

# Effectiveness of a Musculoskeletal Ultrasound Curriculum and Injection Course for Improving Resident Musculoskeletal Ultrasound Knowledge and Confidence

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## Purpose of Study

- There is a limited understanding for content selection in musculoskeletal ultrasound curriculum amongst physical medicine and rehabilitation residency (PM&R) programs.
- Primary objective was to assess a formal PM&R musculoskeletal ultrasound curriculum for increasing residents' knowledge and confidence.
- Secondary objectives included collecting resident interest for fellowship, interest with using ultrasound for patient care, experience with ultrasound, satisfaction with course and resources, and feedback for course.

## Design

- Cohort
- Study received IRB approval through Northwestern University

## Setting

- PM&R residency program at an Academic Institution

## Participants

- 36 residents participated:
  - 12 in Post-graduate Year (PGY) 2
  - 12 in PGY-3
  - 12 in PGY-4

## Hypothesis

- The resident group participating in the intervention will have statistically significant improvements in musculoskeletal ultrasound knowledge and confidence with basic anatomical identification and injection set-up.

## Intervention

- All residents completed pre-intervention surveys voluntarily.
- PGY-3 and PGY-4 were required to complete curriculum. They voluntarily filled out post-intervention surveys.

## Pre-Curriculum Surveys

### Average Interest in Ultrasound For Patient Care

Collective Interest (n=36)	4.2
PGY-2 (n=12)	4.58
PGY-3 (n=12)	4.08
PGY-4 (n=12)	3.91

Likert Scale (1-5): 1 (not at all interested), 2 (slightly), 3 (somewhat), 4 (Interested), 5 (very interested)

### Areas of Clinical Interest for Ultrasound Use

Interventional Musculoskeletal	27 of 36	75%
Diagnostic Musculoskeletal	26 of 36	72%
Spasticity	23 of 36	64%
Electrodiagnostic Applications	18 of 36	50%

### PGY-2 Average Exposure to PM&R Ultrasound Applications

n=12	Observed	Performed
Musculoskeletal Procedures	1.8+/-0.6	1.4+/-0.5
Botox	1.3+/-0.4	1+/-0
Diagnostic	2.1+/-0.6	1.3+/-0.4
EMG/NCS	1.1+/-0.3	1+/-0

Likert Scale (1-5): 1 (none), 2 (1-10 exposures), 3 (11-25 exposures), 4 (26-50 exposures), 5 (>50 exposures)

### Fellowship Interest

Sports Medicine	14
None	14
Pain	4
Palliative Care	1
Pediatrics	1
Traumatic Brain Injury	1
Not sure	1

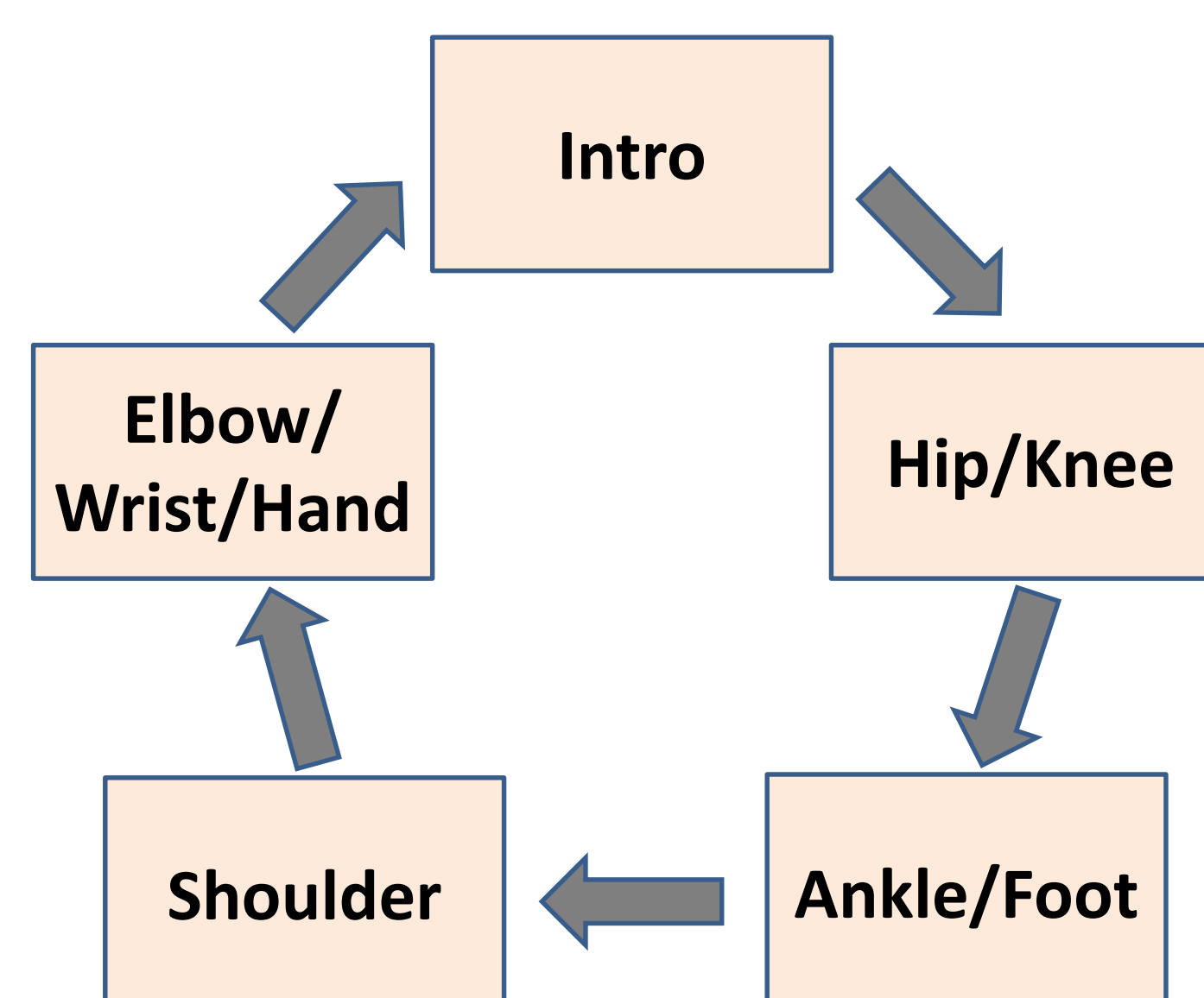
## Pertinent Takeaways

Prior to the curriculum, residents collectively reported being interested in using ultrasound for clinical use. At least 50% of the group endorsed interest in utilizing ultrasound for US guided injections (MSK/Spasticity), diagnostic evaluation, and for supplementing EMG/NCS studies.

At the beginning of the year, the PGY-2 class (n=12) reported little exposure to PM&R ultrasound applications.

This annual curriculum demonstrated a statistically significant summative improvement for musculoskeletal ultrasound knowledge and confidence with basic anatomical identification and injection set-up.

## Structure of Curriculum



### Logistics of Sessions

- Sessions are built into a year long MSK curriculum that reviews each major MSK region covering topics including anatomy, physical exam, kinesiology, pathology, and rehabilitation. See QR code to the left for MSK curriculum structure.
- Attendance is required for PGY-3 & PGY-4
- Ultrasound sessions are 2 hours; 1<sup>st</sup> hour is lecture by attending on topic and 2<sup>nd</sup> hour involves group scanning.
- There are break out groups each led by sports medicine attendings where the area of interest is scanned with a group of 5 to 6 residents.

## Primary Outcomes

### Confidence Differences for Anatomical Identification and Injection Set-up for Musculoskeletal Ultrasound Pre and Post Curriculum

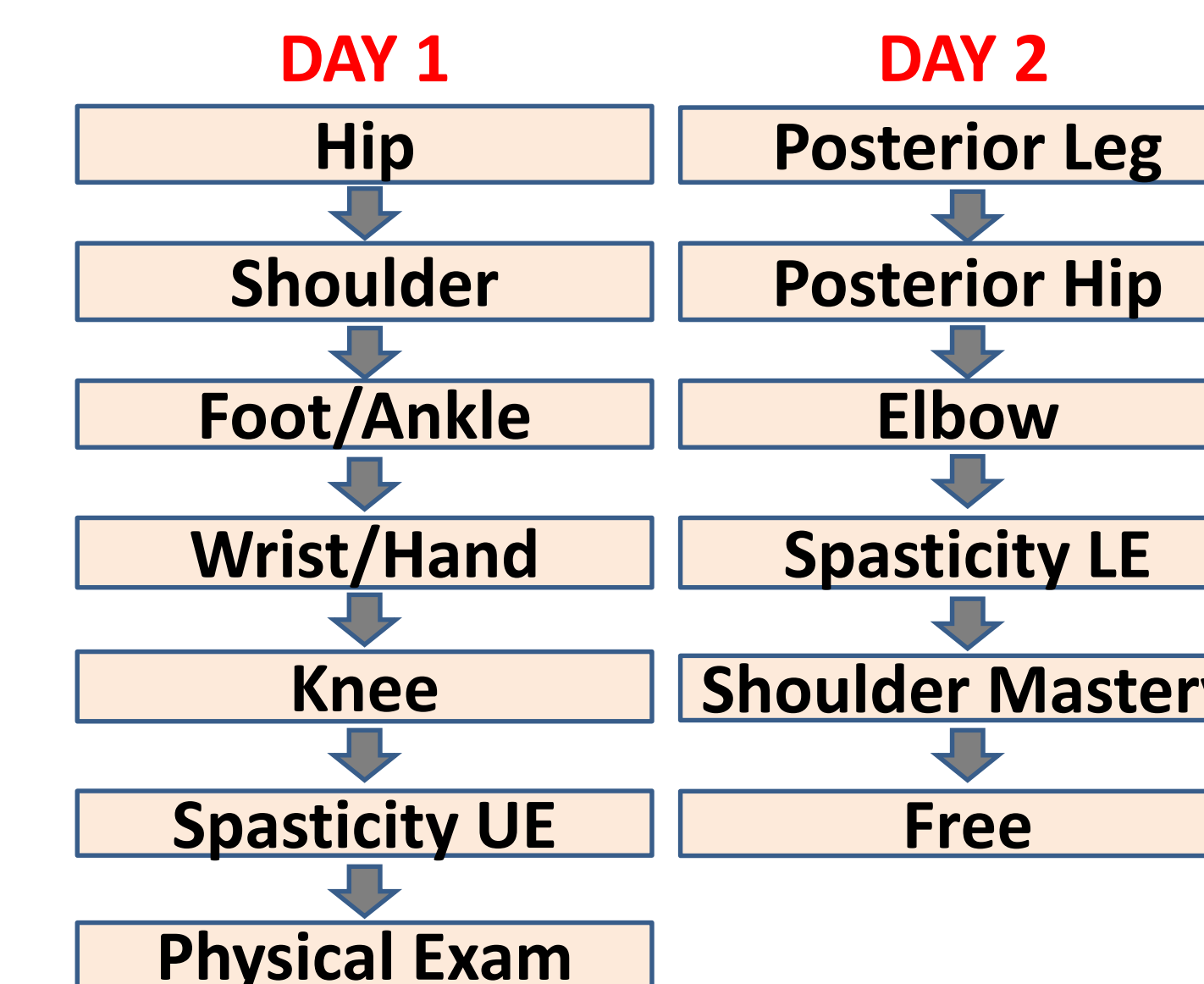
ANATOMICAL IDENTIFICATION	PRE M/SD	POST M/SD	DIFF M/SD	CI (95%)
Fundamentals	2.4+/-1.1	3.6+/-0.9	1.2+/-0.7	0.9-1.5
Shoulder Structures	2.2+/-1.2	3.6+/-1	1.4+/-1	1-1.9
Elbow Structures	1.6+/-0.9	3+/-1.1	1.4+/-0.9	0.9-1.7
Wrist Structures	2+/-1	3.5+/-0.9	1.5+/-1.1	1.1-2.1
Hip Structures	1.8+/-1	3.4+/-0.8	1.6+/-1.1	1.0-2.1
Knee Structures	2.5+/-1.1	4.2+/-0.8	1.7+/-0.8	1.4-2.1
Ankle Structures	1.6+/-0.8	2.8+/-0.7	1.2+/-0.8	0.8-1.5
INJECTION SET-UP				
Shoulder	2+/-1.1	3.6+/-1	1.6+/-0.9	1.2-2
Knee	2.6+/-1.2	3.7+/-0.9	1.1+/-1.1	0.6-1.6
Hip	1.8+/-1	3+/-0.9	1.2+/-1	0.7-1.6
Elbow	1.6+/-0.9	3+/-1	1.4+/-1	1-1.9
Wrist	1.6+/-0.9	3+/-1.2	1.4+/-1.1	0.9-2
Ankle	1.6+/-0.9	2.7+/-0.8	1.1+/-1.1	0.7-1.6
Upper Extremity botox	1.5+/-0.9	2.5+/-1	1+/-1.3	0.4-1.6
Lower Extremity botox	1.5+/-0.9	2.5+/-1	0.9+/-1.2	0.4-1.4

n=22 participants; M/SD=Mean/Standard Deviation; CI= Confidence Interval; DIFF=Difference. Confidence was measured by a Likert Scale (1-5): 1 (not at all), 2 (slightly), 3 (somewhat), 4 (confident) 5 (very confident)

## Structure of Injection Course

### Logistics of Course

- The course occurred over a two day time period and each station was between 40 and 45 minutes in duration. Stations are listed below.
- Each station had two attending physicians guiding the residents through different types of injections on fresh-frozen cadaveric specimens
- There were five groups of five residents.
- The QR code below has more details on the course structure.



### Summation of Confidence and Quiz Results Pre and Post Intervention

	Pre M/SD	Post M/SD	P-Value
Anatomical Identification	2+/-0.4	3.4+/-0.5	<.01
Injection Set-up	1.8+/-0.4	3+/-0.5	<.01
Knowledge Quiz	7.7+/-2.5	9.3+/-2.2	<.01

n=22 participants; M/SD=Mean/Standard Deviation. Confidence was measured by a Likert Scale (1-5): 1 (not at all confident) and 5 (very confident). Confidence was assessed for anatomical identification & injection set-up. Knowledge quiz was out of 12 questions.

## Post-Curriculum Surveys

### Satisfaction with Ultrasound Curriculum And Resources for Ultrasound Training

	Curriculum	Ultrasound Resources
PGY-3 (n=12)	4.2+/-0.6	3.8+/-0.7
PGY-4 (n=11)	4.5+/-0.5	4.4+/-0.8
Cumulative (n=23)	4.3+/-0.6	4.1+/-0.7

Likert Scale (1-5): 1 (not all satisfied), 2 (slightly), 3 (somewhat), 4 (satisfied), 5 (very satisfied)

### Feedback for Improving Curriculum

#### Major Themes

- More focus on spasticity management
- Increase in resources with video instruction emphasis.
- Would also prefer major ultrasound textbooks to be available.

#### Minor Themes

- Absolute basics ultrasound lecture for PGY-2.
- Standardized way to assess basic anatomical identification competence.
- Guided hands-on ultrasound scanning.

## Future Directions

- The curriculum for the following academic year included instructional ultrasound videos to be watched before each scanning session that were created by attending physicians. The purpose was to increase the amount of hands-on scanning time and reduce lecture time.
- An additional session was added which focused on spasticity and neuro correlates.
- Resident-led weekly scanning curriculum was developed to provide more hands on scanning time with each anatomical region.
- Departments should consider increasing exposure to PM&R ultrasound for medical students.

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