Patient Discomfort and Resident Confidence After Knee Intra-articular Injection Simulation Training: A Randomized Control Trial Study

Adae O Amoako¹, George GA Pujalte², Neha Kaushik³ and Timothy Riley⁴

¹Departments of Acute Care and Physical Medicine and Rehabilitation, Mid-Atlantic Permanente Medical Group, Upper Marlboro, MD, USA. ²Department of Family Medicine, Mayo Clinic, Jacksonville, FL, USA. ³Department of Family Medicine, Wellspan Health, Wellspan York Hospital, York, PA, USA. ⁴Department of Family and Community Medicine, Penn State Health Milton S. Hershey Medical Center, Hershey, PA, USA.

ABSTRACT: Teaching primary care providers how to perform musculoskeletal procedures has become increasingly important as more and more patients with orthopedic conditions present in primary care clinics. This study aims to evaluate whether targeted simulation model training in residency can increase residents' comfort level in performing intra-articular knee injections and decrease the pain of the procedure, as reported by patients injected. Residents were randomized into intervention and control groups. The comfort level of the residents as well as the pain levels from the procedures, as reported by patients, was recorded. The mean comfort level for the intervention group was 1.2, compared with that in the control group, which was 2.13; P value was .047. The mean pain level in the intervention group was 1.8, whereas in the control group 3.63; P value was .156. Simulation training may boost residents' comfort level, but not necessarily decrease patient discomfort during intra-articular knee injections.

KEYWORDS: Arthritis, corticosteroid injections, graduate medical education, residency training, family medicine

Introduction

Family physicians remain the gatekeepers for the health of many people in the United States. There are 192 million family medicine office visits annually, which is 1 in 5 office visits—48% more compared with the next most visited specialty.¹ The Accreditation Council for Graduate Medical Education (ACGME), the body that oversees the training of physicians states “the goal of family practice training is to produce fully competent physicians capable of producing high quality care . . . of which should include procedure skills which are within the scope of family practice.”² Whether this has been achievable in the past or currently remains unanswered. The goal of achieving competence and comfort in performing selected ambulatory procedures is not limited to family physicians but for internal medicine trainees as well.³ As the number and variety of procedures performed by primary care physicians (PCPs) continue to dramatically decrease,⁴ one wonders whether decreased ability may become a significant contributing factor among other known factors, such as regulatory requirements and the availability of subspecialists.

Arthritis and other musculoskeletal diseases are some of the most common health problems; these affect more than 40 million adults and the number is expected to reach as high as 60 million by 2020.⁵ These conditions may require intra-articular injections, yet PCPs continue relatively fewer of these than expected.⁶,⁷ Several studies have demonstrated that injection workshops and trainings increase internal medicine residents' confidence and preparedness to perform procedures⁸–¹²; however, there are only few studies looking at family medicine residents.

The objective of the study is to determine whether model simulation training has an effect on the comfort level of family medicine residents in terms of performing knee injections. It also looks into whether or not the pain level of patients getting injected correlated with the injecting resident having undergone model simulation training.

Methods and Study Design

This is a randomized controlled trial. Family medicine residents at Penn State Milton S. Hershey Medical Center (PShMC) were randomized into intervention and control groups. The intervention group underwent 2 model simulation trainings, whereas the control group underwent typical training (no simulation). Both groups were observed in real patient encounters, measuring the comfort level of the injecting residents and the patients’ pain level while undergoing the procedure. Residents rated their comfort level using a 1 to 4 scale of 1 to 10, where 10 signified the highest level of pain. A Wilcoxon rank sum test was used in calculating all P values. The P value of <.05 was defined as the level of statistical significance. Statistical Analysis System (SAS) version 9.3 (SAS Institute Inc.) software was used in all analysis.
Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the PSHMC with study ID STUDY00000104. Informed consent was waived through the IRB.

Results
Out of 29 residents within the residency program, 26 residents participated in the study. In all, 12 were in the intervention group and 14 in the control group (Figure 1). Out of 12, 6 in the intervention group had real patient encounters and out of 14, 7 real patient encounters were recorded for the control group. The minimum and maximum comfort levels for the intervention group were 1.00 and 2.00, respectively. The minimum and maximum comfort levels for the control group were 1.00 and 4.00, respectively. The mean for comfort level for the intervention group was 1.20, whereas that in the control group was 2.13; \( P \) value was .047 (Table 1). The minimum and maximum patients’ pain levels for the intervention group were 0.00 and 4.00, respectively. The minimum and maximum patients’ pain levels for the control group were 1.00 and 9.00, respectively. The mean pain level in the intervention group was 1.80 and in the control group was 3.63; \( P \) value was .156 (Table 2).

Discussion
Family physicians are expected to do several procedures that may contribute to the overall well-being of the individual. The American Academy of Family Practice also states that family medicine residencies should strive to teach residents all procedures within the scope of family medicine. They should, at a minimum, teach residents those procedures done by a substantial number of practicing family physicians both in the ambulatory and inpatient settings.12

In 2003, Sharp et al13 concluded that despite reports that core procedural skills are taught, residents are not being taught in a manner that results in residents feeling competent to perform them. Multiple studies have been done in an effort to improve residents’ intra-articular injection procedural skills. However, none of these studies have assessed the level of patient discomfort during intra-articular injection alongside the level of confidence of the family medicine residents performing them. Based on this preliminary data, model simulation training appears to boost residents’ comfort level in terms of performing corticosteroid knee injections. This study thus introduces a new, patient-centered metric for success in intra-articular injection training and provides a template for future investigators who choose to build on this work. In addition, similar research could be considered for steroid injections involving other joints.

Limitations of the study
The number of residents and patient encounters in this preliminary data is small. We, however, used a statistical instrument which factored in the small sample size. Further multi-institutional studies with larger sample sizes are needed to better characterize model simulation training’s extent of effect.

Conclusions
Residents in the intervention group were significantly more comfortable in terms of performing injection procedures. There was a nonsignificant trend toward decreased pain during the procedure between the groups. Model simulation training

Table 1. Comparison of intervention and control group by residents’ comfort level.

| STUDY GROUP     | TOTAL (N=26) | ENCOUNTERS | MEAN | MIN | MAX | \( P \) VALUE |
|-----------------|--------------|------------|------|-----|-----|--------------|
| Intervention    | 12           | 6          | 1.20 | 1.00| 2.00| .047         |
| Control         | 14           | 7          | 2.13 | 1.00| 4.00|              |

Table 2. Comparison of intervention and control group by patients’ pain level.

| STUDY GROUP     | TOTAL (N=26) | ENCOUNTERS | MEAN | MIN | MAX | \( P \) VALUE |
|-----------------|--------------|------------|------|-----|-----|--------------|
| Intervention    | 12           | 6          | 1.80 | 0.00| 4.00| .156         |
| Control         | 14           | 7          | 3.63 | 1.00| 9.00|              |
appears to boost residents’ comfort level with performing knee injections but does not appear to decrease patients’ discomfort during these same intra-articular knee injections. If training can improve provider comfort with performing the procedure, this could translate to increased PCP procedures in practice and could potentially lead to more timely treatment and lower health care costs.

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Author Contributions
AOA and GGAP designed the study, collated the data, wrote the text together, and contributed to the literature search. NK and TR collated the data and contributed to the literature search. All the authors reviewed and approved the final manuscript.

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