

# Simulation in Physiotherapy Students for Clinical Decisions during Interaction with People with Low Back Pain. Randomized Controlled Trial

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## Research article

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## Abstract

**Background:** Low back pain (LBP) is a symptomatology with a high global prevalence; health professionals, including physiotherapists, must have the skills to create professional actions that increase a quality of life for patients. Clinical simulation can be a pedagogic strategy that facilitates in students adequate training to acquire skills that improve professional reasoning in this clinical situation. The objective of this study was to compare the effects of clinical simulation with simulated patient (SP) versus simulation with role playing (RP) in physiotherapy students for decision-making in clinical skills while caring for a person with LBP.

**Methods.** Experimental study, with 42 participants from two Colombian universities, randomized into two groups (SP n = 21, RP n = 21). The clinical skill was evaluated during the interaction with a person with LBP for which the Objective Structured Clinical Examination (OSCE-LBP) was validated for individuals with low back pain; thereafter, a pedagogical method was conducted that included clinical simulation and, finally, the OSCE-LBP was applied again to compare both groups.

**Results.** Changes occurred in the OSCE-LBP among both groups of students: the scores increased (0.66 and 0.59 in RP and SP, respectively), and neither of the two was superior (difference 0.01 95%CI -0.21 to 0.23).

**Conclusion.** Both types of simulation favour decision-making in professional reasoning in physiotherapy students during interaction with individuals with LBP.

**Contribution of paper:** This is an RCT that explores the use of clinical simulation with simulated patient as a teaching method in decision making by physiotherapists versus traditional use of role playing

## Background

Low back pain (LBP) is one of the principal reasons for consulting health services globally (1,2). Epidemiological reports state that the incidence of this symptomatology is between 60% and 90% in the Western population, affecting almost 80% of people at least once in their lives (3). LBP is considered one of the principal causes of absenteeism and the risks associated with it are diverse, including lifestyle, work and emotional factors, among others (3,4). In physiotherapy, it is the most frequent reason for care, which is why professionals must have the necessary skills to offer those people who consult them a comprehensive approach that minimizes reoccurrence and improves their quality of life. To achieve this, it is necessary for programmes in physiotherapy to provide sufficient tools to enable future professionals to have the skills to interact with people with LBP.

For this interaction, physiotherapists must: 1) perform physiotherapeutic examinations and evaluation that include Interview, standardized systems review, and the selection and application of tests and measurements; 2) discuss the examination findings, supported by professional reasoning; 3) formulate physiotherapeutic diagnosis and prognosis in line with the findings obtained; 4) provide information to patients about a treatment plan according to the examination findings; 5.) execute the treatment plan supported by scientific evidence; and 6) demonstrate humanized treatment and communication skills during the physiotherapeutic interaction (5).

Each of these elements is related to clinical skills for decision-making regarding physiotherapeutic practice as a basis for the development of a professional abilities and skills (6), such as professional reasoning supported by knowledge and values originating from high levels of quality focused on caring for patients (7). This is a process of application of integrated knowledge that includes intuition and permits timely development of examinations or physiotherapeutic interventions (7), through constant reflection during professional interactions.

Simulation can be used as a pedagogic tool that provides students with significant learning regarding decision-making in interacting with people, in this case patients with LBP. It is a potential strategy for developing diverse skills focused on the safety of the patient and the therapist (8). Moreover, it permits the inclusion of simulated patients (9); these are people who receive training in representing a specific health condition with a view to generating teaching or evaluation processes in interpersonal and/or clinical skills (10). Simulations with simulated patients give students an authentic learning experience (10) and, given their closeness to the real scenarios, facilitate effective identification of student performance.

Clinical simulation allows students to get involved in direct interaction with what they are studying, rather than an intellectual observation or description, and enables them to make significant progress in their development through their own experience (11). The World Confederation for Physical Therapy (WCPT) states that students must be guaranteed opportunities for clinical interaction, which should always be accompanied by qualified professionals. Simulations may be linked to this process, given that controlled scenarios promote clinical reasoning, and theoretical information can be used to consolidate learning (12).

The evidence around simulation suggests that this is an educational strategy that increases teamwork capabilities and it should be aligned with the principles of Interprofessional education (13,14). The simulation also promotes core values, communication skills among professionals and with the patients, and patient safety (15–18). Simulation in physiotherapy has been used in a large way for cardiorespiratory practice for training specific manual skills and decision-making processes in intensive unit care. Students that have been trained with this pedagogic strategy give more safety to the patients and get better results in manual and instrumental procedures in general (19–25).

The education-based in simulation has demonstrated students improve "confidence in clinical skills, clinical decision-making, treatment preparation and planning, communication skills, evaluating and modifying interventions, and interprofessional practice"(26).

This study used simulation with standardized patient generating a controlled scenario with a person manifesting LBP, seeking to use the knowledge acquired to make clinical decisions and respond to the needs of people with a health condition framed within a particular context. Thus, the aim of this study was to determine the effects of clinical simulation with standardized patients on physiotherapy students regarding decision-making on clinical skills while caring for a person with LBP.

## Methods

### Design

A randomized controlled trial was performed with formulation of equivalence with physiotherapy students from two Colombian universities. The students were randomized into two groups, SP and RP, to compare the effects of both types of pedagogic intervention supported by clinical simulation. The study was approved by the ethics committee at the University of Boyacá under record number 164 of 09 June 2016, and by the subcommission on research and ethics at University of La Sabana; it was considered of minimum risk and the students were assured that the research process would not affect their semester grades; hence, the evaluations were of a formative nature.

### Subjects

The study included 42 fifth-semester students from two physiotherapy programmes in two Colombian universities, based on the formula for equivalency trials (27), in which size per group; normal two-tail standard deviation; acceptable difference; = standardized standard deviation of both comparison groups.

$$n = 2 \frac{\left[ \left( Z_{1-\frac{\alpha}{2}} + Z_{\beta} \right)^2 \right]}{d^2} s^2$$

At the time of the study, the participants had taken a total of 87 credits and were actively enrolled in the participating programmes. The study excluded students <18 age, those who had been internally or externally transferred from another academic programme in health, exchange students, and those repeating and with prior experiences in simulated practice in other assignments.

The study established a stratified sampling by blocks in each university by using the Epidat program version 3.1 and assigning participants to one of the SP and RP groups, a procedure overseen by a professor not involved with the study. A record of the process was kept (Figure 1).

### Result measurements

The study took into consideration the variables of gender, percentage of attendance of academic activities in SP and RP, level of bilingualism, score on the Colombian "SaberPro" state examination, and participants' accumulated academic grade point average for their undergraduate formation.

The main outcome of this randomized control trial was Objective Structured Clinical Examination for low back pain (OSCE-LBP). It was applied in a blinded way at the start (week 0) and end of the period of the SP and RP interventions (week 8). This instrument was subjected to a content validity process with external experts in the study area (28). Application of the OSCE-LBP, as an evaluation process, was conducted by external professors to the research process to minimize evaluation bias. Training of the human resources applying the OSCE-LBP was carried out through systematic training in developing the OSCE-LBP in its different stages. Additionally, inter-rater correlation coefficient values were obtained (28), and the stages in which the professors had their best performance was identified compared with the denominated gold-standard evaluator (29).

The OSCE-LBP evaluates decision-making in clinical skills while caring for a person with LBP. It has seven stages each with a specific weight, assesses the skills or abilities described by the researchers regarding physiotherapeutic decision-making for a person with LBP, thus:

#### 1) Physiotherapeutic examination (stage 1,2 and 3)

I. Anamnesis: recognizes the symptoms or antecedents including red flags and personal aspects that can guide decision making by physiotherapists in relation to LBP.

II. Revision by systems: recognizes physical symptoms that indicate red flags or signs of peripheral nerve involvement, or signs of LBP.

III. Tests and measurements: applies tests and measurements related to mobility, articular integrity, strength of the lumbo-pelvic complex, and the integrity of the peripheral nerves of the lumbo-pelvic region.

#### 2) Physiotherapeutic evaluation (stage 4)

I. Explains to a person with LBP whether their condition is related to nociceptive LBP, neuropathic LBP or another type (central sensitization).

3) Diagnosis, prognosis and intervention plan (stage 4)

I. Proposes reachable objectives according to the characteristics of the person's LBP.

II. Provides information to the patient about the treatment plan to follow according to findings obtained in the examination related with LBP prognosis.

III. Is clear with the language used and in line with previous aspects of the interaction process.

4) Intervention (stage 5, 6 and 7)

I. Includes therapeutic exercise according to the person's needs and capacity.

II. Includes manual techniques according to the needs.

III. Includes specific physiotherapy techniques according to the needs.

IV. Includes interpretation of scientific evidence that supports the decision-making process (30–36).

5) Demonstrates patient centered-care and communication skills during the process of professional interaction (all stages).

I. Verbal, proxemic, paralinguistic and assertive tactile communication is demonstrated according to the performance context.

The results method of scoring the OSCE-LBP was established on a scale from 0.0 to 5.0. This scoring was obtained with a specific weight for each stage. It was given by a research team in percentages as shown: stage 1: 17%, stage 2: 12% Stage 3: 16%, stage 4: 15%, stage 5: 15%, stage 6: 13%, stage 7: 12%. An equivalency success was determined in the SP and RP interventions with a difference of 0.8 (37).

### Intervention

For both groups, the same pedagogic process was established to achieve the skills related to the interaction with people with LBP (described using the OSCE-LBP) in the following manner:

**I. Learning guide process of therapeutic interaction with a person with LBP.** The guide was distributed two weeks prior to conducting the SP or RP; its intention was to serve as a facilitator of the following phases of the learning process. The guide was constructed by the research team including in its first part information and independent activities for students to carry out a retrospective search about physiotherapeutic examinations and treatment for people with LBP supported in scientific evidence .

**II. Development of skills** through laboratory workshops for the prescription and application of manual techniques and therapeutic exercise for the health condition studied. Each group had 10 hours of classroom sessions prior to the SP or RP, with each session seeking to develop the practical aspects of the learning guide, which in the manual techniques included therapeutic massage (30), and superficial techniques of myofascial release for paravertebral muscles and related to the lumbo-pelvic complex (38). The exercise techniques included central stabilization exercises (39), analytic stretching and principles of postural re-education (40).

**III. Simulation activity:** for group one with standardized patient was constructed supported by a high fidelity guides in simulation training, which for this study is denominated SP. Group two was RP, using a methodology of low fidelity simulation.

The group denominated SP received a teaching strategy based on a class session with simulated practice for decision-making in clinical skills when caring for a person with LBP. Each session lasted approximately 120 minutes, and the clinical case used for the SP sessions was subjected to face validity with experts in the area of study.

Application of the simulated practice was conducted based on experiential knowledge of high fidelity simulation training, considering the following sequence of its elements:

- Context of the scenario: standardized for a clinical scenario of external consultation for the care of a person with LBP using physiotherapy.
- Patient standardization: based on the clinical case elaborated and validated, a script was created for the actor to interpret a person with LBP. Three simulated patients were trained per institution and their participation had a ratio of one patient for every eight students.
- Professor facilitator: a ratio was established of one professor for every eight students, and as in the case established, interpreted by the simulated patient, the professor started by approaching the person who was the object of care by following the characteristics of clinical reasoning.
- Guiding questions: the professor asked guiding questions that sought to stir reflection regarding the clinical situation observed, asking students to imagine other clinical situations and how the intervention would vary according to this.
- Concrete experience: students were permitted to interact with the simulated patient to carry out the reasoning process and thus provide care to the person.
- Debriefing: a meeting was held based on reflective conversation about the learning experience in which all the actors discussed the positive aspects and the learning opportunities. This process was mediated by dialogue and active listening; at the center of it were the students, who reflected on what they

had done, and described their feelings and emotions, what was opportune, and what they would improve for subsequent opportunities with a person with LBP, this kind of data was not used for the purpose of this study.

The RP group, in turn, received a class session based on a “role-playing” simulation strategy, structured for the same purpose established in the SP group. This session lasted approximately 120 minutes, and the learning environment was the classroom in which students assumed different roles to act out; some of them acted like people with LBP and others as physiotherapists. The rolling-playing strategy not included specific training for acting like a patient. The study cases used for the RP group were different from SP group but with a similar level of complexity in LBP. The sequence of elements taken into account in RP group was:

- Division of the student's group into two: 1) physiotherapist and 2) patients.
- Three different case study were given to students case 1 was about pregnancy LBP, case two posttraumatic LBP, case three about nonspecific LBP.
- Both groups of students starting the acting process like physiotherapists or patients.
- At the end of the simulation, the students guided by a professor closed the simulation with a conclusion for each case study, in a not extensive way like the debriefing process in SP group.

### Statistical analysis

Baseline: determined the distribution of the variables (extreme values, symmetries, kurtosis, types of distribution) – for qualitative variables like gender, semester, University (table 1) were calculated relative frequencies (mode and erroneous data), and in all cases, evaluating the amount of data lost by each variable.

The quantitative variables like academic average over 5.0; credits taken according to Colombian educational system (1 credit equals to 48 hours per week in academic activities), bilingualism equal to the number of credits in the English language, and age in years. Those were described with a symmetric dispersion through medians and standard deviation.

To compare the effect of the magnitude, an analysis by intention to treat was performed. Initially, a difference of averages in the main outcome of the study OCSE between SP group and RP group. Also, was estimated the difference between the basal measurement and after the intervention. Thereafter, a comparison was made of the interventions through a two-level hierarchical model of random intercepts and fixed coefficients (level 2: university; level 1: subject). The model is described by the following.

$$y_{ij} = \beta_o + \beta_1IG_{1ij} + \beta_2BM_{2ij} + U_{oj} + e_{ij}$$

i: Individual, j: University, IG: Intervention Group, MB: Basal Measurement

Estimation of parameters was used with a 95% confidence level. Analyses were carried out using STATA version 14.

## Results

The participating population was mostly of female sex, with a mean age of 21 years, an academic average of 3.6 (over 5), and an average of 87 credits taken in the Physiotherapy programme at each university (Table 1).

Table 1. Characteristics of the participants

	<b>Role Playing (RP)</b> n = 21	<b>Simulated Practice (SP)</b> n = 21
<b>Sex</b>		
Male	7 (33.4%)	3 (14.3%)
Female	14 (66.6%)	18 (85.7%)
<b>University</b>		
University of La Sabana	9 (42.9%)	12 (57.1%)
University of Boyacá	12 (57.1%)	9 (42.9%)
Age	21.4 [2.1]	21.6 [2.3]
Academic average	3.7 [0.3]	3.6 [0.2]
Bilingualism	7.8 [4.2]	8.9 [4.8]
Credits taken	87.2 [13.2]	84.7 [11.6]
[ ] = average [standard deviation]		
n (%) = absolute frequency (percentage)		

The table 2 shows that in both RP and SP, the final score increases (0.66 and 0.59 in RP and SP, respectively); when comparing the interventions, it is noted that neither of the two was superior (difference 0.01 95%CI -0.21 to 0.23). The study reports 100% participant adherence.

**Table 2 Comparing the interventions**

	Role Playing n = 21		Simulated Practice n = 21		Difference in Role Playing		Difference in Simulated Practice		Difference in both interventions	
	Baseline	Post-intervention	Baseline	Post-intervention	Diff.	95%CI	Diff.	95%CI	Diff.	95%CI
Mean OSCE - LBP	2.07 [0.45]	2.73 [0.51]	2.16 [0.42]	2.76 [0.48]	-0.66	-0.97 to -0.34	-0.59	-0.89 to -0.30	0.01	-0.21 to 0.23

## Discussion

The study results reveal that pedagogic strategies supported by simulation improve clinical skills in interacting with people with LBP. Both types of simulation generated positive changes in the: 1) examination; 2) evaluation; 3) diagnosis; 4) prognosis; and 5) physiotherapeutic intervention. To date, publications have not been found using simulation to train physiotherapists to interact with people diagnosed with LBP, which could be a powerful tool for enhancing decision-making with respect to one of the primary reasons for consulting health services, and high-quality physiotherapy could be a solution for reducing the reoccurrence of this symptomatology.

Other clinical areas in which physiotherapists work have already demonstrated the positive effects of simulation as a pedagogic approach that develops integrally the skills of the future professional. Some antecedents mention that simulation improves teamwork and the understanding of professional roles (41); it can replace part of the time in clinical institutions (37), contribute to education in cardiorespiratory physiotherapy (20), improve confidence in students and enhance the procedural skills in the different performance areas (42).

For the specific case of performance skills in the musculoskeletal area, Wright et al., (2018) report that after a 100% immersion in clinical simulation for 18 days, students showed significant improvement in their confidence and, in general, in their performance in regard to the clinical approach to patients. The authors report that students who were exposed to rotations in simulated scenarios demonstrated a significantly higher performance in clinical skills than those who did not undergo this immersion.

The types of simulation used for this study were of high fidelity with the standardized patient for group SP and role-playing as a low fidelity scenario in group RP. According to the results, both types contributed to the integration of knowledge developed along the pedagogical process constructed to achieve the learning objectives related to the therapeutic interaction with a person with LBP. Respect to SP group, the potential benefit is that direct interaction with others with a specific training can create an environment quite close to the reality, which can become an alternative with effects comparable with conventional clinical practices (43). With respect to RP group, the literature also reports that it leads students to appropriate the characteristics of the subjects implied in the process and this facilitates integration of knowledge (44).

Although research on clinical simulation as a pedagogic strategy in physiotherapy has increased, it is necessary to continue with reports of this type to enhance student training in therapeutic interaction and thus improve decision-making in the clinical reality (45).

The pedagogic process with simulation in both groups (PS and RP) included other educational activities like literature review, retrospective searches about the examination of LBP, laboratory workshops, and classroom sessions. This aspect would be the main limitation of the present study cause improvement in the final OSCE-LBP assessment be related to these interventions and not just the simulation activity itself.

## Conclusion

From the results herein, it may be stated the pedagogic process, including the simulation activity resulted in improved decision-making by the physiotherapy students during the process of professional reasoning regarding a person with LBP; as for the design proposed, equivalence is evidenced between both types of simulation, RP and SP.

## Practice Points

- Physiotherapeutic reasoning training in Low Back Pain can be combined with simulation scenarios to increased learning enhancement.
- Rolling playing and simulation practice in physiotherapy are teaching strategies that can provide training for musculoskeletal disorders in practitioners of physiotherapy.

## Abbreviations

LBP: Low back pain; SP: Clinical simulation with simulated patient; RP:

Simulation with role playing; OSCE-ML: Objective Structured Clinical Examination

## Declarations

**Ethics approval and consent to Participate:** this study was approved by the ethical committee of clinical center Universidad de Boyaca in June of 2016. The study included an informed consent signature in a writing way for all participants according to a Helsinki declaration and with 8430 Colombian law (1993).

**Consent for publication:** Not Applicable

**Consent to publish:** all authors have given their consent to publish this study

**Availability of data and materials:** the data collected is available in the public archive of the physiotherapy program of the Universidad de Boyaca.

**Competing interests:** the authors declare not have conflict of interest about this manuscript.

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**Authors Contributions:** MLAM, CSC, ADPV, and RPCV were responsible for the design of the study. EACM, RLGO, and MLAO gave advice on assessment, viability, and intervention process respectively, all of them contribute to the research paper writing and have read and approved the manuscript.

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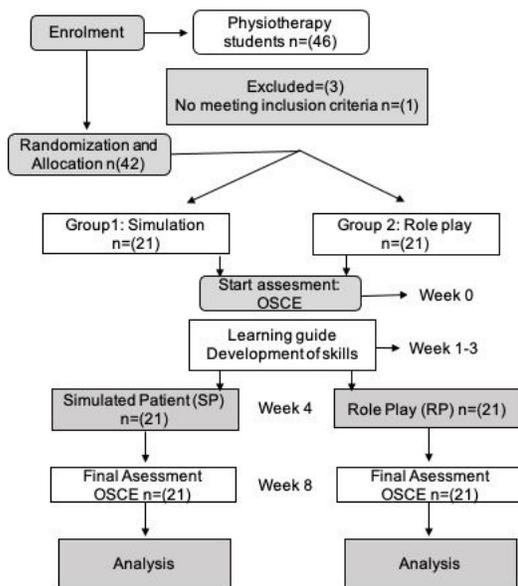
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## Figures



**Figure 1**  
Flow diagram of the study “Simulated practice in physiotherapy students from the University of Boyacá and University of La Sabana on decision-making in clinical skills while caring for a person with LBP”. Intervention group: Simulated practice; control group: “Role playing”.