

Educational needs, self-reported competency and curriculum priorities for point-of-care ultrasound among paediatric surgical providers across Africa: a multinational assessment

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Abstract

Background

Point-of-care ultrasound (POCUS) is increasingly recognised as a core clinical competency that can support timely diagnosis and procedural guidance across a wide range of paediatric surgical conditions. Despite growing international recommendations for competency-based POCUS education, little is known about current training opportunities, self-reported competency, and educational needs among paediatric surgical providers in Africa. This study aimed to evaluate access to ultrasound, POCUS utilisation, self-reported competency, and perceived educational needs to inform curriculum development and workforce capacity building.

Methods

We conducted a multinational cross-sectional online survey of paediatric surgical providers across Africa between March and October 2025 disseminated by the Pan-African Paediatric Surgical Association (PAPSA). The survey explored participant demographics, access to diagnostic imaging, previous POCUS training, POCUS utilisation, self-reported competency, and perceived clinical relevance of 22 diagnostic and five interventional POCUS applications. Descriptive statistics were used to summarise responses, and categorical variables were compared using Chi-squared or Fisher's exact tests.

Results

A total of 149 respondents from 29 African countries completed the survey. Departmental access to ultrasound was reported by 30.9% of participants, whereas 24.8% reported no access to ultrasound equipment. More than one-third (37.6%) did not use POCUS in routine clinical practice. Self-reported competency was limited, with 39.6% reporting no POCUS skills and only 7.4% considering themselves competent to teach others. Competency was positively associated with clinical experience and access to ultrasound equipment. Respondents identified acute abdominal pathology, neonatal imaging, trauma assessment, vascular access, and ultrasound-guided procedures as their highest educational priorities. All participants expressed interest in formal POCUS education, and 97.3% supported integration of competency-based POCUS training into paediatric surgical curricula.

Conclusions

This multinational needs assessment demonstrates substantial educational gaps in POCUS training among paediatric surgical providers across Africa despite strong perceived clinical relevance and universal demand for education. These findings support the development of competency-based curricula, faculty development initiatives, structured assessment frameworks, and sustainable governance strategies to strengthen the paediatric surgical workforce and improve equitable access to clinician-performed ultrasound across diverse healthcare settings.

Background

Point-of-care ultrasound (POCUS) performed by clinicians has become an increasingly important component of clinical practice, enabling bedside diagnosis, supporting clinical decision-making, and facilitating image-guided procedures. Across multiple specialties, POCUS is now recognised as a core clinical competency [1, 2]. International recommendations emphasise the importance of structured education, competency assessment, and governance frameworks to ensure safe and effective implementation of clinician-performed ultrasound [3, 4, 5].

POCUS may be particularly relevant in paediatric surgery, where common clinical presentations such as trauma and acute abdominal conditions can be rapidly assessed at the bedside to support timely diagnosis and management. Evidence shows that clinician-performed ultrasound improves diagnostic accuracy, facilitates procedural guidance, and expedites care in children [2, 3, 6]. As a result, POCUS is increasingly considered an essential competency in paediatric surgical practice.

Despite its growing importance, access to POCUS training remains unevenly distributed globally. International studies have highlighted disparities in equipment availability, structured training, faculty expertise, credentialing systems, and institutional governance, particularly in low- and middle-income countries [7, 8, 9]. These disparities may limit opportunities for clinicians to develop and maintain competency.

In many African healthcare systems, diagnostic imaging is constrained by shortages of radiologists and sonographers, limited infrastructure, financial barriers, and geographical inequities [10, 11, 12]. In this context, POCUS has the potential to strengthen diagnostic capacity and improve timely decision-making, particularly where access to formal imaging services is limited [13]. Studies from Malawi and Uganda have demonstrated that appropriately trained clinicians can use POCUS effectively to identify clinically significant pathologies and influence patient management [14, 15]. By reducing dependence on radiology services, POCUS has the potential to improve equitable access to diagnostic imaging for children in rural and underserved settings. However, successful implementation requires structured education, supervised training, and sustainable competency assessment.

Educational needs assessment is a key step in curriculum development, enabling the identification of gaps between current and required competencies and informing targeted educational interventions [16, 17].

To date, little is known about POCUS education and competency among paediatric surgical providers across Africa. This multinational survey, conducted through the Pan-African Paediatric Surgical Association (PAPSA), aimed to assess access to ultrasound, POCUS utilisation, self-reported competency, training exposure, and perceived educational priorities among paediatric surgical providers. The findings are intended to inform the development of competency-based curricula, faculty development initiatives, and sustainable educational strategies to strengthen the paediatric surgical workforce across Africa.

Methods

Study design and survey development

We conducted a multinational, cross-sectional online survey to evaluate access to diagnostic imaging, utilisation of point-of-care ultrasound (POCUS), and perceived clinical relevance among paediatric surgical providers across Africa. The study was designed to assess the current ultrasound capacity of paediatric surgery providers and existing barriers relevant to clinician-performed ultrasound on the African continent. For this study, POCUS was defined as ultrasound performed at the bedside by a non-radiologist, non-sonographer clinician for diagnostic assessment or procedural guidance.

The survey questions have been developed by a multinational group of paediatric surgeons with expertise in POCUS. The questions have been inspired by the previous Global Survey with adaptation and input by paediatric surgeons from the African continent. The final survey is developed and first used in this study and can be found in the supplement.

The questionnaire was developed in English and translated into French using a forward translation process. Both versions were reviewed by bilingual members of the study team to ensure conceptual equivalence and contextual relevance. The survey was piloted within the investigator group before dissemination to assess clarity, readability, and content validity. Minor wording changes were made following pilot feedback.

Survey domains

The survey was structured to capture key dimensions of diagnostic capacity and workforce readiness:

Demographics

geographic region, healthcare facility type, professional role, and years of paediatric surgical practice.

Access to imaging

availability of ultrasound equipment, access to radiology services, after-hours coverage, and structural barriers to imaging.

POCUS utilisation

frequency of use, recent scan volume, and clinical indications.

Workforce capacity

self-reported competency and confidence in performing and interpreting POCUS.

Perceived clinical relevance

respondent ratings of 22 diagnostic and 5 interventional POCUS applications relevant to paediatric surgical care.

Data collection

The survey was disseminated between March and October 2025 via the Pan-African Paediatric Surgical Association (PAPSA) through newsletters and mailing lists. Participation was voluntary and anonymous. Inclusion criteria included healthcare providers involved in paediatric surgical care in an African country

Data analysis

Survey responses were analysed descriptively. English- and French-language responses were combined for analysis. Countries were grouped into five United Nations-defined African regions: East, West, Central, North, and Southern Africa.

Categorical variables were compared using Chi-squared or Fisher's exact tests, with statistical significance defined as $p < 0.05$. Associations between access to ultrasound, years of experience, and self-reported competency were explored to identify structural determinants of workforce capacity. Analyses were conducted using Python 3.10.

Results

Respondent characteristics

A total of 149 paediatric surgical providers from 29 African countries completed the survey, representing a broad geographic distribution across the continent (Fig. 1). Respondents were predominantly from East Africa (51.0%, $n = 76$), followed by West Africa (23.5%, $n = 35$), North Africa (12.8%, $n = 19$), Southern Africa (6.7%, $n = 10$), and Central Africa (6.0%, $n = 9$).

Most participants worked in tertiary-level hospitals (87.2%, $n = 130$), reflecting a concentration of paediatric surgical services in higher-level facilities. The workforce was predominantly early- to mid-career, with 67.8% ($n = 101$) reporting 2–10 years of practice. Junior clinicians (< 2 years) accounted for 17% ($n = 15$), while only 4% ($n = 3$) reported more than 20 years of experience, indicating a relatively young surgical workforce across settings.

Figure 1: Map of geographic distribution of participants

Access to diagnostic imaging

Access to ultrasound was limited and unevenly distributed. Only 30.9% ($n = 46$) of respondents reported access to an ultrasound machine within their department, while 24.8% ($n = 37$) reported no access to

ultrasound equipment at all. Access was strongly associated with clinical experience ($p < 0.001$), with junior clinicians disproportionately affected: 60% reported no access compared with 23% among providers with 11–20 years of experience.

Radiology service availability was inconsistent. Only 43.6% ($n = 65$) of respondents reported seven-day radiologist coverage, and after-hours access varied substantially by region. Delays in obtaining urgent imaging were common, with 45.6% ($n = 68$) reporting waiting times of 3–6 hours, indicating significant constraints in time-critical clinical pathways.

Respondents identified multiple structural barriers to imaging access, including direct costs to patients (74.5%, $n = 111$), shortages of radiologists and sonographers (60.4%, $n = 90$), limited availability of ultrasound machines (57.0%, $n = 85$), absence of portable devices (53.7%, $n = 80$), and institutional policies restricting ultrasound use to radiology departments (45.6%). Geographic and infrastructural challenges, including distance to imaging facilities (43.6%, $n = 65$) and unreliable electricity supply (19.5%), further constrained access, see Fig. 2.

Figure 2: Barriers reported by participants to use Clinician Ultrasound

Utilisation of point-of-care ultrasound

Despite its perceived relevance, utilisation of POCUS was limited. More than one-third of respondents (37.6%, $n = 56$) reported not using POCUS in clinical practice. Only 10.1% ($n = 15$) reported daily use, while 18.1% ($n = 27$) used POCUS weekly. Infrequent use was common, with a substantial proportion reporting monthly or less frequent use, and over 40% reporting no scans performed in the preceding six months. Among active users, the median number of scans performed per month was fewer than ten.

These findings indicate a substantial gap between the potential utility of POCUS and its integration into routine clinical workflows.

Figure 3: Indications where POCUS is used and Indications of interest to learn

Workforce capacity and competency

Self-reported competency in POCUS was low across the cohort (Fig. 4). A total of 39.6% ($n = 59$) reported no detectable skills, and 18.8% ($n = 28$) reported limited skills without confidence. While 34.2% ($n = 51$) reported basic competence, only 7.4% ($n = 11$) felt capable of teaching others.

Competency was positively associated with both years of experience and access to ultrasound equipment ($p < 0.01$), highlighting the importance of structural access and exposure in skill development.

Figure 4: Overall-self rated competency stated by participants

Perceived clinical relevance and training demand

Respondents consistently rated POCUS as highly relevant across a range of paediatric surgical applications (Fig. 5). Diagnostic indications rated most relevant included acute abdominal conditions such as intussusception (71.8%, $n = 107$), pyloric stenosis (81.2%, $n = 121$), and bowel obstruction (77.2%, $n = 115$), as well as neonatal imaging (cranial ultrasound 85.2%, $n = 127$; necrotizing enterocolitis 85.2%, $n = 127$). Trauma assessment using eFAST was rated highly relevant by 59.7% ($n = 89$).

Interventional applications, including ultrasound-guided vascular access (73.8%, $n = 110$) and abscess drainage (67.8%, $n = 101$), were also prioritised. Across all domains, a clear gap emerged between perceived relevance and current utilisation.

Demand for training was universal. All respondents (100%, $n = 149$) expressed interest in attending POCUS training courses, and 97.3% ($n = 145$) supported integration of POCUS into paediatric surgical curricula. The majority (94.0%, $n = 140$) agreed that paediatric surgeons should be competent in both diagnostic and interventional ultrasound applications.

Figure 5: Self-rated competency of respondents for different POCUS indications

Results

Participant characteristics

A total of 149 paediatric surgical providers from 29 African countries completed the survey, representing all five United Nations regions of Africa (Fig. 1). Participants were predominantly from East Africa (51.0%, $n = 76$), followed by West Africa (23.5%, $n = 35$), North Africa (12.8%, $n = 19$), Southern Africa (6.7%, $n = 10$), and Central Africa (6.0%, $n = 9$).

Most respondents worked in tertiary-level hospitals (87.2%, $n = 130$). The majority were early- to mid-career clinicians, with 67.8% ($n = 101$) reporting between two and ten years of paediatric surgical practice. Junior clinicians (< 2 years' experience) represented 17.0% ($n = 15$), while only 4.0% ($n = 3$) had more than 20 years of experience.

Access to ultrasound and learning opportunities

Access to ultrasound equipment was reported by 30.9% ($n = 46$) of respondents, whereas 24.8% ($n = 37$) reported no access to ultrasound. Access to equipment was associated with years of clinical experience ($p < 0.001$), with junior clinicians reporting the lowest levels of access to ultrasound machines.

The availability of radiology services was heterogeneous. Seven-day radiologist coverage was available to 43.6% ($n = 65$) of respondents, while almost half (45.6%, $n = 68$) reported waiting times of three to six hours for urgent imaging.

Participants identified several barriers that limited opportunities to use and learn POCUS in their clinical practice. The most frequently reported barriers were direct patient costs for imaging (74.5%, $n = 111$),

shortages of radiologists and sonographers (60.4%, $n = 90$), limited availability of ultrasound equipment (57.0%, $n = 85$), lack of portable ultrasound devices (53.7%, $n = 80$), and institutional policies restricting ultrasound use to radiology departments (45.6%, $n = 68$) (Fig. 2).

POCUS utilisation and previous experience

Although POCUS was available in some institutions, routine use remained limited. More than one-third of respondents (37.6%, $n = 56$) reported that they did not use POCUS in their clinical practice. Only 10.1% ($n = 15$) reported daily use, while 18.1% ($n = 27$) used POCUS weekly. More than 40% reported performing no POCUS examinations during the previous six months. Among clinicians who used POCUS, the median number of examinations performed each month was fewer than ten. 30% reported to use ultrasound currently for Focus Assessment with Sonography in Trauma (FAST), 24% currently used ultrasound to evaluate for intussusception and 20% to support abscess drainage; most other paediatric surgery conditions were used only by a limited number of providers, see Fig. 3 on current use and learning interest.

Self-reported competency

Overall self-reported competency was limited (Fig. 4). Nearly two-fifths of respondents (39.6%, $n = 59$) reported no POCUS competency, and a further 18.8% ($n = 28$) reported limited skills without confidence to perform examinations independently. Basic competency was reported by 34.2% ($n = 51$), and only 7.4% ($n = 11$) considered themselves sufficiently competent to teach others, see Fig. 4.

Of 148 respondents with complete data, 62 (41.9%) rated themselves as competent to perform ultrasound. In the multivariable model, previous attendance of a formal ultrasound course was the strongest independent predictor of competency (adjusted OR 17.2, 95% CI 6.5–45.4; $p < 0.001$): 84.4% (38/45) of formally trained respondents were competent versus 23.3% (24/103) of those without formal training. Ultrasound availability was associated with competency in the unadjusted analysis (OR 2.84, 95% CI 1.23–6.57; $p = 0.015$) but this attenuated after adjustment (adjusted OR 1.93, 95% CI 0.70–5.28; $p = 0.20$), consistent with formal training partly mediating the effect of equipment access. Years of experience showed in the regression model for status of competency (adjusted OR 1.02 per category, 95% CI 0.62–1.66; $p = 0.95$), nor did the geographical region. Practicing in a tertiary (vs. non-tertiary) hospital setting was associated with a higher level of competency (OR 0.30, 95% CI 0.09–0.99; $p = 0.049$).

Perceived educational priorities

Respondents identified POCUS as highly relevant to several paediatric surgical applications, and generally less than 30% of participants stated they are currently competent to perform the selected ultrasound visualisation (Fig. 5). Diagnostic applications considered most relevant included pyloric stenosis (81.2%, $n = 121$), bowel obstruction (77.2%, $n = 115$), intussusception (71.8%, $n = 107$), cranial ultrasound (85.2%, $n = 127$), and necrotising enterocolitis (85.2%, $n = 127$). Trauma assessment using extended Focused Assessment with Sonography in Trauma (eFAST) was considered highly relevant by 59.7% ($n = 89$). Ultrasound-guided vascular access (73.8%, $n = 110$) and abscess drainage (67.8%, $n = 101$)

were identified as the highest educational priorities for procedural applications see Fig. 5 on current use, self-rated competency, and interest to learn.

Demand for POCUS education

All respondents ($n = 149$) indicated that they would attend a structured POCUS training programme, while 97.3% ($n = 145$) supported the integration of POCUS into paediatric surgical training curricula. Furthermore, 94.0% ($n = 140$) agreed that paediatric surgeons should be competent in both diagnostic and procedural POCUS applications.

Discussion

This multinational needs assessment provides the first continent-wide evaluation of point-of-care ultrasound (POCUS) education, self-reported competency, and current use among paediatric surgical providers across Africa. Although the majority of respondents recognised POCUS as an important component of paediatric surgical practice, substantial gaps were identified. Respondents identified multiple system-level barriers to ultrasound access, including financial costs to patients, shortages of radiology personnel, restrictive institutional policies, limited availability of portable devices, and delays in accessing imaging services. These findings emphasise that educational interventions alone are unlikely to be sufficient without parallel investment in infrastructure and health system support. The strong support expressed by clinicians for formal education and curriculum integration demonstrates a readiness to strengthen POCUS training across African paediatric surgery providers.

The discrepancy between the perceived importance of POCUS and respondents' self-reported competency leaves opportunity for building educational programmes. Nearly all participants considered POCUS relevant to practice, yet fewer than 10% felt competent to teach it, and almost 40% reported no competency performing ultrasound themselves. Similar findings have been reported among paediatric surgeons and clinicians in both resource-limited and high-resource settings, highlighting the educational gaps which may be caused by limited training opportunities and equipment availability both globally and within Europe [5, 7, 8, 18]. These findings support investing in competency-based programmes that incorporate supervised clinical practice and ongoing assessment for quality assurance [4, 19]. Investing in educating clinical care providers could help to overcome the reported delays in obtaining urgent radiology-performed ultrasound for time-critical paediatric surgical decision-making.

Competency-based medical education may provide an appropriate model for POCUS curriculum development. Contemporary POCUS training extends beyond image acquisition to include image interpretation, clinical decision-making, procedural guidance, and integration into clinical patient care [3, 19]. Consistent with Miller's framework for clinical competence, educational programmes should facilitate progression from knowledge ("knows") and image interpretation ("knows how") to supervised performance ("shows how") and ultimately independent clinical practice ("does") [19, 20]. The high level of interest expressed by respondents suggests that implementation of such programmes would be well received across African paediatric surgical training programmes.

Educational needs assessment is recognised as the first step in curriculum development because it identifies the gap between current and desired competencies while ensuring that educational interventions address learners' needs [16, 17]. Within Kern's six-step approach, the present study represents a targeted needs assessment that can inform learning objectives, educational strategies, implementation, and programme evaluation [17]. Respondents prioritised acute abdominal pathology, trauma assessment and procedural guidance, which would cover the common paediatric surgical clinical scenarios where POCUS has been shown to add to clinical practice. These findings provide a pragmatic framework for curriculum design, supporting a staged approach that initially focuses on core applications before expanding to more advanced examinations [3, 5].

Successful implementation will require investment in both education and infrastructure. The association between access to ultrasound equipment and higher self-reported competency observed in this study highlights that access to ultrasound devices and regular training opportunities with supervised practice are needed. Sustainable implementation should combine structured curricula with access to (portable) ultrasound devices, faculty development, mentorship, and governance processes that support quality assurance and continuing development of skills [21, 22].

Faculty capacity represents a major challenge. With fewer than one in ten respondents reporting confidence to teach POCUS, there is currently insufficient educational capacity to support widespread curriculum implementation on the African continent with local faculties. Regional train-the-trainer initiatives could provide a sustainable model for developing local expertise and building up educational capacity.

Emerging technologies, including tele-ultrasound, remote mentorship, simulation-based education, digital learning resources, and artificial intelligence-assisted image acquisition and interpretation, may further improve access to high-quality POCUS education, particularly where experienced faculty are limited [23, 24]. However, these approaches cannot replace supervised clinical experience.

Integrating POCUS into paediatric surgical curricula has the potential to strengthen capability for timely diagnosis and treatment and improve equitable access to diagnostic ultrasound across Africa. Successful implementation will require collaboration between universities, surgical training programmes, professional societies, radiology departments, ministries of health, and healthcare institutions to ensure that curricula, competency standards, governance, and quality assurance processes are appropriate for local healthcare systems.

This study has several strengths. It represents the first multinational educational needs assessment of POCUS among paediatric surgical providers across Africa and includes participants from 29 countries representing all geographical regions of the continent. Endorsement by the Pan-African Paediatric Surgical Association facilitated broad participation across diverse healthcare settings and provided valuable insight into educational priorities.

The following limitations should be acknowledged. Competency was self-reported rather than objectively assessed, introducing the potential for reporting bias. Participation was voluntary and may have preferentially attracted clinicians with an interest in POCUS, resulting in selection bias. Furthermore, the diversity of healthcare systems across Africa may limit the applicability of findings to individual countries. Nevertheless, the consistency of responses across geographical regions suggests that the educational priorities identified are broadly relevant across African paediatric surgical training programmes.

In conclusion, this study identifies a substantial unmet need for structured POCUS education among paediatric surgical providers across Africa. The combination of low self-reported competency, high perceived clinical importance, and strong demand for formal training provides a compelling argument to invest in scaling up clinician ultrasound for paediatric surgery care providers. Future work should focus on the development, implementation, and evaluation of educational programmes and allocation of resources towards such programmes. As the continental professional body, PAPSA is well positioned to coordinate curriculum development, faculty training, competency standards, and regional mentorship networks.

Conclusion

This multinational needs assessment highlights substantial gaps in POCUS training, competency, and structured educational provision among paediatric surgical providers across Africa. Despite these gaps, POCUS is widely recognised as clinically important, and there is universal interest in formal training and strong support for its integration into curricula. These findings demonstrate a need for structured, competency-based POCUS education supported by standardised curricula, faculty development, and sustainable assessment frameworks. Strengthening POCUS training on the African continent for providers of paediatric surgical services has the potential to improve workforce competency and support more equitable access to diagnostic ultrasound in paediatric surgical care across diverse settings.

List of Abbreviations

FAST Focused Assessment with Sonography for Trauma

LMIC Low- and Middle-Income Countries

PAPSA Pan-African Paediatric Surgical Association

POCUS Point-of-Care Ultrasound

Declarations

Clinical trial number

Not applicable

Human Ethics and Consent to Participate declarations:

Ethical Approval

Ethical approval was granted by the Ethics Committee of the University of Rostock (Approval number: A 2024 – 0224). The study was conducted in accordance with the Declaration of Helsinki.

Consent to Participate

Informed consent was obtained from all participants before participation

Competing interests

There are no competing interests for any author

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Author Contribution

JL: conceptualization, methodology, investigation, data curation, writing, supervision; RS: investigation, writing-review and editing; STÖ: investigation, writing-review and editing; SIH: conceptualization, methodology, investigation, writing-review and editing; GSP: investigation, writing-review and editing; MS: conceptualization, methodology, investigation, writing-review and editing; GN: conceptualization, methodology, writing-review and editing; MC: conceptualization, methodology, investigation, data curation, writing-review and editing. All authors reviewed the manuscript.

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Data Availability

The survey was reviewed and authorised by the Pan-African Paediatric Surgical Association (PAPSA) Board prior to distribution. The final survey instrument is provided as Supplementary Material. The full dataset is available from the corresponding author upon reasonable request.

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Figures

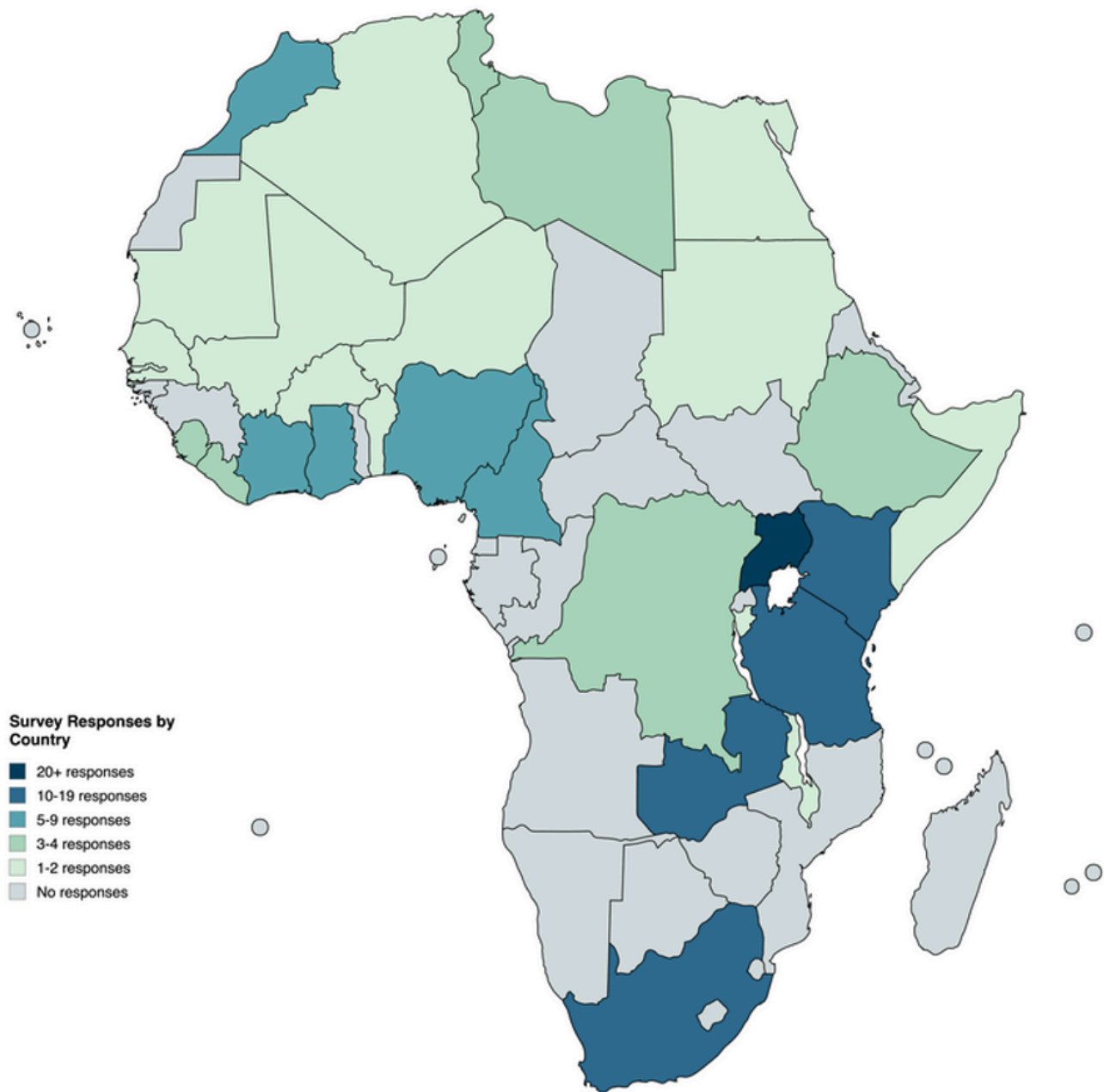


Figure 1

Map of geographic distribution of participants

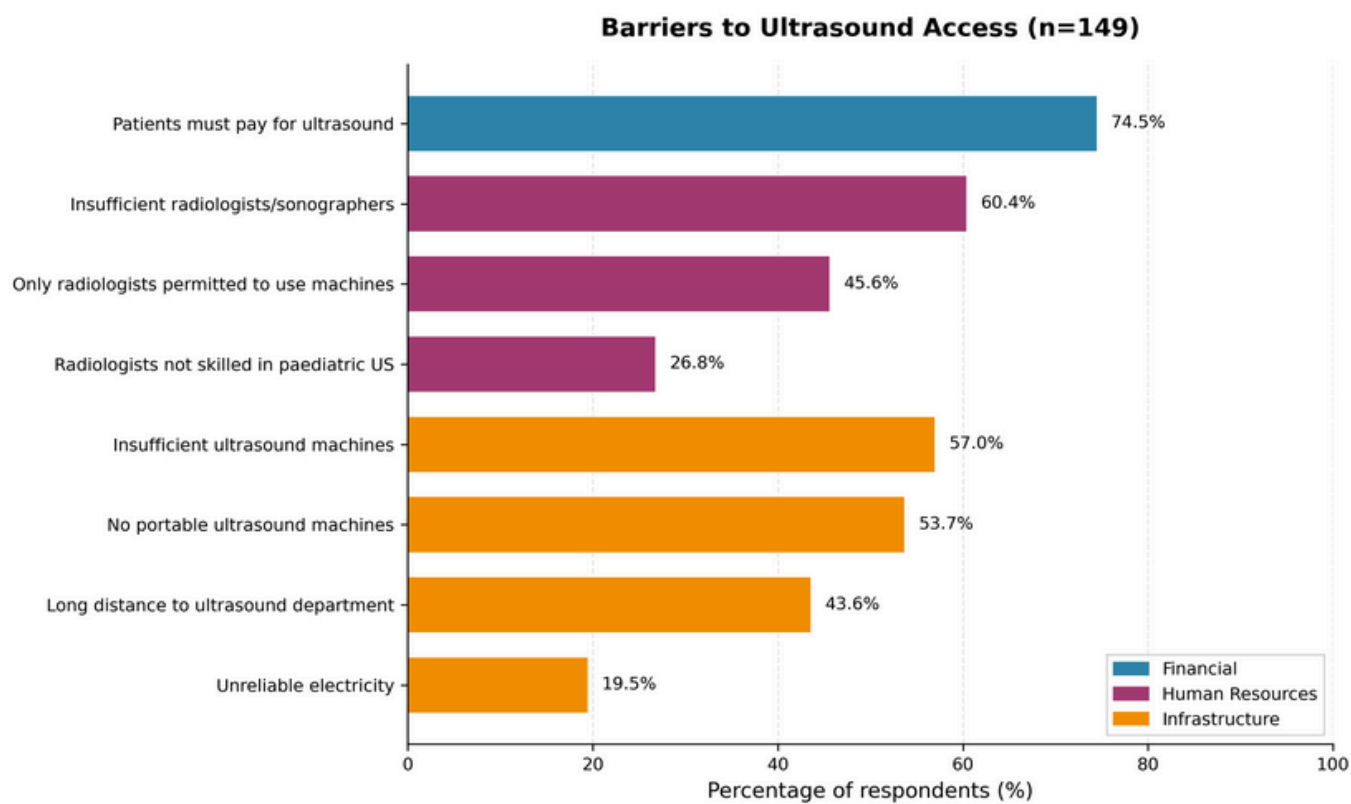


Figure 2

Barriers reported by participants to use Clinician Ultrasound

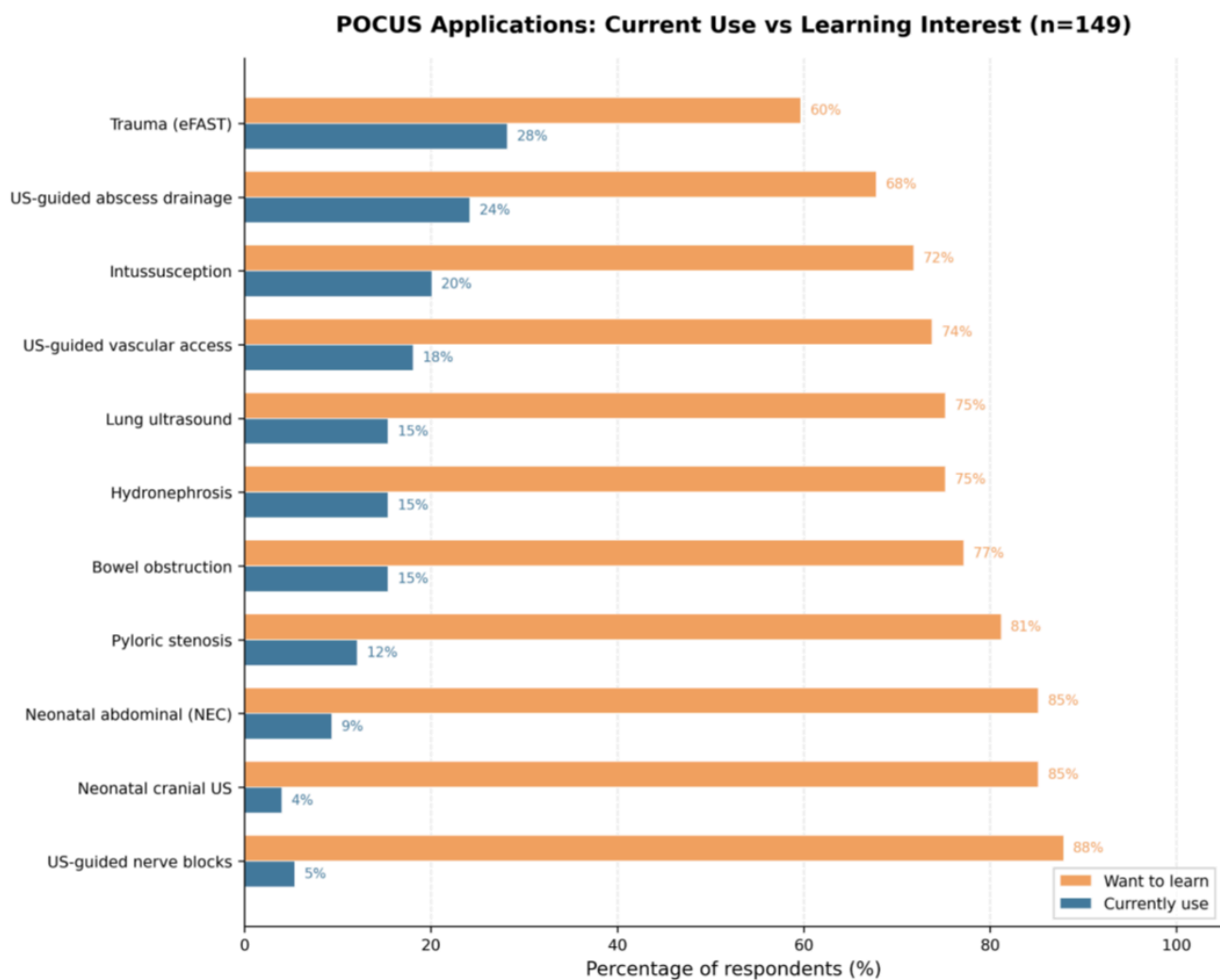


Figure 3

Current Use and Learning Interest of Clinician Ultrasound

Self-Reported Ultrasound Competence (n=149)

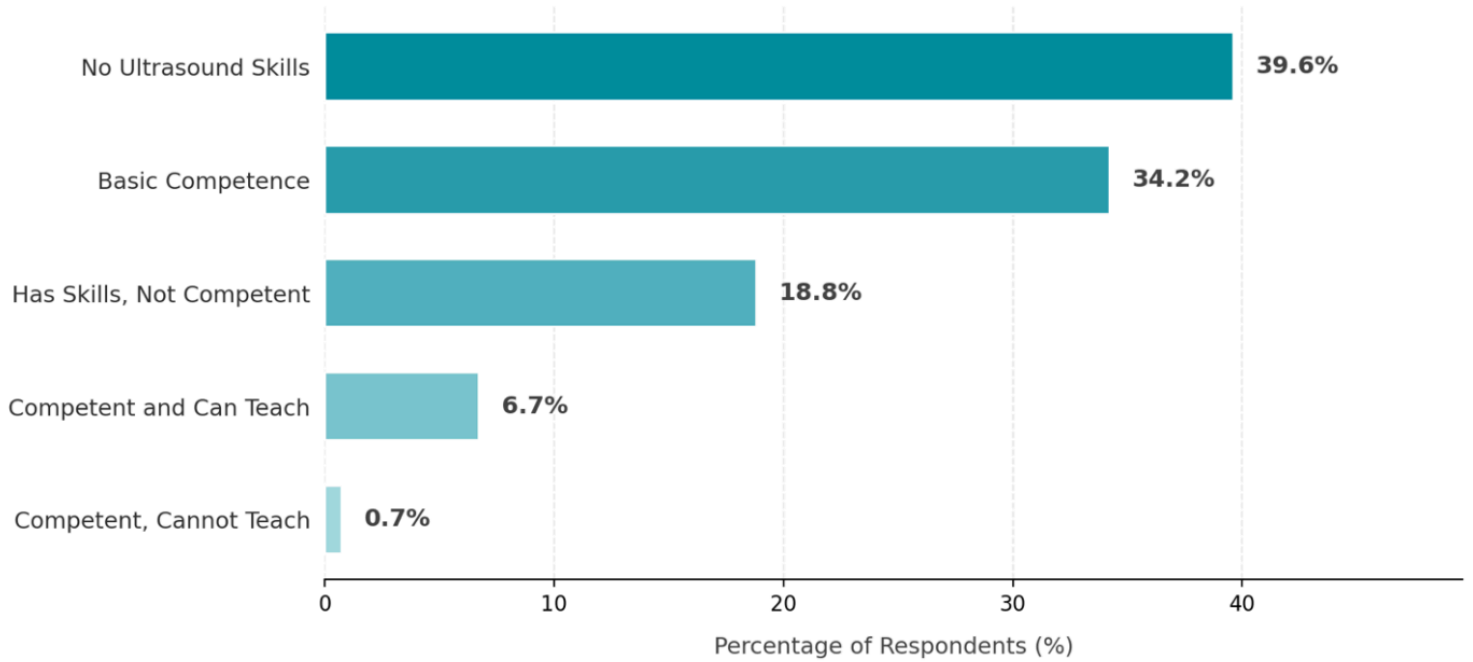


Figure 4

Self-reported ultrasound competency

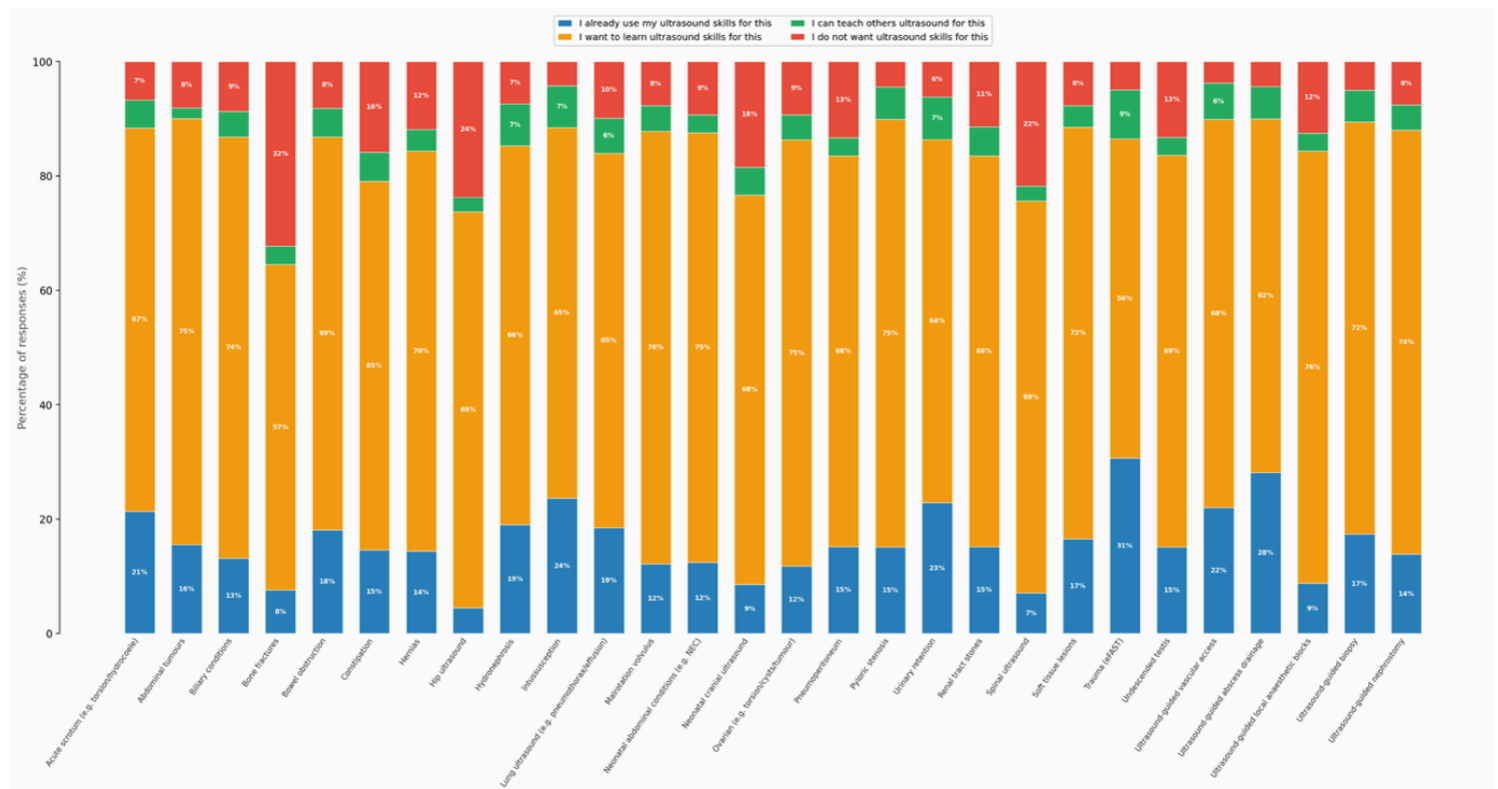


Figure 5

Self-rated competency, current use and interest to learn for selected ultrasound applications in paediatric surgery

Supplementary Files

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

- [0925FinalPAPSAPointofCareUltrasoundPOCUSSurveyforPaediatricSurgeonsinAfrica.pdf](#)