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Original Research

# The Current State of Musculoskeletal Ultrasound Education in Physical Medicine and Rehabilitation Residency Programs

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## Abstract

**Background:** Exposure to musculoskeletal ultrasound (MSUS) is now a mandatory component of physical medicine and rehabilitation (PM&R) residency training. However, reports on the extent of the implementation and efficacy of MSUS education are lacking in the literature.

**Objective:** To determine the extent to which PM&R residencies are implementing MSUS education.

**Design:** Cross-sectional.

**Setting:** Institutional.

**Participants:** Thirty-six of the 78 United States PM&R residency programs accredited by the Accreditation Council for Graduate Medical Education.

**Methods:** All 78 programs were solicited with an online survey via the residency program director and coordinator in July 2014. The 25 questions on the survey were aimed at determining program MSUS educational characteristics and their effectiveness.

**Main Outcome Measures:** Description of teaching methods used for MSUS, residency demographics, characteristics of MSUS faculty expertise, and faculty-perceived competency in MSUS examinations and procedures among residents. Data were analyzed using both descriptive statistics and tests for independence to identify correlations between program characteristics and resident MSUS competency.

**Results:** A response was received from 36 of the 78 residency programs (46.2%). Of the 36 residency programs that responded, 97.2% provide exposure to MSUS (a figure that drops to 44.9% when nonrespondents are included); 61% had mandatory MSUS training (28.2% when including nonrespondents); and 44.4% had a formal curriculum (20.5% when including nonrespondents). The most common MSUS educational tools used were lecture (88.9%), outpatient clinic (86.1%), and hands-on workshops (86.1%). Sixty-one percent of responding programs evaluate residents with formal assessment tools. Overall, faculty at 38.8% and 44.4% of programs believed that at least 50% of residents who graduate are competent in diagnostic and interventional MSUS, respectively. These rates were significantly associated with the use of formal assessment.

**Conclusion:** MSUS education is growing in PM&R, but many programs still have not adopted a formal educational curriculum. Formal assessment to evaluate resident MSUS skills significantly improves faculty-perceived MSUS competency.

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## Introduction

In recent years, interest has intensified regarding the clinical and academic utilization of ultrasound in medicine [1,2]. Ultrasound provides many advantages compared with other imaging modalities: it is relatively inexpensive, does not require radiation exposure, and can be performed in the office by the same clinician who performed the history and physical examination or at the point of care [3]. The use of ultrasound is growing

in all specialties, and it is now successfully being taught as early as during medical school [4-6].

Musculoskeletal ultrasound (MSUS) in particular is an exponentially growing field. Traditionally the use of MSUS had been limited to radiology, but in recent years its use has substantially increased in orthopedics, podiatry, rheumatology, sports medicine, and physical medicine and rehabilitation (PM&R) [1]. In fact, the Medicare and Medicaid volume of billed MSUS examinations increased from 56,254 examinations in 2000 to

233,964 examinations in 2009 [1]. Despite this growth in the use of MSUS, many physicians still cite a lack of training as the number one reason for not incorporating MSUS into their practice [7]. A survey of PM&R physicians in 2010 at the International Congress of PM&R found that only 18% use MSUS in practice, but 92.7% believe education should be mandatory, and only 41% received any MSUS education at all [8].

Recently, MSUS exposure has become a mandatory Accreditation Council for Graduate Medical Education (ACGME) requirement for PM&R residency training. Specifically, it is stipulated that residents must gain experience in "acute and chronic musculoskeletal syndromes, including sports-related injuries, occupational injuries, rheumatologic disorders, and use of musculoskeletal ultrasound" [9]. Other specialties, such as emergency medicine (EM), have already made ultrasound a core competency and require a formal curriculum for their residents as one of its 23 residency milestones [10-13]. Although PM&R residencies are not yet required to establish a formal curriculum, it is only a matter of time until this requirement is established. Regardless of the presence of a mandate or lack thereof, many PM&R residencies are developing and integrating formal MSUS curricula to meet the growing need and desire for MSUS training. However, it is unclear to what extent PM&R residencies are currently incorporating MSUS into their curricula.

Guidance is limited regarding the implementation of MSUS training into PM&R residency programs. The Mayo Clinic PM&R residency program has published the only MSUS educational curriculum to date [14]. The curriculum included online courses, reading assignments, hands-on workshops, and clinical experience and was validated as a successful, comprehensive MSUS curriculum [14]. In addition, many studies across multiple specialties have validated various methods of MSUS education and assessment, including peer instruction, self-directed learning, Web-based programs, cadaver laboratories, simulation centers, clinical rotations, objective structured clinical examination, written examinations, and practical examinations [2,15-27]. Ultimately, many methods exist for both education and assessment, but it is important to note that a blended approach using multiple tools appears to be the most common practice [25].

The aim of this study was to describe the current state of MSUS education among PM&R residency programs. We sought to determine the most commonly used educational and assessment modalities and examine how effectively they are being used. We also sought to examine the effectiveness of these educational programs in creating experienced, competent musculoskeletal ultrasonographers. Ultimately, this information may be used as an educational guide for PM&R residencies initiating or further developing MSUS curricula.

## Methods

A survey was sent to personnel at all 78 ACGME-accredited PM&R residency programs using an online form generated through Google Forms. The 78 PM&R programs were identified through the American Medical Association Fellowship Residency Electronic Interactive Data Access System. The survey was electronically sent to both the program director and program coordinator at each residency program. Instructions provided with the survey requested that the survey be completed by the faculty member who is most involved in MSUS education at the residency program. If that faculty member was not available or nonexistent, the program director was instructed to complete the survey. Responses were received from July to September 2014, with 4 reminders sent in addition to the initial e-mail message.

The survey consisted of 2 sections. The first section consisted of 17 questions about residency demographics and methods used for MSUS education. The second section consisted of 8 questions directed toward MSUS faculty to characterize their MSUS practice and expertise. MSUS practice and expertise questions were optional if the survey was completed by the program director because of a lack of MSUS faculty.

Simple descriptive statistics and respective confidence intervals were calculated. Pearson's  $\chi^2$  tests were performed to determine the correlation between MSUS competency and factors such as a formal written MSUS curriculum, mandatory MSUS training, the number of MSUS faculty, the number of years MSUS education has been implemented, the type of MSUS education methods used, use of an assessment method, access to an ultrasound machine after hours, and the opportunity for residents to teach MSUS. The data were analyzed using JMP Pro 11 (SAS Institute, Cary, NC), and Harvard Catalyst statisticians were consulted to plan the analysis.

## Results

Personnel at 36 of the 78 residency programs responded to the survey (46.2%). Residency program demographics are depicted in Table 1. Of the 36 surveys that were returned, 18 (50%) were completed by the

**Table 1**  
Characteristics of the residency programs surveyed and their musculoskeletal ultrasound curriculum

Variables	Median	Mean
Faculty, n	15	19.9
Residents, n	16	17.8
Faculty teaching MSUS, n	3	3.2
Duration MSUS available, y	3	3.9
Formal curriculum duration, y	2	2.4

MSUS = musculoskeletal ultrasound.

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