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Review Paper: The Role of Simulated Patient in Physiotherapy Education: A Review Article

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ABSTRACT

Introduction: Using Simulated Patients (SPs) in clinical skills education is a common method of training students to improve their skills for future client encounters. This systematic review aims to provide an overview of the SP strategy in Physical Therapy (PT) education.

Materials and Methods: PubMed, Scopus, and Web of Science databases were searched from January 1980 up to November 2019. Different keywords related to the topic were selected using MeSH. Any types of quantitative study design which had used simulation-based learning in physical therapy were eligible for inclusion. Two reviewers read studies and appraised them critically.

Results: A total of 1049 abstracts were retrieved and after reviewing the full-text paper, 11 full-text articles met the inclusion criteria. These studies had used simulated patients for various objectives, including replicate different aspects of knowledge, self-perceived skills, real clinical practice, attitudes, and feasibility. Based on the result of studies, SP as an educational technique can improve student's clinical reasoning skills, communication, and motivation in a safe environment.

Conclusion: SP is a useful learning strategy to deliver learning activities in medical education and physical therapy curricula, facilitating feedback on students' performance with opportunities to interact with real patients and environments.

1. Introduction

Because of the organizational challenges and preventable medical errors in healthcare, the use of healthcare educational methods with higher quality than traditional methods seem to be crucial [1]. Students of health professions often consider the transition from initial theoretical courses to the clinical environment a very stressful condition, therefore it is important to make the same experience before the exposure to the clinical environment [2, 3].

Simulation is an educational technique that creates the same experience as clinical practice in a guided environment [4]. It can educate practitioners within a safe,

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controlled, and structured environment. To amplify real situations, simulation-based education uses various methods, including written case-based scenarios, videos of simulated or real patients, virtual reality, role-play, Simulated Patients (SPs), mannequins, and so on [5, 6].

One of the common simulation methods is using SPs. In this method, SPs who are healthy individuals taught to behave like a real patient or present illness or specific scenario [7]. The use of SPs allows undergraduate students to learn and practice their skills and to prepare for interactions with real patients [8]. Previous studies reported that using SP was a valid, reliable, repeatable, measurable, safe, and corrective educational method [9, 10].

The advantages of SPs for students are the immediate feedback, the ability to reflect on their practice and alter practice accordingly without the ethical and safety implications on real patients [9, 11].

Despite the noted advantages, the SPs program incurs a high cost to both financial aspect and faculty time to train standardized patients [10]. Another limitation is that the quality of feeding back and role-playing relies on how SPs memorize details and behave accordingly [12, 13].

Though some evidence exists in using the simulation for health professional students, there is a lack of knowledge in using this method for physical therapy students. This study aims to review the effectiveness, feasibility, and running procedure of using SPs method in physical therapy education.

2. Materials and Methods

The current systematic review was designed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [14]. This review has not been registered elsewhere.

Search strategy

PubMed, Scopus, and Web of Science electronic databases were searched to find potentially relevant published articles from January 1980 to November 2019. The used keywords for the systematic searching process were ("standardized patients" OR "simulation" OR "simulated patient" OR "role-play) AND ("learning" OR "education" OR "teaching") AND ("physiotherapy" OR "Physical therapy"). More additional studies were identified through a manual search of reference lists of the included articles. Details of the search strategy are shown in Figure 1.

Inclusion and exclusion criteria

The inclusion criteria were as follows: 1. Published studies investigating the effects of the SP on physical therapy students assessing at least one self-reported learning-based outcome measurements like skills, confidence, self-reflection and so on; 2. All studies designed with reported quantitative data, 3. Studies allocating students of different medical fields would have been included if their researchers had reported the results of the physical therapy student group separately. The exclusion criteria were as follows: 1. Conference papers and abstracts published papers; 2. Non-English language articles; 3. Using low or high-fidelity simulation in the comparison group; 4. Qualitative studies, and 5. Observational studies.

Study selection

Two authors (MJ & ND) independently reviewed the eligible studies based on the titles and abstracts. Then, the relevant full-text articles were read carefully according to the inclusion criteria. Any disagreements were resolved by consensus or the third author.

Data extraction

Two independent researchers (MJ & AK) extracted all information from each study independently. The extracted information included the first author's name, the publication year, the country and university where the study was conducted, study design, the intervention of other groups (if there was), the sample size and graduation level of participants, number and the duration of sessions, simulated patient characteristics, outcome measurements, and the assessment tools.

Quality assessment

Two independent authors (MJ & ND) appraised the methodological quality of included articles by using the Medical Education Research Study Quality Instrument (MERSQI) [15]. The MERSQI total scores range from 5 to 18 points, where studies with 5-7 points were considered to be of low quality, 8-9 with moderate quality and those with 10-18 points represented high-quality studies. Details of quality ratings are presented in Table 1.

3. Results

Through the initial search, 2307 articles were identified. Of them, 1258 studies were duplicated and removed. The titles and abstracts of 1049 potentially

relevant studies were screened and 1025 articles were excluded due to not meeting our inclusion criteria. The full-text of remained 24 articles were obtained. After reviewing the full-text paper, 13 articles were excluded. Finally, 11 articles were included in the current systematic review. There was no additional article added to the study following the manual search. Figure 1 shows the study selection process and reasons for study exclusion in the full-text review stage.

Characteristics of studies

Among 11 included articles, seven had pre-post design [9, 16-21]. One article was a nonrandomized-controlled trial [22], and one had a Randomized Clinical Trial (RCLT) design [23]. Two other articles were Randomized Control Trials (RCTs) [24, 25]. Six studies were conducted in Australia [9, 17, 20, 22, 24], three in America [18, 19, 25], one in Canada [23], and in the United Kingdom [21]. The sample size varies from 29 to 202 participants. The participants had BS, MS, or PhD. in physical therapy. A summary of quality assessment also is shown in Table 2.

Educational program:

Researchers of the included studies designed different scenarios to improve communication and interview, taking history, assessment, and treatment skills in both inpatient and outpatient settings. Most researchers designed SP in the group class and only one study used single class design [17]. The number of sessions was from 1 to 10 and their duration was from 20 minutes to 3 hours. Two studies were conducted to compare the SP with role play [22, 25], and one study was designed to evaluate the attitude of students facing SPs versus volunteer patients [23]. A summary of the methodology of included articles is shown in Table 3.

Outcome measures of studies

All included studies used self-reported (subjective) assessment tools to evaluate different educational outcomes such as level of skills, confidence, satisfaction, insight to their ability, etc. Three studies used objective assessment methods to evaluate the knowledge and skill of the students [18, 22, 24]. Also, the feasibility of the SP educational method was evaluated in three different studies [22, 23, 25]. Because of the extent of outcome measures, we categorized them into three categories.

A. Knowledge

Two studies evaluated the knowledge of students. Dalwood et al. used a paper-based test containing quantitative answers for evaluating the understanding of students about musculoskeletal, falls, vestibular, and stroke [17]. The statements were rated on a 5-point Likert scale. Although knowledge was assessed through a subjective method, the results showed that the students reported an increase in their knowledge because of participating in the simulated program. In another study, Hale et al. assessed the student's knowledge of diabetes through an objective method [18]. Their result also reported an increase in student's knowledge about diabetes after 30-minute education by SPs.

Skills

The effects of using SPs on clinical skills (clinical reasoning, communicational ability, etc.) of physical therapy students were evaluated in six studies. In Philip et al. study, an objective structured clinical examination was used to evaluate the student's mobilization and manual handling skills by the staff member [22]. Blackstock et al. evaluated the patient recording, time management, professionalism, and attention to safety by hospital clinical educator objectively [24]. They also assessed other skills by a blinded examiner using the assessment of the physical therapy practice tool. Other researchers of included studies selected subjective assessment tools for evaluating the skills using a self-reporting system [9, 17, 20, 21].

The overall results of these studies show that using SPs is more effective than the traditional educational method in the improvement of clinical and communication skills. Also, improvement in clinical reasoning, the ability of problem-solving and professional manner is reported in students who have participated in the SP educational program. Murphy et al. found no significant difference in interview skills between students who have interacted with SP compared with the volunteer patient programs [23].

Attitudes to the educational program

Different outcome measures have evaluated the student's self-confidence, self-awareness, interest, and anxiety level in the procedure of SP learning using. All researchers of these studies used different types of questionnaires to evaluate attitudes to the program. Most studies show that using SP leads to a significant improvement in motivation and concentration in physical therapy students. Hayward et al. presented an increased

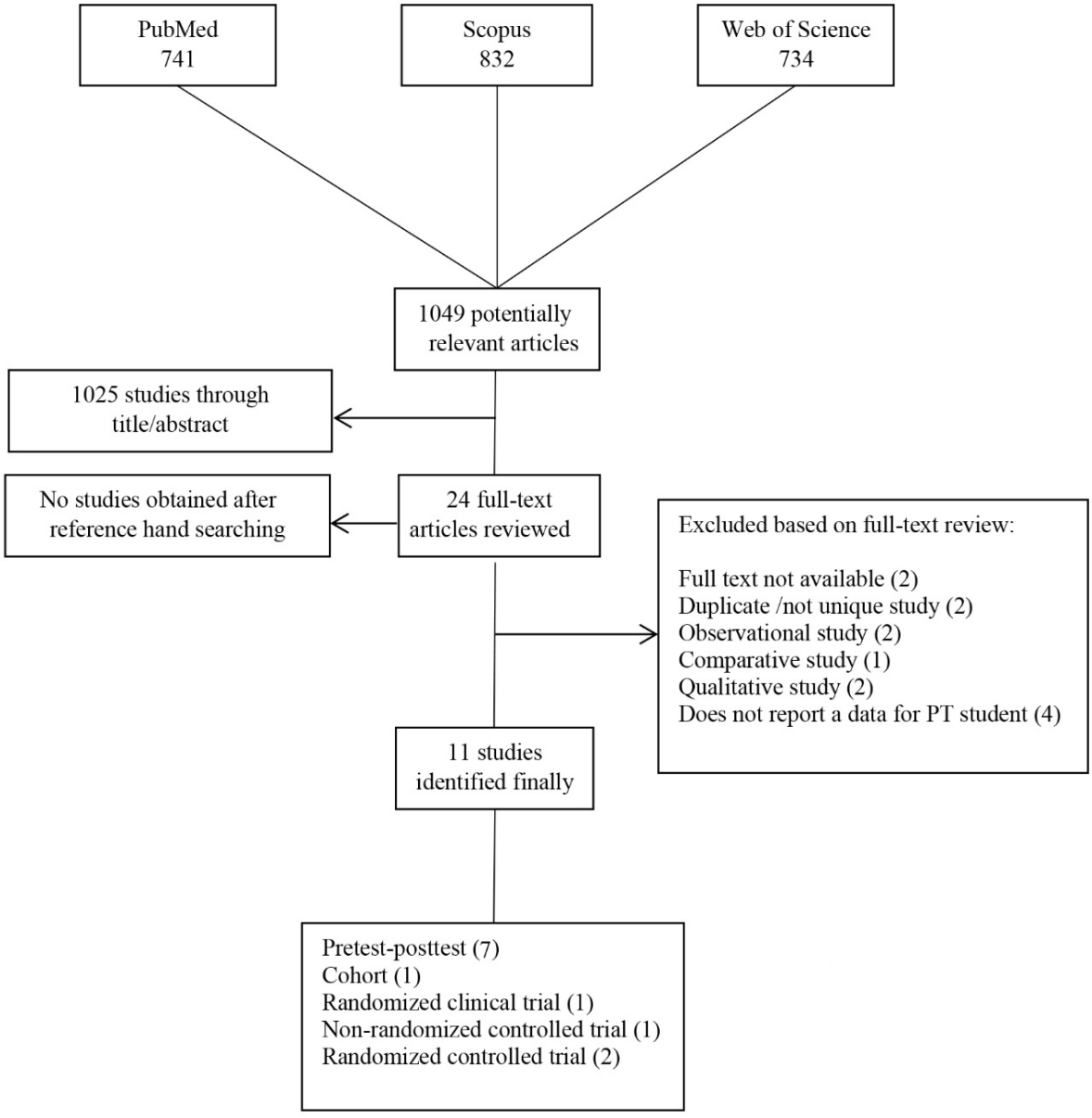

Figure 1. The flow diagram to identify the eligible articles evaluating the effect of CR on lipid profile

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self-confidence level of students for entering the clinical environment after participating in the simulation program [19]. Also, in a cohort study by Lewis et al., a significant improvement of self-confidence and anxiety was shown in physical therapy students after participating in a 1-week SP program [21].

Level of satisfaction

The level of satisfaction was objectively evaluated in three articles. Philip et al. reported that students presented higher satisfaction after participating in an SP program [22]. Mandrusiak et al. showed high satisfaction with junior students of the simulation program because of positive feedbacks from the senior students [9]. In the study by Black et al., the level of satisfaction was reported lower than other outcome measures but students were interested to continue the SP program [25].

Feasibility

In three articles, the cost, total time spent, the feasibility of the process, and the survey response rate were evaluated [22, 23, 25]. In Philip et al. study, the period of education and holding the simulation workshops were reported about 80 hours containing 20 hours for education before the intervention (15 hours for the simulated patient and 5 hours for clinical teacher) and 60 hours

Table 1. Quality assessment of included studies based on MERSQI score

MERSQI Item*	Dalwood et al. (2018) [17]	Dennis et al. (2017) [16]	Phillips et al. (2017) [22]	Murphy et al. (2015) [23]	Mandrusiak et al. (2014) [9]	Blackstock et al. (2013) [24]	Hayward et al. (2010) [19]	Lewis et al. (2008) [21]	Hale et al. (2006) [18]	Black et al. (2002) [25]	Ladyshewsky et al. (1997) [20]
Study design	1.5	1	2	3	1.5	3	1.5	1.5	1.5	3	1
Sampling: No. institutions	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5
Sampling: Response rate	1	1.5	1.5	1.5	1.5	1.5	1	1.5	1.5	1.5	0.5
Type of data	1	1	3	1	1	3	1	1	3	1	1
Validity: Internal structure	0	1	Not applicable	Not applicable	0	0	1	1	1	0	0
Validity: Content	0	1	0	1	0	1	1	1	1	1	0
Validity: Relationships	Not applicable	Not applicable	Not applicable	0	0	1	Not applicable	1	Not applicable	Not applicable	0
Data analysis: Appropriateness	1	1	1	1	1	1	1	1	1	1	1
Data analysis: Complexity of analysis	1	1	2	2	2	2	2	2	2	2	1
Outcomes	1.5	1	1.5	1.5	1	2	1.5	1.5	1.5	1.5	1.5
Total score	7.5	9	9.5	11.5	7.5	16	10.5	12	13	11.5	6.5

* Medical Education Research Study Quality Instrument (MERSQI)

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for the intervention (30 hours for each SP session) [22]. Also, $71.21 was spent on each student in this program. Murphy et al. reported that the SP program cost more than the volunteer patient program ($148 versus $50 per session) [23].

4. Discussion

The current study was designed to evaluate the effectiveness of SP as an educational method in physical therapy curricula. In most studies, SP was presented by the physical therapy students as an effective method for improving clinical reasoning skills, communication skills, basic knowledge, and learning skills. Level of confidence was increased in students after participating in SP learning and they were satisfied with this program. However, the cost of the SP methods in included studies varies widely depending on the details of the application, but most of them spend a relatively high cost for this program.

Recently, traditional teaching and learning methods of clinical subjects are being replaced and facilitated by simulation-based learning tools due to the increasing global requirements [1]. It seems that the limited clinical time for students, lack of adequate feedbacks, and shortened lengths of patients' stay in the hospital can influence medical education for undergraduate students [26, 27]. Therefore, healthcare professionals substitute SP for traditional methods to increase clinical education opportunities.

In the current review, the study designs, methods, and educational outcome measurements varied considerably among the included studies. Therefore, these variations and heterogeneity cause problems in reaching a clear con-

Table 2. Characteristics of included studies evaluating the efficacy of SP on physical therapy education

Scenario	Simulated Patient Person	Single/Group Participation	Role of Students	Number/Duration of the Sessions	Number of Participants /Academic Year/ Graduation Level	The Intervention of Other Groups	Study Design	University	Country	Authors
Musculoskeletal, falls, vestibular and stroke (Inpatient, outpatient and community environments)	Students	Single	Treatment, exercise prescription & discharge planning	2/1 h	79/the third year/ UGS	-	PPI	Monash	Australia	Dalwood et al. (2018) [17]
Sore elbow First: angry patient Second: Chatty patient	student	Group	Making communication (including taking history, etc.)	1/2 h	140/NM/NM	-	PPI	Curtin	Australia	Dennis et al. (2017) [16]
An inpatient old woman after surgery	NM	Group	Assessment & assistance to mobilize and out the patient of bed	1/3 h	108/ the second year/UGS	Peer RP of patient	NRCT Group A: SP scenario without video feedback Group B: SP scenario with optional video feedback (reflection)	South Australia	Australia	Phillips et al. (2017) [22]
NM	Volunteer subjects	Group	Obtaining basic medical and social history from the patient	10/ 20 m	74/1/MSc	VP	RCLT	British Colombia	Canada	Murphy et al. (2015) [23]
Neurology, musculoskeletal & cardiorespiratory	Senior student	Group	Patient interview & physical examination	5/1-2 h	202/the second, third, fourth years/UGS	-	PPI	Queensland	Australia	Mandrusiak et al. (2014) [9]

Scenario	Simulated Patient Person	Single/Group Participation	Role of Students	Number/Duration of the Sessions	Number of Participants /Academic Year/ Graduation Level	The Intervention of Other Groups	Study Design	University	Country	Authors
Acute cardiorespiratory disease in inpatient phase	NM	Group	NM	NM	RCT 1: 176/UGS RCT 2: 173/UGS	4 w clinical immersion only	2 RCT RCT 1: 1 W in SLE before 3 weeks of clinical immersion; RCT 2: 2 W of SLE/ clinical immersion within the 4-week clinical placement	Seven different universities	Australia	Blackstock et al. (2013) [24]
NM	NM	Group	Diagnosis, communication, ethical review	1/30 m	81/the fifth year/ DPT	-	PPI	NM	USA	Hayward et al. (2010) [19]
Musculoskeletal	NM	Group	Assessment, communication	1/30 m	35/the second year/UGS	-	PPI	Metropolitan	UK	Lewis et al. (2008) [21]
Diabetes	Student	Group	History taking. Physical screening/ Each student was randomly assigned to interact with 1 of 4 different SP scenarios	1/30 m	29/the first year/ MSc	-	PPI	Wichita State	USA	Hale et al. (2006) [18]
A 22 years old student who had recent ACL repair A 62 years old woman with cerebrovascular accident	NM	Group	History taking, clinical decision making	1-2 h	39/ the second year/PGS	RP	RCT	Southeastern Michigan	USA	Black et al. (2002) [25]

Scenario	Simulated Patient Person	Single/Group Participation	Role of Students	Number/Duration of the Sessions	Number of Participants /Academic Year/ Graduation Level	The Intervention of Other Groups	Study Design	University	Country	Authors
NM	NM	Group	Students undertook their interview with the SP under videotape. When all students had completed their interviews, the videotapes were exchanged amongst the student peers.	NM	73/the third year/ UGS	-	PPI	Curtin University of Technology	Australia	Ladyshewsky et al. (1997) [20]

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PPI: Pre-Post Intervention Study; NRCT: Nonrandomized Control Study; Rclt: Randomized Clinical Trial; RCT: Randomized Two-Group Study; RP: role-play interactions; VP: Volunteer Patients; W: Week; N: Number of Participants Enrolled; Y: Year; UGS: Undergraduate Student; NM: Not Mentioned; MSc: Master of Science; DPT: Doctor Of Physical Therapy; PGS: Postgraduate Student; h: Hour; m: Minute; ACL: Anterior Cruciate Ligament

Table 3. Outcome measurements and the results of the included studies

Authors	Outcome Measure	Results
Dalwood et al. (2018) [17]	Self-reported: Skills Confidence CPR Time management Self-reflection Feedback Attributes of the program	Self-reported: ↑ Knowledge, skill, confidence, clinical reasoning, time management, and communication No significant change in CPR Simulation was considered safe, supportive, engaging, and valuable for CPR
Dennis et al. (2017) [16]	Self-reported: IMMS ARCS	Self-reported: ↑ Motivation to learn ↑ Confidence, attention, and satisfaction
Phillips et al. (2017) [22]	Feasibility: Process Survey response rate Total time taken Cost Self-reported: Confidence Communication CPR Satisfaction Participant recruitment Objective: The skill of mobilization and manual handling by staff member	Feasibility (reported based on total participants): Process: 95% participant attendance Survey response rate: 85% Total time taken: 80 hours (including 20 hours for pre-intervention training and 60 hours for intervention) Cost: $71.21 per student Self-reported: Participants in both experimental groups represented significantly higher self-efficacy after intervention than before Participants in all groups reported high satisfaction with related activity learning Objective: There was no difference in the clinical examination scores in both SP groups and the RP group.
Murphy et al. (2015) [23]	Feasibility: Cost Self-reported: The efficiency of this learning activity (5 scores) Understanding of patient's goal for coming to physical therapy (yes/no) Asking about the HPI (yes/no) The difficulty of history taking about HPI (5 grades) Asking about the PMH (yes/no) The difficulty of patient's PMH taking (5 grades) Asking about patient's SH The difficulty of patient's SH taking	Feasibility: Cost: $148 for SP and $50 for VP per session Self-reported: There was no statistically significant difference in the student's self-reported with respect to all domains.
Mandrusiak et al. (2014) [9]	Self-reported (VAS): Communication skills Confidence CRP Insight to their ability Act in a professional manner	Self-reported (VAS): Participants represented a significant increase from before to after in all domains except act in a professional manner
Blackstock et al. (2013) [24]	Self-reported: Communication skill Assessment skill Management skill Objective (by the blinded examiner using APP): Professional behavior Communication skill Assessment skill Analysis and planning skill Intervention skill Evidence-based practice Risk management skill Objective (by patients treated by the student): Student communication Physical Care Objective (by hospital clinical educators): Time management Patient recording skill Professionalism Safety	RCT 1: Objective (by the blinded examiner using APP): No significant differences between groups All participants in the experimental group showed significant changes in all measures from baseline in other outcomes without differences between groups. RCT 1: Objective (by the blinded examiner using APP): Participants in the experimental group represented significantly higher scores in 5 of 7 skills than in the control group. All participants in the experimental group showed significant changes in all measures from baseline in other outcomes without differences between groups.

Authors	Outcome Measure	Results
Hayward et al. (2010) [19]	Self-reported: Awareness using PPTCV Confidence for entering the workplace using WS-Ei	Self-reported: Awareness using: significant increase Confidence for entering the workplace: significant increase Student learning level (using reflection)
Lewis et al. (2008) [21]	Self-reported: Confidence and anxiety for communication skills using an invented questionnaire	Both of the confidence and anxiety were significantly higher after than before of intervention
Hale et al. (2006) [18]	Self-reported: Level of student's perception about diabetes using Diabetes Attitude Scale (the third version) Objective assessment of diabetes knowledge	Self-reported: Level of student's perception about diabetes: Significantly increased Objective assessment of diabetes knowledge significantly increased
Black et al. (2002) [25]	Feasibility: Cost Self-reported: Level of satisfaction Level of comfort Level of the usefulness of their experience	Feasibility: Cost: $1767 totally Self-reported: Significantly increase in all domains of student's perception in the first scenario but not for the second
Ladyshewsky et al. (1997) [20]	Self-reported: Communication skill	Significant increase after using the SP learning method

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CPR: Clinical Placement Readiness; IMMS: Instructional Materials Motivation Scale; ARCS: Attention, Relevance, Confidence, And Satisfaction; HPI: History Of Present Injury; PMH: Past Medical History; SH: Social History; VAS: Visual Analog Scale; APP: Assessment Of Physiotherapy Practice Tool; PPTCV: Professional Physical Therapy Core Values; WS-Ei: Work Self-Efficacy Instrument; SP: Standardized Patients; RP: Role Play; VP: Volunteer Patients; RCT: Randomized Controlled Trial

clusion from the review. But it seems that that using the SP provides a dynamic educational source for a supportive medical learning environment. In other words, it allows students to practice and acquire patient care skills in a controlled and safe environment [28, 29].

The previous reviews studied the effect of using the simulation-based learning activities in physical therapy curricula by using the full range of simulation modalities such as virtual reality, role play, written case studies, and mannequins. In 2015, Mori et al. evaluated simulation learning experiences in physical therapy students by a systematic review method using a wide range of simulation modalities to facilitate student's skill development, attitude, and clinical reasoning [30]. Their results supported that students declared a feeling of decrease in anxiety, improving confidence in managing the patient, and expressing high satisfaction with the simulation learning experience [8].

Moreover, the results of a systematic review and meta-analysis in 2016 by Pritchard et al. revealed that SPs' effect was comparable to alternative educational strategies on the development of physical therapy clinical education [31]. However, the available evidence on its utility is still weak and methodological limitations in included studies make it difficult to arrive at unequivocal conclusions about their values.

The current systematic review has some limitations. First, the low number of the included studies may be due to a limited number of specific medical education databases. Second, the review did not include quantitative study or non-English language articles, and as a result, may have missed some information that could have added further insight on the topic. On the other hand, most studies had a pre-post intervention study design, so further RCTs are needed. Third, we could not compare the quality of the included studies because of the different designs and various quality assessment tools. Thus, high-quality studies are required to identify the efficacy of SP method with more complex simulated scenarios or investigate the impact of senior students compared with peers of the same year level or trained SPs, or with other types of learning activities in the PT students.

The current systematic review updates the evidence on SP efficacy and feasibility with a broad perspective. This result supports the positive efficacy of SPs educational methods, but we should consider the high cost of this type of education. Although the level of current evidence and its results are acceptable for switching traditional education to use of SP in some clinical courses, more

studies are needed to study this method on different specific courses like manual therapy, exercise prescription, electrotherapy, etc. Also finding similar methods with lower cost is highly recommended.

5. Conclusion

The use of SP in physical therapy students can significantly improve their knowledge, skill performance, confidence, and satisfaction. Also, this educational method is considered safe, supportive, and valuable for clinical preparation. High quality randomized controlled trial studies are needed to determine the influence of SP training in different courses in the field of physical therapy with the emphasis on the student's clinical skills like their ability in patient care.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article.

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Authors contributions

All authors contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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