



# Point-of-Care Ultrasound Use in Nephrology: A Survey of Nephrology Program Directors, Fellows, and Fellowship Graduates

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**Rationale & Objective:** Adoption of point-of-care ultrasound (POCUS) into nephrology practice has been relatively slow. We surveyed US nephrology program directors, their fellows, and graduates from a single training program regarding current/planned POCUS training, clinical use, and barriers to training and use.

**Study Design:** Anonymous, online survey.

**Setting & Participants:** All US nephrology program directors (n=151), their fellows (academic year 2021-2022), and 89/90 graduates (1980-2021) of the Walter Reed Nephrology Program.

**Analytical Approach:** Descriptive.

**Results:** 46% (69/151) of program directors and 33% (118/361) of their fellows responded. Response rate was 62% (55/89) for Walter Reed graduates. 51% of program directors offered POCUS training, most commonly bedside training in non-POCUS oriented rotations (71%), didactic lectures (68%), and simulation (43%). 46% of fellows reported receiving POCUS training, but of these, many reported not being sufficiently trained/not confident in kidney (56%), bladder

(50%), and inferior vena cava assessment (46%). Common barriers to training reported by program directors were not enough trained faculty (78%), themselves not being sufficiently trained (55%), and equipment expense (51%). 64% of program directors and 55% of fellows reported <10% of faculty were able to perform POCUS. 64% of fellows reported having too little POCUS training. 72% of program directors and 77% of graduates felt POCUS should be incorporated into the fellowship curriculum. 59% of fellows and 61% of graduates desired hands-on POCUS training rather than didactic lectures or simulation.

**Limitations:** Loss of respondents as program directors and fellows progressed through the survey.

**Conclusions:** Nephrology program directors, fellows, and graduates surveyed want POCUS training incorporated into the fellowship curriculum. No group felt sufficiently trained to confidently perform POCUS, and the major barrier to training was lack of sufficiently trained faculty. This highlights the need to “train the trainers” before POCUS can be fully integrated into fellowship training and regularly used in nephrology practice.

## Visual Abstract included

Complete author and article information provided before references.

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As ultrasonography becomes increasingly portable and affordable, point-of-care ultrasound (POCUS) is used more frequently for physical examination at bedside. Compared to some medicine subspecialties, such as cardiology and pulmonary-critical care, nephrology has been slower to incorporate POCUS into formal training and clinical practice, and POCUS training varies widely among fellowship programs.<sup>1-4</sup> The Accreditation Council for Graduate Medical Education requirements for nephrology fellowship training do not include POCUS.<sup>5</sup> POCUS is used in nephrology primarily for temporary dialysis catheter placement and percutaneous kidney biopsy but remains underused in other situations where it might improve patient care.<sup>1,6-8</sup>

In critically ill, dyspneic patients, POCUS may have better diagnostic accuracy than chest radiographs and lung auscultation.<sup>9,10</sup> POCUS evaluation of lung water may have greater sensitivity than rales and peripheral edema in diagnosing volume overload in patients on maintenance dialysis.<sup>11</sup> POCUS is sensitive and specific in diagnosing urinary obstruction in emergency room patients with acute kidney injury<sup>12</sup> and is as effective as computed tomography in diagnosing suspected nephrolithiasis.<sup>13</sup> Using POCUS to evaluate urinary retention and hydronephrosis had a positive effect on patient care

with no evidence of harm in 6 rural New Zealand hospitals.<sup>14</sup> POCUS has other uses in nephrology, including focused inferior vena cava (IVC) assessment, cardiac assessment for left ventricular ejection fraction and pericardial effusion, and dialysis access evaluation.<sup>1,2,5</sup>

Nephrology fellows have indicated a desire for more ultrasound and POCUS training.<sup>3,15</sup> In a 2021 survey, 38% of nephrology fellows reported receiving POCUS training during fellowship, and only 33% of these felt competent to perform POCUS independently.<sup>4</sup> Formal training may improve patient care and make nephrology fellowships more attractive to potential applicants.<sup>16</sup> A survey of Brazilian nephrologists showed 95% desired more POCUS training.<sup>17</sup> Despite this, there are barriers to training in and use of POCUS. These include machine cost, time required to perform exams, perceived concerns of liability related to incorrect/missed diagnoses, lack of trained faculty, lack of departmental support, and even competition from other departments.<sup>1,3,5,13,18</sup>

To better understand how POCUS has been taught and used in nephrology, we conducted anonymous online surveys of US nephrology program directors, current nephrology fellows, and graduates of the Walter Reed nephrology fellowship. Our goals were to assess how

**PLAIN-LANGUAGE SUMMARY**

Adoption of point-of-care ultrasound (POCUS) into nephrology training and practice has been relatively slow. We surveyed US nephrology program directors and their fellows regarding nephrology-specific POCUS training, clinical use, and barriers to training and use. Fifty-one percent of responding program directors offered POCUS training. The most frequent methods of training were bedside, hands-on training, didactic lectures, and simulation. Forty-six percent of their fellows reported receiving training, but the majority did not feel confident in their skills. The greatest barrier to POCUS use and training was lack of trained faculty. In over 50% of programs, fewer than 10% of faculty were reported as being able to perform POCUS. Before POCUS can be fully integrated into nephrology training, faculty must be trained.

POCUS was being taught during fellowship, how POCUS was being used in clinical practice, and the barriers to teaching and use.

**METHODS**

The protocol (EDO-2021-0859) was approved by the Walter Reed National Military Medical Center Department of Research Protections as “exempt from institutional review board review” per 32 CFR 219.104(d)(3i). Surveys were developed by DLC, SP, and CMY and reviewed and edited by RN and DJL for format and clarity.

**Nephrology Program Directors and Fellow Surveys**

US nephrology program directors (N=151) were identified from the Accreditation Council for Graduate Medical Education public list of nephrology specialty programs.<sup>19</sup> Anonymous 15-question online surveys (Item S1) were administered to all program directors between January 5 and March 6, 2022. Respondent internet protocol addresses were blocked. Survey links were delivered by email with delivery receipt. Reminders were sent at 2-week intervals. Respondents were asked to confirm nephrology program director status. If not, they were directed to the end of survey and asked to forward the link to the program director. Program directors entering the survey were asked to forward the anonymous fellow survey link to their fellows and indicate the number of fellows to whom it was sent. Because there are no public lists of active nephrology fellows, this allowed a known number to be contacted and the response rate calculated.<sup>20,21</sup> Participating program directors facilitated access to all fellows in their program, reducing bias and providing validation when comparing program director and

fellow responses. All fellows were potentially represented for a given program, and only fellows from programs with responding program directors were included. Fellow surveys (Item S2) contained 15 questions and were parallel to those of the program directors to allow comparisons.

**Graduate Survey**

The 16-question, anonymous online survey (Item S3) of nephrology program graduates was administered between January 4 and March 5, 2022. Respondent internet protocol addresses were blocked. Reminders were sent at 2-week intervals. Of the 90 Walter Reed National Military Medical Center Nephrology Program graduates from 1986-2021, 89 were surveyed (99%). The survey link was sent individually to each graduate (email or fax) with delivery receipt. When possible, questions paralleled the program director and fellow surveys to allow comparisons. Walter Reed National Military Medical Center first year fellows (N=6 graduates) have attended a 1-month nephrology-specific POCUS rotation since training year 2018-2019 (SP, SC). Fellows must satisfactorily perform 20 kidney and 10 bladder examinations under supervision.

All surveys and survey invitations were preceded by an explanatory text, identifying the surveys as research, indicating that taking the survey implied consent to participate, and allowing respondents to exit if they did not wish to participate. Demographic information collected for program directors and graduates was years of nephrology practice (including fellowship training), geographic location, and practice locale (urban, suburban, or rural). Fellows were asked only for year of training and geographic location. Program site identification was not requested. Graduates were also asked if they were practicing interventional nephrology, whether they were involved in training nephrology fellows, and type of nephrology practice. Survey questions were parallel to allow comparisons.

**Objectives: Program Directors and Fellows**

1. To determine the percentage of surveyed programs that offer POCUS training, what type, geographic distribution, and how it is integrated into the curriculum.
2. To determine the percentage of fellows that have had/will receive POCUS training, of what type, and how it is integrated into the curriculum.
3. To determine fellow confidence in their ability to perform POCUS examinations, and how many they perform.
4. To determine barriers to POCUS training perceived by nephrology program directors.
5. To describe the percentage of clinical faculty estimated by program directors and fellows to be competent in POCUS.

**Table 1.** Demographics of Nephrology Program Directors, Fellows, and Graduates Responding to the Survey

| Survey                                               | Nephrology Program Directors | Nephrology Fellows | Graduates   |
|------------------------------------------------------|------------------------------|--------------------|-------------|
| Number surveyed                                      | 151                          | 361                | 89          |
| Response                                             | 46% (69/151)                 | 33% (118/361)      | 62% (55/89) |
| Forwarded survey to fellows                          | 36% (55/151)                 | NA                 | NA          |
| Median number of clinical fellows                    | 6 (IQR 4,8)                  | NA                 | NA          |
| Number of fellows to whom survey was forwarded       | 361                          | NA                 | NA          |
| On-duty nephrology fellows (2021-2022) <sup>23</sup> | NA                           | 873                | NA          |
| Year of training                                     |                              |                    |             |
| First year                                           | NA                           | 42% (50/118)       | NA          |
| Second year                                          | NA                           | 58% (68/118)       | NA          |
| Time of first POCUS training                         |                              |                    |             |
| None at any time                                     | NA                           | 23% (21/93)        | NA          |
| Medical school                                       | NA                           | 9% (8/93)          | NA          |
| Internal medicine residency                          | NA                           | 49% (46/93)        | NA          |
| Nephrology fellowship                                | NA                           | 14% (13/93)        | NA          |
| Other                                                | NA                           | 5% (5/93)          | NA          |
| In clinical practice                                 | NA                           | NA                 | 86% (47/55) |
| Practicing interventional nephrology                 | NA                           | NA                 | 2% (1/47)   |
| Location                                             |                              |                    |             |
| Northeast                                            | 41% (24/58)                  | 48% (56/116)       | 6% (3/47)   |
| Midwest                                              | 21% (12/58)                  | 26% (30/116)       | 9% (4/47)   |
| West                                                 | 16% (9/58)                   | 13% (15/116)       | 28% (13/47) |
| South                                                | 22% (13/58)                  | 13% (15/116)       | 57% (27/47) |
| Locale                                               |                              |                    |             |
| Urban                                                | 83% (48/58)                  | NA                 | 47% (22/47) |
| Suburban                                             | 12% (7/58)                   | NA                 | 45% (21/47) |
| Rural                                                | 5% (3/58)                    | NA                 | 8% (4/47)   |
| Years in practice                                    |                              |                    |             |
| <5 y                                                 | NA                           | NA                 | 13% (6/47)  |
| 5-10 y                                               | 16% (9/57)                   | NA                 | 21% (10/47) |
| >10-20 y                                             | 49% (28/57)                  | NA                 | 34% (16/47) |
| >20 y                                                | 35% (20/57)                  | NA                 | 32% (15/47) |
| Practice structure                                   |                              |                    |             |
| Academic (associated with fellowship program)        | NA                           | NA                 | 17% (8/47)  |
| Hospital-based health care system                    | NA                           | NA                 | 32% (15/47) |
| Large to medium group practice (≥ 5 nephrologists)   | NA                           | NA                 | 28% (13/47) |
| Small group practice (<5 nephrologists)              | NA                           | NA                 | 17% (8/47)  |
| Other                                                | NA                           | NA                 | 6% (3/47)   |

Abbreviations: IQR, interquartile range; NA, not applicable; POCUS: point-of-care ultrasound.

- To determine whether program directors believe nephrology-specific diagnostic POCUS training should be part of fellowship curricula.

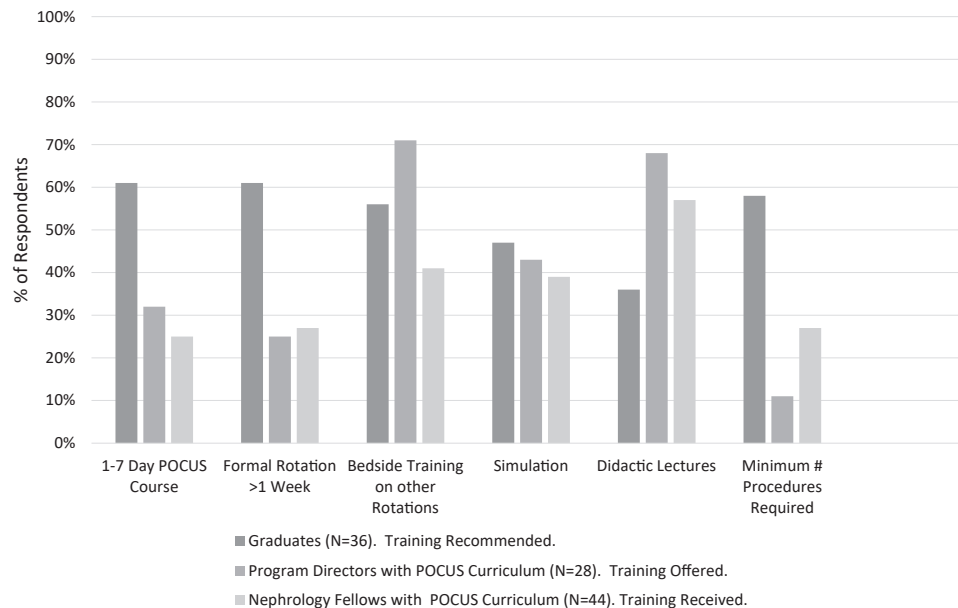
### Objectives: Graduates

- To determine level of POCUS training graduates have received and the relationship of time (<5 years vs 5 or more years) since graduation and use of POCUS in practice.
- To determine when fellowship graduates received training in POCUS, if at all.
- To describe how many and which types of exams are performed in regular clinical practice.

- To describe barriers preventing POCUS use in graduates' clinical practice.
- To describe graduates' opinions on how training should be incorporated into the curriculum.
- To determine which POCUS exams graduates think fellows should be competent to perform at graduation.

### Statistical Analysis

The response rate was calculated as number of complete/partially complete surveys divided by number eligible (RR2).<sup>22</sup> Analysis was descriptive, with percentages, medians, and ranges used as appropriate. Comparison of individual respondents/participating program demographics



**Figure 1.** Methods of POCUS training incorporated into the curriculum and offered to fellows as reported by program directors and received by fellows at programs offering POCUS training compared to training methods recommended by graduates of the Walter Reed Nephrology Program. Abbreviation: POCUS, point-of-care ultrasound.

to the entire population surveyed (to assess nonresponse bias), and comparison of parallel question responses between program directors and fellows were performed using the chi-square or Fisher exact tests.  $P < 0.05$  was considered significant.

## RESULTS

### Program Directors Survey

Forty-six percent (69/151) of US nephrology program directors responded to the survey. The average time spent was 2 minutes with a 79% completion rate (Table S1, Table 1). Fifty-five directors forwarded the survey to 361 fellows, representing 36% of programs. Program and program director demographics are shown in Table 1. Geographic distribution of programs and number of clinical fellows/program was not significantly different than that nationally, and parallel questions within the program directors survey and between the program directors and fellows surveys were answered similarly (Table S2-S3).

Fifty-one percent were currently offering training in POCUS (29/57). Of the 28 programs not currently offering training in POCUS, 13 (46%) were developing a curriculum, 3 (11%) were not planning one, and the remainder were uncertain. Programs with a POCUS curriculum vs those without one were similar based on geographic location (56% [13/23] Northeast vs 47% [16/34] in other areas) and locale (51% [24/47] urban vs 50% [5/10] suburban/rural).

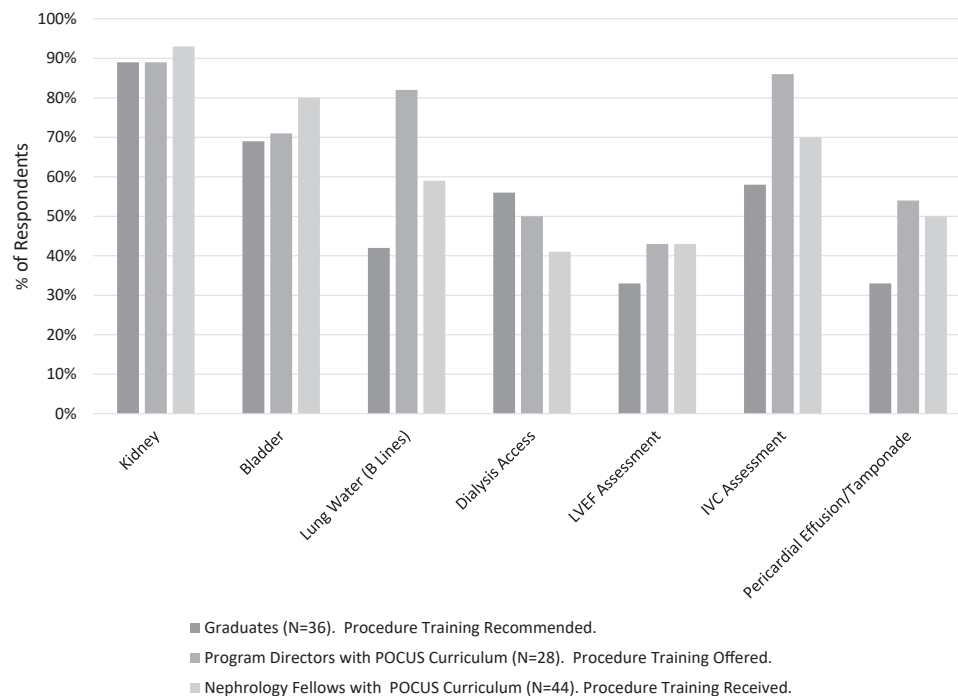
The most common methods of POCUS training by programs (Fig 1) reporting (n=28) were bedside training during non-POCUS oriented rotations (71%), didactic

lectures (68%), and simulation training (43%). Twenty-nine percent offered interventional nephrology training/rotations; only 11% required a minimum threshold number of exams be attained. The most commonly taught POCUS examinations (Fig 2) were kidney (89%), IVC assessment (86%), lung water (82%), and bladder (71%).

Barriers to incorporating POCUS into the curriculum are shown in Fig 3. Most commonly cited were lack of sufficiently trained faculty (78%), program directors themselves not being sufficiently trained/not being confident in their training (65%), and expenses involved in purchasing/maintaining equipment (51%). Sixty-four percent (35/55) of program directors reported that <10% of their faculty were “able to perform any diagnostic POCUS procedure.” Only 15% of programs had >50%-75% of faculty able to perform any diagnostic POCUS procedure, and none had >75%. Fifty-one percent (28/55) of program directors reported having no POCUS training themselves. Seventy-three percent (40/55) of program directors agreed/strongly agreed that POCUS should be a part of the fellowship curriculum, whereas 11% disagreed/strongly disagreed. One program director commented, “...nephrology fellows should train with emergency department, hospital medicine, etc. in an accredited well-organized program. Instead, each program keeps reinventing the wheel on a shoestring” (Item S4).

### Fellow Survey

The survey was forwarded to 361 fellows, representing 36% of US nephrology programs and 41% (361/873) of clinical nephrology fellows (Table 1).<sup>2,3</sup> There was a 33%



**Figure 2.** POCUS procedures taught to fellows reported by program directors and reported as received by fellows at programs with POCUS training compared to procedures recommended for training by graduates of the Walter Reed Nephrology Program. Abbreviations: IVC, inferior vena cava; LVEF, left ventricular ejection fraction; POCUS, point-of-care ultrasound.

response rate (118/361), with an average time of 3 minutes spent, and an 80% completion rate (Table S1, Table 1). Fellow demographics are shown in Table 1. Notably, almost half first received training in POCUS during internal medicine residency.

Forty-six percent of fellows reported either having or being scheduled to have POCUS training as part of their fellowship curriculum. Among these (n=44), the most commonly reported methods of POCUS training are shown in Fig 1 and were similar to those reported by the program directors: didactic lectures on POCUS (57%), simulation training (39%), and bedside training during non-POCUS oriented nephrology fellowship rotations (41%). The most commonly taught POCUS exams (Fig 2) were kidney (91%), bladder (80%), and IVC assessment (70%).

Table 2 shows fellows' level of confidence and frequency of assessments in performing POCUS examinations. Among trained fellows, the highest levels of confidence were reported for lung water (46%), IVC (37%), and bladder (34%) assessment. Fewer than half of trained fellows had performed any given POCUS examination in the past 90 days, and 52% (21/40) did not perform any type of examination in a typical week.

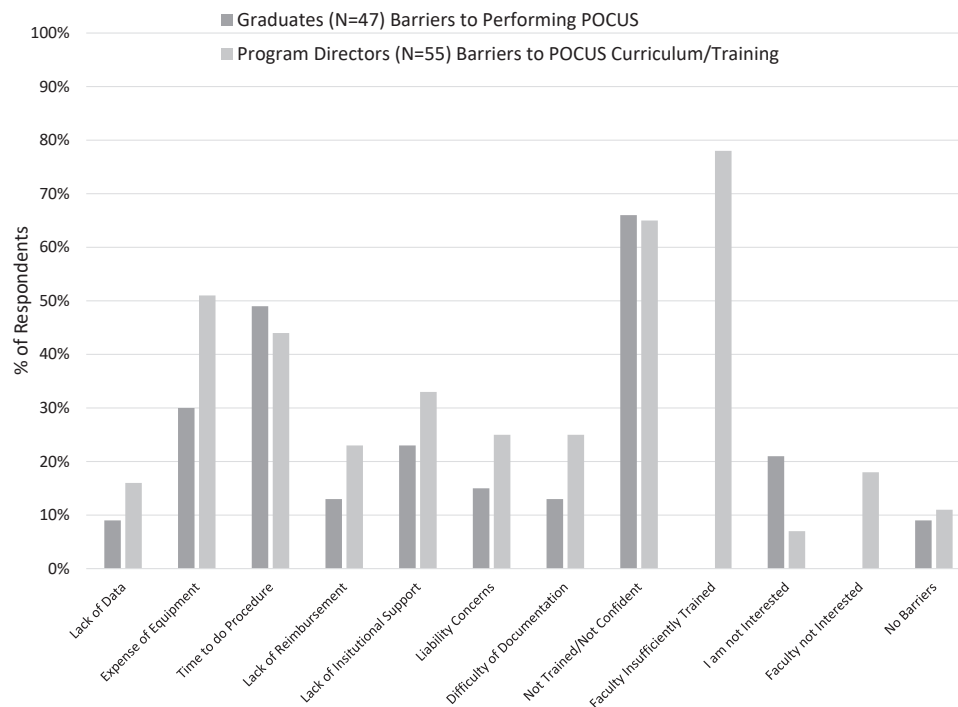
Similar to program directors, 55% (47/85) of fellows reported that <10% of faculty were able to perform diagnostic POCUS; 9% (8/85) reported that >50% of faculty could. Overall, 64% (58/91) reported having too little POCUS training, and no fellow felt they had too much. Of those who received training during fellowship, 38% (15/

40) indicated the amount of training was “just about right,” whereas 50% (20/40) indicated they had received “too little.” The most commonly desired methods of POCUS training were attendance at a 1-7 day course (10/17; 59%) and a formal POCUS rotation >1 week (10/17; 59%). One fellow commented, “It is hard to get additional POCUS training since none of the clinical faculty are themselves trained in POCUS” (Item S4).

### Graduate Survey

There were 55/89 responses from graduates (62% response rate). Average time spent was 3 minutes, with a 98% completion rate (Table S1, Table 1). Forty-seven (86%) were active in nephrology clinical practice. Graduate demographics are described in Table 1. Reported years in practice was not significantly different than that of the entire graduate cohort (see Tables S2-S3). Unlike the program directors, the majority practice in the southern/western United States, and fewer practiced in an urban setting. Although 17% (8/47) belonged to an academic practice, 32% (15/47) were involved in training nephrology fellows. Fifty-three percent (25/47) reported having no POCUS training, and of the 22 that had, 10 had on-the-job training after fellowship. Three had participated in the 1-month POCUS rotation beginning in training year 2018-2019.

Only 7/47 (15%) graduates perform POCUS. Those in clinical practice <5 years were significantly more likely to perform POCUS vs those in practice 5 or more years (3/6 vs 4/41;  $P = 0.03$ ). Of the 7 graduates who perform



**Figure 3.** Barriers to performing POCUS in clinical practice (graduates) or incorporating POCUS into the fellowship training curriculum (program directors). Twenty-one percent of program directors (12/55) also noted that another barrier to incorporating POCUS into the curriculum is that it was not required by the Accreditation Committee for Graduate Medical Education. Abbreviation: POCUS, point-of-care ultrasound.

POCUS, 5 (71%) did 5 or fewer examinations/week. The exams most frequently performed were kidney (100%), bladder (71%), and dialysis access evaluation (71%).

Barriers to performing POCUS (Fig 3) were time required (49%), lack of training (45%), and expenses involved in purchasing/maintaining equipment (30%). Forty-five percent (10/22) of graduates who had prior training reported not feeling confident in their ability to perform POCUS.

Seventy-seven percent (36/47) of graduates felt that POCUS should be incorporated into the fellowship curriculum. Most frequently recommended components of training (Fig 1) were attendance at a 1-7 day nephrology-oriented course (61%), a dedicated rotation >1 week (61%), and attainment of a minimum threshold number

of procedures (59%). Eighty-nine percent of graduates recommended that fellows should be competent in kidney examination at the time of graduation, followed by bladder (69%), IVC assessment (58%), and dialysis access (56%) examinations.

## DISCUSSION

Our survey demonstrates a clear desire for more POCUS training during nephrology fellowship among program directors, fellows, and graduates. The majority of respondents in the 3 groups reported not feeling sufficiently trained or confident to perform POCUS. The most commonly cited barrier to fellow training and subsequent use of POCUS was lack of trained faculty. Without

**Table 2.** Reported Level of Confidence and Frequency of Performing Specific POCUS Examinations among POCUS-Trained Fellows

| POCUS Examination              | Trained     | Trained and Confident/Extremely Confident in Performing | Among Trained, Performed in Last 90 days |
|--------------------------------|-------------|---------------------------------------------------------|------------------------------------------|
| Kidney                         | 62% (56/90) | 27% (15/56)                                             | 36% (20/56)                              |
| Bladder                        | 65% (58/89) | 34% (20/58)                                             | 24% (14/58)                              |
| Lung water                     | 63% (56/89) | 46% (26/56)                                             | 34% (19/56)                              |
| IVC assessment                 | 66% (59/90) | 37% (22/59)                                             | 42% (25/59)                              |
| Dialysis access                | 52% (46/89) | 13% (6/46)                                              | 28% (13/46)                              |
| LVEF assessment                | 53% (48/90) | 17% (8/48)                                              | 23% (11/48)                              |
| Pericardial effusion/tamponade | 62% (55/89) | 22% (12/55)                                             | 18% (10/55)                              |

Abbreviations: IVC, inferior vena cava; LVEF, left ventricular ejection fraction; POCUS, point-of-care ultrasound.

sufficient numbers of trained faculty, it is difficult to teach POCUS, and it is difficult for fellows to subsequently maintain and increase proficiency and confidence.

Among Walter Reed National Military Medical Center graduate respondents, lack of training and procedural confidence were the most common barriers to POCUS use. The majority (66%) of our graduate respondents had not been trained in POCUS or did not feel confident despite prior training. A similar percentage of program directors (65%) also reported not being sufficiently trained or confident. This extended to faculty. The majority of fellows and program directors reported that <10% of faculty were able to perform POCUS.

Trained fellows and graduates may not perform enough POCUS exams to maintain or increase proficiency. The minority of trained fellows regularly did POCUS exams, and this may reflect their lack of confidence in performing the procedures. About half did none in a typical week. Only 15% of graduate respondents performed POCUS in regular clinical practice, and of those, 71% performed 5 or fewer procedures weekly. Even among fellows confident in their initial training, skill atrophy may be a serious concern if there are no trained staff to supervise POCUS procedures after initial training.

The 2 POCUS training methods most commonly recommended by graduates and fellows were a 1-7 day nephrology-oriented POCUS course and a formal rotation longer than 1 week. However, these were less commonly offered by training programs. The most commonly offered types of training were bedside training in non-POCUS oriented rotations, didactic lectures, or simulation. Without enough trained faculty, bedside training may be infrequent and unstructured. Lectures and simulation can only serve as an introduction, but such training is likely all that is feasible for programs with few or no trained faculty.<sup>1</sup>

Kidney, bladder, lung water, and IVC assessment were commonly recommended for inclusion in the POCUS curriculum and were the most common procedures taught in programs offering POCUS training. However, graduates had a somewhat different perspective from program directors on the importance of several POCUS procedures. For example, over 85% of program directors with a POCUS curriculum offered training in lung water evaluation, but only 42% of graduates recommended that it be taught. Seventy-one percent of graduates performing POCUS do dialysis access evaluation, and 56% of all graduates recommended fellows be taught this skill. About half of program directors with a POCUS curriculum offered dialysis access evaluation training, and only 41% of fellows from programs with a POCUS curriculum had received training.

Moore et al<sup>4</sup> recently reported national surveys of nephrology fellows, program directors, associate program directors, and other faculty regarding POCUS training. These results were not available at the time we conducted our survey and were performed in the previous training year. Their fellow survey, which had a 69% response rate, indicated 38% had received

POCUS training, and only 33% of these felt they would be competent to perform it at fellowship completion, in line with our results regarding fellow confidence in performing specific procedures (which ranged between 13%-46%). The faculty survey was an open access (flash poll) survey of program directors, associate program directors, and some interested faculty. Only 23% of respondents indicated that they had a POCUS curriculum, whereas in our survey, 51% did. This may reflect an increase in training programs offering POCUS curricula between the 2 training years or may be because of the flash poll recruitment mechanism. In both surveys, diagnostic kidney ultrasound was identified as the most important/most frequently taught skill, and lack of trained faculty was identified as the greatest barrier to implementing a POCUS curriculum.

Strengths of our survey include that it was a targeted survey, directed only to program directors and their fellows, allowing for equal representation of programs. Fellow and program director surveys were longer and more detailed. We also surveyed graduates of our own program, thus addressing POCUS practice among clinical nephrologists from a single training program with a recently established POCUS curriculum. Response rates were good for an online survey of subspecialist physicians, especially in view of the complexity of survey delivery and dependence on program directors to deliver fellow surveys and reminders.<sup>19,22,24</sup> Eighty percent forwarded the survey to their fellows, and thus we have information from both fellow and program director perspectives for 36% of US nephrology programs. The programs surveyed were similar in terms of geographic location and size to US nephrology programs overall, suggesting that non-responding program directors were not different from respondents with regard to these attributes. Limitations include the loss of respondents as program directors and fellows moved through the survey and inability to ensure that fellows received reminders from their program directors. The graduate survey included only practicing nephrologists who graduated from a single military training program.

Our fellowship has instituted a POCUS training program (SC, SP), a 4-week rotation dedicated to training and practice in nephrology-specific POCUS with a required attainment of a minimum threshold number of procedures. Four classes have completed this program (training years 2018-2019 through 2021-2022). Notably, 50% of our graduates with less than 5 years practice experience (who would have received this training) regularly perform POCUS, significantly higher than those with 5 years or more in practice. Although this particular model may not be feasible in every hospital system, we would recommend dedicated hands-on training and a minimum threshold number of procedures for faculty. Trained

faculty could then train and supervise other faculty and fellows, allowing for continued practice and advancement in confidence.<sup>1,2</sup>

POCUS appears to be part of the nephrology fellowship curriculum in about half of programs nationwide, with about half of programs without such training actively pursuing it. A majority of program directors, fellows, and graduates surveyed agreed that nephrology-specific POCUS should be incorporated into the fellowship curriculum. In general, fellows and program directors do not feel sufficiently trained or confident to perform POCUS, and the greatest barrier to incorporating POCUS into the fellowship curriculum is a lack of trained faculty. By “training the trainers,” nephrology fellowship programs can better integrate POCUS into their curricula. The presence of trained and confident faculty will prevent skill atrophy and build fellow confidence. Some of these fellows will become faculty, and thus, training capacity will grow organically.

## SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

**Item S1:** Program Directors Survey

**Item S2:** Fellows Survey

**Item S3:** Graduates Survey

**Item S4:** Survey Comments

**Table S1:** Response to Survey and Completion of Survey Questions

**Table S2:** External Validity Evidence

**Table S3:** Internal Validity Evidence

## ARTICLE INFORMATION

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## Point of Care Ultrasound (POCUS) Use in Nephrology: A Survey of Nephrology Program Directors, Fellows, and Fellowship Graduates

Kidney  
Medicine

### Study design

Anonymous  
online survey

Response  
Rate



US Nephrology  
Program directors  
(PD)  
(2021 - 22) n = 151

46%



Fellows  
n = 361

33%



Graduates of  
Walter Reed  
Program (1980 -  
2022) n = 89

62%

### Results

Programs offering  
POCUS training

51%

Rotations (71%)  
Didactic lectures (68%)  
Simulation (43%)



46%

Fellows receiving  
POCUS training



Insufficient training reported:  
Kidney (56%)  
Bladder (50%)  
IVC (46%)

### Barriers reported

**Program Directors**  
Not enough trained faculty (78%)  
Themselves not being sufficiently trained (55%)  
Equipment expense (51%)

**Fellows**  
Too little POCUS training (64%)

**Program directors (72%) & graduates (77%)**  
POCUS should be incorporated into the fellowship curriculum

**Preference of fellows (59%) & graduates (61%)**  
Hands-on POCUS training > didactic lectures or simulation

**Conclusion:** Nephrology program directors, fellows, and graduates surveyed want POCUS training incorporated into the fellowship curriculum. No group felt sufficiently trained to confidently perform POCUS. The major barrier to training was lack of sufficiently trained faculty.

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