (Hoste et al, 2018). POCUS can be used in the assessment of the renal tract to examine for hydronephrosis and/or bladder distension, with excellent sensitivity and specificity (Nepal et al, 2020). It is, therefore, an incredibly useful tool to detect early the significant number of AKI cases due to renal tract obstruction and expedite appropriate management. Examples of pathologies are shown in Fig. 2.

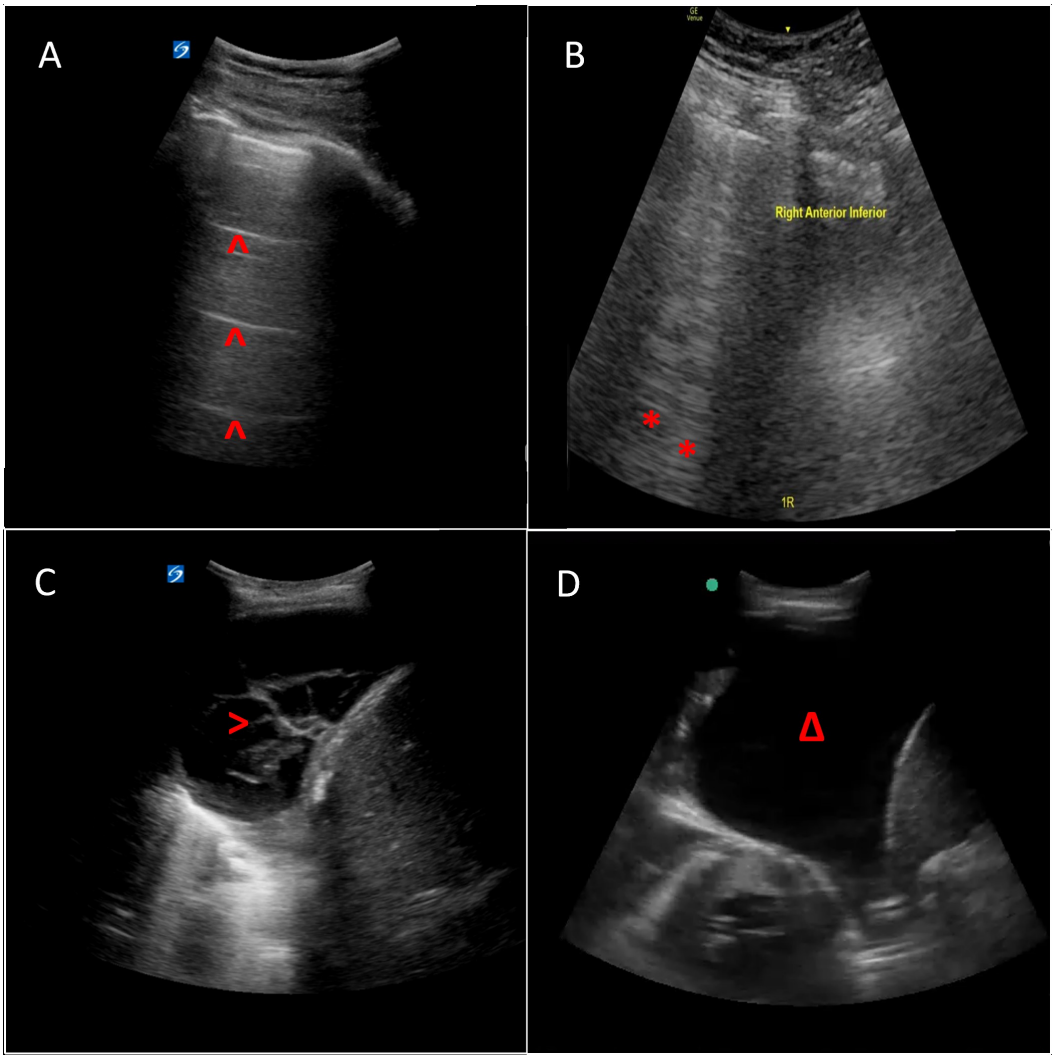

Fig. 1. Example of lung pathologies. (A) Normal lung with regular horizontal A lines (^) indicating air below the pleural line. (B) Vertical ring down artefacts, called B lines (*), indicating pulmonary oedema in this case. (C) Complex pleural effusion with septations (>) in this case caused by empyema. (D) Large simple anechoic effusion (Δ) with spleen to the right and collapsed lung to the left.

Deep Vein Thrombosis Assessment

Most ambulatory care services will have established deep vein thrombosis (DVT) assessment and treatment pathways which are reliant on the availability of ultrasound. The use of POCUS in this cohort means assessing for the presence of proximal lower limb DVT using a three-point compression technique. When compared to the 'gold standard' of a vascular ultrasound technician, this technique has been shown to be highly sensitive and specific in the detection of above knee DVT, with similar rates of diagnostic accuracy (Fischer et al, 2019). Importantly these studies have shown that the time to diagnosis is greatly reduced with the use of POCUS, as might be expected. It is important to note that there is not yet sufficient evidence to use POCUS to routinely exclude DVT and it remains a 'rule-in' test

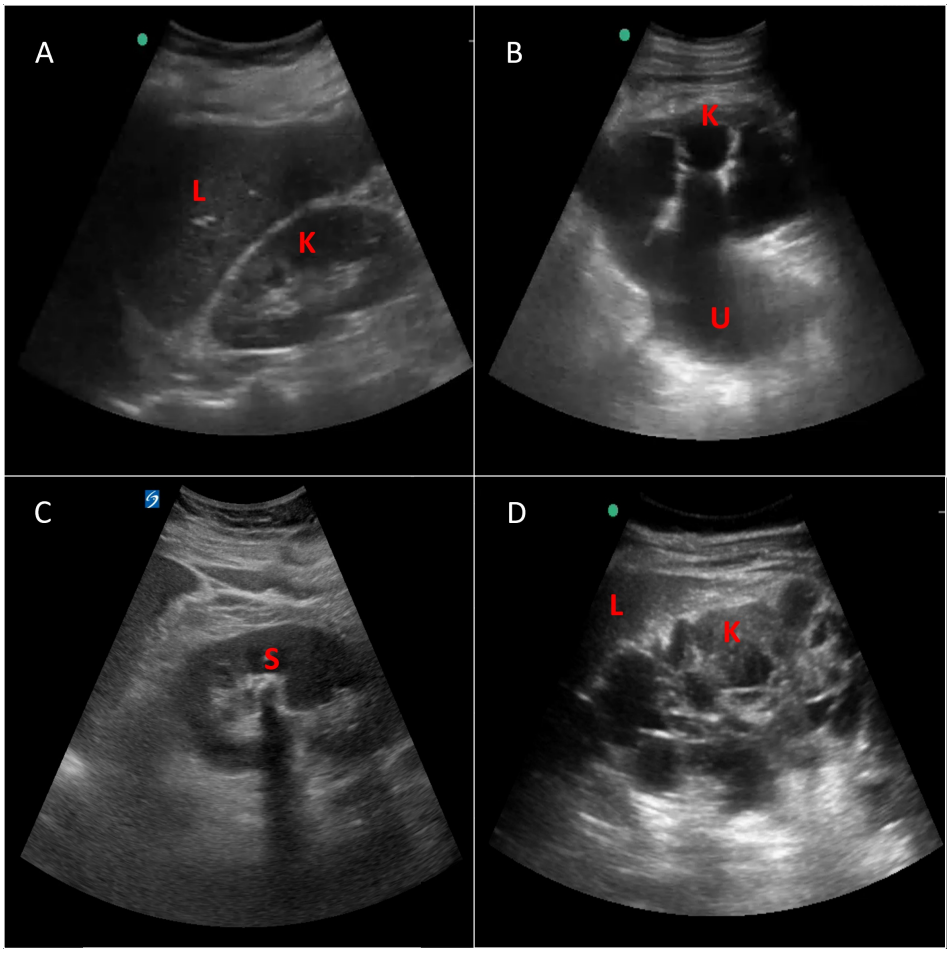

Fig. 2. Example renal pathologies. (A) Normal right kidney (K) with liver (L). (B) Gross hydronephrosis with thinning of kidney parenchyma (K) and visible dilated ureter (U). (C) Renal stone (S) seen as bright white line and dense black acoustic shadow cast below. (D) Polycystic kidney (K) with multiple small black cysts with Liver (L).

only, but it can certainly relieve the pressure on urgent radiology services in the correct circumstances. An example of a DVT is shown in Fig. 3.

Other Uses

Finally, an increasing proportion of presentations with abdominal pathology tend to undergo a management pathway that takes them through the computed tomography (CT) scanner, but POCUS can provide useful assessment that may offer an alternative. For example, it allows for the early recognition of intrabdominal free fluid that would be missed by clinical examination. In the USA, the use of POCUS is recommended to reduce the rate of complications and increase the success rate from paracentesis (Mercaldi and Lanes, 2013), although this is not yet the case in the UK. In those presenting with suspected renal colic, POCUS as a first line investigation is associated with similar outcomes to CT and departmental ultrasound (Smith-Bindman et al, 2014).

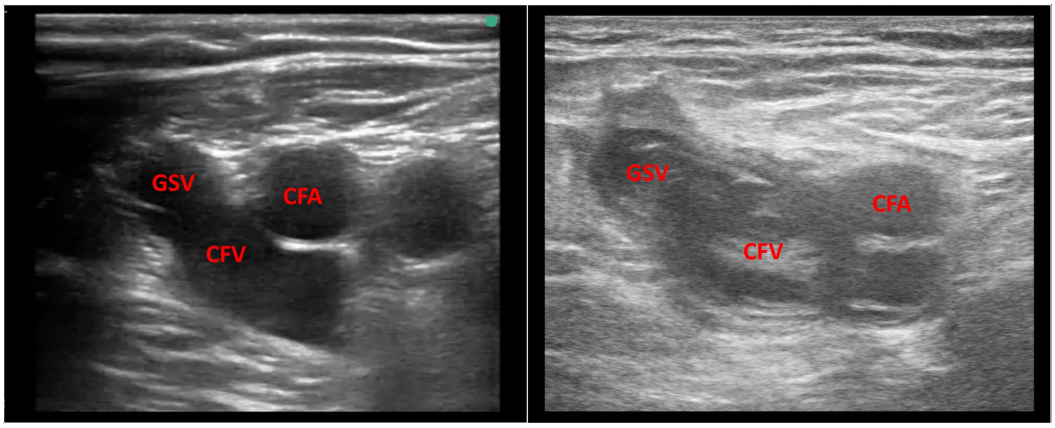

Fig. 3. DVT example. Example of a normal saphenofemoral junction (left) and a proximal DVT extending into the saphenous vein (right) visible as grey-white echos within the vessel lumen. GSV, great saphenous vein; CFV, common femoral vein; CFA, common femoral artery; DVT, deep vein thrombosis.

Beyond the Core Skills—What More Can POCUS Offer?

There are a multitude of additional POCUS skills that are not a part of FAMUS or FUSIC heart curricula that can be of potential use to IM physicians. These are both diagnostic and procedural, and are summarized in Table 1 above.

Lumbar punctures are one of the more common procedures performed in medicine. Most doctors who undergo Foundation or Core training in the UK will have competencies in the performance of lumbar punctures. Historically, palpation of surface landmarks has been used to identify the appropriate interspinous space for needle insertion, but POCUS can be used to help identify these spaces with greater accuracy and may be especially helpful in some patient groups such as the elderly or obese who are often a more challenging population (Mofidi et al, 2013). Ultrasound guidance is associated with decreased failure rate, decreased procedure duration and lower pain scores for patients (Millington et al, 2018) and should surely become part of internal medicine training in due course.

As lung ultrasound is quick and relatively easy to learn, it has been included in several different protocols to assess components beyond the respiratory system. For example, findings on LUS correlate with the Left Ventricular End Diastolic Pressure (LVEDP), which is useful in the assessment of cardiac function and increased retrograde pulmonary congestion (Garcia et al, 2023). The Fluid administration limited by lung sonography (FALLS) protocol uses lung ultrasound to aid haemodynamic assessment (Lichtenstein, 2013)—the presence of artefact within the lungs indicates either a patient who would not benefit from fluid resuscitation, or its development during treatment can be used to assess when one should stop administering fluid.

Beyond this there is potential that multiorgan assessment protocols could help to answer more complex lines of questioning about a patient's clinical state and trajectory, providing answers to 'can I observe a beneficial change when I intervene?',

or 'what does this predict for their clinical course?'. For example, the process of venous excess ultrasound (VExUS) scoring uses a defined ultrasound protocol to evaluate the inferior vena cava (IVC) and the severity of venous congestion in three organs—the liver, kidney and gut. This was validated initially in post operative cardiac patients to identify those at risk of acute kidney injury due to venous congestion (Beaubien-Souligny et al, 2020), but more recently increased VExUS scores in those with sepsis at the front door have been shown to be associated with increased odds of 24-hour mortality, intensive care unit (ICU) admission or need for renal replacement therapy (Prager et al, 2024). It has also been used in the prognosis of acute decompensated heart failure requiring hospital admission; high scores at admission predict inpatient mortality, acute kidney injury and a higher re-admission rate (Landi et al, 2024).

The use of VExUS has also been incorporated into recently developed advanced POCUS modules such as 'FUSIC HD' (Miller et al, 2022), which show how sequentially scanning accessible organs can help with dynamic assessment. For example, complete assessment of a patient with an acute kidney injury with POCUS is more than looking for signs of obstruction, it should also involve looking at the heart, lungs, potential spaces within the abdomen and incorporating the ultrasonic signs of venous congestion. The 'pumps, pipes and leaks' approach facilitates comprehensive POCUS assessment of these organs as an adjunct to clinical examination, and offers the possibility of observing real-time haemodynamic consequences of interventions when performed serially (Batool et al, 2023). However, it remains unclear how best to apply this to benefit patients within internal medicine (when often the disease severity is lower than in critical care), and this is an area that requires further study. The vast majority of evidence in support of VExUS is derived from critical care populations, and it is important to reflect the different patient populations typically seen in internal medicine may offer alternative outcomes when these advanced techniques are used.

There has also been interest in the evaluation of the optic nerve sheath diameter as a proxy for papilloedema, and therefore valuable in the assessment of intracranial pressure. This has potential advantages in IM where a diagnosis of idiopathic intracranial hypertension is suspected, and may be particularly valuable where fundoscopy is difficult or not tolerated. However, the studies vary widely in the approach used for measurement of the sheath diameter, and comparison with the 'gold standard' assessment is also variable (Aletreby et al, 2022), so this is also an area that requires further evaluation before widespread adoption.

More than Just a Diagnostic Tool?

There are other considerations beyond diagnostic accuracy when it comes to POCUS, and these include the patient's experience of their care. A 2015 study looked at whether POCUS causes patients pain (Laursen et al, 2015) and found the reported discomfort to be 'very low' overall, and all but one of nearly 300 patients were prepared to undergo a further examination if required during a future care episode. Another study documented a "POCUS positive care effect", describing a

benefit to the patient of this additional time with their care provider, the potential for further active listening, as well as the opportunity to look at the images at the same time thus including them in the process (Balmuth et al, 2024). Some even describe feeling as though they are being taken more seriously and found that POCUS increased their confidence in the physician's assessment (Andersen et al, 2021).

Barriers to Ultrasound Accreditation

Regardless of the evidence for the benefits of POCUS, it is undeniable that developing skills in its use requires dedicated time, expense and effort. A lack of equipment, lack of supervision and lack of protected time for scanning account for a large proportion of the documented reasons why those trying to gain accreditation may run into difficulty (Reid et al, 2018). When examining the progress of the FAMUS accreditation in the 2 years following its launch, only approximately 20% of those who had attended a course had managed to successfully gain full accreditation (Russell et al, 2021), suggesting these barriers are indeed preventing clinicians turning their initial enthusiasm into competence. Interestingly, these same barriers recur in the literature regardless of the specialty interrogating them (Tan et al, 2024) suggesting that these struggles are common, and not restricted to individual specialties trying to develop their training programmes. They also provide clear targets for improvement.

The lack of available trainers is a challenge faced across all UK specialties trying to deliver ultrasound competencies to their trainees, including in respiratory medicine (Sivakumar et al, 2017). There is both a lack of personnel to deliver this training, and perhaps more importantly little ring-fenced money to support it. This means much is being done reliant on the goodwill of a relatively small number of trainers, which makes embedding sustainable training pathways difficult.

Potential Solutions

There are approaches to try to tackle these issues. In 2021 around 80% of Acute Medical Units in the UK had access to dedicated ultrasound equipment (Aggarwal et al, 2023), up from 58% in 2019 (Knight et al, 2020). Some of these devices now use alternate technology to the traditional piezoelectric crystals, and their ability to harness the connectivity of smartphones to upload images to cloud based storage for assessment means that they also offer opportunities in remote supervision (Baribeau et al, 2020). The acknowledgement of a lack of available trainers has meant that alternatives to face-to-face learning, such as remote review of scans, have been developed to facilitate accreditation via a 'distance learning' approach. This may enable an individual trainer to support training for multiple clinicians in different sites. The use of online learning resources such as videos and instructional e-modules also offers further options, and has been shown to be as effective as in person instruction in POCUS (Moses et al, 2020). These strategies can also help to challenge the issues around rotational training, and the frequent departmental and geographical changes that resident doctors undergo. The optimum mix of face to face and distance supervision has not yet been established and remains an important

question to answer to ensure high quality training across the UK even in areas with relatively few trainers.

The next stages of progression may include another growth area in medical technology—Artificial Intelligence (AI). The application of AI could be valuable in assisting training through optimising images, recognising pathology and even generating reports (Huang et al, 2024). In theory, this should provide support in education and accreditation, as well as in furthering successful and appropriate POCUS use.

Another approach adopted by some medical teams involves a 'group learning' approach of weekly 'ultrarounds', when multiple patients are scanned and discussed together (Onen et al, 2022). This may help to embed POCUS as part of normal practice alongside developing the trainees' skills under direct supervision with immediate feedback. There is evidence which supports peer-to-peer teaching as being as beneficial as faculty-led methods (Rong et al, 2022).

One of the most robust solutions to many of these issues, but also one that is unlikely in the current climate, is to support this training with adequate funding to allow trainees and trainers the time and resource required. As a core part of the AIM training programme, it is hoped that the resource to train in POCUS competencies in AIM will be centrally funded, but it has been shown previously in respiratory medicine that this does not always follow (Sivakumar et al, 2017). Whilst there is no current mandate for POCUS training within internal medicine it is unlikely that significant financial resource will be available to support wider rollout of IM POCUS competencies. However, in the future if it were integrated as a mandatory part of the curriculum that would hopefully lead to financial support to help deliver the training.

So, Is POCUS Worth the Bother?

There is a variety of evidence as outlined here that there are benefits in diagnostic and procedural accuracy that POCUS brings to the specialty of internal medicine, and a clear enthusiasm from Resident Doctors to learn these skills. A recent statement from the Academy of Medical Royal Colleges Resident Doctors' committee highlighted 'focused echocardiography and ultrasound' as an important technology needing a national strategy to allow equitable access for postgraduate training (Akhtar, 2024). A survey of UK based AIM trainees and senior clinicians found a significant majority felt POCUS should be a core part of their specialty training (Smallwood et al, 2015), although no such data exists for the wider internal medicine cohort. Within acute internal medicine, it is hoped the integration of POCUS into the curriculum will harness this enthusiasm and serve to improve recruitment and retention into the specialty—particularly relevant at a time of widespread disenchantment amongst the resident doctor workforce.

Where the evidence remains inadequate, and would perhaps help to inform the opinions of those who remain unconvinced by the benefits of POCUS, is assessing how POCUS impacts the wider workflow within internal medicine. Where POCUS is integrated routinely into daily practice, is there an effect on the efficiency of the

wider system? Does it lead to more or less downstream radiology requests? Does it have an effect on patient flow, or on the length of stay of patients with certain conditions, or possibly their outcomes? Is it cost effective to have senior clinicians performing this as part of their routine clinical work? Many of these questions form a common part of the discourse when discussing the role POCUS has within clinical practice, and for all of them, there is no current adequate data. These are important areas for future study, and while it is necessary to stress that as a diagnostic test, POCUS should not be expected to improve length of stay, mortality or flow *per se*, its effects on these parameters are nonetheless important to understand.

Another aspect that is important to address when considering the POCUS educational community, as with many other established faculties within healthcare, is the importance of diversity and representation. Typically, women and ethnic minorities have made up a minority of leadership positions within POCUS education and training groups, both in the UK and abroad (Dessie et al, 2022). We know that visibility and availability of diverse mentors and role models go a long way to ensure shared success in education; this will help to depart from the 'boys with their toys' attitude that may seem harmless but could reasonably undermine the strategy for furthering POCUS education across all medical specialties.

When considering the merits of whether it is of value to embed POCUS into internal medicine, it is important to appreciate that in order to succeed, collaboration is needed across specialties including radiology, intensive care, emergency, cardiology, acute and respiratory medicine, alongside internal medicine. There are already great examples of cross specialty working to achieve these goals—during the COVID-19 pandemic, the Society for Acute Medicine (SAM) and the Intensive Care Society (ICS) rapidly developed the CORONA (COre ultRasOund of covid in iNtensive care and Acute medicine) service evaluations in both Acute Medical Units (AMUs) and ICU (Parulekar et al, 2023; Knight et al, 2022). These studies highlighted how lung and cardiac ultrasound in both specialties deployed rapidly at the outset of the pandemic could inform practice and guide prognosis in this rapidly changing environment. Alongside this, SAM, the Royal College of Radiologists and British Medical Ultrasound Society have published a joint statement of support for POCUS training (Rubin et al, 2019), in order to help foster relationships between these involved organisations. Further work to integrate internal medicine educational bodies into the conversations will be beneficial.

The final concern frequently raised when considering the role of POCUS is that mistakes or missed pathologies may leave clinicians open to litigation. There is no evidence to support this assertion; in fact, available data from the USA suggest the majority of lawsuits involving POCUS occur because it was not undertaken when it could have been, rather than because it was undertaken to an unacceptable standard (Russ et al, 2022).

Conclusion

The evidence to support the integration of POCUS as part of the assessment and management of acutely unwell patients is now extensive. The integration of

core POCUS skills as a mandatory part of the AIM curriculum could provide a framework for more widespread adoption across internal medicine in general. To facilitate this there remains a need for all specialties to continue to work together to deliver the training and governance; there are barriers to being able to deliver this at scale, but also increasingly available solutions. Where gaps in the evidence exist (for example the impact on the patient journey through the system, or on departmental radiology services) there is a need for further study to maximize the potential benefits. Perhaps rather than asking 'should we bother', we should instead be asking 'why would we not bother?'.

Key Points

- The increasing evidence in support of POCUS in medicine over the last decade has driven its inclusion as a mandatory skill in the training curricula of multiple specialties.
- There is an established evidence base that supports the use of certain POCUS modalities in assisting patient assessment, as well as improving the safety of some practical procedures.
- Although there are well documented barriers to achieving competencies in POCUS, there are attempts to address these aided by recent advances in technology and practice.
- It is important to harness the enthusiasm and appetite for POCUS education and training amongst the medical workforce.
- A national strategy that facilitates POCUS as a routine part of care will need cross specialty collaboration to address concerns around governance, infrastructure, training and implementation.

Availability of Data and Materials

All the data of this study are included in the article.

Author Contributions

Both authors made substantial contributions to conception and design, edited the manuscript and approved it for final submission. LO'S created the first draft. NS collected and provided the imaging data. Both authors revised it critically for important intellectual content. Both authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethics Approval and Consent to Participate

All images were acquired as part of routine clinical care with verbal consent obtained where relevant.

Acknowledgement

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

Nicholas Smallwood is Chair of the Focused Acute Medicine Ultrasound working group. Laura O'Sullivan declares no conflict of interest.

References

Aggarwal S, Shanmugam R, Knight T, Atkin C, Clare S, Smallwood N, et al. Geographic variation in point of care ultrasound provision: results from a national audit. The Ultrasound Journal. 2023; 15: 16. https://doi.org/10.1186/s13089-023-00314-9

Akhtar W. Utilisation of modern technologies in post-graduate medical education and curricula. Academy Resident Doctor's Committee Report. 2024. https://www.aomrc.org.uk/wp-content/uploads/2024/10/ARDC_modern_technologies_031024.pdf (Accessed: 16 April 2025)

Aletreby W, Alharthy A, Brindley PG, Kutsogiannis DJ, Faqihi F, Alzayer W, et al. Optic Nerve Sheath Diameter Ultrasound for Raised Intracranial Pressure: A Literature Review and Meta-analysis of its Diagnostic Accuracy. Journal of Ultrasound in Medicine. 2022; 41: 585–595. https://doi.org/10.1002/jum.15732

Andersen CA, Brodersen J, Rudbæk TR, Jensen MB. Patients' experiences of the use of point-of-care ultrasound in general practice - a cross-sectional study. BMC Family Practice. 2021; 22: 116. https://doi.org/10.1186/s12875-021-01459-z

Balmuth EA, Luan D, Jannat-Khah D, Evans A, Wong T, Scales DA. Point-of-care ultrasound (POCUS): Assessing patient satisfaction and socioemotional benefits in the hospital setting. PLoS ONE. 2024; 19: e0298665. https://doi.org/10.1371/journal.pone.0298665

Baribeau Y, Sharkey A, Chaudhary O, Krumm S, Fatima H, Mahmood F, et al. Handheld Point-of-Care Ultrasound Probes: The New Generation of POCUS. Journal of Cardiothoracic and Vascular Anesthesia. 2020; 34: 3139–3145. https://doi.org/10.1053/j.jvca.2020.07.004

Batool A, Chaudhry S, Koratala A. Transcending boundaries: Unleashing the potential of multi-organ point-of-care ultrasound in acute kidney injury. World Journal of Nephrology. 2023; 12: 93–103. https://doi.org/10.5527/wjn.v12.i4.93

Beaubien-Souligny W, Rola P, Haycock K, Bouchard J, Lamarche Y, Spiegel R, et al. Quantifying systemic congestion with Point-Of-Care ultrasound: development of the venous excess ultrasound grading system. The Ultrasound Journal. 2020; 12: 16. https://doi.org/10.1186/s13089-020-00163-w

Ben-Baruch Golan Y, Sadeh R, Mizrakli Y, Shafat T, Sagy I, Slutsky T, et al. Early Point-of-Care Ultrasound Assessment for Medical Patients Reduces Time to Appropriate Treatment: A Pilot Randomized Controlled Trial. Ultrasound in Medicine & Biology. 2020; 46: 1908–1915. https://doi.org/10.1016/j.ultrasmedbio.2020.03.023

Blyth L, Atkinson P, Gadd K, Lang E. Bedside focused echocardiography as predictor of survival in cardiac arrest patients: a systematic review. Academic Emergency Medicine. 2012; 19: 1119–1126. https://doi.org/10.1111/j.1553-2712.2012.01456.x

Cogliati C, Bosch F, Tung-Chen Y, Smallwood N, Torres-Macho J. Lung ultrasound in COVID-19: Insights from the frontline and research experiences. European Journal of Internal Medicine. 2021; 90: 19–24. https://doi.org/10.1016/j.ejim.2021.06.004

Dessie AS, Lewiss RE, Stolz LA, Acuña J, Adhikari S, Amponsah D, et al. The state of gender inclusion in the point-of-care ultrasound community. The American Journal of Emergency Medicine. 2022; 56: 283–285. https://doi.org/10.1016/j.ajem.2021.07.021

Fischer EA, Kinnear B, Sall D, Kelleher M, Sanchez O, Mathews B, et al. Hospitalist-Operated Compression Ultrasonography: a Point-of-Care Ultrasound Study (HOCUS-POCUS). Journal of General Internal Medicine. 2019; 34: 2062–2067. https://doi.org/10.1007/s11606-019-05120-5

Flower L, Waite A, Boulton A, Peck M, Akhtar W, Boyle AJ, et al. The use of echocardiography in the management of shock in critical care: a prospective, multi-centre, observational study. Intensive Care Medicine. 2024; 50: 1668–1680. https://doi.org/10.1007/s00134-024-07590-6

Garcia MVF, Wiesen J, Dugar S, Adams JR, Bott-Silverman C, Moghekar A, et al. Lung ultrasonography derived B-line scores as predictors of left ventricular end-diastolic pressure and pulmonary artery wedge pressure. Respiratory Medicine. 2023; 219: 107415. https://doi.org/10.1016/j.rmed.2023.107415

Hoste EAJ, Kellum JA, Selby NM, Zarbock A, Palevsky PM, Bagshaw SM, et al. Global epidemiology and outcomes of acute kidney injury. Nature Reviews. Nephrology. 2018; 14: 607–625. https://doi.org/10.1038/s41581-018-0052-0

Hothi SS, Sprigings D, Chambers J. Point-of-care cardiac ultrasound in acute medicine–the quick scan. Clinical Medicine. 2014; 14: 608–611. https://doi.org/10.7861/clinmedicine.14-6-608

Huang W, Koh T, Tromp J, Chandramouli C, Ewe SH, Ng CT, et al. Point-of-care AI-enhanced novice echocardiography for screening heart failure (PANES-HF). Scientific Reports. 2024; 14: 13503. https://doi.org/10.1038/s41598-024-62467-4

Knight T, Clare S, Smallwood N, Lasserson D. Gaps in point of care ultrasound provision and the cost of ultrasound equipment provision: results of a nationwide audit of acute medical units. Acute Medicine. 2020; 19: 64–68. https://doi.org/10.52964/AMJA.0803

Knight T, Parulekar P, Rudge G, Lesser F, Dachsel M, Aujayeb A, et al. Point-of-care lung ultrasound in the assessment of COVID-19: results of a UK multicentre service evaluation. Acute Medicine. 2022; 21: 131–138. https://doi.org/10.52964/AMJA.0912

Lamont T, Surkitt-Parr M, Scarpello J, Durand M, Hooper C, Maskell N. Insertion of chest drains: summary of a safety report from the National Patient Safety Agency. BMJ (Clinical Research Ed.). 2009; 339: b4923. https://doi.org/10.1136/bmj.b4923

Landi I, Guerritore L, Iannaccone A, Ricotti A, Rola P, Garrone M. Assessment of venous congestion with venous excess ultrasound score in the prognosis of acute heart failure in the emergency department: a prospective study. European Heart Journal Open. 2024; 4: oeae050. https://doi.org/10.1093/ehjopen/oeae050

Laursen CB, Sloth E, Lassen AT, Davidsen JR, Lambrechtsen J, Henriksen DP, et al. Does point-of-care ultrasonography cause discomfort in patients admitted with respiratory symptoms? Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2015; 23: 46. https://doi.org/10.1186/s13049-015-0127-x

Lichtenstein D, Goldstein I, Mourgeon E, Cluzel P, Grenier P, Rouby JJ. Comparative diagnostic performances of auscultation, chest radiography, and lung ultrasonography in acute respiratory distress syndrome. Anesthesiology. 2004; 100: 9–15. https://doi.org/10.1097/00000542-200401000-00006

Lichtenstein D. FALLS-protocol: lung ultrasound in hemodynamic assessment of shock. Heart, Lung and Vessels. 2013; 5: 142–147. https://pmc.ncbi.nlm.nih.gov/articles/PMC3848672/

Lichtenstein DA, Meziere GA. Relevance of Lung Ultrasound in the Diagnosis of Acute Respiratory Failure*: The BLUE Protocol. Chest. 2008; 134: 117-125. http://dx.doi.org/10.1378/chest.07-2800

Martin R, Lau HA, Morrison R, Bhargava P, Deiling K. The Rising Tide of Point-of-Care Ultrasound (POCUS) in Medical Education: An Essential Skillset for Undergraduate and Graduate Medical Education. Current Problems in Diagnostic Radiology. 2023; 52: 482–484. https://doi.org/10.1067/j.cpradiol.2023.06.003

McCormick E, Flanagan B, Johnson CD, Sweeney EM. Ultrasound skills teaching in UK medical education: A systematic review. The Clinical Teacher. 2023; 20: e13635. https://doi.org/10.1111/tct.13635

Mercaldi CJ, Lanes SF. Ultrasound guidance decreases complications and improves the cost of care among patients undergoing thoracentesis and paracentesis. Chest. 2013; 143: 532–538. https://doi.org/10.1378/chest.12-0447

Miller A, Peck M, Clark T, Conway H, Olusanya S, Fletcher N, et al. FUSIC HD. Comprehensive haemodynamic assessment with ultrasound. Journal of the Intensive Care Society. 2022; 23: 325–333.

https://doi.org/10.1177/17511437211010032

Millington SJ, Silva Restrepo M, Koenig S. Better With Ultrasound: Lumbar Puncture. Chest. 2018; 154: 1223–1229. https://doi.org/10.1016/j.chest.2018.07.010

Mofidi M, Mohammadi M, Saidi H, Kianmehr N, Ghasemi A, Hafezimoghadam P, et al. Ultrasound guided lumbar puncture in emergency department: Time saving and less complications. Journal of Research in Medical Sciences. 2013; 18: 303–307. https://pmc.ncbi.nlm.nih.gov/articles/PMC3793375/

Moses A, Weng W, Orchanian-Cheff A, Cavalcanti RB. Teaching Point-of-Care Ultrasound in Medicine. Canadian Journal of General Internal Medicine. 2020; 15: 12–29. https://doi.org/10.22374/cjgim.v15i2.368

Nepal S, Dachsel M, Smallwood N. Point-of-care ultrasound rapidly and reliably diagnoses renal tract obstruction in patients admitted with acute kidney injury. Clinical Medicine. 2020; 20: 541–544. https://doi.org/10.7861/clinmed.2019-0417

Onen B, Ghaffari E, Gaied J, De Butts R, Bowen J, Lasserson D. The use of live and continuous training 'ultrarounds' to enhance use of point-of-care ultrasound on a busy ambulatory assessment unit. Future Healthcare Journal. 2022; 9: 36–37. https://doi.org/10.7861/fhj.9-2-s36

Parulekar P, Powys-Lybbe J, Knight T, Smallwood N, Lasserson D, Rudge G, et al. CORONA (COre ultRasOund of covid in iNtensive care and Acute medicine) study: National service evaluation of lung and heart ultrasound in intensive care patients with suspected or proven COVID-19. Journal of the Intensive Care Society. 2023; 24: 186–194. https://doi.org/10.1177/17511437211065611

Prager R, Arntfield R, Wong MYS, Ball I, Lewis K, Rochwerg B, et al. Venous congestion in septic shock quantified with point-of-care ultrasound: a pilot prospective multicentre cohort study. Canadian Journal of Anaesthesia. 2024; 71: 640–649. https://doi.org/10.1007/s12630-024-02717-1

Reid G, Bedford J, Attwood B. Bridging the logistical gap between ultrasound enthusiasm and accreditation. Journal of the Intensive Care Society. 2018; 19: 15–18. https://doi.org/10.1177/1751143717733163

Rice JA, Brewer J, Speaks T, Choi C, Lahsaei P, Romito BT. The POCUS Consult: How Point of Care Ultrasound Helps Guide Medical Decision Making. International Journal of General Medicine. 2021; 14: 9789–9806. https://doi.org/10.2147/IJGM.S339476

Roberts ME, Rahman NM, Maskell NA, Bibby AC, Blyth KG, Corcoran JP, et al. British Thoracic Society Guideline for pleural disease. Thorax. 2023; 78: 1143–1156. https://doi.org/10.1136/thorax-2023-220304

Rong K, Lee G, Herbst MK. Effectiveness of Near-Peer Versus Faculty Point-of-Care Ultrasound Instruction to Third-Year Medical Students. POCUS Journal. 2022; 7: 239–244. https://doi.org/10.24908/pocus.v7i2.15746

Rubin C, Evans R, Freeman S, Smallwood N, Newman-Sanders T. POCUS Point of Care Ultrasound, Royal College of Radiology Newsletter. 2019. Available at: https://www.acutemedicine.org.uk/download/joint-rcr-bmus-sam-statement/ (Accessed: 16 April 2025)

Russ B, Arthur J, Lewis Z, Snead G. A review of lawsuits related to point-of-care emergency ultrasound applications. The Journal of Emergency Medicine. 2022; 63: 661–672. https://doi.org/10.1016/j.jemermed.2022.04.020

Russell J, Dachsel M, Gilmore A, Matsa R, Smallwood N. Focused Acute Medicine Ultrasound (FAMUS): uptake, completion and barriers to accreditation after two years. Acute Medicine. 2021; 20: 187–192. https://doi.org/10.52964/AMJA.0863

Sivakumar P, Kamalanathan M, Collett AS, Ahmed L. Thoracic ultrasound experiences among respiratory specialty trainees in the UK. Clinical Medicine. 2017; 17: 408–411. https://doi.org/10.7861/clinmedicine.17-5-408

Smallwood N, Dachsel M, Gilmore A. Focused acute medicine ultrasound (FAMUS): curriculum outline of a new ultrasound standard for acute internal medicine. Clinical Medicine. 2017; 17: s24. https://doi.org/10.7861/clinmedicine.17-3-s24

Smallwood N, Matsa R, Lawrenson P, Messenger J, Walden A. A UK wide survey on attitudes to point of care ultrasound training amongst clinicians working on the Acute Medical Unit. Acute Medicine. 2015; 14: 159–164.

Smith-Bindman R, Aubin C, Bailitz J, Bengiamin RN, Camargo CA, Jr, Corbo J, et al. Ultrasonography versus computed tomography for suspected nephrolithiasis. The New England Journal of Medicine. 2014; 371: 1100–1110. https://doi.org/10.1056/NEJMoa1404446

Tan MZ, Brunswicker A, Bamber H, Cranfield A, Boultoukas E, Latif S. Improving lung point-of-care ultrasound (POCUS) training and accreditation - a multidisciplinary, multi-centre and multi-pronged approach to development and delivery using the action learning process. BMC Medical Education. 2024; 24: 713. https://doi.org/10.1186/s12909-024-05653-2

World Health Organization (WHO). Use of Chest Imaging in Covid-19: a rapid advice guide, WHO/2019 nCoV/Clinical/Radiology_imaging/2020.1. 2020. Available at: https://www.who.int/publications/i/item/use-of-chest-imaging-in-covid-19 (Accessed: 19 December 2024).