INPLASY

Effects of Standardized Patients (SP) Combined Case-Based Learning (CBL) in Chinese Clinical Education : a systematic review and meta-analysis

INPLASY202560118

doi: 10.37766/inplasy2025.6.0118

Received: 29 June 2025

Published: 29 June 2025

Corresponding author:
Jinbo He

hejinbo1988@163.com

Author Affiliation:
Department of Otolaryngology, Head and Neck Surgery, Taihe Hospital, Hubei University of Medicine.

Yu, ZZ; Zhao, Z; Chen, XY; Shi, JY; Liang, YT; Zhang, XC; Qu, MJ; Huang, MY; Li, PP; Li, D; Li, M; He, JB.

ADMINISTRATIVE INFORMATION

Support - This work was supported by the Shiyan City Taihe Hospital Fund (No.2019JJXM021, No.2020JJXM052, No.2022JJXM082, No.2024JJXM029), the Hubei University of Medicine Teaching and Research Project (YHJ2018021),Shiyan City Scientific Research Fund(24Y030,24Y059)and Hubei University of Medicine Graduate Education and Teaching Research Approved Project (YJ2025066).

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202560118

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 29 June 2025 and was last updated on 29 June 2025.

INTRODUCTION

Review question / Objective P (Population):
Chinese medical students and resident physicians engaged in clinical education.
I (Intervention):
SP+CBL teaching approach.
C (Comparison):
LBL teaching approach.
O (Outcomes):
Teaching satisfaction (binary variable):
Coded as 1 if very satisfied or satisfied with the teaching effectiveness, and 0 otherwise, derived from questionnaire surveys.
Theoretical knowledge achievements (continuous variable):
Scores obtained through standardized examinations, with a total score of 100.
Clinical practice performance (continuous variable):
Scores obtained through standardized Mini-Clinical Evaluation Exercise (Mini-CEX) 11and
Objective Structured Clinical Examination (OSCE) Multi – Station Assessment12, with total
score of 100.

Rationale Building on prior research , this study is grounded in the theoretical frameworks of situated learning theory, cognitive load theory, and competency modeling. We hypothesize that integrating standardized patients (SP) with case-based learning (CBL) strengthens the development and consolidation of clinical practice skills among Chinese medical students and resident physicians by reducing cognitive load through contextualized practice, while concurrently fostering their comprehensive competencies.

Notably, prior studies have primarily focused on meta-analyses of single teaching modalities or analyzed the effects of the SP+CBL model solely through randomized controlled trials (RCTs) , lacking a comprehensive systematic quantitative synthesis of this combined approach. While preliminary studies have demonstrated its feasibility, an integration of the effect sizes is absent, and available outcome measures are quantifiable. Consequently, this research adopts a meta-analysis approach aligned with Cochrane recommendations. This methodology generates higher-level evidence to address critical gaps left by fragmented qualitative studies, thereby providing evidence to inform scaled implementation of SP+CBL within Chinese medical education.

Condition being studied Modern medicine prioritizes skilled doctors capable of addressing patients' needs effectively. However, traditional teaching methods tend to focus primarily on knowledge transmission, often overlooking the crucial aspect of skill development. The concept of Standardized Patients (SP) was first proposed by a physician from the University of Southern California. SPs are individuals who have undergone rigorous standardized and systematic training to accurately simulate the clinical characteristics of patients, including their medical histories, physical symptoms, and emotional responses.Participating in SP programs allows learners to acquire various valuable skills, including interpersonal communication, motivational interviewing, clinical writing, and interprofessional teamwork. Additionally, they are exposed to rare disease state that are infrequently encountered in real clinical settings, further enhancing their learning experience.Case-Based Learning (CBL) employs clinical cases as educational material, creating a simulated clinical learning environment for students to develop the ability to apply foundational theoretical knowledge to solve clinical problems.

METHODS

Search strategy English Database Search Starategy
PubMed :
("medical students"[Text Word] OR "resident doctors"[Text Word] OR "medical trainees"[Text Word] OR "clinical trainees"[Text Word] OR "physicians"[Text Word] OR "medical professionals"[Text Word]) AND ("standardized patient"[Text Word] OR "simulated patient"[Text Word] OR "actor patient"[Text Word] OR "patient simulation"[Text Word]) AND ("case-based learning"[Text Word] OR "CBL"[Text Word] OR "problem-based learning"[Text Word] OR "PBL"[Text Word] OR "case study"[Text Word]) AND ("lecture-based learning"[Text Word] OR "LBL"[Text Word] OR "traditional teaching"[Text Word] OR "conventional teaching"[Text Word] OR "didactic teaching"[Text Word] OR "lecture teaching"[Text Word]) AND ("satisfaction"[Text Word] OR "teaching satisfaction"[Text Word] OR "student satisfaction"[Text Word] OR "exam scores"[Text Word] OR "knowledge"[Text Word] OR "theoretical knowledge"[Text Word] OR "clinical competence"[Text Word] OR "clinical skills"[Text Word] OR "learning outcomes"[Text Word] OR "clinical performance"[Text Word] OR "operational skills"[Text Word])
Web of Science:
TS=("randomized controlled trial" OR "clinical trial" OR "RCT" OR "controlled before-and-after study" OR "quasi-experimental" OR "pre-post test" OR "cohort study" OR "observational study" OR "longitudinal study" OR "systematic review")
AND
TS=("medical students" OR "resident doctors" OR "clinical trainees" OR "medical professionals" OR "clinical interns" OR "medical educators" OR "healthcare trainees" OR "resident physicians")
AND
TS=("standardized patient" OR "simulated patient" OR "actor patient" OR "virtual patient" OR "patient simulation" OR "patient actor")
AND
TS=("case-based learning" OR "CBL" OR "problem-based learning" OR "PBL" OR "interactive learning" OR "structured learning" OR "clinical case studies" OR "simulated case learning")
AND
TS=("lecture-based learning" OR "LBL" OR "traditional teaching" OR "conventional teaching" OR "didactic teaching" OR "active learning" OR "blended learning" OR "lecture-based instruction")
AND
TS=("satisfaction" OR "teaching satisfaction" OR "student satisfaction" OR "exam scores" OR "knowledge acquisition" OR "theoretical knowledge" OR "clinical competence" OR "clinical skills" OR "learning outcomes" OR "skills improvement" OR

"behavioral change" OR "clinical performance" OR "operational skills" OR "skill development")
Cochrane Library:
("medical students" OR "resident doctors" OR "medical trainees")
AND(("standardized patient" OR "simulated patient") AND ("case-based learning" OR "CBL" OR "case studies")) AND("lecture-based learning" OR "LBL" OR "traditional teaching" OR "conventional teaching") AND("satisfaction" OR "knowledge" OR "clinical skills")
Education Resources Information Center (ERIC):
("case-based learning" OR "case method" OR "case-based instruction" OR "CBL")
AND
("medical education" OR "medical students" OR "clinical teaching" OR "residency education")
AND
("teaching methods" OR "instructional methods" OR "education strategies")
AND
("academic performance" OR "student satisfaction" OR "clinical competence" OR "learning outcomes")
Chinese Database Search Starategy
China National Knowledge Infrastructure (CNKI):
标准化病人 + '标准化病人(sp)' + 标准化病人教学 + 标准化病人教学法 + 标准化病人的培训 + 标准化病人培训
案例教学 + 案例教学法 + 案例教学模式 + 案例教学方法 + 案例教学法的应用 + 案例教学法应用
理论知识成绩 + 理论知识评分 + 理论知识考核 + 理论知识学习+教学满意度 + 教学满意度评价 + 学生教学满意度 + 临床教学满意度 + 课程教学满意度 + 课堂教学满意度+临床实践能力 + 临床实践能力考核
Wanfang :
(("医学生" OR "临床医学生" OR "住院医师" OR "规培医师" OR "规范化培训" OR "临床教学" OR "临床实践教学")
AND
(("标准化病人" OR "SP" OR "模拟病人") AND ("案例教学法" OR "CBL" OR "以案例为基础的学习"))
AND
("传统教学法" OR "讲授式教学" OR "LBL" OR "以授课为基础的学习")
AND
("教学满意*" OR "理论知识" OR "考试成绩" OR "临床技能" OR "操作评分" OR "实践能力"))
VIP :
(("医学生" OR "临床医学生" OR "住院医师" OR "规培医师" OR "规范化培训" OR "临床教学" OR "临床实践教学")
AND
(("标准化病人" OR "SP" OR "模拟病人") AND ("案例教学法" OR "CBL" OR "以案例为基础的学习"))
AND
("传统教学法" OR "讲授式教学" OR "LBL" OR "以授课为基础的学习")
AND
("教学满意*" OR "理论知识" OR "考试成绩" OR "临床技能" OR "操作评分" OR "实践能力")).

Participant or population It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

Intervention The experimental group implemented a blended pedagogy integrating CBL with SP. Clinically relevant cases were designed to align with curricular objectives, with SPs trained to authentically replicate patient symptoms, medical histories, and physical signs. Students engaged in small-group sessions to perform SP-based interviews, physical examinations, and collaborative case analyses, followed by diagnostic and therapeutic decision-making. Competency assessments utilized dynamic tools such as Mini-CEX or OSCE , targeting clinical reasoning, procedural proficiency, and communication skills.

The control group followed conventional teaching methodologies centered on LBL, relying on didactic lectures via slides or textbooks. Bedside teaching involved real patients but was constrained by inconsistent case availability and patient participation. Case discussions and ward rounds lacked standardized simulation, focusing instead on observational learning. Assessments prioritized theoretical knowledge retention through written examinations, supplemented by basic procedural drills using manikins.

Comparator Population-Intervention-Comparison-Outcomes (PICO) framework to systematically examine: Chinese medical students' and resident physicians' competencies, comparative effectiveness against traditional pedagogical

methods, and measurable impacts on learner satisfaction and performance outcomes.

Study designs to be included Randomized Controlled Trials.

Eligibility criteria The inclusion criteria were as follows:
(1) Study type: RCTs evaluating the intervention effects of SP combined with CBL on clinical practice teaching.
(2) Study population: Chinese medical students and resident physicians engaged in clinical practice.
(3) Intervention Measures: Controls received the LBL teaching model, while experimental groups received the SP+CBL teaching model.
(4) Outcome Measures: Teaching satisfaction, theoretical knowledge achievements, and clinical practice performance.
The exclusion criteria were as follows:
(1) The study was unrelated to SP+CBL.
(2) Non-controlled studies.
(3)Studies not reporting key outcomes :teaching satisfaction, theoretical knowledge achievements, clinical practice performance.
(4)Studies with data that cannot be extracted or converted.
(5) Inaccessible full-text literature.
(6) Non-Chinese or non-English literature.

Information sources PubMed, Web of Science, Cochrane Library, Education Resources Information Center (ERIC),China National Knowledge Infrastructure (CNKI), Wanfang Database, and the VIP Database from their inception up to April 30, 2025.

Main outcome(s) Teaching satisfaction (binary variable):
Coded as 1 if very satisfied or satisfied with the teaching effectiveness, and 0 otherwise, derived from questionnaire surveys.
Theoretical knowledge achievements (continuous variable):
Scores obtained through standardized examinations, with a total score of 100.
Clinical practice performance (continuous variable):
Scores obtained through standardized Mini-Clinical Evaluation Exercise (Mini-CEX) and
Objective Structured Clinical Examination （OSCE） Multi – Station Assessment, with total score of 100.

Quality assessment / Risk of bias analysis The RevMan5.4 Cochrane Risk-of-Bias (ROB) tool was used to evaluate methodological quality, focusing on seven critical criteria, including the randomization sequences generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting of study results (reporting bias), and other conceivable sources of bias.Each bias was categorized as "low risk", "high risk", or "unclear risk".

Strategy of data synthesis The meta-analysis was conducted using RevMan 5.4 software. Based on the a priori assumption of high heterogeneity in educational intervention studies, a RE model was pre-specified for Meta-analysis initially, and the model was ultimately adjusted according to the heterogeneity of results to output the final calculation results. If p heterogeneity > 0.1 and I2 < 50%, it indicates that all the studies are homogeneous, and the FE model is chosen for final analysis; if p heterogeneity < 0.1 and I2 ≥ 50%, it indicates heterogeneity among the studies, and a RE model is chosen for final analysis.For continuous variables, such as the theoretical knowledge achievements and the clinical practice performance, the mean differences (MD) was calculated, while for binary variables like teaching satisfaction, the odds ratios (OR) was calculated.Additionally, the 95% confidence intervals (CI) were calculated for each effect size. To assess the stability of observed results, the leave-one-out (LOO) method was applied to sequentially exclude each piece of literature.13 Subgroup analyses were performed to compare outcomes between medical students and resident physicians, focusing on differences in theoretical knowledge acquisition and practical skill performance across distinct stages of medical education and potential sources of heterogeneity were systematically explored to enhance interpretability. Ultimately, the evidence certainty thresholds were determined following the GRADE evidence criteria: High, Moderate, Low, and Very Low.

Subgroup analysis See Supplementary Materials 3, in the assessment of theoretical knowledge achievement, the medical student subgroup included 21 studies (MD=6.46, 95%CI=5.02–7.91, p<0.001) with considerable heterogeneity （pheterogeneity < 0.00001, I2 = 95%）, while the resident physician subgroup included 6 studies (MD=3.45, 95%CI= 1.75–5.16, p<0.001) with moderate heterogeneity（p heterogeneity =0.09, I2 = 48%. For clinical practice performance , the medical student subgroup comprised 21 studies (MD=7.50, 95%CI=5.85–9.15, p<0.001)with

considerable heterogeneity (p heterogeneity < 0.00001, I2 = 97%) , and the resident physician subgroup included 6 studies (MD=8.09, 95%CI=4.88–11.29, p<0.001)with considerable heterogeneity (p heterogeneity < 0.00001, I2 = 86%).

Sensitivity analysis After the systematic LOO method exclusion of each individual study, MD was recalculated from 5.74 to 6.13 , I2 was recalculated from 93% to 94%, and the overall findings remained consistent, suggesting the relative stability of the study results(see Supplementary Materials 2). The meta-analysis revealed that, in contrast to traditional teaching methods, combinations of SP and CBL had significantly greater theoretical knowledge achievements (MD=5.91, 95%CI=4.63–7.18, p<0.00001), as shown in Figure4.
After systematically LOO method excluding each individual study, MD was recalculated from 6.05 to 7.96, I2 was recalculated from 95% to 96%, and the overall findings remained consistent, suggesting the relative stability of the study results(see Supplementary Materials 2). The meta-analysis revealed that SP combined with CBL led to a notable improvement in clinical practice proficiency (MD=7.62, 95%CI=6.16–9.08, p<0.001) , as shown in Figure 5.

Country(ies) involved China.

Keywords Standardized Patients(SP); Case-Based Learning (CBL);Chinese Clinical Education;Meta-Analyses.

Contributions of each author
Author 1 - Zizhong Yu - ZZY the guarantor of this study and designed the study and reviewed the initialmanuscript.
Email: yurick0994@163.com
Author 2 - Zhao Zhao - ZZ extraction and analysis of data ,drafting the initial manuscript.
Email: zouxiaojindao11@163.com
Author 3 - Xinyue Chen - XYC extraction and analysis of data ,drafting the initial manuscript.
Email: 1814812098@qq.com
Author 4 - Jiayi Shi - SJY extraction and analysis of data ,drafting the initial manuscript.
Email: sjy20030120@163.com
Author 5 - Yiting Liang - YTL substantial contributions to data collection and interpretation.
Email: 15336285036@163.com
Author 6 - Xicheng Zhang - XCZ substantial contributions to data collection and interpretation.
Email: 1907271572@qq.com
Author 7 - Mengjiao Qu - MJQ substantial contributions to data collection and interpretation.
Email: 1828397429@qq.com
Author 8 - MeiYu Huang - MYH substantial contributions to data collection and interpretation.
Email: 2714024798@qq.com
Author 9 - Panpan Li - PPL substantial contributions to data collection and interpretation.
Email: 211750554@qq.com
Author 10 - Dan Li - DL contributed to the study methodology and corrected the final version of the manuscript.
Email: lidan1980@163.com
Author 11 - Man Li - ML contributed to the study methodology and corrected the final version of themanuscript.
Email: manli1866@163.com
Author 12 - Jinbo He - JBH contributed to the study methodology and corrected the final version of themanuscript.
Email: hejinbo1988@163.com