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EMERGENCY MEDICINE**



Title-Pediatrics and child health Residents' perception and knowledge towards Point of care ultrasound practice

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Approval

This is to certify that the proposal entitled "Pediatrics and child health Residents' perception and knowledge towards Point of care ultrasound practice" by Dr. Robel Sintayehu for partial fulfillment of the requirement for the degree of specialty certificate of Emergency and Critical Care complies with the regulations of the university and meets the accepted standards concerning originality and quality which was carried out under advisors Dr. Tigist worku and Dr. Yohannes Feleke

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Acronyms and Abbreviation

ACEP-American College of Emergency Physician

AAP-American Academy of Pediatrics

AAU –Addis Ababa University

AOR-Adjusted Odds ratio

COR-Crudes Odds ratio

CI- Confidence interval

ED-Emergency Department

EFAST-Extended Focused Assessment with Sonography for Trauma

ESPNIC- European Society of Pediatric and Neonatal Intensive Cares

FAST- Focused Assessment with Sonography for Trauma

PEM-Pediatric Emergency Medicine

PICU-Pediatric Intensive Care Unit

POCUS- Point-of-care ultrasonography

SPHMMC-St. Paulos Hospital Millennium Medical College

TASH-Tikur Anbessa Specialized Hospital

Abstract

Background: Point-of-care ultrasound is an evolving field in medical education and emergency practice. Numerous pieces of evidence support the use of point-of-care ultrasound in children to improve outcomes. Pediatrics as a specialty has been relatively late to adopt point-of-care ultrasound with a significant gap in specific recommendations and implementation. Assessing pediatrics residents' perception and knowledge is one of the crucial factors for the successful integration of point-of-care ultrasound into pediatric emergency and critical care practice.

The objective of the study is to describe pediatric residents' perception towards pediatric point-of-care ultrasound practice and identify factors associated with the knowledge of point of-care ultrasound.

Method A cross-sectional study assessed the perception and knowledge of 97 pediatric residents from year 1 to year 3 in two tertiary hospitals in Addis Ababa. An online questionnaire was used to collect data on demographics, perception, and knowledge towards point-of-care ultrasound. The data was entered and analyzed using SPSS version 26 software using analytic and descriptive parameters. Binary and multivariable logistic regression analyses were done to identify factors associated with point of care ultrasound knowledge.

Result - Majority (70.1%) of residents have a good understanding of the potential use of point-of-care ultrasound for pediatrics. A majority (67%) of residents rated good perception on point-of-care ultrasound as a valuable tool for improving diagnostic accuracy. On the importance of integrating point-of-care ultrasound training into pediatric residency programs, 70.1% of residents have a good perception. The most significant perceived barrier to point-of-care ultrasound practice is a lack of training (72.2%). Residents with any form of point-of-care ultrasound training were significantly more likely to score above the median knowledge assessment (AOR=58.46; 95% CI: 5.835-585.858; P-value=0.01). Residents who reported using point-of-care ultrasound once a month or once a week were significantly more likely to have a good knowledge of point-of-care ultrasound compared to those who never or rarely used it (AOR= 9.000; 95% CI: 2.307-35.118; P-value=0.020) and (AOR=7.661; 95% CI: 1.375-42.695; P-value=0.039), respectively.

Conclusion and recommendation - Our findings aligned with the broader trend of pediatric residents advocating for the integration of point-of-care ultrasound into pediatric curricula. This integration is likely to increase acceptance among pediatric residents. Our results highlight the importance of prior training and regular use of point-of-care ultrasound in enhancing the knowledge of pediatric residents. We recommend that further studies be conducted to assess the impact of educational interventions on the pre- and post-knowledge of pediatric residents towards point-of-care ultrasound. Another area of interest for future research would be the factors hindering the integration of point-of-care ultrasound into pediatric curricula.

Introduction

In pediatric practice, point of care ultrasound allows for rapid, convenient serial reassessments aimed at improving diagnosis. The last two decades have witnessed substantial progress in the development and application of pediatric POCUS. Nevertheless, the advancement has been met with some degree of contention [1]. The first widespread implementation of Pediatric POCUS into practice was urged in 2014 [2]. Following this initiation, a pediatric institutional POCUS training program was conducted in 2015 [3]. In the same year the American Academy of Pediatrics recommended the integration of POCUS training into pediatric emergency fellowships and for physicians [4]. While guidelines for adult patients were published by the Society of Critical Care Medicine in 2015, the European Society for Pediatric and Neonatal Intensive Care has since published comprehensive, evidence-based guidelines [5]. Subsequently, advancements have been made in POCUS training and clinical implementation within both pediatric critical care and emergency medicine settings [6]. A curriculum standard and core POCUS content for PEM fellowships were defined by the Pediatric Emergency Medicine POCUS Network in 2019 [7].

Statement of the problem

Significant uncertainties persist regarding competency standards and training requirements, with variable implementation and adoption. The 2019 national survey found that no pediatric residency programs had a mandatory POCUS curriculum, and less than fifteen percent offered it as an elective [8]. Compared to ten years ago, there has been a notable rise in PEM fellowship training programs, with seventy-seven percent reporting its inclusion in a 2020 survey of program directors [4]. The trend of implementation in more than a hundred surveyed academic pediatric critical care units was found to be low and varied, largely attributed to deficiencies in user training, competence, and confidence [9]. Point of care ultrasound program development emphasizes five key elements: training, credentialing, image storage, documentation, and quality assurance [6]. A significant gap of robust evidence has prevented the establishment of recognized standards for these key components. One survey highlighted a critical deficit of qualified instructors as educators [7]. The rise of Pediatric POCUS has left many questions unanswered, including those related to competency and training.

Significance of the study

In Ethiopia there is no single study which shows the extent of Pediatric POCUS practice and most of the data are inconclusive. Assessing pediatrics residents' perception and knowledge is one of the crucial factors for the successful integration of point-of-care ultrasound in pediatric emergency and critical care practice. This also aims to serve as an input for stake holder for future implementation and curriculum development. This study assessed pediatric residents' perception towards pediatric point of care ultrasound practice and identify factors associated with the knowledge of point of care ultrasound.

Literature Review

Point-of-care Ultrasonography is the use of ultrasound imaging by a clinician at the patient's bedside or point of care for immediate diagnostic and therapeutic purposes [2]. This technique will enable the physician to correlate real-time images with the patient's presenting signs and symptoms [10]. Point-of-care ultrasound can be easily repeated and used for a variety of purposes, including diagnosis and guiding medical procedures [5]. Pediatric emergency and ICU patients often present with ultrasound-detectable abnormalities. It is also an ideal imaging modality for children due to its lack of exposure to radiation and its ability to be performed without sedation [11] A wide range of medical specialties, such as anesthesia, neonatology, internal medicine, family medicine, critical care medicine, and emergency medicine, employ ultrasound [12]. But important to consider, according to the American Academy of Pediatrics policy statement is that "clinicians should be aware that point of care ultrasonography is better used as a rule in and not a rule out diagnostic modality" [13]. In light of the current status, more than seventy percent of fellowship programs in the United States provide formal ultrasound training and less than fifteen percent of residency program offered it as an elective [1] [8]. While various training programs exist, they lack standardized quality assurance and credentialing processes. Additionally, image storage and documentation practices are often inconsistent. While national, regional, and institutional courses are available, they can be costly and limited in accessibility

The body of literature pertaining to point-of-care ultrasound in the pediatric setting is limited and it is still not well codified. Nevertheless, there aren't many studies that look at how pediatric residents use point-of-care ultrasound. One study conducted with the objective to implement a multi-staged POCUS curriculum and retrospectively assess resident skill and comfort improvement. The curriculum introduced POCUS topics such as basic and advanced cardiac, lung, skin/soft tissues and procedural based ultrasound to all pediatric residents. Study participants demonstrated a thirty percent improvement in POCUS comfort level following the training. It also demonstrated improvement to recognize and interpret POCUS images. Furthermore, all the study participants reported improvement in their practice. This study also highlighted the feasibility of integrating POCUS into pediatric residency training program [12]. In a meta-analysis conducted suggests Pediatric emergency physicians should embrace POCUS as a safe and effective tool for diagnosis, critical care management, and procedural guidance, ultimately enhancing overall patient care [14]. There are several studies which shows about the attitude, level of confidence and comfort of performing Pocus among pediatric residents. According to the studies pediatric residents have little POCUS training and perform poorly on POCUS knowledge testing. While most residents in one study reported a high likelihood of using POCUS in their clinical practice, their confidence levels remained relatively low, particularly in specific scan areas. Nevertheless, all residents agreed that the value of POCUS justified the time investment [15]. A basic POCUS curriculum can be instituted during the PICU and emergency rotation to improve resident knowledge and comfort [16]. Consequently, pediatric emergency and critical care medicine providers will embrace this technology in everyday practice. So far there is no single study or literature found on the trend of POCUS practice in Ethiopia. This gap could be a potential area of study for future in the country. However, one study conducted in Addis Ababa demonstrated that POCUS is the most commonly performed procedure in adult emergency departments [21].

Objective

General Objective

To describe pediatric and child health residents' perception and knowledge towards point of care ultrasound practice in two teaching hospital in Addis Ababa

Specific Objectives

To identify factors associated with the knowledge of Pediatric residents towards point of care ultrasound practice

To describe comfort and confidence level of pediatric residents towards point of care ultrasound practice

Eligibility Criteria

Inclusion criteria

Pediatric Residents should with at least six months of experience in pediatrics department

Pediatric residents should have rotated in ICU or PEM setting

Exclusion criteria

No POCUS exposure at All

Unable to participate in the study due to serious illness

Materials and Method

Study Area and Study Period

The study took place in two tertiary hospitals in Tikur Anbessa and St. Paul's Hospital Millennium Medical specialized hospital located in Addis Ababa, the capital city of Ethiopia. Tikur Anbessa Specialized Hospital is found in the capital city of Addis Ababa and is the largest referral hospital in the country, and serves approximately 370,000- 400,000 patients a year but the exact number is not known. There are 98 residents attending the postgraduate program in the Department of

Pediatrics and Child Health at TASH. St. Paul's Hospital Millennium Medical College, there are 72 residents enrolled in the postgraduate program of pediatrics and child health. It is also located in the capital city of Addis Ababa. The college initiated Ethiopia's first integrated modular and problem-based curriculum for its undergraduate medical education and is currently expanding to postgraduate programs including pediatric residency. The study was conducted from May to November/2024 G.C

Study design and Population

A cross-sectional study on pediatric residents' perception and knowledge towards point of care ultrasound was conducted in two Tertiary hospitals in Pediatrics department. The study was conducted from May to November 2024 G.C. Pediatric Residents from Year 1 to Year 3 at TASH and SPHMMC were included in the study after informed consent was guaranteed.

Source population were all pediatric residents working in Addis Ababa city.

Study population included pediatric residents in two teaching hospitals of Addis Ababa city.

Sampling frame were pediatric residents in two teaching hospitals and participated in the study

Sample size determination and Sampling Procedure

The required sample size for achieving a 95% confidence interval with a 5% margin of error and proportion of participants with good perception is taken as 50% as there is no similar study done.

The formula for calculating the sample size n for estimating a single proportion is:

$$n = \frac{Z^2 \cdot p(1-p)}{d^2}$$

Where:

n = required sample size

Z = Z-value (the number of standard deviations from the mean corresponding to the desired confidence level; for 95% confidence, $Z \approx 1.96$)

p = estimated proportion of the population = 0.5

d = margin of error = 0.05

$$n = \frac{1.96^2 \cdot 0.5(1-0.5)}{0.05^2} = 377$$

Since the sampling frame is <10000, i.e., we use the adjustment formula

$$n_{adj.} = n / (1 + (n/N))$$

where $n_{adj.}$ = Adjusted sample size

n = calculated sample size

N = Study population

Assuming target population of pediatric residents is approximately 170

$$n_{adj.} = 384 / (1 + (384/170)) = 117$$

Adjust for Non-response rate is taken as 5%

$$117 * (1 / (1 - NR)) = 123$$

Sampling Procedure – used non-probability sampling (a combination of convenience and quota sampling). The selection of the sample was based on ease of access and convenience. However, to avoid bias and ensure an even distribution of residents from years 1 to 3, a fixed, equal quota was used for each year

Data quality control

The primary investigator, in collaboration with pediatric chief residents, undertook the responsibility of data collection. Before entering the information into the SPSS program, the responses were reviewed daily for completeness of the data.

Methods of data collection and analysis

The data was collected on online questionnaires using a google data collections format from pediatric residents. Assessment questionnaires was provided to assess the perception and knowledge of pediatric residents towards POCUS. All the collected data was organized and analysed by the principal investigator. Study participants' identification was not disclosed to the third party and remained confidential. The questionnaire is prepared in English. Informed consent, in written form, was obtained before physician data collection. Each participant was accessed

through their respective hospital. Data was not collected from those physicians who were not cooperative to give consent. The questionnaire included demographics, evaluation of comfort, confidence, perception and knowledge base. At the end of the questionnaire, a graded knowledge test was provided to the participants. The data was entered and analyzed using SPSS version 26 software using analytic and descriptive parameters. Missing data was treated as missing during analysis. The descriptive data was described using mean with standard deviation, median with interquartile range and mode. Perception and knowledge was assessed using ten questions and twenty questions respectively which was adopted from a previous similar study [17]. The computed median value was used to categorize good and poor perception and knowledge towards POCUS. Since the perception variables were categorical and measured on a Likert scale, they were dichotomized into two groups: above and below the median score. p-value of less than 0.2 in bi-variable analysis were included in multivariable analysis which was conducted to identify factors associated with the level of knowledge towards POCUS. A P-value less than 0.05 was considered statistically significant.

Operational Definitions

Perception – "The belief or opinion that people have as a result of realizing or noticing something"[18]

Good perception towards POCUS- Those who score above the median from perception questions.

Poor perception towards POCUS Those who score below the median from perception questions.

Good comfort and confidence in POCUS Practice - Those who score above the median from comfort questions.

Bad comfort and confidence in POCUS Practice- Those who score below the median from comfort questions.

Good knowledge of POCUS- Those who score above the median from knowledge questions.

Poor knowledge of POCUS- Those who score below the median from knowledge questions

Ethical consideration

The study was conducted after permission letter was secured from Ethics Review Committee from the department of emergency and critical care. The data was held confidential and used for the purpose of this study and will not be shared with any third parties

Result

The response rate is 78.86% from the calculated sample size. The possible reason for this response rate could be that the study was conducted in the pediatric department and residents were not able to complete the form due to scheduling conflicts and limited availability. However, even with this challenge, the response rate is still quite high

Sociodemographic

In the study, there were a total of 97 residents, Participants were from Tikur Anbessa Specialized Hospital 54.6%(n=55) and St. Paulo's Hospital accounted for 45.4% (n=42). The mean age of the study residents is 30.34 years; 95% CI (29.84 to 30.85) with SD of 2.368. The majority of the residents are male (60. 2%). The overall distribution of residents across the three years is relatively even, with a slight predominance of Year 3 residents.

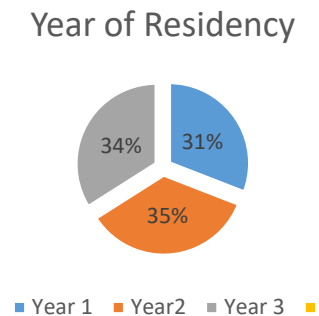


Figure 1

Pediatric Residents' Comfort and Confidence with Pediatric POCUS

The majority of residents (79.4%) reported poor comfort with POCUS practice. A similar trend is observed in self-reported confidence levels, with 78.4% of residents reporting poor confidence to interpret POCUS images. From area of comfort to perform pediatric POCUS, a significant proportion (36.1%) felt uncomfortable with all areas of pediatric POCUS and 35.1% felt comfortable with IVC POCUS.44.3% of residents never use POCUS in their practice. A significant majority (68%) of residents have not received any formal or informal training in POCUS during their residency program

Table 1 : Comfort and confidence towards Pediatric POCUS practice

	Frequency(Percent)	95%CI
Any formal/informal training on POCUS		
Yes	31(32.0%)	22.7-41.2
No	66(68.0%)	58.8-77.3
Self-reported level of comfort to practice		
Poor	77(79.4%)	71.1-87.6
Good	20(20.6%)	12.4-28.9
Self-reported level of confidence to interpret POCUS images		
Poor	76(78.4%)	69.1-86.6
Good	21(21.6%)	13.4-30.9
Area of comfort to perform pediatric POCUS		
FAST Exam	11(11.3%)	5.2-17.5
Lung Scan	14(14.4%)	7.2-20.6
IVC	34(35.1%)	25.8-44.3
Cardiac	3(3.1%)	0-7.2
None of it	35(36.1%)	26.8-46.4
Self-reported frequency of POCUS practice		
Never	43(44.3%)	34.0-54.6
Once a year	12(12.4%)	6.2-19.6
Once a month	14(14.4%)	7.2-22.7
Once a week	28(28.9%)	20.6-37.1

Pediatric Residents' Perceptions Towards POCUS Practice

A significant majority (70.1%) of residents have a good understanding on the potential use of POCUS for pediatric patients while 29.9% rated poor. A majority (67%) of residents rated good perception on POCUS as a valuable tool for improving diagnostic accuracy. On the Perception of the importance of Integrating POCUS training to pediatric residency program ,70.1% of residents have good perception. The most significant perceived barrier to POCUS practice is a lack of training (72.2%). The most preferred intervention to improve POCUS proficiency is dedicated practice with an ultrasound machine (40.2%).

Table 2 : Perceptions of pediatric residents towards POCUS practice

Characteristics	Frequency(Percent)	95%CI
Understanding of the potential use of pediatric pocus for pediatric patients		
Poor	29(29.9%)	21.6-39.2
Good	68(70.1 %)	60.8-78.4
Perception on use of POCUS for diagnostic accuracy		
Poor	32(33%)	23.7-42.3
Good	65(67%)	57.7-76.3
Perceived barriers to POCUS practice		
Lack of training	70(72.2%)	62.9-81.4
Lack of Equipment	14(14.4%)	8.2-21.6
Qualified faculty as educators	12(12.4%)	6.2-19.6
Not useful for my patient	1(1%)	0-3.1
Perception on the importance of integrating POCUS training to paediatric residency program		
Poor	29(29.9%)	20.6-39.2
Good	68(70.1%)	60.8-79.4
Perceived intervention to become more proficient on POCUS practice		
Dedicated practice with Ultrasound machine	39(40.2 %)	30.9-50.5
Hands on Workshops with simulated scenario	28(28.8%)	19.6-40.2
Faculty mentorship for image acquisition and interpretation	16(16.5%)	9.3-23.7
Didactic lectures on POCUS applications	11(11.3%)	5.2-17.5
Access to online learning modules	3(3.1%)	0-7.2

Factors Contributing to Pediatric Residents' Knowledge of POCUS

A total of 49(51%) of residents below the median on the POCUS exam, while 47(49%) residents scored above the median. This suggests that the majority of residents achieved a score below the lower threshold. Year 1 residents had the highest proportion (77%) scoring below the threshold. Year 3 residents had the highest proportion (73%) scoring above the threshold. 17 residents (52%) from year 2 Scored above the median. Residents with previous POCUS training were significantly more likely to score above the median POCUS score with the AOR 58.46 (95% CI: 5.835-585.858), indicating a strong positive association between training and POCUS knowledge.

Residents in Year 2 and Year 3 were found to have a higher likelihood of having a good knowledge of POCUS compared to Year 1 residents. Residents who reported using POCUS once a month or once a week were significantly more likely to have a good knowledge of POCUS compared to those who never or rarely used it.

Table 3: Factors Contributing to the Knowledge of Pediatric residents toward Pediatric POCUS application

Characteristics	Score of POCUS Questions		COR95%CI	AOR 95%CI	P-Value	
	Good	poor				
Sex	Female	20(20.83%)	18(18.75%)	Reference	Reference	0.254
	Male	27(28.13%)	31(32.3%)	0.784(0.345-1.770)	0.447(0.112-1.783)	
Age	26-29	16(18.18%)	21(23.86%)	Reference	Reference	0.826
	30-33	21(23.86%)	15(17.04%)	1.837(0.726-4.650)	1.173(0.283-4.857)	
	34-37	5 (5.68%)	10(11.36%)	0.656(0.187-2.302)	0.512(0.069-3.826)	
Institution	St. Paulo's	20(23.95%)	22(19.79%)	Reference	Reference	0.153
	TASH	27(25%)	26(31.25%)	1.648(0.732-3.708)	3.305(0.642-17.023)	
Previous POCUS training	No	18(18.75%)	47(48.95%)	Reference	Reference	0.01
	Yes	29(30.20%)	2(2.08%)	58.46(5.835-585.858)	37.861(8.178-175.275)	
Year of Residency	Year 1	7(7.29%)	23(23.95%)	Reference	Reference	0.078
	Year 2	17 (17.7%)	16(16.66%)	3.092(1.043-9.171)	7.061(0.804-62.04)	
	Year 3	24(25%)	9 (9.37%)	8.762(2.798-27.434)	8.254(0.968-70.373)	

Self-reported frequency of POCUS practice	Never	Once a year	Once a month	Once a week	Reference	Reference		
	7(7.29%)	6(6.25%)	9 (9.37)	25(26.04%)	35(36.45%)	5.000(1.24-20.124)	3.634(0.671-19.785)	0.134
				3((3.12%)		9.000(2.307-35.118)	7.661(1.375-42.695)	0.020
						57.5(10.964-301.562)	14.386(1.138-181.927)	0.039

Discussion

The objective of this study is to describe pediatric residents' perception towards pediatric point of care in government teaching hospitals in Addis Ababa, Ethiopia; to identify factors associated with the knowledge of point of care ultrasound in two teaching government hospitals in Addis Ababa.

In this study findings, the majority of residents have a good understanding of the potential use of POCUS for pediatric patients. As well, they rated well on perception of POCUS as a valuable tool for improving diagnostic accuracy, on the potential use of POCUS for pediatric patients, and on the importance of integrating POCUS training into the pediatric residency program

A significant majority of residents (79.4%) reported poor comfort and confidence with POCUS practice and interpretation of POCUS images. Residents with any form of POCUS training were more likely to score above the median POCUS knowledge assessment with a statistical significance. But a significant majority (68%) of residents have not received any formal or informal training in POCUS during their residency program. Another statistically significant finding of the study was residents who reported using POCUS once a month or once a week were more likely to have a good knowledge of POCUS compared to those who never or rarely used it. Residents in Year 2 and Year 3 were also found to be marginally significant likelihood of having a good knowledge of POCUS compared to Year 1 residents.

Our study suggests that pediatric residents not only understand potential use of POCUS but also regard it as crucial for enhancing diagnostic accuracy. As well, They rated well on the importance of integrating POCUS training into the pediatric residency program. This is supported by a national survey indicating that 96% of pediatric trainees believe POCUS is an important skill in pediatrics, with 92% advocating for its inclusion in residency training programs [19]. Similar study found that 56% of pediatric residency program directors felt that all residents should be trained in POCUS, reflecting a widespread acknowledgment of its value in clinical practice.

While our findings emphasize a positive perception of POCUS, they also underscore the need for structured training programs. In line with this, a study conducted at the University of Catania reported that 100% of participants expressed the necessity for formal POCUS training within their residency curriculum [20]. This parallels our results showing that residents rated the integration of POCUS training as important for their education. Despite the favorable attitudes towards POCUS, barriers to effective training persist. Our study reflected that the most perceived barrier by pediatric residents to POCUS practice is a lack of training (72.2%), similar challenges were noted in other research, where 94% of pediatric residency program directors cited a lack of qualified instructors as a significant obstacle to implementing POCUS training [1] [19][20]

The finding from our study showed only thirty-two percent of pediatric residents had received previous training in POCUS, whether informal, such as bedside training, or formal. On a national need assessment survey reveal variability in how this training is implemented across different residency programs. For instance, some programs offer informal bedside education, only 37% provide any formal POCUS training [9]. Pediatric residents with any form of POCUS training were more likely to score above the median POCUS knowledge assessment which is statistically significant as reflected in our study. For instance, a study conducted at a large children's hospital found that after a two-week POCUS course, residents demonstrated significant improvements in self-reported confidence and knowledge across various POCUS competencies, including image acquisition and interpretation ($P < 0.01$) [17]. In addition, the majority of our participants reported poor comfort with point-of-care ultrasound (POCUS) practice and rated poor confidence in interpreting POCUS images. Thus, prior exposure to POCUS training can enhance both comfort and knowledge levels among pediatric residents.

Another statistically significant finding associated with POCUS knowledge is self-reported frequency of practice and using point-of-care ultrasound (POCUS) once a month or once a week were

significantly more likely to have good knowledge of POCUS compared to those who never or rarely used it. The relationship between the frequency of POCUS use and self-reported confidence is well-documented in other research. A study conducted on pediatric residents showed that those who regularly utilized POCUS in clinical settings felt significantly more confident in their skills compared to those with limited exposure. This aligns with our findings, as residents using POCUS weekly or monthly had markedly better knowledge scores than those who rarely or never used it [12] [20]

Conclusion and recommendation

Our results highlight the importance of prior training and regular use of point of care ultrasound in enhancing the knowledge of pediatric residents. These factors are crucial for the successful implementation of point of care ultrasound in pediatric training programs. While there is a clear recognition of the value of POCUS training, addressing barriers to effective implementation will be essential for maximizing its benefits in pediatric education. Developing comprehensive curricula that emphasize hands-on experience could significantly improve both resident competence and patient care outcomes in pediatric settings. We recommend that further studies be conducted to assess the impact of educational interventions on the pre- and post-knowledge of pediatric residents towards point of care ultrasound. Another area of interest for future research would be the factors hindering the integration of point-of-care ultrasound into pediatric curricula.

limitation and strength of the study

The strength of this study is that it is the first of its kind in Ethiopia to explore this specific aspect. Although selection bias could not be avoided as the method used is convenience sampling method, the study's objective was to get a better understanding through exploration of the barriers to POCUS practice in pediatric and child health department in the selected teaching hospitals. The other limitations of our study are the discrepancy between the actual sample size of the participants and the calculated sample size, which was due to a high rate of non-response, and the fact that the study was conducted in only two teaching hospitals. This may limit the generalizability of our findings to the broader population

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Annexes

Annexe 1: Information Sheet and Consent form

Name of Principal Investigator: Dr Robel Sintayehu

Introduction This information sheet and consent form is prepared by the investigator whose main aim is to study Pediatric Residents' perception of Point of care ultrasound practice and factors affecting knoweldge towards its practice in two teaching governmetal hospital.

Purpose: The purpose of the study is to identify the perception of Pediatric Residents' on point of care ultrasound which is currently unknown; also, the study aims to identify the factors that affect knoweldge toward its practice.

Procedures: you are kindly invited to take part in our research because we believe you can provide the necessary information for the research. Participation in the study is voluntary. If you are willing to participate in our project, you need to understand and sign the consent form. Then, you will be asked to give your response by the data collectors. All the responses given by the participants and the results obtained will be kept anonymous and confidential. No one outside the research team will have access to your responses.

Risk and/or Discomfort: There is no risk that this research will pose to its participants. **Benefits:** This study will have paramount importance. It will generate a hypothesis for further research done in this area. Further, the result will be communicated to the respective stakeholders, including the Federal Ministry of Health, for reviewing for the possibilities of integrating in to pediatric residency training program.

Incentives: There is no incentive associated with the study

Confidentiality and Anonymity: The information we will collect from this research project will be confidential. Information about you that will be collected from the survey will be stored in a file, which will not have your name on it, and it will not be revealed to anyone except the principal investigator.

Right to Refuse or Withdraw: you have the full right to refuse to participate in this research (you can choose not to respond to some or all of the questions). If you do not wish to participate, this will not affect you. You also have the full right to withdraw from this study without losing your rights as a site resident.

Persons to contact for further information: If you have any questions, you can contact the principal investigator at the following address:

Name: Dr. Robel Sintayehu

Tel: +251940314580

Email:robsent09@gmail.com

If you agree to participate in this study, I appreciate your truthfulness. And after having this consent form read to you, please put a sign below to show if you are willing to participate (No need to write your name). Are you willing to participate in this study? Yes [] No []

Annexe 2: Questionnaire

Instructions:

Please select the answer that best reflects your experience or perspective.

1.Sociodemographic character

1.1. Years of residency _____

1.2. Age _____

1.3. Sex _____

1.4 Current Role-----A. Resident B. Fellow C. Attending Physician D. Other (Please specify)

2. Comfort and Confidence:

1. How comfortable are you with the basic principles of POCUS physics?
 - a) Not comfortable at all
 - b) Somewhat comfortable
 - c) Comfortable
 - d) Very comfortable

2. How confident are you in your understanding of the following common pediatric POCUS applications? (Select all that apply)
 - a) Abdominal ultrasound (e.g., assessing for appendicitis)
 - b) Urinary tract ultrasound (e.g., evaluating for hydronephrosis)
 - c) Lung ultrasound (e.g., diagnosing pneumonia)
 - d) Head ultrasound (limited use in pediatrics, e.g., fontanel assessment)
 - e) Other (Please specify)

3. How would you rate your ability to interpret pediatric-specific ultrasound images?
 - a) Not able to interpret
 - b) Limited ability to interpret
 - c) Somewhat able to interpret
 - d) Able to interpret most images
 - e) Very comfortable interpreting images

4. How comfortable are you performing the following basic pediatric POCUS exams? (Select all that apply)
 - a) FAST exam (for evaluating trauma)
 - b) IVC
 - c) Cardiac
 - d) Lung
 - e) Other (Please specify)

5. Have you received any formal training in pediatric POCUS?

- No
- Yes, during residency/fellowship
- Yes, through a dedicated POCUS course

6. How often do you use point-of-care ultrasound?

- a) – Never 2 – Once a year 3 – Once a month 4 – Once a week 5 – Daily

7. What barriers exist for your use of point-of-care ultrasound (choose all that apply)?

- a. lack of training
- b. lack of equipment
- c. not useful for my patients
- d. other: _____

3. Perception Assessment

8. How well do you understand the potential uses of point-of-care ultrasound?

- 1 – Not at all 2 – Somewhat 3 – Neutral 4 – Very 5- Extremely

9. How strongly do you agree with the following statements about pediatric POCUS? (Select one answer for each statement)

- **Statement:** POCUS can improve diagnostic accuracy in pediatric patients.
 - Strongly disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly agree
- **Statement:** POCUS can help reduce radiation exposure in pediatric patients compared to traditional X-rays.
 - Strongly disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly agree
- **Statement:** POCUS can be a valuable tool for guiding procedures in pediatric care.
 - Strongly disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly agree

11. How can we best support you in becoming more proficient in pediatric POCUS?
(Select all that apply)

- More didactic lectures on POCUS applications
- Hands-on workshops with simulated scenarios
- Access to online learning modules
- Faculty mentorship for image acquisition and interpretation
- Dedicated practice time with ultrasound machines
- Other (Please specify)

Knowledge Assessment

1. What is the **BEST** probe to use for a pneumothorax evaluation?

- a) Linear probe
- b) Curvilinear probe
- c) Phased array probe
- d) Endocavitary probe

2. Which of the following measures provides an estimate of a patient's volume status?

- a) IVC diameter > 1 cm
- b) IVC collapse during respiration
- c) IVC size relative to aorta
- d) b and c
- e) all of the above

3. Which of the following is an indication for performing bedside echocardiogram?

- a) Undifferentiated shock or hypotension
- b) Assessment of volume status
- c) Evaluation for pericardial effusion
- d) b and c
- e) All of the above

4. Which substance is the **WORST** for the transmission of ultrasound?

- A) Liquid
- B) Air
- C) Soft tissue

5. Which of the following correctly labels the anatomic structures seen in the parasternal long axis view?

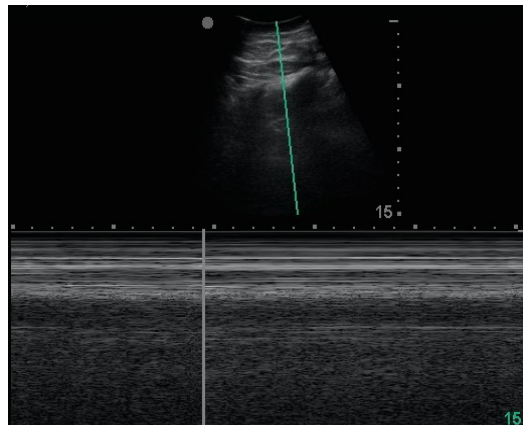


C = mitral valve, D = aortic valve

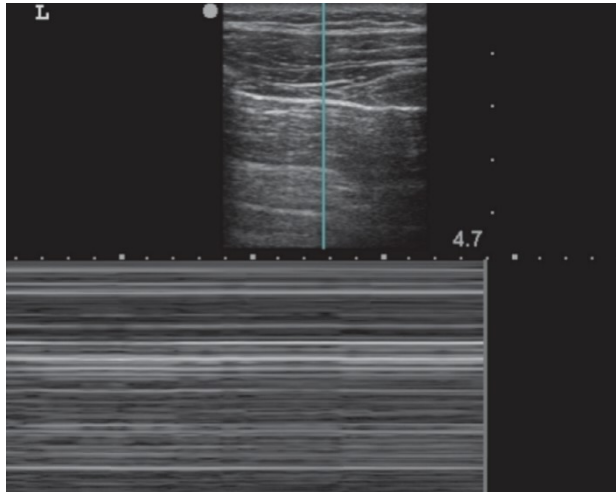
- A) A = right ventricle, B = left ventricle, C = aortic valve, D = left atrium
- B) A = left ventricle, B = right ventricle, C = pulmonary valve, D = right atrium
- C) A = pericardial effusion, B = left ventricle, C = aortic valve, D = left atrium
- D) A = right ventricle, B = left ventricle,

6. During the scan, you found evidence of pneumothorax. Which of the following images indicate the presence of pneumothorax?

a)



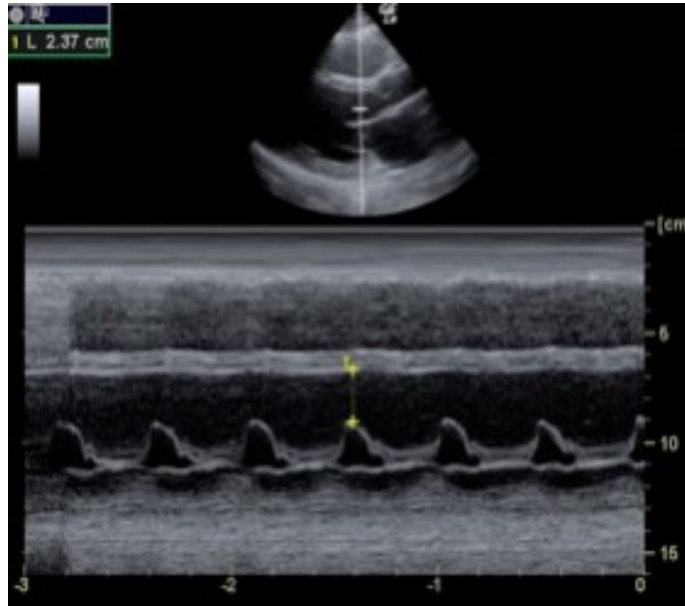
b)



c)



d)

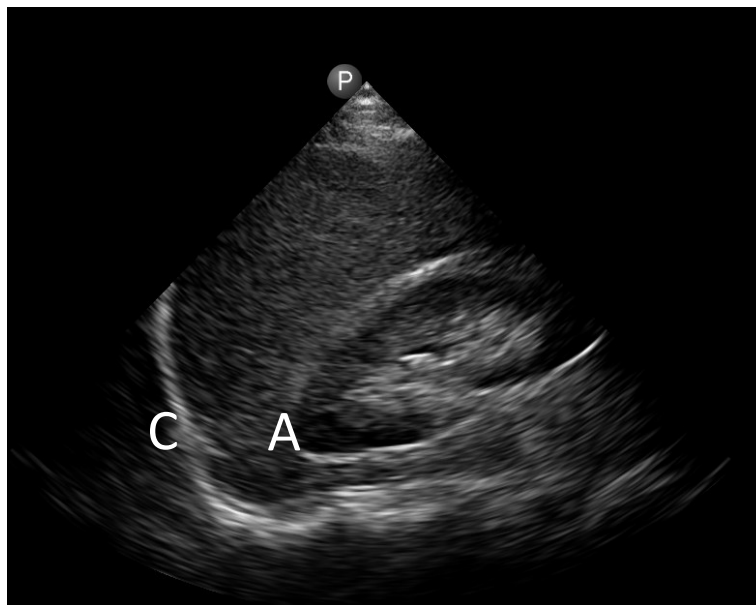


7. Which of the following can be seen on ultrasound in a patient with pneumothorax?

- a) B-lines
- b) A-lines
- c) “Barcode” sign
- d) “Seashore” sign

Please circle **TRUE** or **FALSE** for the questions below (Questions 9 and 10).

8. The following structures are labeled accurately. T or F



A=mirrorartifact,

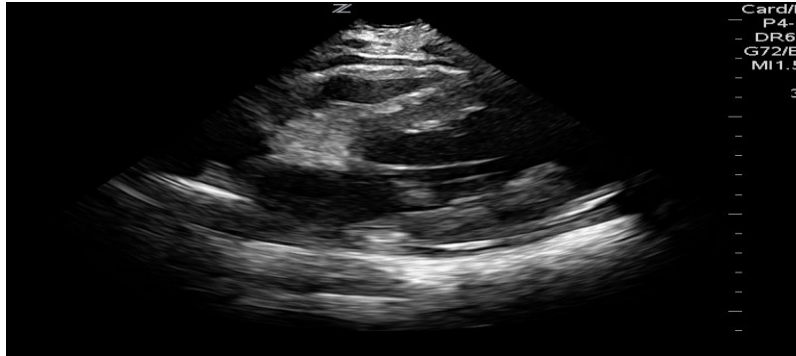
B=spineshadow,C=diaphragm, D= liver

9. The following image indicates the presence of pleural effusion. T or F



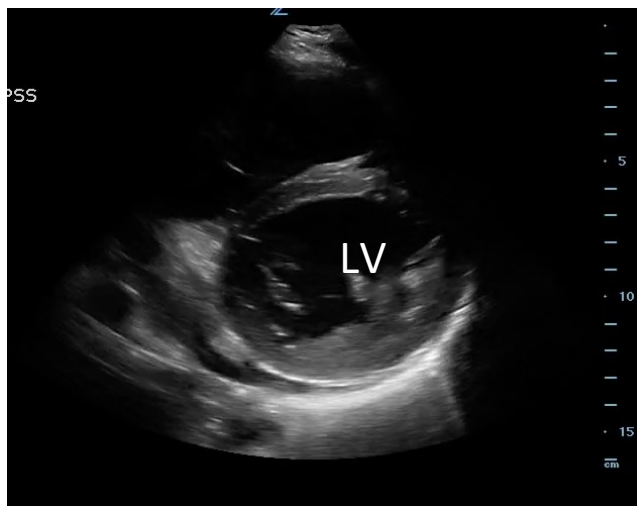
10. Which of the following is **NOT** a component of the echocardiogram exam?
- a) Apical 4-chamber
 - b) Parasternal short axis
 - c) Mid-axillary
 - d) Sub-costal
11. Which of the following measures provides an estimate of a patient's volume status?
- a) IVC diameter > 1 cm
 - b) IVC collapse during respiration
 - c) IVC size relative to aorta
 - d) b and c
 - e) all of the above
12. Which substance is the **WORST** for the transmission of ultrasound?
- D) Liquid
 - E) Air
 - F) Soft tissue

13. The following image indicates presence of pericardial effusion. T or F

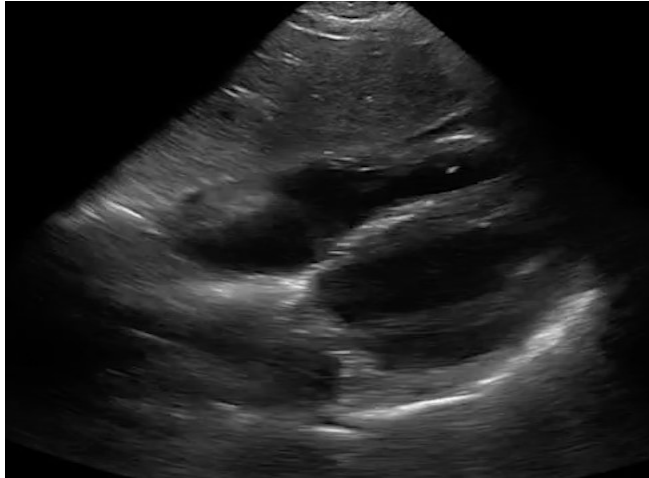


14. IVC collapsibility can be assessed in the transverse or longitudinal plane. T or F

15. The anatomic structures in the following image taken from the parasternal short axis are labeled correctly: T or F



16. The following US image is obtained from which cardiac view?



A. Parasternal long axis

B. Parasternal short axis

C. Apical four chamber

D. Subcostal

17. Which of the following option(s) are normal lung findings?

a) Lung point

b) Absence of lung sliding

c) Presence of lung sliding

d) B-lines

18. The following options are true about A-lines **EXCEPT**

a) Horizontal, hyperechogenic lines representing reverberations of the pleural line

b) It is a normal finding

- c) It indicates the presence of pneumothorax
- d) It is an artifact

19. While scanning the patient for the evidence of pneumothorax, which is the most helpful anatomic landmark that can be used to find the pleura?

- A) Rib shadow
- B) Lung tissue
- C) Heart
- D) Overlying soft tissues

20. The following ultrasound finding shows ?

- A) A-lines
- B) Bar code
- C) B-lines
- D) Artifact

