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Teaching Pediatric Residents to Use Point of Care Ultrasound for the Detection of Pneumonia

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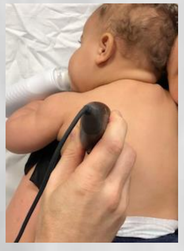
Background



Worldwide, pneumonia is the leading infectious cause of mortality in children under five years of age[1]. Chest radiographs are the standard imaging modality used to aid in the diagnosis of pneumonia[2]. However, conventional radiography is not readily available in many resource-limited settings[3]. Point-of-care ultrasonography (POCUS) has been proposed as a promising alternative to diagnose pneumonia in resource-limited settings, due in part to the cost, durability, and portability of ultrasound machines[4]. There is a need for sustainable, replicable training modalities for POCUS. Most pediatric residency programs in the US report limited or no training in POCUS[5]. Developing and validating POCUS training modules are important steps needed in order to share this emerging field across global health partnerships.

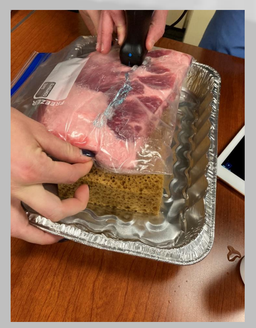
Project Goals

To develop and deploy a mastery-based learning curriculum to train US-based pediatric residents in POCUS for pediatric pneumonia

1) Assess residents' experiences with and views of POCUS
2) Assess residents' confidence before and after training
3) Assess residents' skills before and after training
4) Compare residents' POCUS with X-Ray impressions

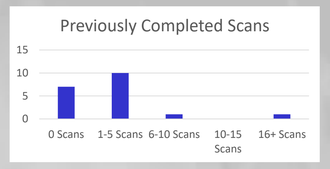
Replicate the curriculum at partner sites with limited access to conventional radiography

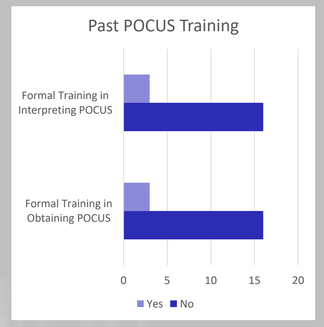
Methods



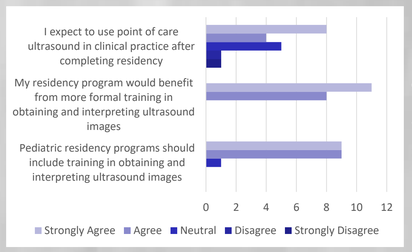
Resident participants completed a 2-hour course comprised of a didactic portion and deliberate practice on lung phantoms with expert guidance from faculty. Participants also engaged in volunteer scanning sessions and clinical time with pediatric emergency medicine faculty as able. Residents who received the training completed surveys regarding their experiences with and their impressions of POCUS. They were also asked to provide diagnostic impressions of 16 lung ultrasound images across 3 cases before and after training. Trained residents are now in the phase of completing lung POCUS in situ in the emergency department and on the inpatient wards, on patients receiving chest X-Rays for evaluation of pneumonia. Additionally, trained residents are now being recruited to lead trainings for peers. We will compare residents' impressions of the POCUS images they obtain to radiologists' impressions of corresponding chest X-Rays.

Figures:

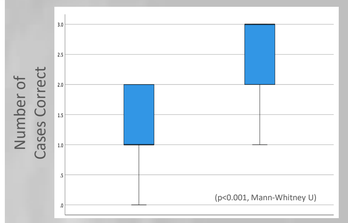




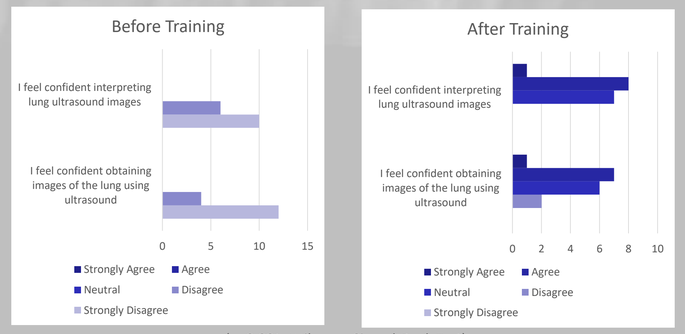
Impressions of POCUS:



Improvement in Diagnostics:



Confidence with POCUS:



(p<0.001, Wilcoxon Signed-Rank Test)

Results

A total of 20 pediatric residents have participated to date. Of those who completed the survey, 4 residents (21%) reported receiving previous formal training in POCUS. Nine residents (47%) had personally obtained any ultrasound scan prior to the training, though only 2 (11%) had obtained more than 5 ultrasound scans. The majority of residents (63%) expected to use POCUS in clinical practice after completing residency. Eighteen (95%) felt that pediatric residencies should include training in obtaining and interpreting ultrasound images. All residents felt that the use of POCUS could add to patient care. Residents ranked their confidence with obtaining and interpreting lung ultrasounds as higher following the training ($p<0.001$). On average, residents arrived at the correct diagnosis for 1.13 out of 3 cases prior to the training and 2.53 out of 3 cases following the training, with a statistically significant difference ($p<0.001$). Residents are actively obtaining scans in the emergency department and wards at Lurie Children's Hospital. To date, 7 scans have been completed in situ in the hospital.

Limitations

- Training completed on a voluntary basis – unprotected time and competing clinical responsibilities
- Sampling bias – volunteer trainees may be more interested or skilled in POCUS; patient participants recruited as a convenience sample
- Difficult to replicate pathology in phantoms or models
- Fewer pneumonia diagnoses given social distancing protocols during a pandemic
- Difficult to define pneumonia, X-ray findings may be equivocal
- Generalizability – findings may not be generalizable to settings with different frequencies or etiologies of pneumonia

Conclusions

- There is an **unmet demand** for formal POCUS curricula in residency
- Residents expect to **use POCUS in future clinical practice**
- This training **improved residents' confidence** in obtaining and interpreting lung POCUS
- The training successfully taught residents to **interpret ultrasound cases**
- **There is potential for similar training to be adapted to lower-resource settings, to improve providers' ability to detect pneumonia**

References

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[4]Pereda, M. A., et al. (2015). "Lung ultrasound for the diagnosis of pneumonia in children: a meta-analysis." Pediatrics **135**(4): 714-722.

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