Evaluating the impact of structured POCUS training during internal medicine clerkship and residency training

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ABSTRACT

Background: *Point of Care Ultrasound (POCUS) is a vital tool in rheumatology for detecting pathologies like osteophytes and joint effusion. Its integration into rheumatology electives during internal medicine clerkship and residency is limited, despite its emphasis in pre-clinical years.*

Methods: *In this QIRB-approved, single-center, prospective study (2022–2023), third- and fourth-year medical students and internal medicine residents in a two-week rheumatology elective voluntarily completed online surveys. These surveys assessed their confidence using POCUS in rheumatology, using a 5-point Likert scale.*

Results: *A survey of 25 residents and 10 medical students found that 84% of residents and 90% of students rated POCUS training as valuable or very valuable. Both groups felt more confident identifying knee joint effusion (average scores: 3.5 for students, 2.6 for residents) compared to other ultrasound techniques and pathologies. Confidence was lower in hip ultrasounds (2.20 for students, 1.68 for residents) and chondrocalcinosis identification (2.20 for students, 1.76 for residents). Among participants, 28% of residents and 70% of students had prior informal POCUS training. Previous training significantly increased comfort levels, with average scores of 2.86 for students and 2.30 for residents, compared to 2.69 and 1.91 for those without prior training (P-values: <0.001).*

Conclusion: *Prior experience significantly enhances confidence and comfort, reinforcing the need for early, comprehensive, and targeted POCUS training in medical curricula to address proficiency gaps.*

Keywords: Education, medical, undergraduate, rheumatology, point-of-care systems, ultrasonography

INTRODUCTION

Ultrasonography has evolved over the past fifty years due in part to recent advancements in portability, quality, and affordability, driving the expansion of point-of-care ultrasound (POCUS), previously defined as ultrasonography performed and interpreted by the clinician at bedside.[1] Point-of-care ultrasound is a rapidly deployed diagnostic tool performed by attending physicians across multiple disciplines; it supplements traditional radiological investigations due to its immediacy and the growing demand for diagnostic imaging.[2] A major benefit of integrating POCUS into routine clinical practice is that sonographic results enhance the physical examination, eliminating the need to move patients for additional imaging or involve other clinicians.[2] Specialized clinicians can develop expertise in using ultrasound for focused assessments of specific organs, pathologies, or procedural guidance, complementing the broader examinations typically performed by radiologists.[1]

One specialization is the use of ultrasound in rheumatology, which has clinical applications in both

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diagnosing and monitoring rheumatologic diseases. The ability of ultrasound to detect inflammatory changes makes it a particularly useful tool in rheumatoid arthritis. It effectively detects inflammatory markers, such as synovial effusion, periarticular soft tissue swelling, and power Doppler signals, which are essential for the comprehensive management of rheumatoid arthritis.[3] This imaging technique also has an important role in early detection and intervention by identifying subclinical inflammation and initial erosive changes in joints, essential for effective treatment strategies in inflammatory arthritis.[3] The demand for POCUS training is growing, with a recent Canadian survey highlighting that only 42% of resident trainees received formal training, while 89% of program directors felt formal training should be a formal part of rheumatology training.[4]

As ultrasound technology becomes a staple in rheumatology, its impact on medical education becomes increasingly important. The widespread use of ultrasound in the diagnosis of rheumatologic diseases offers a unique opportunity to integrate advanced imaging techniques into the medical curriculum. A recent national survey of medical schools found that while the majority of schools did include ultrasound in their curricula, most schools required ultrasound sessions in the preclinical years and focused on cardiac and gallbladder ultrasound, and the e-FAST examination.[5] The majority of schools, however, lacked a longitudinal ultrasound curriculum throughout the clinical years of medical school. One survey-based study across multiple institutions indicated that a majority of medical students lacked confidence in the interpretation of medical imaging and would prefer more teaching about radiology in their clerkships.[6] Other studies have investigated medical students' confidence in using ultrasound as a tool to learn anatomy early in the medical school curriculum.[7] However, there is a relative paucity of literature on the impact of ultrasound teaching sessions within rheumatology on medical students' confidence in using this modality during the clinical years of their education.

Methods

This single-center observational prospective study was performed at the Texas Tech University Health Science Center (TTUHSC) School of Medicine Permian Basin (Odessa, TX) campus during the first semester of the 2022–2023 academic year. It used a post-intervention survey to assess the impact of structured ultrasound training on the confidence of participants. The study population included third- and fourth-year medical students and internal medicine residents who completed a two-week rheumatology elective at the TTUHSC Permian Basin campus during the study period. Exclusion criteria included prior formal experience with ultrasound in rheumatology or orthopedics. Prior informal POCUS training in other clinical settings, such as the intensive care unit or emergency department, was not considered an exclusion criterion.

A 5-point Likert scale survey through Qualtrics (Qualtrics XM, Seattle, WA) was administered at the completion of the rheumatology elective. This survey contained questions regarding participants' subjective comfort level with technical aspects of ultrasound, their confidence in identifying findings, such as osteophytes, periarticular soft tissue swelling, joint effusion, and chondrocalcinosis of the knee, hip, and hands, and their overall comfort with ultrasound of these areas.

During the elective, participants engaged in standardized ultrasound curriculum sessions, which included demonstrations of ultrasound techniques and hands-on practice. The curriculum covered various joints, including the knee, hip, and hand, and taught participants to identify anatomical landmarks and pathologic findings using the GE LOGIQ-e portable ultrasound (GE HealthCare, Chicago, IL), under the guidance of experienced instructors. The practical sessions also involved supervised hands-on ultrasound scanning with patient consent.

Data analysis was performed using SPSS (IBM Corp., Armonk, NY) to carry out descriptive statistics, paired sample t-tests, and ANOVA tests to compare mean confidence scores between subgroups. The reliability of the survey responses was assessed using Cronbach's alpha. The study ensured ethical compliance, with all participant data de-identified and securely stored. Participants were informed about the study's purpose and procedures and consented verbally before participating in the surveys and educational sessions.

Results

The structured POCUS training during the internal medicine clerkship and residency training was evaluated via surveys among 25 residents and 10 medical students enrolled in the rheumatology elective. Residents and medical students performed ultrasounds in about one-third of clinic visits, averaging 15 patients per day during a two-week elective rotation. Five residents and one medical student opted out of the POCUS training during the elective.

Confidence in performing POCUS varied significantly across different ultrasound techniques. However, when comparing medical students who opted to do the POCUS training (n = 9) to those who did not (n = 1), no significant difference was observed in their confidence levels; however, the small sample size of the latter group precludes meaningful statistical comparison. Mean confidence score comparisons for residents are presented in Table 1. Residents who received specific POCUS training (n = 20) reported a higher confidence in performing knee ultrasounds, with a significant difference indicated by a p-value of 0.009. Medical students and residents scored an average confidence of 3.5 and 2.6, respectively, for identifying knee joint effusion. Confidence scores for hip ultrasounds were lower, averaging 2.20 for students and 1.68 for residents. The analysis found no significant differences in confidence for hip ultrasounds with a p-value of 0.1636.

Table 1. Comparison of Ultrasound Confidence Between Pocus-trained and Non-trained Resident Participants in Rheumatology

Outcome Variable	POCUS Training (n = 20)	No POCUS Training (n = 5)	P-value
Knee Ultrasound Confidence	2.65	1.4	**<0.05***
Hand Ultrasound Confidence	2.15	1.20	**<0.05***
Hip Ultrasound Performance	1.8	1.2	0.16
Comfort Using Power Doppler	2.1	1.6	0.31
Clinical Acumen in Diseases	4.15	3.8	0.31

*P < 0.05 considered statistically significant.

Confidence scores for identifying chondrocalcinosis were also low, averaging 2.20 for students and 1.76 for residents. Participants with prior informal POCUS training reported higher comfort levels, averaging 2.86 for students and 2.30 for residents, compared to those without previous training, who scored 2.69 for students and 1.91 for residents. The impact of prior informal POCUS training on confidence levels was statistically significant, with p-values ≤0.001 for both student and resident comparisons. The surveys revealed that 84% of residents and 90% of medical students rated the POCUS training as either valuable or very valuable.

Discussion

This study evaluated the comfort levels of residents and medical students with the use of POCUS during a rheumatology elective, particularly for those with prior informal training. Our findings reveal that over 85% of participants acknowledged the significant value of POCUS training in medical education, aligning with similar studies.[8,9] Residents with previous POCUS experience demonstrated greater confidence in performing knee and hand ultrasounds, though their confidence in hip ultrasounds remained comparable to those without prior experience, possibly due to the complexity of the hip structures and associated pathologies.

Medical students at our institution reported higher average confidence scores in POCUS than residents across various anatomical structures. This discrepancy could be explained by the Dunning-Kruger effect, in which individuals with limited knowledge overestimate their competence.[10] In addition, many residents in our cohort received their medical training internationally, where ultrasound education is less prevalent. For instance, while 73% of U.S. medical schools incorporate an ultrasound curriculum, such exposure is considerably rarer in Asian medical schools, which may contribute to the lower confidence observed among our international medical graduates.[11]

Consistent with the literature, both students and residents with prior POCUS experience reported enhanced confidence in their abilities.[9] This correlation between prior exposure and self-assessed competence suggests that early and continued POCUS training could translate to improved practical performance, although our study did not directly assess performance outcomes. The effectiveness of ultrasound training in medical school is evident in the short term, as demonstrated by students successfully performing ultrasound scans and identifying pathologies immediately after training.[12] However, there is limited research on the long-term retention of ultrasound skills among those with minimal initial ultrasound exposure, emphasizing the need for ongoing exposure throughout medical education.

Our study provides valuable insights into POCUS training within rheumatology for medical students and residents, although it is not without limitations. Conducted at a single institution, the findings may have limited generalizability due to potential selection bias. The small sample size of 35 may not fully represent the broader range of educational backgrounds found in other academic settings, particularly those with a higher proportion of U.S. medical graduates. The imbalance in group sizes (with and without training) may skew the data, limiting the strength of comparisons. Moreover, the reliance on self-reported confidence could introduce reporter bias and inaccuracies in self-assessment. The absence of a pre-elective survey also limits our ability to distinguish the effects of prior POCUS training from those acquired during the elective. Further research is necessary to explore effective integration of POCUS training across various medical disciplines.

Conclusions

This study emphasizes the critical importance of POCUS training in clinical education, receiving high ratings from both medical students and residents. It demonstrates that prior experience with POCUS before participating in a rheumatology elective significantly enhances confidence and comfort, highlighting the need for early, comprehensive, and targeted training in medical curricula. While prior experience with POCUS positively impacts confidence, the need for structured, continual training is evident to ensure both immediate and long-term proficiency in ultrasound techniques. Further research is needed to fine-tune the integration of POCUS training and to evaluate its long-term impact on clinical practice and patient outcomes.

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References

1. Moore CL, Copel JA. Point-of-care ultrasonography. N Engl J Med 2011;364(8):749–57.
2. Hashim A, Tahir MJ, Ullah I, et al. The utility of point of care ultrasonography (POCUS). Ann Med Surg (Lond) 2021; 71:102982.
3. Di Matteo A, Mankia K, Azukizawa M, et al. The role of musculoskeletal ultrasound in the rheumatoid arthritis continuum. Curr Rheumatol Rep 2020;22(8):41.
4. Tana T, Al Osaimi N, Gazel U, et al. Musculoskeletal point-of-care ultrasonography training among Canadian postgraduate rheumatology programs. Eur J Rheumatol 2023;10(1):8–11.
5. Russell FM, Zakeri B, Herbert A, et al. The state of point-of-care ultrasound training in undergraduate medical education: Findings from a national survey. Acad Med 2022;97(5):723–7.
6. Dmytriw AA, Mok PS, Gorelik N, et al. Radiology in the undergraduate medical curriculum: Too little, too late? Med Sci Educ 2015;25(3):223–7.
7. Nausheen F, Young C, Brazil J, et al. Confidence level and ability of medical students to identify abdominal structures after integrated ultrasound sessions. Ultrasound Int Open 2020; 6(1):E7–13.

8. Brown CC, Arrington SD, Olson JF, et al. Musculoskeletal ultrasound training encourages self directed learning and increases confidence for clinical and anatomical appreciation of first year medical students. Anatomical Sciences Ed 2022;15(3):508–21.
9. Kessler C, Bhandarkar S. Ultrasound training for medical students and internal medicine residents—A needs assessment. J Clinical Ultrasound 2010;38(8):401–8.
10. Kruger J, Dunning D. Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. J Personality Social Psychology 1999;77(6): 1121–34.
11. Leung KY, Bala K, Cho JY, et al. Utility and challenges of ultrasound education for medical and allied health students in Asia. Hong Kong Med J [Internet] 2024 [cited 2024 Jun 14]; Available from: https://www.hkmj.org/abstracts/v30n1/75.htm
12. Hoppmann R, Hunt P, Louis H, et al. Medical student identification of knee effusion by ultrasound. ISRN Rheumatology 2011; 2011:1–3.