

SUPPLEMENTARY MATERIAL

Table of Contents

- **APPENDIX 1:** Details of the POCUS survey results
- **APPENDIX 2:** POCUS survey questionnaire circulated to Pediatric Nephrology community
- **APPENDIX 3:** Delphi Methods
- **Supplementary Figure 1A-1c:** Additional Results of International POCUS in Pediatric Nephrology Survey
- **Supplementary Figure 2:** Online dashboard of POCUS virtual course

APPENDIX 1: Details of the POCUS survey results

A research survey was sent to 225 pediatric nephrology specialists to assess the state of POCUS in the practice of pediatric nephrology. A panel of nephrologists with extensive POCUS experience developed the survey questions to measure the implementation of POCUS by pediatric nephrologists. The survey questions included single response multiple choice, multiple selected responses, and the Likert scale. All survey responses were confidential, with no financial reward for participating. The data was analyzed in Microsoft Excel.

Of those 225 pediatric nephrology specialists who responded to the survey, 134 fully completed the survey (59.6% completion rate). 51.5% of respondents were pediatric nephrology consultants either at a hospital or private practice, 23.9% were pediatric nephrology chairs, 6.7% were program directors, 2.2% were associate program directors, and 10.4% answered other, including residents and fellows. 84.8% of respondents stated that they did not have a formal pediatric nephrology program integrated into their fellowship program. Additionally, 57.4% of respondents did not have any experience with POCUS. Of note, 52.3% of respondents who utilized POCUS in their practice used self-directed learning to establish competency. Respondents reported a varying number of patients in their practice or hospital that required POCUS, ranging from none to 600.

87.4% of respondents believe that formal POCUS training should either be mandatory in pediatric nephrology fellowship programs or that it is highly necessary. The top skills that respondents valued in a formal POCUS program were learning sonographic diagnostic evaluation of kidneys and urinary tract, bladder ultrasound, kidney allograft ultrasound, and procedural applications such as hemodialysis line placement and kidney biopsy (Figure 1).

Most respondents believed that POCUS certification for fellows should require at a minimum of 5-20 scans in areas such as kidney scans and procedural applications before they can be considered POCUS certified. 83.2% of respondents believed that the optimal length of time for POCUS training through fellowship training was 3-6 months. 43.9% of respondents stated the optimal evaluation criteria was for a real time demonstration of scans with evaluations and a provisional diagnosis. Some other barriers that were found included lack of coordination with institutional imaging/ POCUS experts/ Pediatric Intensivists, lack of coordination with Pediatric Radiology to learn and implement, lack of ultrasound equipment, lack of financial support, and lack of dedicated time during training.

APPENDIX 2: POCUS survey questionnaire circulated to Pediatric Nephrology community:

Q1. Please choose your Pediatric Nephrology position title below:

[Check all which are applicable]

- Chair, Pediatric Nephrology/Professor
- Pediatric Nephrology Fellowship Program Director
- Pediatric Nephrology Fellowship Associate Program Director
- Pediatric Nephrologist Consultant (Hospital/Private Practice/Both)
- Other _____

Q2. In what country is your practice is based? [Drop down menu]

.....

Q3. In what city and state is your practice based? [Drop down menu]

.....

Q4. How many years of experience do you have in pediatric nephrology, post fellowship:

- <5 years
- 5-10 years
- 10-15 years
- >15 years

Q4. Consider your own pediatric nephrology fellowship, was there a Point-of-Care Ultrasonography (POCUS) curriculum integrated into your program?

- Yes (SKIP TO QUESTION Q6)
- No
- Not sure

Q5. Do you have experience with POCUS?

- Yes (Go to Question 6, 7)
- No (SKIP TO QUESTION Q8)
- Other

Q6. How did you acquire the skill in POCUS?

- Just-in-time training
- Self-directed learning
- POCUS training course
- Formal POCUS certification
- Other _____

Q7. In general, how confident are you in using POCUS as a part of pediatric nephrology practice?

[Responses arrayed horizontally in a Likert scale format]

- Very Confident
- Confident
- Somewhat Confident
- Somewhat Not Confident
- Not Confident

Q8. How necessary is it to offer POCUS training to fellows during pediatric nephrology fellowship training?

- Essential and should be made mandatory
- Highly necessary
- Somewhat necessary
- Not at all necessary
- Not sure

Q9. Currently, is there a POCUS training for pediatric nephrology fellows in your program?

- Yes; we have an established curriculum
- Yes; we are in process of developing a curriculum
- No; but we are planning on developing a dedicated POCUS training for our fellows (SKIP TO QUESTION Q15)?
- No; and we do not intend on planning on developing a dedicated POCUS training for our fellows (SKIP TO QUESTION Q15)?
- Not Sure (SKIP TO QUESTION Q15)

Q10. How long has your program incorporated POCUS training?

- <5 years
- 5-10 years
- 10-15 years
- >15 years
- Not Sure

Q11. Is there a pediatric POCUS expert available in your program for the training of fellows?

- Yes [Skip to Q12]
- No [Skip to Q13]
- Not sure [Skip to Q13]

Q-12 Who is responsible for POCUS training in your institute?

- Pediatric Nephrology consultant
- Pediatric Radiologist
- Adult Radiologist
- Interventional Radiologist
- Emergency Medicine
- Pediatric Intensivist
- Other.....
- Not sure

Q13. Which of the following describes the POCUS education and training of your fellows? **Select all that apply:**

- Each fellow receives discrete training blocks (e.g. 1, 2, 4, or 8-week rotation).
- Fellows learn this from intensivist while in PICU
- Fellows learn from radiologist while in PICU
- Fellows receive longitudinal training throughout their fellowship.
- Other _____

Q14. What is the typical duration of the POCUS training in your pediatric nephrology program?

- <1 month
- 1-6 months
- One year
- Two years

- Other _____
- Not sure

Q15. On average, how many pediatric nephrology patients need POCUS monthly?

Q16. In your opinion, in what form should POCUS training be delivered to the fellows in pediatric nephrology? Select all that apply.

- Didactic live educational sessions (audio-visuals/lecture)
- Online Modules
- Supervised scanning shifts
- Unsupervised scanning shifts
- Simulation laboratory structured course
- Discussion of ultrasounds performed by each fellows and other colleagues as quality improvement process, with the mentors/experts
- A POCUS workshop at the institution/facility (lecture + hand-on)
- An additional POCUS fellowship after completion of nephrology fellowship
- Other _____

Q17. In pediatric nephrology, what components of the POCUS curriculum and its applications should be included?

Please rate the importance of the following topics to pediatric nephrology training in the following grades.

1= very important

2= somewhat important

3= neutral

4= somewhat unimportant

5= very unimportant

6= I don't know

- Ultrasound physics and knobology
- Sonographic diagnostic evaluation of kidneys and urinary tract
 - Size, shape and location of the kidney
 - Hydronephrosis/Urinary space
 - Potential kidney injuries – AKI/CKD
 - Tumor/cysts
 - Obstructions and stones
 - Blood flow to the kidneys
 - Congenital anomalies
- Bladder Ultrasound
- Renal Allograft Ultrasound
- Lung Ultrasound
- Cardiac Ultrasound/FOCUS
- Advanced POCUS: Volume Status assessment [lung ultrasound, FoCUS, venous congestion]
- Procedural applications
 - HD Line Placement
 - AV Dialysis Access Evaluation
 - Kidney Biopsy
- Others _____

Q18. In your opinion, what is the optimal length of time for POCUS training (cumulative over fellowship years) in pediatric nephrology fellowships?

- 3 months
- 6 months
- 6-12 months
- >1 year

Q19. In your opinion, to graduate, pediatric nephrology fellows need to meet which of the following specific milestones or benchmarks? Select all that apply.

- Minimum number of scans to be performed for each application
- Real-time hands-on demonstration of scans with evaluation/provisional diagnosis
- A written based test with a passing score
- Fellows are not required to meet any POCUS-specific milestones or benchmarks to graduate
- Other __ [text box of 4000-5000 characters]_____

Q20. What is the MINIMUM number of scans a fellow must complete for each of the POCUS pediatric nephrology applications before they can be considered POCUS certified? (Check one box for each USG Type)

USG Type	Number of Scans				
	<5 scans	5-20 scans	21-50 scans	>50 scans	Not Sure
Renal					Not Sure
Renal Allograft					Not Sure
Bladder					Not Sure
Lung					Not Sure
Basic FOCUS					Not Sure
Volume status assessment					Not Sure
HD catheter placement					Not Sure
AV Dialysis access					Not Sure
PD access					
Kidney biopsy					Not Sure
Quantification of venous congestion					Not Sure

Q21. What barriers do you believe prevent 'POCUS training' implementation in pediatric nephrology fellowships?

Please rate the importance of the following topics to pediatric nephrology training in the following grades.

1= very important

2= somewhat important

3= neutral

4= somewhat unimportant

5= very unimportant

6= I don't know

- Lack of POCUS experts
- Lack of coordination with institutional imaging/ POCUS experts/ Pediatric Intensivists
- Lack of coordination with Pediatric Radiology to learn and implement

- Lack of ultrasound machines and other equipment
- Lack of financial support
- Lack of dedicated time during training
- Lack of POCUS regulatory body
- Inability to bill the patient
- Opposition from radiology department
- The fear, that an important diagnosis will be missed
- Lack of efficient evidence for pediatric nephrology POCUS
- Increased risk of medico-legal risk while performing scans especially during catheter placements, if not done correctly
- There are no barriers
- We have ready access to ultrasound in both inpatient and outpatient departments
- Other____[text box 4000-5000 characters]_____

Q22. In your opinion, can POCUS also help in out-patient care in Pediatric Nephrology? (E.g., in taking care of febrile infants with suspected pyelonephritis, antenatal hydronephrosis, graft dysfunction etc?)

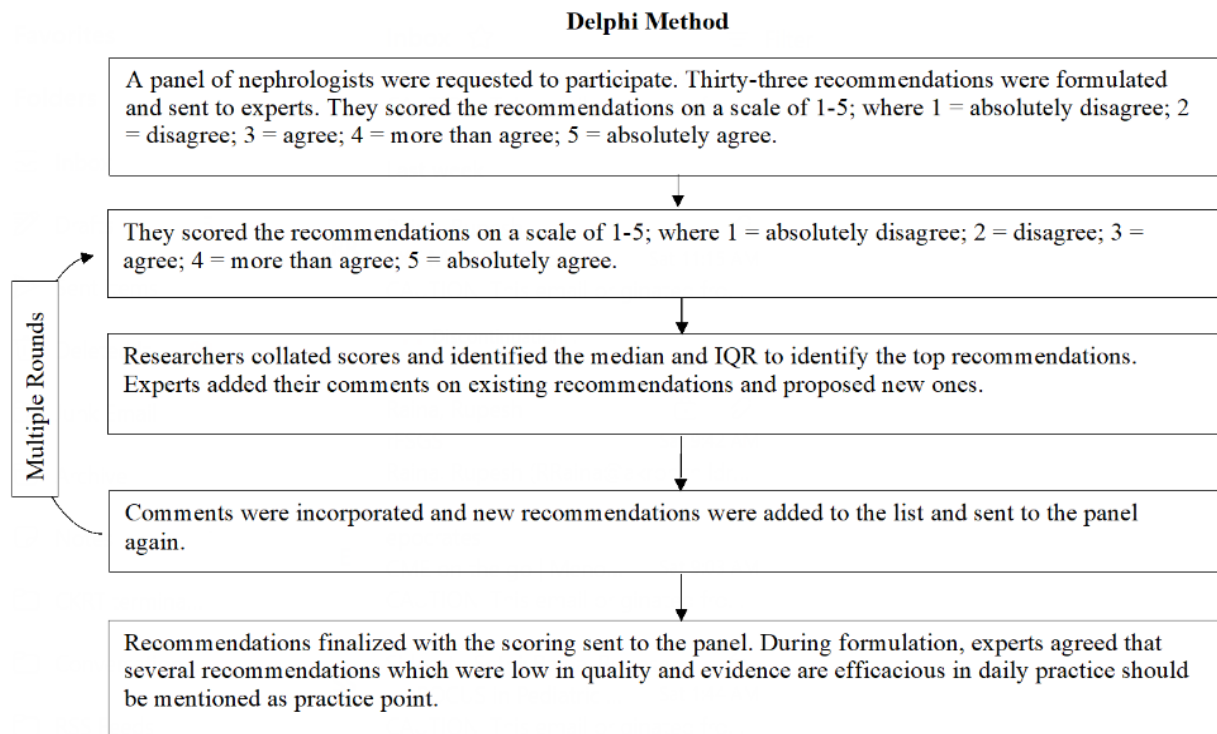
- Yes
- No
- Not sure

Q23. In your opinion, would integrating the POCUS training program into Pediatric Nephrology Fellowships (and therefore creating a POCUS competency) improve the doctor-patient relationship and trust?

- Yes
- No
- Not sure

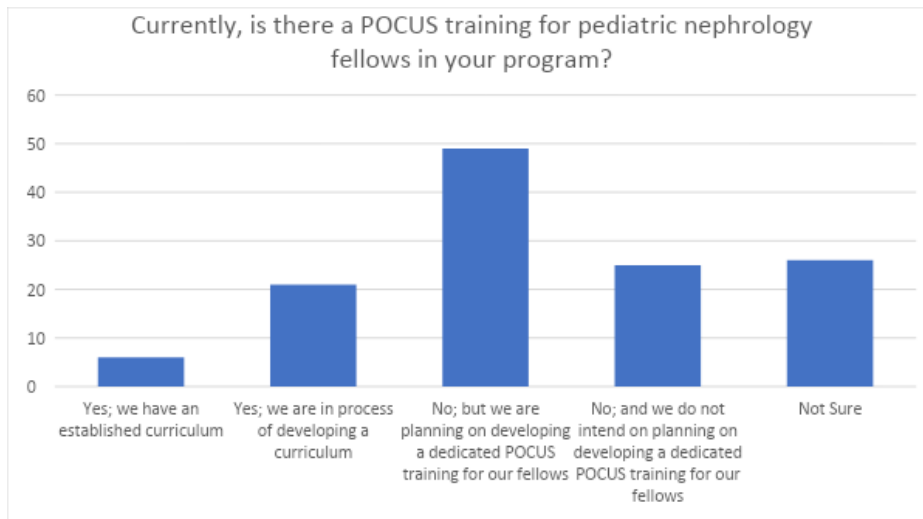
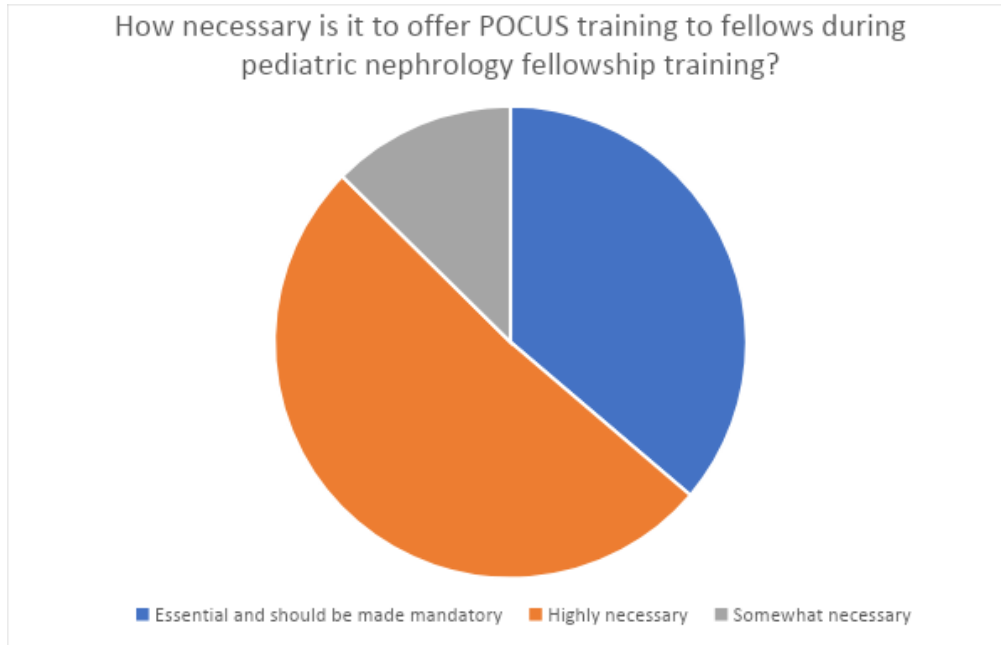
Appendix 3: Delphi Methods

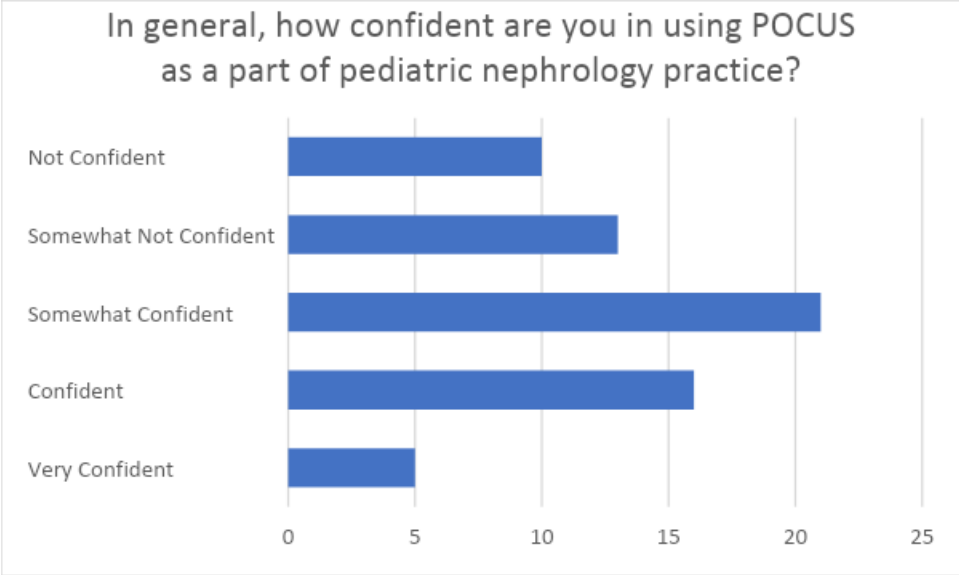
A Delphi method was used to frame this consensus guideline. Expert nephrologists were identified and assigned to sections based on their expertise. Recommendations for each section were discussed via web-conferences with everyone to achieve unbiased outcomes. Each recommendation is individually and anonymously graded by the panelists on a 5-point grading system; where 1 = absolutely disagree; 2 = disagree; 3 = agree; 4 = more than agree; 5 = absolutely agree. The scores were collated and the median and IQR were identified as the top recommendations. The experts added their comments on existing recommendations and proposed new ones. Comments were incorporated and new recommendations were added to the list and sent to the panel again. They repeated the scoring process and this cycle continued numerous times until a set of high-quality recommendations were finalized. Any recommendations that did not have significant or extensive evidence, despite being significant to clinical practice based on the panelist's experience, were categorized as clinical practice guidelines.



Supplementary Figure 1A-C

Additional Results of International POCUS in Pediatric Nephrology Survey





The PICU Nephrology Courses online platform can be found at

<https://www.picunephrologyvideos.com>

Supplementary Figure 2: Online dashboard of POCUS virtual course

STORE / COURSE / VIRTUAL POINT OF ...

Virtual Point of Care Ultrasound Course Curriculum

'Virtual Course on Point of Care Ultrasound in Pediatric Nephrology' with assessment based on OSCE. The course is endorsed by PCRRT-ICONIC Foundation. Around 500 trainees and faculty from 40+ countries, attended live course.

Syllabus

01	Basics	16 Lessons	^
	Basics & Knobology	Video • 46m 5s	
	Self Assessment Questions: Basics & Knobology	Pdf	
	POCUS in Pediatric Nephrology	Video • 31m 35s	
	Self Assessment Questions POCUS in Pediatric Nephrology	Pdf	
	Renal Allograft Ultrasound	Video • 25m 36s	
	Fluid Overload in Critical Children: Concepts	Video • 50m 59s	
	Lung Ultrasound	Video • 28m 9s	
	Self Assessment MCQs Lung Ultrasound	Pdf	
	Focused Cardiac Ultrasound	Video • 31m 27s	
	Self Assessment Focused Cardiac Ultrasound	Pdf	
	Venous Excess Doppler Ultrasound (VeXus)	Video • 43m 8s	
	Self Assessment MCQs Integrative Volume Assessment & VeXUS	Pdf	
	POCUS in Pediatric COVID	Video • 26m 29s	
	Self Assessment MCQs POCUS & Pediatric COVID	Pdf	
	Bladder POCUS	Video • 27m 13s	
	Self Assessment MCQs Bladder POCUS	Pdf	
02	Application of POCUS to Pediatric Nephrology	9 Lessons	v