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St. Paul's Hospital Millennium Medical College

**Comparison of chest ultrasound to chest X-ray in
the diagnosis of pneumonia in the pediatric
emergency department of St Paul's Millennium
Medical College**

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Addis Ababa, Ethiopia

February 2026



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Comparison of chest ultrasound to chest X-ray in the diagnosis of pneumonia in the pediatric emergency department of St Paul's Millennium Medical College

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Abbreviations and Acronym

CT- Computed Tomography

CXR – Chest X-ray

ED - Emergency Department

EOPD - Emergency outpatient department

FoAFEM - friends of African emergency medicine

LUS - Lung Ultrasound

LMIC - low and Middle Income Countries

ICU – Intensive care unit

NPV - Negative Predictive Value

OPD – Outpatient Department

PPV - positive predictive Value

POCUS - Point of care ultrasound

SPHMMC - St Paul's Hospital Millennium Medical College

WHO – World Health Organization

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Abstract

Background In Ethiopia, pneumonia causes over 40,000 deaths annually in children under five years old. Point-of-care lung ultrasound (LUS) is a promising radiation-free bedside tool for diagnosing pneumonia, but evidence on brief training in low-resource settings is limited(1, 2). This study evaluated the feasibility of a 2-day 6-zone LUS training for pediatric residents and compared their pneumonia detection performance to expert chest X-ray interpretations.

Objective - To compare the performance of LUS performed by pediatric residents in the diagnosis of pneumonia to Chest X-ray in patients evaluated in the pediatric ER of SPHMMC

Methods A prospective study at SPHMMC Pediatric Emergency Department (Addis Ababa, Ethiopia) trained 7 pediatric residents in 2 days on 6-zone lung ultrasound (LUS) for pneumonia. Seventy one children (age >2 months to <14 years) with suspected pneumonia underwent resident-performed LUS as well as Chest X ray . Results were compared and agreement was evaluated using concordance, sensitivity/specificity, kappa for key LUS findings.

Results In this prospective study 71 children (>2 months to <14 years; mean age 37 ± 42 months) with suspected pneumonia received LUS and Chest X ray. Chest Xray, read by two radiologists, confirmed pneumonia in 69% of cases (radiological confirmed). Residents reported image acquisition difficulty in 63% of cases, with mean scan time of 17.8 minutes. Resident-performed LUS showed fair agreement with Chest Xray (69% concordance, $\kappa=0.38$, $p<0.001$), sensitivity 96%, specificity 38%, PPV 77%, NPV 80%, and overall accuracy 77%.

Conclusion While the overall accuracy of LUS performed by pediatric residents who had brief training was only moderate, the high sensitivity and moderate NPV strongly support LUS for ruling out pneumonia and guiding initial management. Resident inexperience likely reduced LUS specificity and agreement with Chest x ray compared to expert studies. However, These findings suggest that intensified, large-scale training could establish LUS as a reliable diagnostic alternative in resource-limited settings like Ethiopia, where radiology access is limited.

1.1 Background and statement of the problem

Childhood pneumonia is still a significant clinical and public health problem. Pneumonia is the leading cause of morbidity and mortality in children under-five worldwide, accounting for 16 % of the deaths in this age group. In 2016 alone, it was estimated that 900,000 under-five children died of pneumonia globally (3, 4). Africa bears 50% of the burden of global under-five mortality from pneumonia.(2, 5)

Ethiopia is one of the countries with the most significant burden of pneumonia. Ethiopia ranks 6th among countries in morbidity and mortality from pneumonia (2), one of five countries accounting for nearly half of under-five pneumonia deaths (4). Annually, approximately 40,000 Ethiopian children under five die from pneumonia (6).

Since many disease conditions mimic pneumonia, such as bronchiolitis and asthma, early diagnosis and treatment of pneumonia are essential in decreasing morbidity and mortality. The diagnosis of pneumonia is typically clinical but can be aided by imaging. Despite low specificity, a chest X-ray is still the gold standard in the diagnosis of pneumonia, as a direct pathological investigation is invasive and not practical in most patients. .(7)

A significant number of clinically diagnosed pneumonia patients have normal chest x-ray findings(8). According to various meta-analyses, chest X-rays have a sensitivity of 71% to 81% in the diagnosis of childhood pneumonia and a specificity of 91-98%(8) Although chest X-ray remains the standard primary tool for diagnosis, lung ultrasound is increasingly favored over it owing to better sensitivity and no ionizing radiation risk(9)

Lung ultrasound (LUS) is increasingly considered a valuable tool for diagnosing pediatric pneumonia, particularly in low-resource settings like Ethiopia. The medical literature supports its use due to several advantages over traditional Chest X ray . (7, 10)

LUS has demonstrated high sensitivity and specificity for diagnosing pediatric pneumonia. A systematic review and meta-analysis reported a sensitivity of 95% and specificity of 96% for LUS in diagnosing pneumonia in children, suggesting it is highly accurate (11). Another meta-analysis found LUS to have a sensitivity of 94% and a specificity of 85.5%. LUS has advantages such as

being radiation-free, cost-effective, and easy to perform, making it suitable for resource-limited settings (7)

In low-resource settings, lung ultrasound (LUS), typically performed by radiologists or experienced operators, offers a practical alternative to Chest X ray for diagnosing pediatric pneumonia. It is portable, radiation-free, cost-effective, and repeatable, with particular benefits where Chest X ray access is limited (e.g., for ill patients needing oxygen, as portable CXR and oxygen are often unavailable). Meta-analyses show LUS achieves higher sensitivity (~94-95.5%) than Chest X ray (~86-89%), with similar or comparable specificity (~85-95% vs. ~90-98%), high inter-rater agreement, and advantages in detecting small consolidations or effusions.(8, 11)

Despite this established utility, most studies in our country compare LUS by radiologists against Chest X ray, with limited data on point-of-care ultrasound (POCUS) performed by non-radiologists such as pediatric residents or trainees. Evidence from other settings suggests trainee-performed POCUS can be feasible and accurate after training, yet local data remain scarce in resource-constrained environments. Currently, Chest X ray remains routine while LUS is reserved for complications. This study assesses the feasibility and accuracy of pediatric residents performing lung ultrasound for diagnosing pediatric pneumonia.

1.2 Rationale of the study

Patients with pneumonia commonly present to pediatric emergency departments. Early accurate diagnosis is essential to improve outcomes and reduce resource burden.

Yet in Ethiopia, LUS is rarely used in routine pediatric emergency care, particularly by resident physicians—the frontline providers in tertiary centers like St. Paul’s Millennium Medical College. No local data exist on whether short training (e.g., 2 days) enables pediatric residents with limited ultrasound experience to reliably perform and interpret a standardized LUS protocol for suspected pneumonia, or how their findings compare to expert Chest X ray readings.

This feasibility study trains pediatric residents in a 2-day program and assesses their LUS performance against independent expert Chest X ray interpretations in children with suspected pneumonia. Demonstrating acceptable feasibility and preliminary accuracy in this high-burden context would provide critical proof-of-concept to support integrating LUS training into residency curricula, decreasing Chest X ray dependence, reducing radiation and delays, and enabling scaleable training nationwide to improve timely pneumonia diagnosis and management across Ethiopia’s resource-constrained health system.

2. Literature review

Childhood pneumonia remains a significant public health issue in Ethiopia, particularly among children under five years of age. The prevalence of pneumonia in this age group varies across different regions of Ethiopia. A study conducted in peri-urban areas of North-Eastern Ethiopia reported a prevalence of 17.1% among children under five(12) . Another study in Gondar City found a prevalence of 12%(12).

Pneumonia is the leading cause of evaluations in pediatric Emergency units. A cross-sectional retrospective study done at Yekatit 12 Hospital, one of Ethiopia's largest hospitals, demonstrated that pneumonia's burden in hospital admissions from 2017 to 2021 was 25.99 % of admissions in children 1 month to 5 years (13) . Another cross-sectional prospective study done at Gamo zone (southern Ethiopia) in 2021 showed the prevalence of pneumonia at Arbaminch Referral Hospital to be 30% (14).

A meta-analysis by Alamneh and his colleague in Ethiopia reviewed 12 articles on the prevalence of pneumonia in emergency departments. It showed Ethiopia's pooled magnitude of pneumonia in those under five to be 20.68% (I² = 97.9% p ≤ 0.001). (22). The study included 10 institution-based and 2 community-based studies.(2)

A meta-analysis done in 2015 by Maria and her colleagues showed LUS to have a sensitivity of 96% (95% CI 94-97%), specificity of 93% (95 % CI 90-96%), and positive and negative likelihood ratios were 15.3(95% CI 6.6 -35.3) and 0.06 (95% CI 0.03-0.11) respectively. They reported that 5 of the studies were done with highly experienced radiologists. The stated limitation of the study was the small number of patients in each study. The study supports the current evidence of LUS as an imaging alternative for diagnosing pediatric pneumonia (15).

Another systematic review done on twenty-two studies with a total of 2470 patients found a pooled sensitivity, specificity, and DOR for lung POCUS of 0.95 (95% CI: 0.94 to 0.96), 0.90 (95% CI: 0.87 to 0.92), and 137.49 (95% CI: 60.21 to 313.98), respectively. The pooled sensitivity, specificity, and DOR for pediatric pneumonia diagnosed by Chest X ray was 0.91 (95% CI: 0.90 to 0.93), 1.00 (95% CI: 0.99 to 1.00), and 369.66 (95% CI: 137.14 to 996.47), respectively. (8)

A prospective comparative study done at Cairo University Children's Hospital , comparing the performance of LUS in diagnosing pneumonia in children included 50 children admitted with a diagnosis of pneumonia. A result of Radiological findings demonstrated lung consolidation in 48 patients (96%) by Chest X ray, 49 (98%) patients by LUS, and all 50 patients (100%) by CT chest. Pleural effusion was found in 8 (16%) patients by CT chest, all detected by LUS (100%). Only five were correctly detected by Chest X ray (specificity 62.5%) in addition to 3 false positive cases, demonstrating LUS's superiority to Chest X ray for certain pneumonia-related complications (16)

Another cross-sectional observational study compared the performance of LUS with chest CT done in Nepal on 90 children aged 45 days to 14 years diagnosed with pneumonia. LUS demonstrated 100% specificity and 82.2 % sensitivity in diagnosing pediatric pneumonia, an accuracy of 84.9%, a positive predictive value of 100%, and a negative predictive value of 50% with chest CT as gold standard. The sensitivity and specificity of LUS was 100% for detecting complications such as para-pneumonic effusion, empyema, and abscess formation.(17)

A study done in Zambia on 50 patients compared radiologist-performed LUS to Chest X ray, demonstrating sensitivity of LUS for pneumonia detection at 61% (95% CI: 0.52-0.84). The specificity, PPV, and NPV were 77% (95% CI: 0.56-0.91). 70% (95% CI: 0.62-0.94) and 69% (95% CI: 0.56-0.79) respectively. On this study the sensitivity of LUS was lower than in other studies even though it was performed by radiologists (18)

A South African cohort study by Sunder et al evaluated the performance of LUS in the diagnosis of under-five pneumonia in non-radiologist professionals, demonstrating equal detection of consolidation with lung ultrasound compared to Chest x-ray and better inter observer agreement (Kappa=0.72, 95% CI: 0.58-0.86 vs. 0.32, 95% CI: 0.13-0.51).) compared to the chest x-ray (Kappa=0.61, 95% CI: 0.50-0.75 (19).

A study done from Mozambique and Pakistan on 230 pneumonia patients under 18 years old showed LUS demonstrated better interrater reliability with kappa estimates of two LUS interpreters above 0.8 compared to-0.036- 0.619) for Chest X ray (20).

A cross-sectional study done in Ethiopia at Tikur Ambesa Hospital on 79 patients under 14 years old with radiologically diagnosed pneumonia who underwent LUS by two consultants radiologists detected consolidations in 41.7% of cases, compared to 43.5% for Chest X ray, demonstrating a sensitivity of 97.8%, specificity of 95.2%, positive predictive value (PPV) of 93.6%, and negative predictive value (NPV) of 98.4%. LUS showed higher accuracy for interstitial lung patterns (sensitivity 93.6%, specificity 97.4%). The agreement between LUS and Chest X ray was excellent, with Cohen's Kappa values of 0.908 for consolidation and 0.863 for interstitial pneumonia. LUS also identified more pleural effusions (11.1%) compared to Chest X ray (6.5%) (21).

Another study conducted in Ethiopia at Tikur Anbesa Hospital involving 72 children under five with community-acquired pneumonia was performed by a senior radiology resident. This study compared chest ultrasound with Chest X-ray and demonstrated a sensitivity of 95% (95% CI, 89-100), specificity of 86% (95% CI, 80-92), positive predictive value of 91% (95% CI, 85-97), and negative predictive value of 92% (95% CI, 86-98) for chest ultrasound compared to chest X-ray.(22)

In most of the above studies, radiologists or radiology residents did most of the LUS. As a resource-limited country with few radiologists, knowing the test characteristics of POCUS performed by non radiologist physicians and trainees is crucial. A study conducted by Bedetti shows that non-expert technicians were able to detect comet lines after two 15-minute observations, demonstrating a significant tight correlation ($r = -0.958$, $p < 0.001$) between two observations in the same patient across both expert and beginner groups. (23)

A prospective study by Zhan and his colleague compared CXR in children aged 0-15 years to POCUS performed by pediatric residents with minimal practical ultrasound experience. The prevalence of consolidations by chest radiography was 50%. Lung ultrasound had a sensitivity of 40% (95% confidence interval [CI], 30%-51%), specificity of 91% (95% CI, 83%-96%), positive likelihood ratio of 4.71 (95% CI, 2.21-10.04), and negative likelihood ratio of 0.65 (95% CI, 0.54-0.79), suggesting benefit even in the hands of inexperienced users(24)

A prospective comparative study done in Pakistan on 262 pediatric patients with pneumonia showed sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, and frequency of LUS vs. Chest X ray in diagnosing pneumonia of 95.28%, 87.5%, 99.59%, 36.84%, 95.04%, and 96.95% respectively. The study proposes that lung ultrasound is the best imaging modality in children with pneumonia, with both good sensitivity and specificity compared with Chest Xray (25)

A prospective cross-sectional study in Patan Hospital, Nepal, examined the sensitivity and specificity of LUS in the diagnosis of pneumonia in children under five compared to Chest X ray. Ultrasound was performed by 22 different treating clinicians, including medical officers, residents, emergency medicine (EM) fellows, and EM faculty. Eighty-four patients (23%) were diagnosed with pneumonia by Chest X-ray. Sensitivity, specificity, positive and negative likelihood ratios for the clinician's LUS interpretation were 89.3% (95% CI 81–95), 86.1% (95%CI 82–90), 6.4, and 0.12, respectively. LUS demonstrated good diagnostic accuracy for pneumonia with an area under the curve of 0.88 (95% CI 0.83–0.92). Inter-rater agreement between clinician and expert ultrasound interpretation was excellent ($k = 0.85$). However, in this study, the professionals were not blinded by the Chest x-ray results of the patient.(17)

3. Objective

3.1 General objectives

This study aims to evaluate the accuracy of LUS performed by pediatric residents for diagnosing pneumonia in children after a standardized brief training.

3.2 Specific objectives

- Primary: To determine the test characteristics (sensitivity, specificity, positive predictive value, and negative predictive value) of resident-performed LUS for the diagnosis of pneumonia in the PED of SPHMMC using chest x ray as the gold standard.
- Secondary: To gather residents feedback on the brief training in LUS, including perception ease clarity and overall usefulness for pediatric residents with limited prior ultrasound experience.

Research Question

What is the diagnostic accuracy of lung ultrasound performed by briefly-trained pediatric residents compared to Chest X-ray in detecting pneumonia among children presenting to SPHMMC pediatric emergency department

PICO Format

- **Population:** age 2 month to 14 years admitted to SPHMMC with the diagnosis of pneumonia based on WHO pneumonia definition
- **Index test:** Lung ultrasound done by pediatric residents.
- **Comparative:** Chest X-ray read by two independent radiologists
- **Outcome:** Diagnostic accuracy metrics of LUS for detecting pneumonia.

4. Materials and Methods

4.1 Study setting

The study was conducted in the pediatric emergency unit of St. Paul's Hospital Millennium Medical College (SPHMMC), a tertiary referral center in Addis Ababa, Ethiopia. St. Paul's Hospital Millennium Medical College was originally established by the late Emperor Haile Selassie in 1968 and began accepting medical students in 2007. It received its current name by decree of the Council of Ministers in 2010. It is one of the largest government hospitals in Ethiopia, with a capacity of 700 beds. The hospital saw an average of 1200 emergency and outpatient patients daily. The pediatric wings of the hospital had 133 patient beds, of which 29 were in the pediatric emergency rooms. Four triage rooms (yellow, green, red, and orange) were used for patient triaging, and there were two isolation rooms. The pediatric emergency department saw an average of approximately 500 patients per month who were under 15 years of age.

4.2 Study period

The study was conducted from May 2025 to February 2026.

4.3 Study design

A hospital-based prospective cross-sectional study design was used.

4.4 Target population and study population

The target population consisted of pediatric patients presenting to the St. Paul's Hospital Millennium Medical College pediatric emergency department with respiratory concerns. The study population included all pediatric patients aged 2 months to 14 years who were admitted to the SPHMMC pediatric emergency department, met the WHO clinical criteria for pneumonia, and underwent a Chest X-ray.

4.5 Eligibility criteria

Inclusion criteria Patients aged 2 months to 14 years who presented to the pediatric emergency department with clinical suspicion of pneumonia based on the WHO clinical criteria and underwent a Chest X-ray.(26)

Exclusion criteria

- Previous diagnosis of chronic lung conditions such as bronchiectasis, tuberculosis, lung fibrosis, cystic fibrosis, or interstitial lung disease, or prior lung surgery.
- Need for immediate intubation and positive-pressure ventilation on a mechanical ventilator.
- Absence of a caregiver.
- Chest X-ray performed more than 24 hours prior to enrollment.

4.6 Sampling technique and sample size determination

4.6.1 Sampling method Consecutive sampling was employed until the desired sample size was reached. Patient were taken only when the trained pediatric resident available ,on working days and day time.

4.6.2 Sample size The sample size was determined using the single population formula for sensitivity and specificity studies, based on the following assumptions:

- Expected proportion (p) = 25% (based on previous data on the prevalence of pneumonia in hospitals)
- Margin of error (w) = 5% (0.05)
- Confidence level = 95% ($Z = 1.96$)

The sensitivity of lung ultrasound in detecting pneumonia was assumed to be 95% and specificity 90%, based on prior studies. An estimated average of 312 patients with pneumonia were admitted to the pediatric emergency department during the study period. Calculations were performed as follows:

For sensitivity: $n = (1.96)^2 \times 0.95 \times (1 - 0.95) / (0.05)^2 \approx 292$

For specificity: $n = (1.96)^2 \times 0.90 \times (1 - 0.90) / (0.05)^2 \approx 94$

After adjustment using a reduction formula accounting for prevalence and feasibility, the final sample size was set at 150 participants.

Consecutive sampling was employed in the pediatric emergency department until the desired number was reached or the study period ended. However, due to lower-than-anticipated patient admissions with suspected pneumonia during the study time frame, logistical constraints, and eligibility restrictions in this real-world clinical setting, only 71 patients were enrolled

4.7 Study variables

Independent variables: Age, sex, comorbidities

Dependent variables: Lung ultrasound findings, chest X-ray findings, diagnostic accuracy of physicians using point-of-care ultrasound for pneumonia

4.8 Data collection methods

Each patient who met the inclusion criteria and whose caregiver provided consent underwent LUS performed by a trained pediatric resident. The treating physician independently decided whether a chest X-ray was indicated. Lung ultrasound was performed and interpreted by a LUS -trained pediatric resident, and the procedure was completed within 24 hours of the chest X-ray (either investigation could be performed first).

Prior to the study, nine pediatric residents who expressed interest and had appropriate schedules received a 2 day training consisting of lectures by a pediatric radiologist and hands-on teaching on LUS. They took a pre and post-training test and then received more hands-on training by an emergency and critical care specialist as well as 1 week of supervised scanning which only seven of them taken.

Chest X-rays were obtained only when ordered by the treating physician for clinical purposes, not for research.

Each chest X-ray was independently interpreted by two radiologists. In cases where the two radiologists disagreed, both reviewed the images together again. A final diagnosis was made only after they reached complete agreement. The agreed-upon chest X-ray interpretation was taken as gold standard for diagnosing pneumonia.

The Butterfly iQ™ ultrasound device was used for POCUS, with a frequency range of 1–10 MHz. The thorax was divided into six regions (2 anterior, 2 lateral, 2 posterior) to cover the entire lung surface. Each region was scanned in both longitudinal and transverse planes. Anterior and lateral areas were examined with the patient supine, while posterior regions were examined with the patient prone or sitting. The duration of each ultrasound examination was recorded. All of the ultrasounds performed by residents were recorded by on the butterfly cloud application for future reference and expert opinion on image quality and interpretation.

Findings were immediately reported on a standardized diagram dividing each lung into the six regions. The resident performing POCUS was blinded to the chest X-ray results before reporting. Ultrasound findings were later compared with chest X-ray interpretations in terms of laterality (right/left) and location (superior/inferior, medial/lateral, anterior/posterior).

A structured ultrasound form was completed exclusively by a trained pediatric resident who performed and interpreted the point-of-care ultrasound (POCUS) examination. This resident was not involved in the patient's clinical care and had no access to the patient's clinical history, physical examination findings, laboratory results, or other diagnostic information. All clinical data were recorded separately by the treating resident or attending physician

4.9 Operational definitions

Pneumonia was defined according to WHO criteria (clinical diagnosis of cough or difficulty breathing with age-adjusted tachypnea: ≥ 50 breaths/min for 2–11 months, ≥ 40 breaths/min for 1–5 years, > 20 breaths/min for > 5 years) plus the presence of focal consolidation on chest X-ray as determined by a radiologist(26).

Pneumonia was radiologically diagnosed on chest X-ray when a radiologist identified one or more of the following findings:

- Consolidation as focal or lobar alveolar opacity
- air bronchogram – air filled bronchi visible within area of consolidation
- silhouette sign (loss of normal interface between lung and adjacent structures such as the heart, diaphragm, or mediastinum due to adjacent opacity),
- multi-focal infiltrates -patchy or multiple areas of increased opacity, or
- pleural effusion (blunting of the costophrenic angles or layering fluid as an associated finding)

Definite pneumonia on lung point-of-care ultrasound (POCUS) Pneumonia was definitively diagnosed on lung ultrasound when **at least one** of the following findings was seen

- **Subpleural consolidation** accompanied by **either**:
 - shred sign (irregular, ragged deep border of the consolidation, resembling shredded tissue), **or**
 - dynamic air bronchogram (hyperechoic branching air artifacts moving with respiration within the consolidation);
- **Dynamic air bronchogram** (visible as mobile, hyperechoic linear or branching structures within consolidated lung tissue, distinguishing it from static air bronchograms seen in atelectasis);
- **Hepatization** (complete loss of normal lung aeration with the consolidated lung appearing hypoechoic and liver-like in echotexture, often with air bronchograms);

- **Pleural effusion** (anechoic or hypoechoic fluid collection in the pleural space, typically associated with consolidation or other signs of infection, as a supportive finding in the context of pneumonia).
- **Focal or multiple B-lines** (three or more vertical hyperechoic lines extending from the pleural line to the bottom of the screen in one or more intercostal spaces, indicating interstitial syndrome, when present in combination with consolidation or other signs(27)

Comorbidity: Any known illness other than pneumonia that was likely to affect the clinical presentation or outcome.

4.10 Data quality assurance

Lung ultrasound and chest X-ray findings were documented separately. Study forms were checked completeness before data entry. Electronic copies of chest X-ray results were saved on a dedicated desktop in the emergency department for later review.

4.11 Data analysis and interpretation

Sonographic findings were compared with official chest X-ray readings interpreted by two independent radiologist, LUS interpretations were those made by the performing resident. Sensitivity, specificity, positive predictive value, negative predictive value, and likelihood ratios were calculated for lung ultrasound compared with chest X-ray (reference standard), with 95% confidence intervals. Data were analyzed using SPSS version 26.

4.12 Ethical considerations

Ethical approval was obtained from the Institutional Review Board of the Department of Pediatrics and Child Health at St. Paul's Hospital Millennium Medical College. Informed consent was obtained from each patient's caregiver. Patients/caregivers who declined participation were excluded. The decision to obtain a chest X-ray remained entirely with the treating physician and was not influenced by the study

5.Result

Study Population and Demographics

A total of 71 children were included in the study. As shown in table 1. The majority were between 2 and 59 months of age with a Mean age of 3 years and 1 month. There were more males than females, with 59.2% (42/71) being male and 40.8% (29/71) female. Participants were predominantly from Addis Ababa, representing 42.3% (30/71) of the sample.

Table -1 Demographic Characteristics of Study Participants

Demographic Data			
		Frequency	Percent
Age	2-12 month	27	38.0
	13-59 month	28	39.4
	60-120 month	10	14.1
	121-216 month	6	8.5
Sex	Male	42	59.2
	Female	29	40.8

Clinical profile of study participants

Among the 71 patients included in the study as seen in Table 2, cough was the most frequently reported presenting symptom, occurring in 74.6% (53/71) of cases. Fast breathing was noted in 46.5% (33/71) of the participants, while fever was present in 21.1% (15/71).

Table 2 Presenting Symptoms of Study Participants

Presenting symptoms	Frequency	Percent
Cough	53	74.6
Fast Breathing	33	46.5
Fever	15	21.1
Shortness of breath	9	12.7
Others	2	2.28

Regarding underlying comorbidity as seen in the table 3 , more than half of the participants (56.3%, 40/71) had no documented comorbidity. Among those with comorbidity, cardiac disease was the most frequently reported, occurring in 12.7% (9/71) of the children. Neurological conditions were present in 8.5% (6/71), while malnutrition and endocrine disorders were reported in 4.2% (3/71) and 5.6% (4/71), respectively.

Regarding respiratory support at presentation, the majority of patients (83.1%, 59/71) received intra-nasal oxygen therapy as seen in Table 4. Continuous Positive Airway Pressure (CPAP) was used in 14.1% (10/71) of the children. Only 2.8% (2/71) were not on any form of respiratory support at the time of assessment.

Table 3: Respiratory Support at time of data collection

Respiratory support	Frequency	Percent
CPAP	10	14.1
Intra Nasal	59	83.1
No support	2	2.8
Total	71	100.0

Regarding clinical examination sub costal or intercostal retractions were the most frequently observed sign, present in 69.0% (49/71) of the patients. Nasal flaring was noted in 39.4% (28/71), while grunting was documented in 32.4% (23/71). Chest in drawing was reported in 18.3% (13/71), and head nodding, a sign of severe respiratory distress, was observed in 4.2% (3/71). Overall, the majority of children exhibited clinical features consistent with increased work of breathing, with retractions being the predominant physical finding.

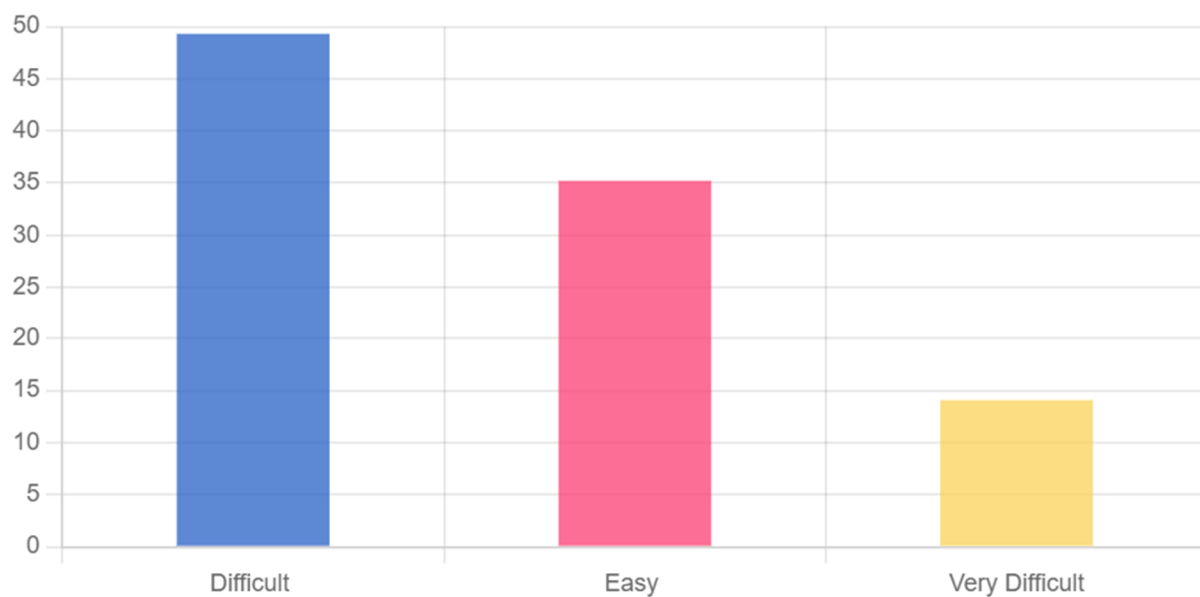
Coarse crepitations were the most frequently observed abnormal finding, present in 46.5% (33/71) of the patients. Fine crepitations were noted in 21.1% (15/71), while decreased air entry and normal breath sounds were documented in 12.7% (9/71) and 18.3% (13/71), respectively. Absent air entry and bronchial breath sounds (BBS) were each observed in 2.8% (2/71), and wheezing was identified in 4.2% (3/71).

Performance of Lung Ultrasound by Residents

The acquisition of lung ultrasound images by the residents was perceived as follows: out of the 71 performed LUS the majority, 35 (49.3%), found to be difficult; 25 (35.21%) rated it as easy; and 10 (14.08%) considered it very difficult.

The duration required to perform lung ultrasound was reported in 70 out of 71 encounters . The average time taken was 17.77 minutes, with a median of 15 minutes and a mode of 15 minutes. The standard deviation was 5.56 minutes, indicating moderate variability in procedure time among the participants.

Figure 1 - perceived difficulty of image acquisition

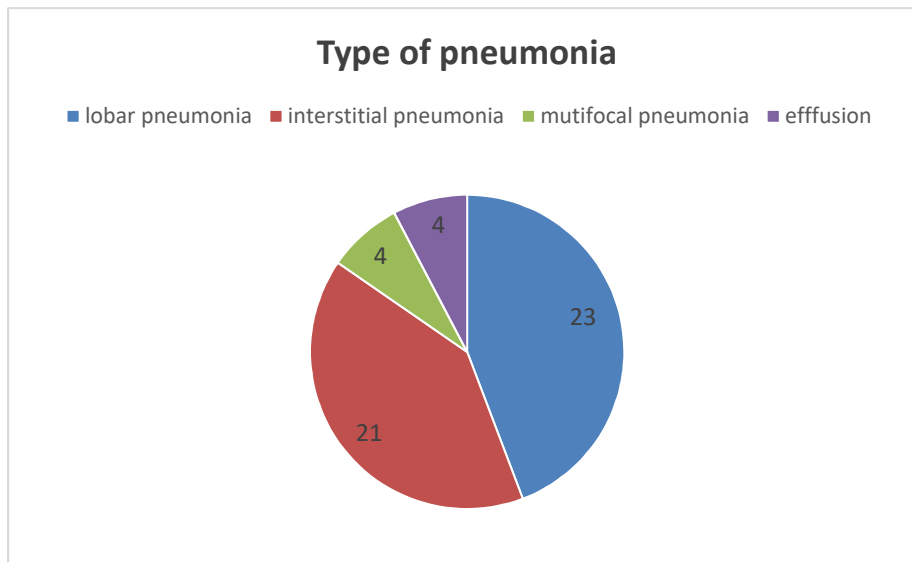


Diagnostic Performance of Lung Ultrasound Compared to Chest X-ray

A total of 71 patients were evaluated using both chest X-ray and lung ultrasound. Based on chest X-ray findings (gold standard), 49 patients had pneumonia(69% pneumonia prevalence) and 22 did not.

Among the patients with confirmed pneumonia on chest X- ray, lobar consolidation was the most frequent pattern with 23 out of 49 cases (49.6%), followed by an interstitial pattern in 21 cases (42.8%), and finally multi-focal pneumonia and pleural effusion each seen in 4 patients (8.1 %).

Figure 2 - chest x ray type of pneumonia



Lung Ultrasound correctly identified 47 of the 49 pneumonia cases and missed 2 cases. Among patients without pneumonia on X-ray, ultrasound incorrectly identified 14 as having pneumonia and correctly classified 8 as negative.

A total of 71 patients were included in this study. Using chest X-ray as the reference standard, lung ultrasound identified pneumonia with 96.0% sensitivity and 38.1% specificity (PPV 78.7%, NPV 80.0%, accuracy 78.9%, LR+ 1.55, LR– 0.11) in a cohort with 69% pneumonia prevalence. See table no 5.

As shown in Table 6, a Cohen's kappa test was performed to assess agreement between lung ultrasound and chest X-ray in detecting pneumonia. There was **fair agreement** between the two imaging modalities, $\kappa = 0.38$, $p < 0.001$, based on 71 evaluated cases.

Among the 71 children, chest X-ray (CXR) identified pneumonia as right-sided (n=29), left-sided (n=11), bilateral (n=9), or absent (n=22). Lung ultrasound (LUS) showed exact side agreement (right, left, bilateral, or none) with CXR in only 29/71 cases (40.8%). Among the 22 CXR-negative

cases, LUS was falsely positive in 14 (63.6%)—right: 4, left: 2, bilateral: 8—while 8 (36.4%) were correctly negative, indicating frequent false-positive findings on LUS, particularly bilateral calls.

Table 4 Presence of Pneumonia on x-ray * Presence of Pneumonia on US Cross-tabulation

Presence of Pneumonia on x-ray * Presence of Pneumonia on US Cross-tabulation					
			Presence of Pneumonia on US		Total
			No	Yes	
Presence of Pneumonia on x-ray	No	Count	8	14	22
		Expected Count	3.1	18.9	22.0
		% within Presence of Pneumonia on x-ray	36.4%	63.6%	100.0%
		% within Presence of Pneumonia on US	80.0%	23.0%	31.0%
	Yes	Count	2	47	49
		Expected Count	6.9	42.1	49.0
		% within Presence of Pneumonia on x-ray	4.1%	95.9%	100.0%
		% within Presence of Pneumonia on US	20.0%	77.0%	69.0%
Total		Count	10	61	71
		Expected Count	10.0	61.0	71.0
		% within Presence of Pneumonia on x-ray	14.1%	85.9%	100.0%
		% within Presence of Pneumonia on US	100.0%	100.0%	100.0%

Table 5 Diagnostic Performance Summary

Metric	Value	Metric	Value
Reference Standard	Chest X-ray	Reference Standard	Chest X-ray
Sensitivity	96.0%	True Positives (TP)	47
Specificity	36.0%	False Positives (FP)	14
Positive Predictive Value (PPV)	77.0%	True Negatives (TN)	8
Negative Predictive Value (NPV)	80.0%	False Negatives (FN)	2
Accuracy	77.0%	Total (N)	71

Table 6 -Table 5 Cohen's kappa test agreement between lung ultrasound and chest X-ray in detecting pneumonia**Symmetric Measures**

	Value	Asymptotic Standard Error ^a	Approximate T ^b	Approximate Significance
Measure of Agreement Kappa	.380	.116	3.616	.000
N of Valid Cases	71			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Resident Feedback on Training and Feasibility

The lung ultrasound training program was highly valued by all participants , who unanimously agreed that both the training and also the substituent research were useful and relevant for their future clinical practice. 6 out of 7 participants report feeling confident in their ability to perform LUS and detect pneumonia in subsequent patient care. However, participants identified several important barriers to effective implementation .4 out of 7 felt that the training time was insufficient

and expressed a need for more supervised practice , to overcome uncertainty in interpretation and diagnosis. The most commonly reported challenges includes difficulty with patient cooperation(71%) , probe and equipment related handling and time constraints.

Table 6: Cross-tabulation of Side Affected – Chest X-ray vs. Lung Ultrasound

Side affected according to x-ray * Side affected according to US Cross-tabulation

			Side affected according to US				
			Right	Left	Bilateral	None	Total
Side affected according to x-ray	Right	Count	7	2	19	1	29
		Expected Count	4.5	4.1	16.3	4.1	29.0
		% within Side affected according to x-ray	24.1%	6.9%	65.5%	3.4%	100.0%
		% within Side affected according to US	63.6%	20.0%	47.5%	10.0%	40.8%
	Left	Count	0	6	5	0	11
		Expected Count	1.7	1.5	6.2	1.5	11.0
		% within Side affected according to x-ray	0.0%	54.5%	45.5%	0.0%	100.0%
		% within Side affected according to US	0.0%	60.0%	12.5%	0.0%	15.5%
	Bilateral	Count	0	0	8	1	9
		Expected Count	1.4	1.3	5.1	1.3	9.0
		% within Side affected according to x-ray	0.0%	0.0%	88.9%	11.1%	100.0%
		% within Side affected according to US	0.0%	0.0%	20.0%	10.0%	12.7%
	None	Count	4	2	8	8	22
		Expected Count	3.4	3.1	12.4	3.1	22.0
		% within Side affected according to x-ray	18.2%	9.1%	36.4%	36.4%	100.0%
		% within Side affected according to US	36.4%	20.0%	20.0%	80.0%	31.0%
Total	Count	11	10	40	10	71	
	Expected Count	11.0	10.0	40.0	10.0	71.0	
	% within Side affected according to x-ray	15.5%	14.1%	56.3%	14.1%	100.0%	
	% within Side affected according to US	100.0%	100.0%	100.0%	100.0%	100.0%	
			%				

6. Discussion

In this study of 71 children with suspected pneumonia, the most common presenting symptoms were cough (74.6%), retractions (69.0%), and fast breathing (46.5%), aligning closely with typical clinical presentations of pediatric pneumonia reported in the literature. These findings are consistent with most studies, which frequently highlight cough, fever, and difficulty breathing as the primary symptoms.(21)

Over half of the participants had no comorbidity, while cardiac and neurological conditions were notable among those with underlying issues, emphasizing the increased vulnerability of such children in resource-limited settings like Ethiopia.

In our study the prevalence of x ray confirmed pneumonia was 49 out of 71 patients (69%) . This is comparable to a Tikur Anbessa study which showed the prevalence of radiology confirmed pneumonia to be 73% (21) using lobar and interstitial patterns radiologically confirmed pneumonia. However this prevalence is higher than most other studies such as in which radiologically confirmed pneumonia was 50%(24) and the study in Nepal showing a prevalence of 23%.(28) This might be due to the operational definitions of taking consolidation only as radiologically confirmed pneumonia which will decrease the number of positives substantially. In our study for instance 42 % of the radiologically confirmed pneumonia showed an interstitial pattern .(17)

The perceived difficulty of performing lung ultrasound (LUS) was notable: 49.3% of examinations were rated as difficult, and 14% as very difficult. Overall, approximately two-thirds (about 63.3%) were performed with some level of difficulty. Although no direct literature benchmarks exist for this metric, this high proportion likely stems from the brief 2-day training period, limited hands-on supervised practice (as the pediatric residents were novices in ultrasound), and the additional task of recording 12 videos per patient for future reference.

The average time to complete LUS was 18 minutes (range: up to 22–23 minutes), which is longer than reported in several other studies. For instance,(24) reported examination times of 7–20 minutes in children with suspected pneumonia. This difference may be attributed to the residents' inexperience with ultrasound and the time required to record multiple videos.

These findings underscore the need for more extensive supervised training in LUS to improve the ease of performance, reduce perceived difficulty, and shorten examination times in resource-limited settings.

Using CXR as the gold standard (pneumonia prevalence of 69%) pediatric resident-performed ultrasound showed high sensitivity but low specificity with PPV of 78% NPV of 80%. This high sensitivity aligns with multiple meta-analyses and studies on pediatric LUS, where pooled sensitivity often exceeds 90-96% (15). In various other studies the sensitivity ranged as shown: 95% ; Ethiopian studies at Tikur Anbesa ~95-97.8% (21, 22); Pakistan 95.28%(25); Nepal 89.3% (17). Our sensitivity matches or exceeds many reports, even though performed by residents rather than radiologists/experts.

However, the notably low specificity contrasts with higher values in the literature (often 85-96% in meta-analyses (8, 10, 11) and Ethiopian studies (21). Lower specificity here may reflect resident inexperience, over-calling artifacts (e.g., B-lines or minor findings as pneumonia), or the high pneumonia prevalence inflating false positives. Studies with non-radiologists/residents show variable specificity (e.g., lower in some novice settings , but good in trained clinicians).

Not all radiologist-performed LUS studies showed excellent sensitivity and specificity either. Camello et al performed a study in Zambia with LUS using a Butterfly iQ done by radiologists showing a sensitivity of 61% (95% CI: 0.52-0.84). The specificity was 77% (95% CI: 0.56-0.91). Positive predictive value (PPV) 70% (95% CI: 0.62-0.94) and negative predictive value (NPV) 69% (95% CI: 0.56-0.79).(18)

In resource-limited African contexts, similar patterns occur, with LUS often more sensitive but prone to false positives when operators are trainees. As subplural consolidations are not measured during data collection falsely labeling artifacts and small subplural consolidations may contribute to much false positive results. Moreover, Chest X ray is not the ideal gold standard as it can have sensitivity as low as 88 %. Thus not all positive findings on LUS that are negative on Chest X ray are necessarily false positives. (8). Future quality assurance of the recorded videos with expert opinion is important. Notably, however, at the current juncture, Chest X ray is the best gold standard option we have.

Even though the sensitivity is high it might be due to the overly picked false positive which also reflected with low specificity ,PPV 78.7%, NPV 80.0%, accuracy 78.9%, LR+ 1.55, LR– 0.11) in a cohort with 69% pneumonia prevalence is consider as moderate predictor suggesting this can be use in day to day practice.

Fair agreement was observed between resident-performed LUS and expert-interpreted chest X-ray for pneumonia detection ($\kappa = 0.38$, $p < 0.001$). This is lower than the excellent agreement reported in studies involving radiologists or radiology technicians (e.g., $\kappa = 0.86$ – 0.91 in the Tikur Anbessa Specialty Hospital study in Ethiopia(21, 22), and similar high values in expert-performed LUS studies from Mozambique and Pakistan(20). However, it exceeds the poor agreement ($\kappa = 0.18$, 95% CI: -0.02 to 0.37) reported by Venkatakrishna et'al. in a South African cohort comparing physician-performed LUS to CXR.(19)

Inter observer agreement among residents was not assessed due to logistical and technical constraints. Nevertheless, literature consistently shows that LUS exhibits better inter observer agreement than Chest X ray for pediatric pneumonia, particularly when performed by trained non-radiologists. The saved videos from this study will enable future video-based inter observer variability analysis.

Side (laterality) agreement was poor, with exact matching across categories (right, left, bilateral, or none) in only 40.8% of cases. LUS frequently overcalled bilateral involvement, especially in CXR-negative or right-sided cases (e.g., 63.6% of CXR-negative cases were deemed positive on LUS, often bilateral). This discrepancy may arise from LUS's greater sensitivity for subtle or subpleural changes missed by CXR, combined with interpretation challenges among novice resident operators.

These findings highlight operator-dependent variability and the learning curve associated with brief training in residents. Despite limitations in specificity and side agreement, LUS demonstrated high sensitivity and moderate negative predictive value, making it particularly valuable for initial screening or ruling out pneumonia in Ethiopian pediatric emergency settings. Here, CXR access can be delayed, costly, or unavailable, and radiation exposure remains a concern in children.

Future research should focus on structured, extended training protocols for residents to enhance specificity, inter-rater agreement, and overall performance. Comparisons should incorporate clinical outcomes or composite reference standards, and evaluations should extend to rural or low-resource Ethiopian contexts to better assess LUS feasibility and impact.

Conclusion

In this cohort of 71 children with clinically diagnosed pneumonia in an Ethiopian hospital, resident-performed lung ultrasound demonstrated excellent sensitivity (96.0%) for detecting pneumonia compared to CXR, with fair overall agreement but notably lower specificity (38.1%) and moderate feasibility challenges (perceived difficulty in ~63% of residents and average procedure time of ~18 minutes). These findings reinforce LUS as a promising, radiation-free, point-of-care alternative to CXR for pediatric pneumonia diagnosis, especially in high-prevalence, resource-constrained environments like Ethiopia. While resident inexperience likely contributed to reduced specificity and agreement compared to expert-performed studies, the high sensitivity supports its role in ruling out disease and guiding initial management.

Limitation

- Small sample (n=71 vs planned 150) limits power and generalization, though suitable as a pilot for future larger studies.
- Chest X ray as an imperfect reference standard risks misclassification bias (e.g., LUS "false positives" may be Chest X ray -missed true cases), lowering specificity; no true gold standard exists for pediatric pneumonia.
- Single-center urban design (Addis Ababa) with high pneumonia prevalence limits generalizability to rural or low-prevalence settings (spectrum/selection bias).
- No inter-rater reliability assessment; frequent technical interruptions; non-standardized 6-zone video recording hindered expert review.
- Lack of complete blinding of the resident to the clinical data and CXR image which can lead to information Bias

Recommendation

- **Intense longitudinal standardize training - beyond brief session** - should be prioritized for pediatric residents to address low specificity and perceived difficulty and prolonged scan time to improve speed and acceptability of the LUS and over all feasibility .
- **Integrate LUS into routine practice** through structured, hands-on training for pediatric residents and non-radiologists to rapidly improve specificity, agreement, acquisition confidence, and reduce perceived difficulty.
- **Larger mutli center studies are essential** to validate extended training effect and confirm clinical impact and support calculable adoption across Ethiopian and similar LMICS.
- **Advocate for national policy and curriculum changes** to embed point-of-care LUS training in Ethiopian pediatric residency programs and guidelines, building on LMIC evidence of its diagnostic value where radiology is scarce.

7. Work plan and budget breakdown

7.1 work plan

S N	Activities	Time frame									
		Oct 2024	Nov 2024	Dec 2024	June 2024	July 2024	Aug 2024	Sept/ oct 2024	Oct /Dec 20204	Jan /feb 2025	Feb / mar 2025
1.	Proposal finalization										
2.	Ethical review										
3.	Study tool development										
4.	Orientation and staff training										
5.	Data collection										
6.	Data analysis										
7.	Draft Thesis										
8.	Final Thesis										
9.	Defense										
10.	Finalization of Thesis										
11.	Dissemination of Thesis										

7.2 Budget breakdown

Budget line	Description	Quantity	Unit cost per	Total cost ETB
Personnel				
Trainer	5 thousand per day for 2 people	3	5000 birr	20,000
Data collector and coordinatory	400 per case	1		30,000
Health professionals taking ultrasound	400 per each ultrasound	75		30,000
Chest x ray comment	200 per x ray	2	14200	28,400
SPPS data entry and data analyzer			10,000	
Sub total				118,400
Training				
Refreshment	3 thousand per day	2		6000
Paper	750 per piece	1		750
Marker	50 birr per piece	3		150
Sub total				6900
Stationary				
Paper	750 per piece	5		3750
Print	3 birr per page	800		2400
Pen	90			900
Subtotal				7050
Grand total				131,950

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Lung ultrasound reporting format

Patient Card number - _____

Age - _____ sex - _____

Address region _____ sub-city _____ Phone number _____

Presenting symptom - _____

☐ Known co-morbid disease - cardiac

☐ Neurology

☐ Renal

☐ Endocrine

☐ Severe malnutrition

☐ Immuno-compromised -

Other _____ Respiratory support - Intra-nasal prong _____ liter

Face mask _____ liter CPAP _____ cm of water depth

VS PR _____ RR _____ Temp _____ Saturation _____ BP if Available _____

Chest finding _____

☐ ☐ ☐ Distress _ Flaring _____ grunting

☐ ☐ Sub costal retraction _____ intercostal retraction _____ chest indrawing

☐ ☐ Head nodding _____ supra-sternal retraction

☐ ☐ ☐ ☐ Auscultation finding - normal finding _____ decreased air entry

absent air entry

☐ ☐ ☐ BBS _____ fine crepitation _____ coarse crepitation _____ pleural

rub

☐ ☐ ☐ ☐ Percussion : resonant _____ hyper resonant _____ dull _____ stony

dull

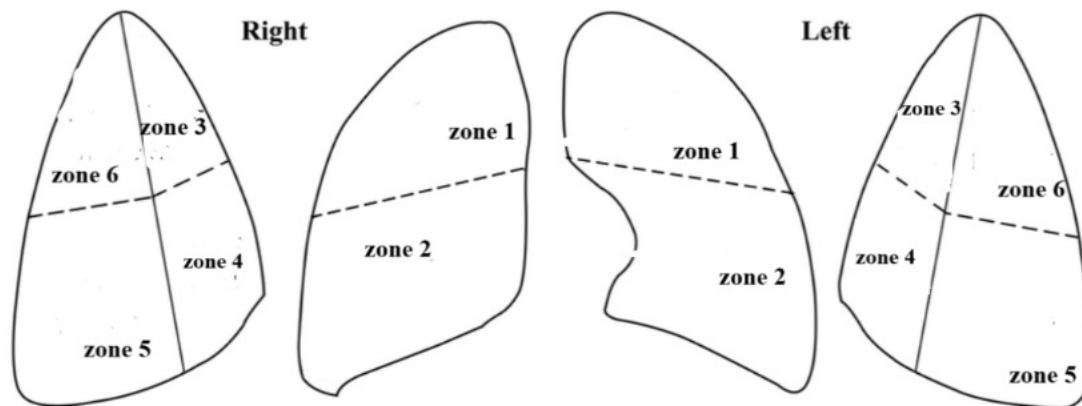
Operator- Code

Year of residency _____

☐ ☐ ☐ Image acquisition Easy _____ Difficult _____ very Difficult

Date and time of image acquisition - _____

Duration of the ultrasound time - _____ minutes



	Right lung	Left lung
Zone 1		
Zone 2		
Zone 3		
Zone 4		
Zone 5		
Zone 6		

Appendices

1. Appendix 1: Participants' information sheet

Title-Comparison of chest ultrasound to chest X-ray in the diagnosis of pneumonia in the pediatric emergency department of St Paul's Millennium Medical College

Before you decide to take part in this study, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask questions if anything you read needs to be clarified. Take time to decide whether or not you want to take part.

Purpose of the Study :The purpose of this study is to see the performance of Lung ultrasound in detecting pneumonia patients admitted in pediatric emergency patients at St. Paul's Hospital Millennium Medical College from

Why I have been chosen :You have been selected for this research as your child has been admitted with the diagnosis of pneumonia.

Do I have to take part? No, it is up to you to decide whether to participate. If you choose to participate, you will be given this information sheet to keep and asked to sign a consent form. If you decide to participate, you are free to withdraw at any time and without a reason.

What will happen if I take part? If you agree to participate in the study, your child will have a bedside ultrasound performed by a trained pediatric resident. The ultrasound result will be compared with your child's chest X-ray result. The proper ultrasound will take less than 20 minutes to complete.

Are there possible disadvantages and/or risks in taking part? There will be no side effects or harm to your child as ultrasound is safe and has no side effects.

What are the possible benefits of taking part? The lung ultrasound done on your child will aid further in the diagnosis and management of your child's condition. Further, the result of this research will significantly impact the direction of childhood pneumonia diagnosis.

Will my taking part in this project be kept confidential?

The information gathered from your child's chart and investigation will be kept confidential and used only for this research purpose by the research data collector and investigator. Your child's name will be replaced in the data with the code given during the data collection.

What will happen to the results of the research project?

The findings from this study will be used to increase the already known knowledge in diagnosing pneumonia in children. Your data will remain confidential. The results of this study will be presented in terms of a group of individuals. If any individual data are present, the data will be totally anonymous. If you wish to review a summary of the research findings, you can indicate this to the investigator.

Who is organizing and funding the research?

This research is being conducted by Dr. Kalkidan Gebremeskel, a pediatric emergency and critical care fellow at St. Paul's Hospital Millennium Medical College, to fulfill a sub-specialty study that has been approved by the St. Paul's Hospital Millennium Medical College Ethics Committee. The research is funded by St. Paul's Hospital Millennium Medical College, the School of Public Health, and the School of Medicine.

Ethical review of the study

The project has been reviewed by the St. Paul's Hospital Millennium Medical College Ethics committee

Contact for further information

Dr.Kalkidan Gebremeskel Email - Kalism2@yahoo.com

+251 911567048

Annex 2: Informed consent form

The purpose of this research is to see the performance of Lung ultrasound in detecting pneumonia in pediatric patients admitted with clinical suspicion of pneumonia to the pediatric emergency of St. Paul's Hospital Millennium Medical College from May to July 2025

I have read the Participant Information Sheet or had someone read it to me in a language that I understand. I understand the purposes, procedures, and risks of the research described in the project.

I have had an opportunity to ask questions, and I am satisfied with the answers I have received.

I freely agree to participate in this research project as described and understand that I can withdraw at any time during the project without affecting my future care. I know that I will be given a signed copy of this document to keep.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

የተሳታፊዎች መረጃ መስጫ

የጥናት ርዕስ- በቅዱስ ጳውሎስ ሚሊኒየም ሜዲካል ኮሌጅ የህፃናት ድንገተኛ ክፍል ውስጥ የሳንባ ምች በሽታን ለመመርመር የሳንባ አልትራሳውንድ አፈፃፀም

በዚህ ጥናት ውስጥ ለመሳተፍ ከመወሰንዎ በፊት ጥናቱ ለምን እየተካሄደ እንዳለ እና ምን እንደሚያጠቃልል መረዳት አስፈላጊ ነው። እባክዎ የሚከተለውን መረጃ በጥንቃቄ ለማንበብ ጊዜ ይውሰዱ እና ከፈለጉ ከሌሎች ጋር ይወያዩ። ያነበቡት ነገር ግልጽ ካልሆነ ጥያቄዎችን ይጠይቁ። ለመሳተፍም ሆነ ላለመሳተፍ መወሰን ይችላሉ።

የጥናቱ ዓላማ : የዚህ ጥናት አላማ በቅዱስ ጳውሎስ ሆስፒታል ሚሊኒየም ሜዲካል ኮሌጅ የህፃናት ድንገተኛ ህመምተኞች የሳንባ ምች ታማሚን ለመለየት የሳንባ አልትራሳውንድ አፈፃፀምን ለማየት ነው።

የዚህ ጥናት አላማ በኢትዮጵያ ጊዜ አቆጣጠር

እኔ ለምን ተመረጥኩኝ? ለዚህ ጥናት የተመረጡት ልጆች በድንገተኛ ክፍላችን ውስጥ ለሳንባ ምች ህክምና ስለተኛ ነው።

እኔ መሳተፍ አለብኝ? አይደለም፤ ለመሳተፍ ወይም ላለመሳተፍ መወሰን የእርስዎ ውሳኔ ነው። ለመሳተፍ ከወሰኑ፤ ይህን የመረጃ ወረቀት ለማቆየት እና የፍቃድ ፎርም እንዲፈርሙ ይጠየቃሉ። ለመሳተፍ ከወሰኑ፤ በማንኛውም ጊዜ እና ምክንያት ሳይሰጡ አሁንም ነጻ ነዎት።

በመሳተፌ ምን አደርጋለሁ? በጥናቱ ለመሳተፍ ከተስማሙ ልጅዎ በሰለጠነ የህፃናት እስፔሻሊቲ ህክምና ተማሪ የሳንባ የአልትራሳውንድ ምርመራ ይኖረዋል። የአልትራሳውንድ ውጤቱ ከልጅዎ የደረሰ ኤክስ ሬይ ውጤት ጋር ይነጻጸራል

ጥናቱን በመሳተፍ አንጻር ጉዳዮች እና/ወይም አደጋዎች ሊኖሩ ይችላሉ? አልትራሳውንድ ደህንነቱ የተጠበቀ እና ምንም የጎንዮሽ ጉዳት ስለሌለው በልጅዎ ላይ የሚደርሰው የጎንዮሽ ጉዳት ወይም አደጋ የለም።

መሳተፍ ምን ጥቅሞች አሉት? በልጅዎ ላይ የተደረገው የደረት አልትራሳውንድ የልጅዎን ሁኔታ ለመመርመር እና ለመረዳት የበለጠ ይረዳል። በተጨማሪም የዚህ ምርምር የመጨረሻ ውጤት በልጆች የሳንባ ምች ምርምር ላይ ትልቅ ተጽእኖ ይኖረዋል።

በዚህ ፕሮጀክት ውስጥ መሳተፍ በምስጢር ይያዛል? ከልጅዎ ካርድ እና ምርመራ የተሰበሰበው መረጃ በሚስጥር ይጠበቃል። እና ለዚህ የምርምር ዓላማ በምርምር መረጃ ሰብሳቢ እና መርማሪ ብቻ ይታያል። በተጨማሪም በመረጃው ውስጥ የልጅዎ ስም በመረጃ አሰባሰብ ወቅት በተሰጠው ኮድ ይተካል።

የምርምር ፕሮጀክቱ ውጤት ምን ይሆናል? የዚህ ውጤት ግኝት በልጆች ላይ የሳንባ ምች በሽታን ለመመርመር ቀድሞውኑ የሚታወቀውን እውቀት ለመጨመር ጥቅም ላይ ይውላል። የእርስዎ መረጃ በሚስጥር ይቆያል። የዚህ ጥናት ውጤት ለግለሰብ ወይም ለቡድን ውስጥ ይቀርባል። ማንኛውም የግል መርጃ ካለ ውሂቡ ሙሉ በሙሉ የማይታወቅ ይሆናል። የምርምር ግኝቶችን ማጠቃለያ ለመገምገም ከፈለጉ ይህንን ለመርማሪው ማመልከት ይችላሉ።

ጥናቱን እያደራጀና እየረዳ ያለው ማነው? ጥናቱ የሚሰራው በቅዱስ ጳውሎስ ሆስፒታል ሚሊኒየም ሕክምና ኮሌጅ የሕፃናት ድንገተኛ እና ፅኑ ሕመማን ሕክምና ተማሪ በሆነችው በዶ/ር ቃልኪዳን ገብረመስቀል ሲሆን፤ ይህ ጥናት በቅዱስ ጳውሎስ ሆስፒታል ሚሊኒየም ህክምና ኮሌጅ ለሚሰጠው የ ሰብአዊ ምርመራ ሰራተኛነት ማሟያ የሚሰራ ነው ። ጥናቱን በገንዘብ የተደገፈው በቅዱስ ጳውሎስ ሆስፒታል ሚሊኒየም ሕክምና ኮሌጅ፤ የማሕበረሰብ ጤና ሳይንስ እና ሕክምና ትምህርት ክፍል ነው።

የጥናቱ የሥነምግባር ግምገማ/ኢትካል ረቢው/ ፕሮጀክቱ በቅዱስ ጳውሎስ ሆስፒታል ሚሊኒየም ሜዲካል ኮሌጅ የሥነ ምግባር ኮሚቴ ተገምግሟል

ለበለጠ መረጃ ያነጋግሩ

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የተሳታፊዎች መረጃ መስጫ

የጥናት ርዕስ- በቅዱስ ጳውሎስ ሚሊኒየም ሜዲካል ኮሌጅ የሕፃናት ድንገተኛ ክፍል ውስጥ የሳንባ ምች በሽታን ለመመርመር የሳንባ አልትራሳውንድ አፈፃፀም

በዚህ ጥናት ውስጥ ለመሳተፍ ከመወሰንዎ በፊት ጥናቱ ለምን እየተካሄደ እንዳለ እና ምን እንደሚያጠቃልል መረዳት አስፈላጊ ነው። እባክዎ የሚከተለውን መረጃ በጥንቃቄ ለማንበብ ጊዜ ይውሰዱ እና ከፈለጉ ከሌሎች ጋር ይወያዩ። ያነበቡት ነገር ግልጽ ካልሆነ ጥያቄዎችን ይጠይቁ። ለመሳተፍም ሆነ ላለመሳተፍ መወሰን ይችላሉ።

መልስ ሰጪ መረጃ መስጫ

ውድ መልስ ሰጪ፣

በቅድሚያ በዚህ ጥናት ላይ በመሳተፍ መልስ ለመስጠትና መጠይቁን ለመሙላት ፈቃደኛ በመሆንህ/ሽ አመሰግናለሁ።

የስምምነት ማረጋገጫ

እኔ መልስ ሰጪ ከላይ የተጠቀሰውን መረጃ በሚገባኝ ቋንቋ አንብቤና ተረድቼ፣ የጥናቱንም ዓላማ፣ ቅደም ተከተሉን እና ሊከሰቱ የሚችሉ ሁኔታዎችን በሚገባ ተገንዝቤያለሁ። ግልጽ ያልሆነልኝንም ነገር በመጠየቅ በቂ መልስ ለማግኘትም ችያለሁ። በዚህም መሰረት ያለምንም ተጽዕኖ በጥናቱ ላይ መጠይቁን በመሙላት ለመሳተፍ ፈቃደኛ ነኝ። እንዲሁም በማንኛውም ጊዜ መጠይቁን መሙላት ማቋረጥ እንደምችል ተነግሮኛል። በዚህም ምክንያት ምንም አይነት የሚደርስብኝ ጉዳት እንደሌለ አውቄ ይህንን የስምምነት ማረጋገጫ በመፈረም ለማስረጃነት እንዲቀመጥ ፈቅጃለሁ።

የመልስ ሰጪ ፊርማ ቀን _____

የአጥኚዋ ፊርማ ቀን _____

8. Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: _____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____