

# Using Peer Role-playing to Improve Student Skills for Musculoskeletal Physical Examinations

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## Research article

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# Abstract

The traditional curriculum for medical students in Japan does not include sufficient opportunity for the students to develop their skills for musculoskeletal examination and clinical reasoning and diagnosis. So, many residents report a lack of confidence in performing these tasks. Our aim was to assess the effectiveness of peer role-playing to improving these skills among 90 women medical students who were completing their first orthopaedic clinical clerkship. Participants were allocated into two groups. One group participated in role-play (the simulation group) and the other did not participate in role-play because of the clerkship schedule or almanac circumstance (the no-simulation group). This program consisted of two modules: the simulation-based module and the outpatient encounter module. Each module included two sessions. The simulation-based module had two parts: a structured encounter with role-play for musculoskeletal cases, and a structured debriefing with the course supervisor including self-reflection. The students' performance was observed and assessed using the mini clinical evaluation exercise (mini-CEX) for musculoskeletal cases in the simulation-based module (Day1) and the outpatient encounter module (Day2). The simulation-based module increased the physical examination score on the mini-CEX because of the encounters with real-life patients with musculoskeletal symptoms. This result suggests that role-play as a peer enhancing simulation may help to improve the competency of medical students in performing a musculoskeletal physical examination in a clinical setting.

## Introduction

As we enter the era of a super-aged society, we can expect an increase in the number of individuals who experience musculoskeletal (MSK) pain and impairment in joint and spine function. It is estimated that MSK and connective tissue diseases rank behind digestive and cardiovascular diseases in terms of outpatient visits, accounting for 12% of all outpatient hospital consultations in Japan (Overview of the citizen life basic survey in 2016, Overview of Patient Survey in 2017). Day et al. [1] reported that 15–30% of visits to primary care physicians in the US were for MSK disorders, particularly those of the lower extremity. Considering this pattern of consultation, the ability of physicians to rapidly and accurately diagnose MSK conditions of the limbs and spine, based on a sound physical examination and clinical reasoning, is essential to practice in primary care. Currently, in Japan, the medical education curriculum provides few opportunities for learners to focus on physical examination. As such, there is a need to provide more educational opportunities for MSK physical examination and clinical reasoning in the medical curriculum. This has been a strategic goal of medical education since 2001, as well as an important component of the United States Medical Licensing Examination (USMLE Step 2). In the UK, the gait-arms-legs-spine (GALS) program has been strategically included in undergraduate medical education to improve learners' competence with MSK examination and diagnosis [2]. However, even this strategic initiative was reported to be insufficient for learners to acquire confidence with physical examinations [3] and to effectively link findings to diagnosis through clinical reasoning [4].

Simulation that is aligned with sound educational principles and theory and provides an authentic opportunity for practice and feedback on performance has been shown to be effective in facilitating the

development of clinical competency and satisfaction of learners[5, 6]. Because of such evidence, we have implemented simulation-based opportunities for our learners to develop skill in MSK physical examination and clinical reasoning in the orthopaedic clinical clerkship rotation in our university hospital.

The purpose of this study was to assess the effectiveness of our simulation-based program using peer role-playing for MSK physical examination and clinical reasoning and diagnosis in performing these skills. We sought to answer the following question: Does peer role-play in simulated MSK cases develop our students' ability to perform a physical examination, exercise clinical reasoning and arrive at a diagnosis in a clinical setting?

## Methods

### Program design and educational strategies

The study group included 90 fifth year women medical students who participated in our simulation-based program as part of their orthopaedic clinical clerkship. Students classified the simulation group (N = 64) and the no simulation group (N = 26). The no simulation group were defined who did not participate 'peer role-play' session for reasons of clerkship and almanac schedule. (Details of 'peer role-play' session was mentioned later.) Rotations were performed in groups of 4 or 5 students. All participants had completed the MSK component of coursework, as in a classroom, including physical examination, clinical reasoning, and diagnosis, and they had training in enhanced clinical reasoning during their internal medicine clerkship.

Our program used peer role-play (student to student) using MSK symptoms. Learners had two specific goals: (1) To perform an MSK physical examination as part of a patient's first medical visit for the stated problem, ensuring patient comfort; and (2) To present to their supervisor their clinical reasoning process for establishing a clinical diagnosis after this first patient visit. The clinical assessment of these goals was based on a review of the literature regarding the motivation of learners to develop skills in MSK physical examination, clinical reasoning, and diagnosis.

We surveyed the pre-learning status to all participants prior to the program. The questionnaire points of pre-survey were 1) Experience of watching the standardized educational movie about MSK physical examination before the program, 2) Experience of participating in role-playing as an educational strategy for MSK physical examination during their pre-clinical clerkship rotation, 3) Experience of encountering an MSK patient during one of their previous rotations in other departments, 4) Students' motivation to improve their skills of MSK Physical examination (4-point scale), 5) Students' motivation to improve their skills of Clinical reasoning (4-point scale).

The simulation group was defined to take part in all module of the program on Day1 and Day2. The no simulation group was defined to part in only the second module on Day 2. The program consisted of two modules with two sessions in each module. On Day 1, the first session of the first module consisted of 'peer role-play' on an MSK case (choice of a spine, upper extremity or lower extremity case), in which the

interaction between the simulated patient (another student) and the student was not scripted. The second session included the following structural elements to guide learning: recording the interaction to provide feedback; requiring the student to explain their process of MSK physical examination and clinical reasoning; having the supervisor assist the student, as needed, during the interaction; having the supervisor use the mini clinical evaluation exercise (mini-CEX) to assess the student's performance; and having the supervisor provide feedback to the student regarding her performance, and self-reflecting by the student to prepare for the next step. The supervisors' feedback included both oral and short-text feedback, and it was focused on both technical skill and clinical reasoning.

On Day 2, the first session of the second module included the following structural learning elements: providing the students with real-life patient information from the patient's pre-interview sheet. Next, the student examined including history taking and physical examination to the real-life patient who has MSK-related symptoms in the consultation room of the orthopaedic surgery department. The supervisor observed and assessed student's performance by mini-CEX. The second session included reviewing the completed mini-CEX assessment with the student; discussing the physical examination and the clinical reasoning with the student and providing feedback on the oral and written assessment provided by the supervisor; self-reflecting by the student for the next step. Assessment viewpoints on the mini-CEX were 1) History taking, 2) Physical examination, 3) Communication, 4) Clinical reasoning and diagnosis, 5) Humanity and Professionalism, 6) Management and 7) Overall. We confirmed that all participants including students and real-life patient provided informed consent. This study was approved by Tokyo Women's Medical University Ethics Review Board.

## **Data collection and analysis**

It was compared the pre-survey of program, and the main symptom part of a real-life patient in an outpatient encounter between the simulation group and no-simulation group by statistical analysis. We evaluated the effectiveness of the peer role-play education module using quantitative outcomes: the mini-CEX of the outpatient encounter at the orthopaedic clinical clerkship. We compared the answers given to the pre-survey by the simulation group (N = 64) and the no-simulation group (N = 26). We determined the no-simulation group who could not participant 'peer role-playing' on Day 1 due to a clerkship schedule or almanac circumstance. All students completed a real-life outpatient MSK encounter module at the orthopaedic clerkship. We compared the mini-CEX outcomes for the MSK cases for both the simulation group and the no-simulation group. For the Physical examination and Clinical reasoning components of the mini-CEX, we compared between-group differences using an unpaired *t*-test. All analyses were performed using JMP® Pro 15 (SAS Institute Inc., Cary, NC, USA).

## **Results**

The results of the pre-survey indicated how many students had taken part in the following educational activities regarding MSK physical examination, clinical reasoning, and diagnosis: 100% of the simulation group and 96.2% of the no-simulation group had watched the standardized educational movie about MSK physical examination; 90.3% of the simulation group and 88.5% of the no-simulation group had

participated in role-playing as an educational strategy for MSK physical examination during their pre-clinical clerkship rotation; and 17.5% of the simulation group, 11.5% of the no-simulation group had encountered an MSK patient during one of their previous rotations in other departments (e.g. emergency department, neurology and rheumatology). There were no significant differences between the simulation group and no-simulation group by Pearson's chi-square test (Table 1). Students' motivation to improve their skills at MSK Physical examination and Clinical reasoning were not significantly different between the groups, as indicated by Fisher's exact test (motivation for Physical examination:  $p > .05$ ,  $p = .095$ , motivation for Clinical reasoning:  $p > .05$ ,  $p = .079$ ; Table 2).

However, there was a significant difference between the groups for the Physical examination component of the mini-CEX scores for the real-life outpatient MSK encounters, according to Fisher's exact test ( $p < .05$ ,  $p = .043$ ). There was also a significant difference between the groups on the Overall component of the mini-CEX, according to Fisher's exact test ( $p < .05$ ,  $p = .011$ ).

The scores for the History-taking component of the mini-CEX did not show a significant difference between the groups, according to Pearson's chi-square test ( $\chi^2 (1) = 0.718$ ,  $p > .05$ ,  $p = .40$ ). Moreover, scores for the Communication, Clinical reasoning, Humanity and Professionalism, and Management components of the mini-CEX were not significantly different between the groups, according to Fisher's exact test (Communication:  $p > .05$ ,  $p = .18$ , Clinical reasoning:  $p > .05$ ,  $p = .30$ , Humanity and Professionalism:  $p > .05$ ,  $p = .92$ , Management:  $p > .05$ ,  $p = .85$ ). (Fig. 1)

## Discussion

We have provided evidence of the effectiveness of simulation-based education to improve the skills of students for performing an MSK physical examination. We used peer role-play as a simulation, with students assuming the role of a patient with MSK symptoms in a clinical clerkship setting.

A meta-analysis had reported the effectiveness of simulation-based medical education (SBME) for improving clinical skills among medical learners [7]. Another study reported on the effectiveness of SBME in improving diagnostic skills for rheumatoid arthritis and osteoarthritis [8]. Yet another study showed that medical students had difficulty in improving their MSK physical examination skills during regular clinical clerkship activities. However, small group interactive clinical skills courses, with multi-source feedback provided to students, produced considerable improvement in clinical skills after several months [6]. These findings underline the importance of clinical skills laboratory sessions, including simulation-based opportunities, in improving skills and clinical reasoning. In this study, we showed in the short term that SBME could be effective in enhancing learners' skills at MSK physical examination during clinical clerkships, and that the mini-CEX could be a timely and effective workplace-based assessment tool. Of note with regard to SBME, a review article reported no significant difference in learning between high- and low-fidelity simulation [9]. That study supports our use of low-fidelity simulation, namely peer role-play, to improve physical examination skills. Our results suggest that peer role-play is a valid form of low-fidelity simulation education. On the other hand, our results did not demonstrate an improvement in competency

for Clinical reasoning and diagnosis. One reason for this might be that the role-playing was limited achieving clinical reasoning competency for the real-life patient in a clinical setting by its low validity and reliability. We addressed this issue, in part, by providing an ad-lib encounter based on MSK cases without a script. However, a recent study indicated the importance of using standardized patients to enhance clinical skills in MSK assessment when the timeframe for laboratory-based practice is limited [10]. It is important to note that while the use of SBME to enhance clinical skills has yet to be fully justified, simulation-based education has been shown to be a valuable and effective approach for teaching communication skills during a patient encounter. However, there is limited evidence on how this translates to patient outcomes, and no indication of the economic benefit from this type of training compared to other methods [11]. There is a need for future research to consider more fully the optimal format for clinical-based education and its full role in medical education.

The peer role-play simulation used in this study was implemented by one faculty member who is a specialist of orthopaedic and health profession education. This helped to ensure the consistency and reliability of the education and assessment among participants. However, this approach is not sustainable, as it places a high demand on one individual. Team teaching using an OSCE format would provide a more sustainable approach for clinical skills training in a structured program of medical education. Battistone used OSCE stations developed by two orthopaedic surgeons, two rheumatologists, and a primary care provider with orthopaedic experience [12]. Other studies have recommended the use of near-peer teaching in medical student education, particularly for hands-on skills [13]. One possible way to blend these two approaches might be to involve patients as educators in sessions on MSK physical examination. In the same way, including physician tutors to work with students on clinical reasoning, based on outcomes for History and Physical examination, can enhance student learning. This strategy would allow physicians to use their teaching time more efficiently and, possibly, increase students' opportunity to become comfortable with basic skills in MSK physical examination, clinical reasoning and diagnosis [14].

Feedback is an important component of workplace-based assessments of student performance in clinical practice. In our study, for the sake of consistency and to ensure that the feedback provided was comprehensive, feedback was provided by the same supervisor for all the students and it was based on the mini-CEX. A previous study has demonstrated the effectiveness of using the mini-CEX to improve student skills during their 3-year clerkship by providing multiple repeated opportunities for feedback on specific clinical tasks [15]. Certainly, in our study, the objectivity of assessment would have been increased if there had been two or more assessors. However, increasing the number of assessors with sufficient experience is challenging, considering the limitations of human resources in the workplace (hospitals, clinics, and educational programs). We have to note the low-to-moderate reliability of the mini-CEX, with between-rater variability being the greatest source of error. This is particularly true if assessments are conducted by both attending physicians and residents, since residents provide higher scores, on average, than faculty [16]. In our study, we were able to assess students' performance at the workplace using the mini-CEX and timely and formative feedback on the outpatient encounter from a reliable, experienced supervisor. Despite any variability in the mini-CEX in general, this assessment does

provide the opportunity for repeated reflection on the formative feedback provided by the supervisor, as well as the students' self-reflection on their performance on each dimension of the encounter. For feedback effectiveness, one study has suggested that supervisors of clinical education were prepared to comprehend every factor influencing feedback on mini-CEX to improve the students' learning response [17]. This study suggests that in peer role-playing, assessment and formative feedback from an experienced supervisor, using the mini-CEX, and student self-reflection effectively enhanced clinical skills, especially the physical examination of an outpatient with symptoms of MSK.

## Limitations

Since all the subjects in this study were women students (because the field of education and research was a women's medical university), it is necessary to conduct a similar study with male students to confirm the generalizability of the results. The stage of learning development differs slightly from group to group because the students rotate through the orthopaedic clerkship over a year. There is also the possibility of assessor's bias of the mini-CEX because only one person, a supervisor, assessed all students in the study. Additional studies are required to confirm the validity of these assessments.

## Conclusion

Simulation-based instruction combining peer role-play as low fidelity simulation, supervisor feedback and self-reflection was effective in improving the skills of students with MSK physical examination and overall. Moreover, the study was well timed to include the outpatient encounter during the orthopaedic clerkship. The multiple assessment opportunities provided by using the mini-CEX seems to have been beneficial in improving learning outcomes. To achieve competency and establish long-term clinical skills for learners, further ingenuity is necessary for simulation-style, formative feedback and debriefing. Further research is required to identify optimal SBME opportunities to enhance student skills.

## Abbreviations

MSK  
Musculoskeletal; mini-CEX:Mini clinical evaluation exercise; SBME:Simulation-based medical education;  
OSCE:Objective structured clinical examination

## Declarations

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### **Availability of data and materials**

Data will not be shared publicly to prevent possible inference of the identities and clinical performance of participating students.

### **Authors' contributions**

KY and YO were responsible for defining the research questions and writing the manuscript, including the analysis with SK and interpretation of data. YO and AS significantly contributed to development workplace-based assessment and interpretation of data. KY, YH, NI and KO developed the program at the mandatory clerkship rotation in Orthopaedic surgery and implemented assessment it along with TO. All authors contributed to and approved the final manuscript for publication.

### **Competing of interests**

The authors declare that they have no competing interests.

### **Ethics approval and consent to participate**

An educational exemption was obtained for this research from the Tokyo Women's Medical University Ethics Review Board (study HUM5531). All participants were confirmed including students and real-life patient provided informed consent.

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## Tables

Table1. The percent of student who had each previous learning experience before the rotation of orthopaedics.

Previous leaning experience	Simulation group (N = 64)		No-simulation group (N = 26)	
	Yes	<i>P value</i>	Yes	<i>P value</i>
Watching educational movie	100%	.93	96.2%	.89
Role playing as an educational strategy	90.3%	.96	88.5%	.94
Encountered an MSK patient	17.5%	.73	11.3%	.58

Table2. Students' motivation to improve their skills of MSK Physical examination and Clinical reasoning

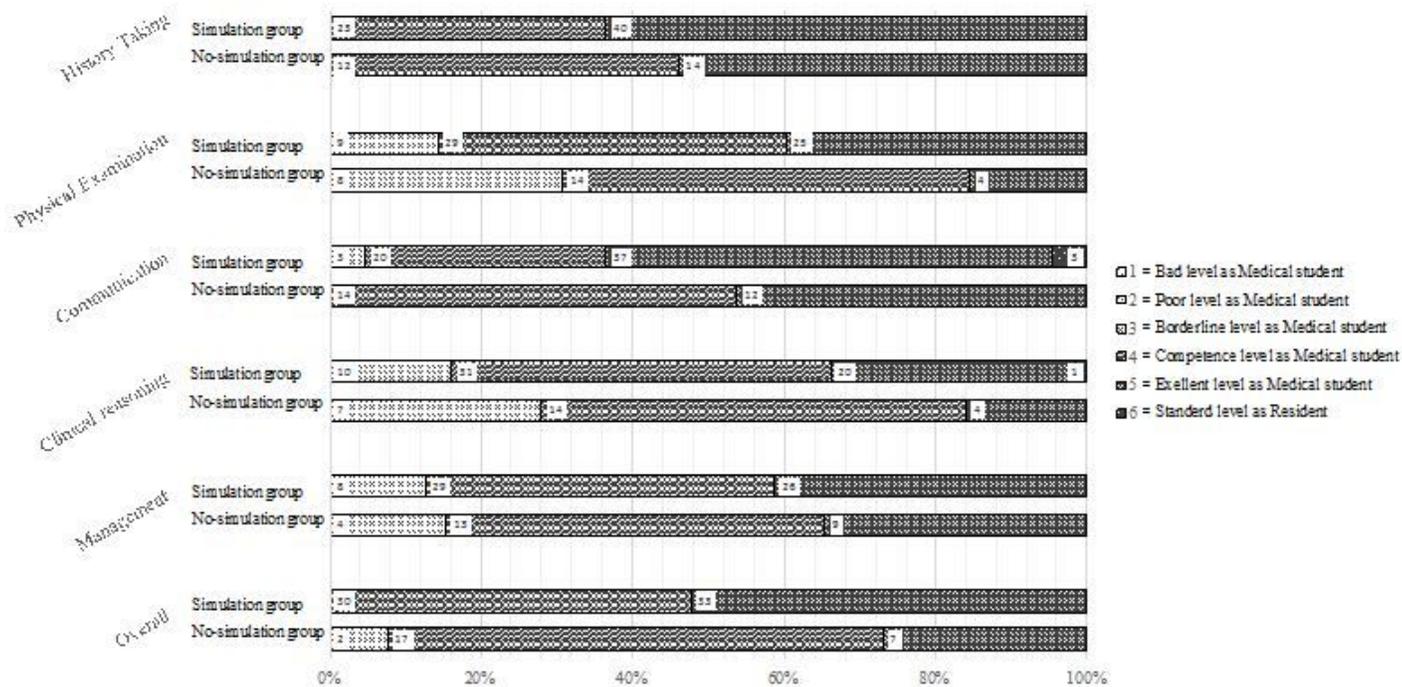
Table2-A. Would you like to improve your Physical examination skills for the musculoskeletal system?

5-point scale	3 (Undecided)	4 (Agree)	5 (Strongly Agree)	Total
Simulation group	2	25	29	56
No-simulation group	3	5	11	19
Total	5	30	40	75

Table2-B. Would you like to improve your ability to perform clinical reasoning of the musculoskeletal system?

5-point scale	3 (Undecided)	4 (Agree)	5 (Strongly Agree)	Total
Simulation group	3	26	27	56
No-simulation group	3	4	12	19
Total	6	30	39	75

## Figures



**Figure 1**

Score Distribution of mini-CEX assessment items for all Participants