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Study on the Application Effect of CBL Combined with Standardized Patient (SP) Teaching Model in Clinical Teaching of Residents in Respiratory Medicine

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Abstract: *Objective:* To explore the application value of casebased learning (CBL) combined with a standardized patient (SP) teaching model in the clinical teaching of residents during standardized residency training in respiratory medicine, and to compare the training effects between the traditional teaching model and the CBL+SP combined model, so as to provide practical evidence for optimizing the teaching program in respiratory medicine residency training. *Methods:* A total of 98 residents who rotated through the Department of Pulmonary and Critical Care Medicine in our hospital from July 2023 to July 2025 were selected as study subjects and randomly divided into a control group (n=49, receiving traditional lecturebased LBL teaching) and an observation group (n=49, receiving CBL combined with SP teaching model) using a random number table. The training period was 3 months. After training, the two groups were compared in terms of theoretical examination scores, clinical comprehensive ability (assessed by the MiniCEX scale), and skill operation examination scores; teaching satisfaction was surveyed using a selfdesigned questionnaire. *Results:* The theoretical examination scores, skill operation scores, MiniCEX subdomain scores, and overall teaching satisfaction in the observation group were all higher than those in the control group (all P<0.05). *Conclusion:* The CBL combined with SP teaching model can effectively enhance residents' theoretical mastery, clinical practical ability, doctorpatient communication, and clinical reasoning skills in respiratory medicine, with higher teaching satisfaction. This model is suitable for promotion and application in clinical teaching of respiratory medicine residency training.

Keywords: Casebased learning; Standardized patient; Respiratory medicine; Standardized residency training; MiniCEX

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1. Introduction

Standardized residency training is a critical component of clinical medical talent development, with the core objective of cultivating residents' solid theoretical foundation, clinical thinking, practical skills, and

doctorpatient communication abilities, thereby facilitating the transition from medical student to clinical physician [1]. Respiratory medicine encompasses a wide range of diseases, with conditions such as chronic obstructive pulmonary disease, bronchial asthma, and interstitial lung disease often presenting overlapping clinical manifestations, which places high demands on residents' comprehensive analytical and differential diagnostic capabilities [2]. The traditional lecturebased LBL teaching model, which emphasizes knowledge delivery through instructorled lectures, places residents in a passive receiving role, lacks opportunities for real clinical scenario practice, and often results in a disconnect between theory and clinical practice, as well as weak doctorpatient communication skills, making it difficult to fully meet the competency development requirements of residency training [3]. Casebased learning (CBL) centers on real clinical cases, using casebased questioning, discussion, and analysis to guide residents in actively structuring diagnostic reasoning, identifying key differential points, and formulating treatment plans, with a particular focus on strengthening clinical thinking skills [4]. Standardized patients (SP), after systematic training, can accurately reproduce the symptoms, signs, and emotional states of real patients, enabling repeated practice of historytaking, physical examination, and doctorpatient communication in a simulated setting, while avoiding issues such as patient noncooperation, nonreproducible clinical conditions, and medical safety risks inherent in real clinical teaching, thus providing residents with a safe environment for handson practice. CBL alone lacks facetoface doctorpatient interaction scenarios, while SP alone lacks the indepth case analysis component; the combination of the two can complement each other, integrating indepth case discussion with simulated clinical scenario practice. This study enrolled 98 respiratory medicine residents to compare the training effects of the CBL+SP combined model and the traditional LBL model, aiming to provide reference data for teaching reform in respiratory medicine residency training.

2. Materials and methods

2.1. General information

A total of 98 residents who completed their rotation training in the Department of Pulmonary and Critical Care Medicine in our hospital from July 2023 to July 2025 were selected as study subjects and randomly divided into a control group and an observation group using a random number table, with 49 residents in each group. Inclusion criteria: (1) fulltime clinical medicine bachelor's degree or above, entering the respiratory medicine rotation for the first time; (2) completed the residency orientation program, informed of the study content, and voluntarily signed informed consent; (3) completed the 3month training period and were able to participate fully in all teaching activities and assessments; (4) complete clinical teaching records. Exclusion criteria: (1) previous clinical work or rotation experience in respiratory medicine; (2) cumulative leave of more than 7 days during the training period, or withdrawal from the study; (3) absence from examinations or incomplete questionnaire responses.

There were no statistically significant differences between the two groups in terms of gender, age, educational background, or prerotation theoretical scores (P>0.05), indicating comparability (**Table 1**).

Table 1. Comparison of general information between the two groups of residents [Mean ± SD, n(%)]

Group	Male/Female	Age (years)	Education (Bachelor/Master or above)	Baseline theoretical score (points)
Control group (n=49)	22/27	24.71±1.83	31/18	72.26±5.41

Observation group (n=49)	20/29	24.45±1.76	33/16	71.84±5.67
t/x^2 value	0.167	0.715	0.180	0.384
P value	0.683	0.476	0.671	0.702

2.2. Teaching faculty and SP preparation

Teaching faculty: All instructors were attending physicians or above in the Department of Respiratory Medicine, with at least 5 years of experience in residency training. Prior to the teaching sessions, all instructors received unified training on teaching methods and became familiar with the CBL discussion process, SP assessment scoring criteria, and the evaluation standards of the MiniCEX scale.

Standardized patients (SP): Six SP actors were recruited. Senior respiratory physicians developed standardized case scripts covering five common respiratory diseases: acute exacerbation of chronic obstructive pulmonary disease, bronchial asthma, communityacquired pneumonia, pleural effusion, and interstitial lung disease. The SPs underwent a 4week specialized training program to become proficient in simulating patient complaints, history of present illness, past medical history, physical signs, and emotional responses, and to master the key points of providing feedback on residents' historytaking and communication behaviors. After training, they were assessed, and only those who passed the assessment were allowed to participate in the teaching activities. A respiratory medicine CBL case bank was established, with each case including complete clinical data such as medical history, physical examination findings, laboratory reports, chest CT, and pulmonary function reports.

2.3. Teaching methods

The rotation period for both groups of residents was 3 months, during which daily ward rounds and oncall duties were identical.

2.3.1. Control group: Traditional LBL (lecturebased learning) teaching model

The control group received teachercentered classroom instruction, with two theoretical lectures per week covering the pathogenesis, diagnostic criteria, and treatment principles of common and frequently occurring respiratory diseases. Bedside teaching was conducted using real ward cases, where instructors demonstrated historytaking and physical examination, while residents observed and learned. Routine assignments were given after class, and a unified endofrotation examination was administered upon completion.

2.3.2. Observation group: CBL combined with SP standardized patient teaching model

On the basis of basic theoretical lectures, the observation group received a combination of CBL case seminars and SP simulation exercises, with one CBL case discussion session and one SP simulation clinical training session per week.

(1) CBL case seminars: Complete case materials were distributed to residents three days before class, requiring them to review the materials in advance and prepare preliminary diagnoses, differential diagnoses, selection of ancillary tests, and treatment plans. Class sessions were primarily driven by resident presentations and discussions, with instructors guiding the discussion through questioning, exploring doubtful points of the case, and sorting out the diagnostic reasoning chain. At the end of the discussion, instructors summarized and provided feedback, corrected erroneous reasoning, and highlighted key and difficult points.

(2) SP simulation clinical training: Residents completed the full clinical process with SPs, including selfintroduction, history taking, focused physical examination, condition disclosure, communication and explanation, and preliminary treatment plan presentation. SPs provided interactive feedback on the spot. After the training, instructors used the MiniCEX scale to provide itembyitem feedback on the residents' deficiencies in historytaking, physical examination, communication, and humanistic care. Residents then reflected and practiced repeatedly on their weak areas.

The CBL cases and SP simulation cases were matched onetoone, ensuring close integration of theoretical case discussion and practical simulation.

2.4. Observation indicators

All assessments were conducted by senior physicians who were not involved in the teaching, using a blinded scoring method.

(1) Theoretical and clinical skills assessment: The theoretical examination was a closedbook written test, with a full score of 100, including multiplechoice questions, term explanations, and case analysis questions, covering all teaching content of the respiratory rotation. The clinical skills assessment (full score of 100) included preoperative evaluation for thoracentesis, procedural operation, aseptic technique, postprocedure management, and recognition of complications.

(2) MiniCEX scale scores: Seven dimensions were assessed: historytaking, physical examination, clinical judgment, communication skills, humanistic care, organizational efficiency, and overall performance. Each dimension was scored from 1 to 9, with 9 being the best and 1 being the worst.

(3) Teaching satisfaction questionnaire: The questionnaire included five items: stimulating learning interest, enhancing clinical thinking, improving communication skills, recognition of the teaching model, and overall teaching effectiveness. Responses were categorized as satisfied, average, or dissatisfied. Overall satisfaction rate = (number of satisfied cases) / total cases × 100%.

2.5. Statistical methods

Statistical analysis was performed using SPSS 27.0 software. Continuous data were expressed as mean ± standard deviation (Mean ± SD), and comparisons between groups were made using independent samples *t*tests. Categorical data were expressed as number of cases (percentage) and compared using the chisquare test. A P value of <0.05 was considered statistically significant.

3. Results

3.1. Comparison of theoretical and skills assessment scores between the two groups

The observation group achieved significantly higher scores in both theoretical examination and clinical skills assessment compared with the control group ($P < 0.001$), as shown in **Table 2**.

Table 2. Comparison of theoretical and skills assessment scores between the two groups of residents (Mean ± SD, points)

Group	Theoretical examination score	Practical skill examination score
Control group (*n*=49)	76.37±6.24	74.12±5.86
Observation group (*n*=49)	84.62±5.73	83.49±6.17

t	6.817	7.716
P	<0.001	<0.001

3.2. Comparison of mini-CEX Dimension scores between the two groups of resident physicians

The observation group scored higher than the control group in history taking, physical examination, clinical judgment, communication skills, humanistic care, organizational efficiency, and overall performance (all $P < 0.001$), as shown in **Table 3**.

Table 3. Comparison of Mini-CEX scale dimension scores between the two groups of resident physicians (Mean ± SD, points)

Dimension/Item	Control group (*n*=49)	Observation group (*n*=49)	*t*	*P*
History taking	6.04±0.71	7.42±0.65	10.109	<0.001
Physical examination	5.87±0.75	7.26±0.69	9.678	<0.001
Clinical judgment	5.73±0.68	7.31±0.72	11.168	<0.001
Communication skills	5.61±0.80	7.54±0.63	12.952	<0.001
Humanistic care	5.92±0.74	7.47±0.66	10.937	<0.001
Organizational efficiency	5.84±0.77	7.23±0.70	9.292	<0.001
Overall performance	5.80±0.72	7.36±0.64	11.018	<0.001

3.3. Comparison of teaching satisfaction between the two groups of residents

The overall teaching satisfaction rate in the observation group was 93.88%, which was higher than that in the control group (73.47%, $P<0.05$), as shown in **Table 4**.

Table 4. Comparison of teaching satisfaction between the two groups of residents [n (%)]

Group	Satisfied	Average	Dissatisfied	Overall satisfaction rate	x^2	*P*
Control group (*n*=49)	36 (73.47)	9 (18.37)	4 (8.16)	36 (73.47)	7.470	0.006
Observation group (*n*=49)	46 (93.88)	2 (4.08)	1 (2.04)	46 (93.88)		

4. Discussion

The core objective of standardized residency training is to cultivate residents' post competency, which requires not only a solid theoretical foundation but also the establishment of complete clinical thinking and proficiency in comprehensive skills including history taking, physical examination, clinical procedures, doctorpatient communication, and humanistic care. Respiratory medicine encompasses a wide range of diseases, some of which present with overlapping clinical manifestations and rapid progression, posing high demands on residents' comprehensive diagnostic and therapeutic abilities. The traditional lecturebased learning (LBL) model, dominated by teacher instruction, places residents in a passive knowledgereceiving role, lacking active thinking and simulated diagnostic scenarios, which can easily lead to a disconnect between theory and clinical practice. Meanwhile, constrained by factors such as real patient informed consent, disease variability, and medical safety, residents have limited opportunities for repeated practice in history taking and communication. Some residents, upon entering clinical settings, may encounter issues such as disorganized inquiry, rigid communication, and

weak humanistic awareness when facing real patients [5].

Casebased learning (CBL) uses real cases as carriers, guiding residents to independently consult materials and engage in discussion and analysis around the cases, translating textbook theoretical knowledge into concrete case scenarios, prompting residents to actively construct diagnostic and differential diagnostic reasoning chains, transforming the traditional didactic model, and enhancing selfdirected learning ability [6]. However, CBL alone is confined to paperbased case discussions and lacks facetoface doctorpatient interaction scenarios, so residents cannot obtain practical training in history taking, communication, and physical examination. Standardized patients (SP) can accurately reproduce real patient consultation scenarios, allowing residents to practice the entire patient reception process in a riskfree environment, including history collection, physical examination, condition disclosure, and doctorpatient communication. SP can also provide feedback on the consultation experience, helping residents identify shortcomings in humanistic care and communication skills, thereby compensating for the insufficiency of clinical teaching resources [7]. The combination of CBL and SP, first using CBL for indepth case discussion to sort out diagnostic reasoning and then relying on SP for simulated clinical practice, achieves an organic integration of theoretical thinking and simulated practice, leveraging the synergistic advantages of both teaching models [8].

The results of this study showed that residents in the observation group achieved significantly higher theoretical examination scores and practical skill scores compared with the control group ($P < 0.05$); and across all dimensions of the MiniCEX scale, the observation group scored higher than the control group. This indicates that the combined CBL+SP teaching model not only consolidates residents' theoretical knowledge but also significantly improves comprehensive clinical abilities, including history taking, physical examination, clinical judgment, doctorpatient communication, and humanistic care. The reasons are analyzed as follows: CBL case discussions prompted residents to actively consult literature and deepen their understanding of pathogenesis, differential diagnostic keys, and treatment principles of respiratory diseases [9]; SPbased simulations provided safe and repeatable clinical scenarios, allowing residents to repeatedly practice the entire consultation process, while instructors provided timely feedback and correction on onsite performance, accelerating the improvement of clinical thinking and practical skills [10]. Questionnaire survey results showed that the overall teaching satisfaction in the observation group was 93.88%, higher than 73.47% in the control group, indicating that residents generally approved of this teaching model and considered it capable of stimulating learning initiative and narrowing the gap between theory and clinical practice.

This study still has certain limitations: it is a singlecenter study with a sample size of 98 cases, which is limited; the SP cases only covered common respiratory diseases, with fewer involving critical or rare conditions; and no longterm followup was conducted, lacking data on residents' subsequent clinical performance in practice. Future studies may adopt a multicenter design, expand the sample size, and enrich the SP case bank to include severe and uncommon cases; meanwhile, incorporating DOPS operational assessments and OSCE objective structured clinical examinations will further improve the multidimensional teaching evaluation system and continuously optimize the residency training program in respiratory medicine.

In conclusion, the application of CBL combined with standardized patients in residency training of respiratory medicine can significantly improve residents' theoretical knowledge, clinical practical skills, clinical reasoning, and doctorpatient humanistic communication abilities, with high teaching satisfaction

and superior outcomes compared with traditional lecturebased teaching. This approach is worthy of wider promotion and implementation in standardized residency training in respiratory medicine.

Disclosure statement

The authors declare no conflict of interest.

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