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BRIEF REPORT

Current Use and Barriers to Point-of-Care Ultrasound in Rheumatology: A National Survey of VA Medical Centers

Ayesha Iqbal · Madiha Ahmad · Kevin J. Murray · Jison Sim · Terry J. S. Lund · Anthony J. Andrade · Ariadna Perez-Sanchez · Michael J. Mader · Elizabeth K. Haro · Jason P. Williams · Robert Nathanson · Nilam J. Soni

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ABSTRACT

Introduction: Point-of-care ultrasound (POCUS) can assist rheumatologists in monitoring disease activity, establishing diagnoses, and guiding procedural interventions. POCUS use has been increasing, but little is known about current use and barriers among rheumatologists. The purpose of this study was to characterize current POCUS use, training needs, and barriers to use among rheumatologists in practice.

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A. Iqbal · M. Ahmad · J. Sim · J. P. Williams
Medicine Service, Atlanta VA Medical Center, Atlanta, GA, USA

A. Iqbal · M. Ahmad · J. Sim
Division of Rheumatology, Emory School of Medicine, Atlanta, GA, USA

A. Iqbal
e-mail: aiqbal@emory.edu

M. Ahmad
e-mail: madiha.t.ahmad@emory.edu

J. Sim
e-mail: jison.sim@emory.edu

K. J. Murray
Medicine Service, Louis Stokes Cleveland VA Medical Center, Cleveland, OH, USA

K. J. Murray
Department of Medicine, Case Western Reserve University School of Medicine, Cleveland, OH, USA
e-mail: Kevin.Murray1@va.gov

T. J. S. Lund · A. J. Andrade · R. Nathanson · N. J. Soni
Medicine Service, South Texas Veterans Health Care System, San Antonio, TX, USA

T. J. S. Lund · A. J. Andrade · A. Perez-Sanchez · R. Nathanson · N. J. Soni (✉)
Division of Hospital Medicine, University of Texas Health San Antonio, 7703 Floyd Curl Drive, MC 7885, San Antonio, TX 78229, USA
e-mail: sonin@uthscsa.edu

T. J. S. Lund
e-mail: Terry.Lund@va.gov

A. J. Andrade
e-mail: Anthony.Andrade@va.gov

A. Perez-Sanchez
e-mail: perezsanchez@uthscsa.edu

R. Nathanson
e-mail: nathansonr3@uthscsa.edu

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Methods: A prospective observational study of all Veterans Affairs (VA) medical centers was conducted using a web-based survey sent to all chiefs of staff and rheumatology chiefs about current POCUS use, training needs, barriers, and policies.

Results: All chiefs of staff ($n = 130$) and rheumatology chiefs at VA medical centers ($n = 95$) were surveyed with 100% and 84% response rates, respectively. The most common diagnostic POCUS applications were evaluation of synovitis, joint effusion, tendinopathies, bursitis, and rotator cuff. The most common procedural applications were arthrocentesis and joint, bursa, and tendon injection. Most rheumatology chiefs (69%) expressed interest in training for their group. The most common barriers to POCUS use were lack of trained providers (68%), funding for training (54%), training opportunities (38%), funding for travel (38%), and ultrasound equipment (31%). Lack of POCUS infrastructure was common, and few facilities had POCUS policies (20%), image archiving (25%), or quality assurance processes (6%).

Conclusion: Currently, half of rheumatology groups use diagnostic and procedural ultrasound applications. Most rheumatology groups desire training, and lack of training and equipment were the most common barriers to ultrasound use. Deliberate investment is needed in ultrasound training and infrastructure for systematic adoption of POCUS in rheumatology.

Graphical Abstract available for this article.

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M. J. Mader · E. K. Haro
Research Service, South Texas Veterans Health Care System, San Antonio, TX, USA

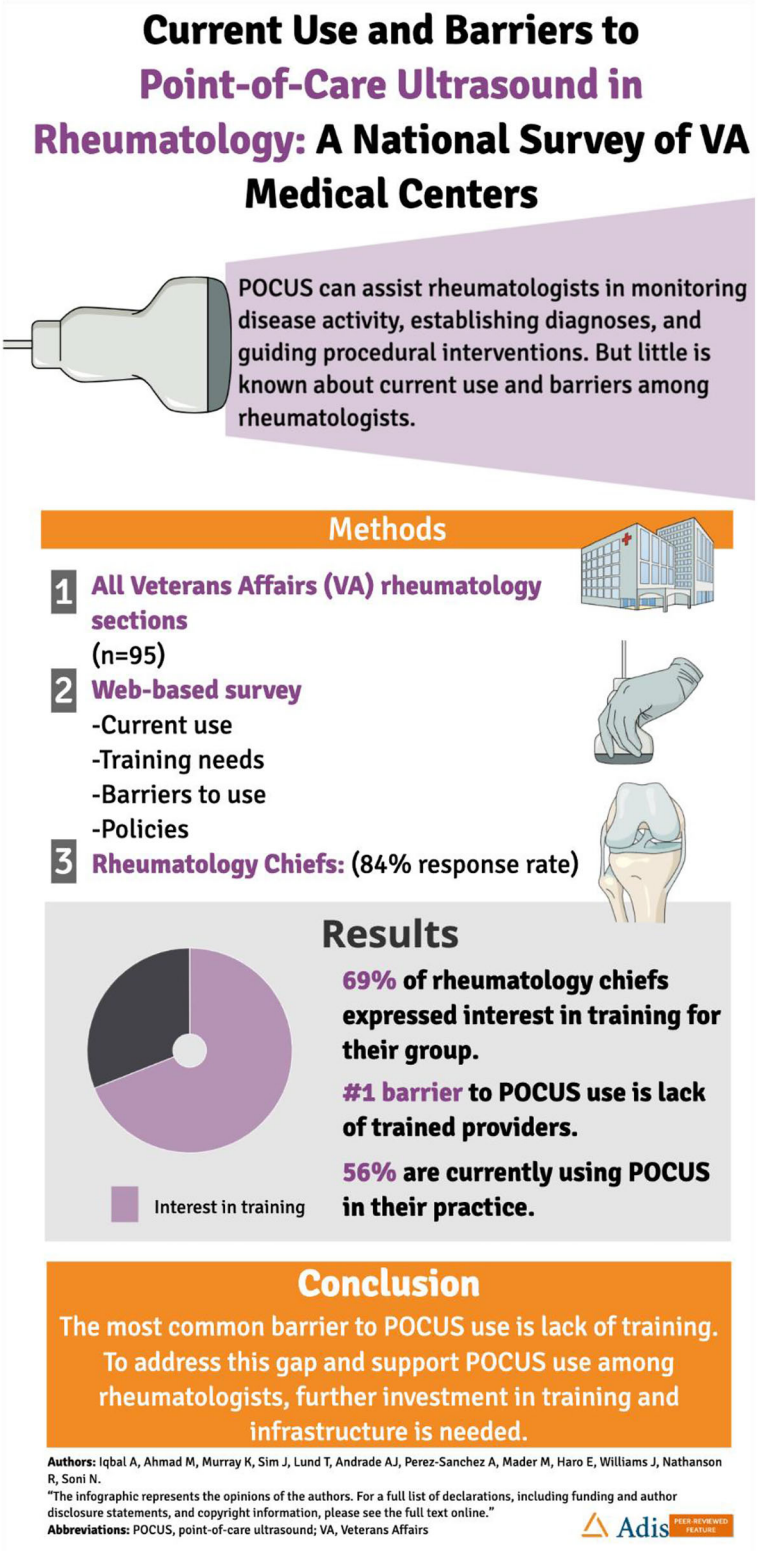
M. J. Mader
e-mail: Michael.Mader2@va.gov

J. P. Williams
Division of Hospital Medicine, Emory School of Medicine, Atlanta, GA, USA
e-mail: jason.phillip.wiliams@gmail.com

E. K. Haro · N. J. Soni
Division of Pulmonary Diseases and Critical Care Medicine, University of Texas Health San Antonio, San Antonio, TX, USA

E. K. Haro
e-mail: haro@uthscsa.edu

Graphical Abstract:



Keywords: Barriers; Musculoskeletal ultrasound; Point of care ultrasound; POCUS; Training

Key Summary Points

Point-of-care ultrasound (POCUS) in rheumatology can be utilized to differentiate inflammatory from non-inflammatory conditions, discerning between various inflammatory arthropathies such as rheumatoid arthritis and spondyloarthritis, monitoring disease activity, and allowing performance of image-guided procedures.

A national survey of rheumatology services at Veterans Affairs medical centers was conducted and demonstrated the most common diagnostic POCUS applications were evaluation of synovitis, joint effusion, tendinopathies, bursitis, and rotator cuff, and most common procedural applications were arthrocentesis and joint, bursa, and tendon injection.

The most common barriers to POCUS use were lack of trained providers, funding for training, training opportunities, funding for travel, and ultrasound equipment. A lack of POCUS infrastructure was common and included lack of POCUS-specific policies, image archival, and quality assurance.

Deliberate investment in development of POCUS training programs and infrastructure is needed to overcome current barriers to expand POCUS use in rheumatology.

DIGITAL FEATURES

This article is published with digital features, including a Graphical Abstract, to facilitate understanding of the article. To view digital features for this article, go to https://doi.org/10.6084/m9.figshare.25370254.

INTRODUCTION

Point-of-care ultrasound (POCUS) use has become increasingly prevalent in rheumatology since the 1990s. The first guidelines on musculoskeletal ultrasound in rheumatology were published in 2001, and since then, several organizations, including the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB), American College of Rheumatology (ACR), and European League Against Rheumatism (EULAR), have published guidelines which have further advanced POCUS use in the diagnosis and management of rheumatic diseases [1–4].

POCUS allows rapid, non-invasive evaluation of both structure and function of the musculoskeletal system. Ultrasound can facilitate diagnosis and differentiation of inflammatory arthropathies to guide targeted therapies, especially in early disease [5]. Most important, the ability to perform dynamic, real-time examinations of the musculoskeletal system is a unique advantage of POCUS that is not possible with plain radiography, computed tomography, or magnetic resonance imaging [6].

Despite the growing enthusiasm and benefits of POCUS in rheumatology, POCUS training is not required by the Accreditation Council for Graduate Medical Education (ACGME) during rheumatology fellowship. Currently, there is limited understanding of how rheumatologists are receiving training and using POCUS in clinical practice. To assess the current use, training needs, and barriers to POCUS use in rheumatology, we conducted a nationwide survey of all rheumatology groups within the Department of Veterans Affairs (VA) healthcare system. Our findings can guide expansion of POCUS use and development of training curricula in rheumatology.

METHODS

A prospective observational study of all VA medical centers was conducted between June 2019 and March 2020 using a web-based survey. A multidisciplinary POCUS Technical Advisory Group with physicians from emergency medicine, internal medicine, hospital medicine, pulmonary medicine, and critical care collaborated with the VA's Healthcare Analysis and Information Group to develop and disseminate a web-based survey systemwide (Verint Systems, Inc.® 2019). The Institutional Review Board of the University of Texas Health Science Center San Antonio reviewed and deemed this study to be non-research (Protocol Number HSC20210630NRR; NCT03296280). VA medical centers provided consent for participation and publication of this study. The same survey and statistical analysis methods have been used in our previously published articles analyzing data from other specialties [7–10].

The web-based survey included questions on current use, barriers to use, institutional support, equipment, and training needs of POCUS. Question types were multiple-choice; forced-choice (yes/no); open-ended with numerical or free-text entry; and free-text boxes when "other" was selected. For questions of prevalence, respondents were provided the option to answer as few (1–25%), some (26–50%), many (51–75%), most (76–99%), or all (100%).

The survey was deployed in two phases. First, a survey was distributed to all chiefs of staff (n = 130) of VA medical centers nationwide between August and October 2019. The chief of staff survey included 10 questions about facility-level POCUS use, training, competency, and policies, and contact information of the rheumatology chief (Supplementary Materials Supplemental File 1). Second, a survey with 18 questions was sent to all rheumatology chiefs at each facility to obtain service-level data on diagnostic and procedural POCUS use, training needs, workflows, and equipment availability (Supplementary Materials Supplemental File 2). Rheumatology chiefs reported on POCUS use on behalf of their service and specialty at their respective VA medical center. The survey period for rheumatology chiefs started in December 2019 but ended early in March 2020 because of the COVID-19 pandemic.

In 2015, we conducted a similar prospective observational study of all VA medical centers. Instead of querying all rheumatology chiefs, the chiefs of staff forwarded the survey to all specialty service chiefs that the chiefs of staff believed were using POCUS. To account for this difference in data collection, a subgroup analysis of 21 rheumatology groups that answered both the 2015 and 2020 surveys was conducted to assess trends in POCUS use.

We used the paired chi-squared test to compare facility characteristics between groups that currently use POCUS and those that do not use POCUS. A p value less than 0.05 was considered statistically significant.

RESULTS

All chiefs of staff (n = 130) and rheumatology service chiefs (n = 95) at VA medical centers were surveyed with 100% and 84% response rates, respectively. Characteristics of rheumatology groups completing the survey are summarized in Table 1, divided by groups that use versus do not use POCUS. Most rheumatology groups were from urban VA medical centers categorized as high complexity. Groups that use POCUS were more likely to have at least two full-time equivalent rheumatologists on staff (42% vs 17%, p = 0.016). The median number of rheumatology clinic patient visits per year from respondent sites was 1320 (IQR 930–2170). About half (45%) of rheumatology groups reported having fellows, and 39% provided POCUS training to fellows.

Current Use

Most rheumatology groups (56%) reported having at least one provider using POCUS. Musculoskeletal diagnostic and procedural applications were more commonly used compared to non-musculoskeletal applications (Fig. 1). The most common procedural POCUS applications were arthrocentesis followed by injection of joints, bursa, and tendons. The

Table 1 Characteristics of point-of-care ultrasound use in rheumatology groups

Characteristic	All groups (n = 80)	POCUS users (n = 45)	POCUS non-users (n = 35)	p value
Internal medicine beds				
< 50	25 (31%)	11 (24%)	14 (40%)	0.14
≥ 50	55 (69%)	34 (76%)	21 (60%)	
Rheumatology FTEs				
< 2	55 (69%)	26 (58%)	29 (83%)	0.016
≥ 2	25 (31%)	19 (42%)	6 (17%)	
Rheumatology clinic volume (patients per month)				
< 100	30 (28%)	13 (29%)	17 (49%)	0.071
≥ 100	50 (72%)	32 (71%)	18 (51%)	
Complexity level[a]				
High	70 (88%)	40 (89%)	30 (86%)	0.67
Low	10 (12%)	5 (11%)	5 (14%)	
Region				
Northeast	21 (26%)	12 (27%)	9 (26%)	0.55
Midwest	19 (24%)	11 (24%)	8 (23%)	
South	24 (30%)	11 (24%)	13 (37%)	
West	16 (20%)	11 (24%)	5 (14%)	
Location				
Urban	77 (96%)	44 (98%)	33 (94%)	0.58
POCUS training desired				
Yes	55 (69%)	35 (78%)	20 (57%)	0.048
Process to obtain POCUS training				
Yes	16 (20%)	11 (24%)	5 (14%)	0.26
Service chief supports training (onsite or regional POCUS course)	69 (86%)	40 (89%)	29 (83%)	0.44
Facility POCUS policies exists	16 (20%)	11 (24%)	5 (14%)	0.26
POCUS training by CME course				
0	N/A	5 (11%)	N/A	N/A
1–25%		17 (38%)		
> 25%		21 (47%)		
Unknown		2 (4%)		
POCUS training during residency				

Table 1 continued

Characteristic	All groups (n = 80)	POCUS users (n = 45)	POCUS non-users (n = 35)	p value
0	N/A	17 (38%)	N/A	N/A
1–25%		12 (27%)		
> 25%		13 (29%)		
Unknown		3 (7%)		
POCUS training during fellowship				
0	N/A	28 (62%)	N/A	N/A
1–25%		7 (16%)		
> 25%		6 (13%)		
Unknown		4 (9%)		

POCUS point-of-care ultrasound, *FTE* full-time equivalent, *CME* continuing medical education
[a]High complexity facilities have high levels of patient volume, patient risk, specialists, teaching, and research. Low complexity facilities have medium to low levels of patient volume and patient risk, and some to little teaching or research

most common diagnostic POCUS applications were evaluation for synovitis, joint effusion, tendinopathies, bursitis, and shoulder/rotator cuff tears. A complete list of all POCUS applications currently used and training desired is shown in Supplementary Materials Supplemental Table S1.

Training

Most rheumatology groups (69%) desired POCUS training, and groups that currently use POCUS had significantly greater desire for training than groups that do not use POCUS (78% vs 57%, p = 0.048). Nearly all rheumatology chiefs (86%) supported sending their rheumatologists to a local or regional POCUS training course; however, relatively few chiefs (20%) had a process to obtain training for their rheumatologists. Among groups that use POCUS, training was received more frequently through continuing medical education (CME) courses than during residency or fellowship (Table 1).

Desire for training in all these diagnostic and procedural musculoskeletal POCUS applications exceeded current use (Fig. 1). Among diagnostic POCUS applications, training was most desired in bursitis and shoulder/rotator cuff evaluation, whereas injection of tendons, joints, and bursa were the most desired procedural applications. From 2015 to 2020, desire for training in ultrasound for tendinopathies, joint effusion, and arthrocentesis increased (Fig. 2). Few service chiefs (< 7%) reported POCUS use or desire for training in non-musculoskeletal applications, such as cellulitis, abscess, or foreign body evaluation.

Barriers

Most rheumatology groups (87%) reported barriers to POCUS use (Table 2). The greatest barriers to POCUS use were related to training: lack of trained providers, funding for training, training opportunities, and funding for travel. Lack of infrastructure and equipment were the second and third most common barriers.

Only 20% of rheumatology groups reported having policies on POCUS use, and 16% had specific policies on privileging, clinical use, documentation, image archiving, and ultrasound equipment maintenance. Among rheumatology groups that use POCUS, 25% reported archiving images, and only 6% performed quality assurance (QA). However, 53%

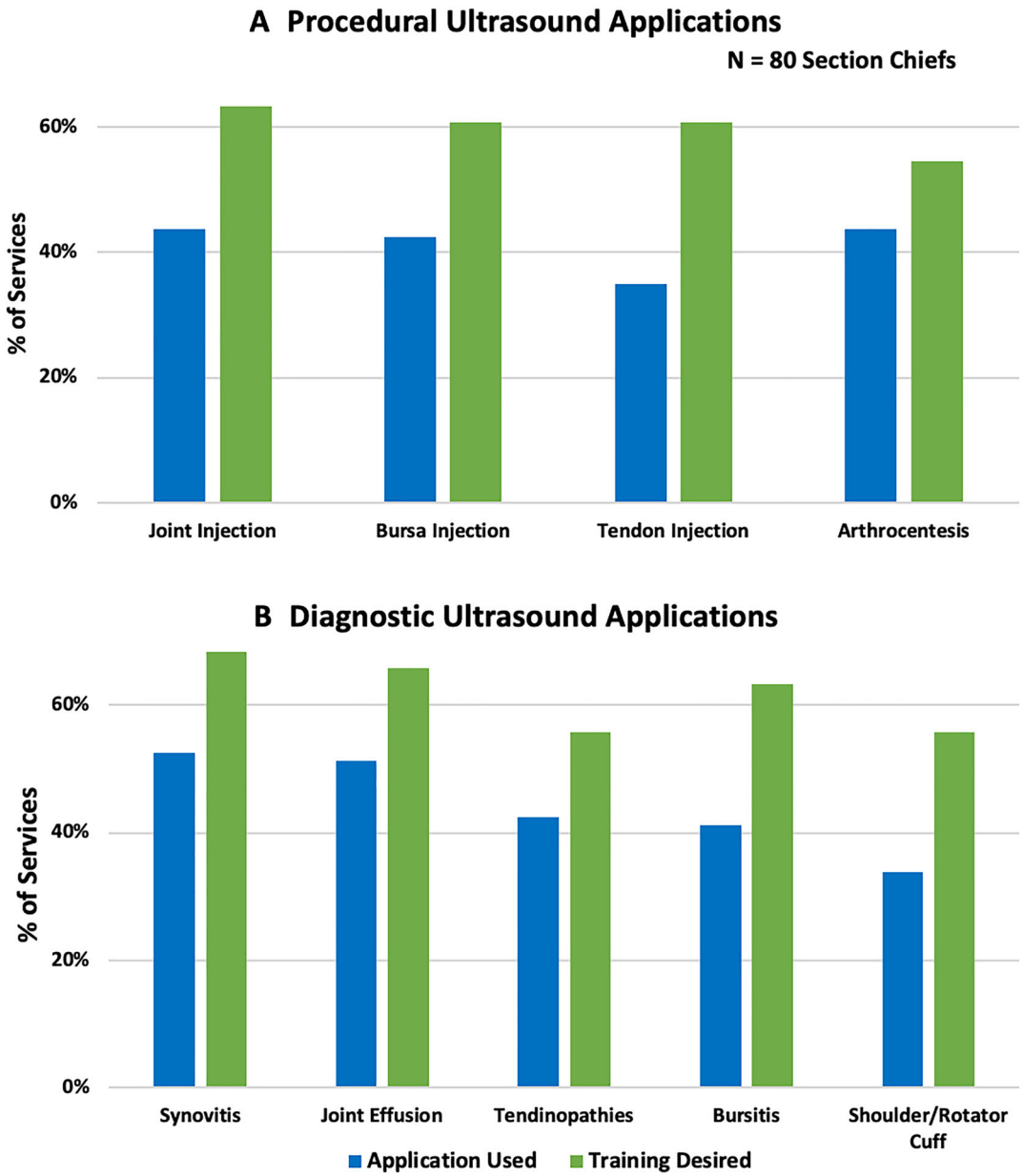


Fig. 1 Current use and desire for training in procedural (**a**) and diagnostic (**b**) point-of-care ultrasound applications in rheumatology

of rheumatology user groups without a QA process expressed interest in establishing a QA process. Half of POCUS user groups (49%) reported creating POCUS encounters and entering billing codes into the electronic health record. Rheumatology groups that do not use POCUS were more likely to report lack of a clinician champion as a barrier (23% vs 4%, $p = 0.018$).

One-third of rheumatology groups reported lack of ultrasound equipment as a barrier, although lack of equipment was less often reported by rheumatology groups that use versus do not use POCUS (16% vs 51%, $p = 0.0006$). Among groups that use POCUS, a

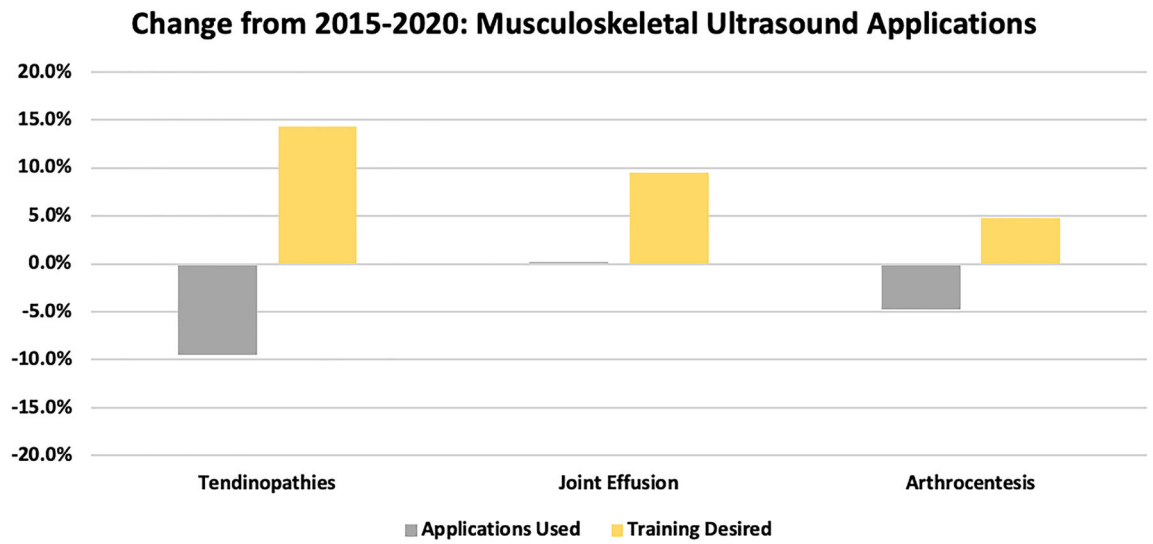


Fig. 2 Changes in musculoskeletal ultrasound use and desire for training in rheumatology from 2015 to 2020

vast majority (87%) reported having at least one ultrasound device dedicated to their service (Supplementary Materials Supplemental Table S2). Only one group reported having a handheld ultrasound device.

DISCUSSION

We have conducted the largest national survey of current use, training needs, and barriers to musculoskeletal ultrasound use among rheumatology groups in the USA. Most rheumatologists recognize the value of musculoskeletal ultrasound, but only half of VA rheumatology groups are currently using common diagnostic and procedural musculoskeletal applications. Several barriers have been identified that must be overcome to facilitate integration into clinical practice, and our findings can guide future POCUS implementation efforts in rheumatology.

POCUS has unique advantages in the care of patients with rheumatic diseases. Since the 1990s, early initiation of more aggressive therapies has been emphasized for inflammatory arthropathies to control disease activity, minimize joint damage and disability, and improve quality of life [5]. However, prolonged delays of several months continue to be an ongoing challenge, and clinical assessment supplemented by an ultrasound examination may facilitate early diagnosis [11, 12]. Ultrasound can help differentiate inflammatory from non-inflammatory conditions, and although further study on use of ultrasound in treat-to-target strategies is needed, initial evidence suggests that ultrasound can facilitate earlier diagnosis and assist in achieving disease remission [13]. Additionally, ultrasound can guide invasive bedside procedures and permit real-time, dynamic evaluation of the musculoskeletal system, a unique characteristic that is not possible with static imaging modalities [6, 14, 15]. Multiple organizations, including EFSUMB, ACR, and EULAR, have published guidelines on the use of ultrasound in rheumatic diseases [1–4].

Lack of training, including lack of funding and opportunities for training, was the most frequently reported barrier to ultrasound use by rheumatology groups. Training as a top barrier to POCUS use has been reported by multiple specialties, including primary care, emergency medicine, hospital medicine, and critical care [7–10]. Most rheumatology chiefs support POCUS training, but only 20% of chiefs had a process of obtaining POCUS training for their rheumatologists. Without a deliberate

Table 2 Barriers to point-of-care ultrasound use in rheumatology groups

Barrier	Number of groups reporting barrier (n = 80)
Training	
Lack of trained providers	54 (68%)
Lack of funding for training	43 (54%)
Lack of training opportunities	30 (38%)
Lack of funding for travel	30 (38%)
At least one of the training barriers listed above	61 (76%)
Infrastructure	
Lack of funding for support staff	20 (25%)
Lack of image archiving	19 (24%)
Lack of standard reporting form	15 (19%)
Lack of funding for simulation space	14 (18%)
No clinician champion	10 (13%)
Lack of privileging criteria	9 (11%)
Lack of facility leadership support	7 (9%)
At least one of the infrastructure barriers listed above	42 (53%)
Equipment	
Lack of ultrasound equipment	25 (31%)
Lack of funding for US equipment	17 (21%)
At least one of the equipment barriers listed above	27 (34%)
Other	
No perceived benefit	5 (6%)
No barriers identified	10 (13%)

investment in training, POCUS use by rheumatologists in practice is unlikely to increase simply over time as seen in our data from 2015 to 2020. To help address the training gap for rheumatologists in practice, the Ultrasound School of North American Rheumatologists (USSONAR) developed a CME course in 2008 to provide mentor-based training over an intensive 8-month period. The formalized musculoskeletal ultrasound curriculum includes reading materials, online assignments, and hands-on training followed by a competency evaluation. While USSONAR and other EULAR and ACR courses have been instrumental in training more rheumatologists, relatively few rheumatologists in practice are able to participate because of the costs, time requirements, and limited availability [16–18]. Though attending POCUS CME courses has been the most common method of receiving training and several courses are available nationwide, training is a complex barrier for rheumatologists in practice that warrants further investigation.

POCUS training has been increasingly incorporated into rheumatology fellowship curricula. In 2008, 41% of rheumatology fellowship programs reported offering ultrasound training which increased to 94% by 2016 with 41% having formal POCUS training curricula [19]. Although competency in POCUS is not mandated by ACGME, the 2023 requirements state clinical sites must have access to ultrasound, and "fellows must demonstrate knowledge of the indications for and interpretation of ultrasonography" [20]. Additionally, the 2022 ACGME Supplemental Guide for Rheumatology includes ultrasound as a competency milestone under procedures for patient care [21]. Some European countries, including Germany and Italy, mandate musculoskeletal ultrasound training during rheumatology fellowship, and we anticipate similar trends in the USA. Since approximately 74% of medical schools and 61% of internal medicine residency programs had POCUS training curricula in 2019–2020, many new fellows seek rheumatology fellowship programs to continue building their musculoskeletal ultrasound skillset, and programs that offer ultrasound training will likely maintain a competitive advantage in recruitment [22, 23]. Recent consensus-based recommendations for Canadian rheumatology residency programs, as well as ACR resources, can guide development of ultrasound training curricula by rheumatology fellowship programs in the USA [24].

Lack of POCUS infrastructure, including image archiving, support staff, and standardized documentation, and limited access to ultrasound equipment were additional barriers identified. Image archiving and documentation are needed for disease monitoring and comparison of images longitudinally as recommended by ACR [3], as well as to fulfill billing requirements. A third of rheumatology groups reported lack of ultrasound equipment as a barrier. In comparison, utilization of POCUS among European rheumatologists appears to be much higher with 90% of providers reporting access to an ultrasound machine [25].

Our study has limitations. Self-reported data were collected from chiefs of staff and rheumatology chiefs, and despite the high response rates, the reported data may not accurately reflect actual clinical practice. Further, data were collected from rheumatology chiefs practicing at VA medical centers which may limit generalizability to other healthcare systems.

CONCLUSION

POCUS use can facilitate early diagnosis and management of patients with rheumatic diseases. Currently, half of rheumatology groups use common diagnostic and procedural ultrasound applications recommended by national guidelines. Lack of training is the main barrier to ultrasound use for rheumatologists in practice, and the desire for training exceeds current use. A deliberate investment in POCUS infrastructure and training is needed to expand POCUS use in rheumatology.

Author Contributions. Michael J. Mader, Elizabeth K. Haro, Jason P. Williams, Robert Nathanson and Nilam J. Soni conceived the study, designed the study questions, and collaborated with VA Health Analysis and Information Group to develop the protocol. Michael J. Mader, Elizabeth K. Haro, Jason P. Williams, Robert Nathanson, and Nilam J. Soni supervised the conduct of the study and data collection. Michael J. Mader, Jason P. Williams, Robert Nathanson, and Nilam J. Soni provided oversight of recruitment of participating centers. Ayesha Iqbal, Madiha Ahmad, Kevin J. Murray, Jison Sim, Terry J.S. Lund, Anthony J. Andrade, Ariadna Perez-Sanchez, Michael J. Mader, Elizabeth K. Haro, Jason P. Williams, Robert Nathanson, and Nilam J. Soni provided statistical advice on study design and analyzed the data. Ayesha Iqbal, Madiha Ahmad, Kevin J. Murray, Jison Sim, Terry J.S. Lund, Anthony J. Andrade, Ariadna Perez-Sanchez, Michael J. Mader, Elizabeth K. Haro, Jason P. Williams, Robert Nathanson, and Nilam J. Soni contributed to drafting parts of the manuscript, and all authors contributed substantially to its revision. Michael J. Mader, Jason P. Williams, Robert Nathanson, and Nilam J. Soni take primary responsibility for the data presented in

this manuscript. Nilam J. Soni takes responsibility as the corresponding author and manuscript as a whole.

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Data Availability. The datasets generated during and/or analyzed during the current study are available from Nilam J. Soni, MD MS, and Michael Mader, MS, on reasonable request.

Declarations

Conflict of Interest. Ayesha Iqbal, Madiha Ahmad, Kevin J. Murray, Jison Sim, Terry J.S. Lund, Anthony J. Andrade, Ariadna Perez-Sanchez, Michael J. Mader, Elizabeth K. Haro, Jason P. Williams, Robert Nathanson and Nilam J. Soni, MD MS declare that they have no competing or conflicts of interest related to this manuscript.

Disclaimer. The contents of this publication do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

Ethical Approval. The Institutional Review Board of the University of Texas Health Science Center San Antonio reviewed and deemed this study to be non-research (Protocol Number HSC20210630NRR). VA medical centers provided consent for participation and publication of this study.

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