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Application of scenario simulation combined Mini-CEX teaching model in gynecology and obstetrics resident teaching: A case study of paclitaxel and cisplatin use

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Abstract: This study aims to investigate the application of scenario simulation combined with the Mini-CEX teaching model on the instruction of paclitaxel and cisplatin use in gynecology and obstetrics residents. A retrospective analysis was conducted, selecting 32 gynecology and obstetrics residents who received traditional teaching from July 2019 to June 2021 as the control group, and another 27 gynecology and obstetrics residents who received scenario simulation combined with Mini-CEX teaching from July 2021 to June 2023 as the observation group. In comparison to controls, participants from our observational cohort demonstrated superior performance across both theoretical examinations and case analyses (P<0.05). Furthermore, within our observational cohort we observed heightened proficiency across all seven dimensions assessed by Mini-CEX compared to controls (P<0.05). Additionally, the total score of teaching satisfaction in observation group was significantly higher than that in control group (P<0.05). Notably, the satisfaction score of the observation group was significantly higher than that of the control group (P<0.05). The application of scenario simulation combined with Mini-CEX teaching mode has a positive impact on the instruction of paclitaxel and cisplatin use in gynecology and obstetrics residents. It improved clinical competence and satisfaction and is worth promoting.

Keywords: Scenario simulation teaching mode, Mini-CEX, gynecology and obstetrics, resident, paclitaxel and cisplatin.

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INTRODUCTION

With the continuous advancement of medical education, the traditional teaching model is no longer sufficient to meet the current demands for comprehensive training of resident physicians (Zhao *et al*., 2020). Obstetrics and gynecology, as a crucial branch of medicine, necessitates physicians to possess not only a strong theoretical foundation but also advanced clinical operational skills and the ability to handle emergencies adeptly. In this context, it is particularly crucial to explore more efficient and practical teaching methods. Simulation-based teaching is a method that replicates a realistic clinical scenario and evolves the situation, enabling trainees to immerse themselves in it and make judgments and decisions based on different scenarios, thereby deepening their understanding of theoretical knowledge and enhancing their ability to solve real-world problems (Shan *et al*., 2022). Mini-CEX is a performance assessment tool that integrates teaching and evaluation functions. It was introduced by the American College of Internal Medicine in 1995 and has been widely utilized in global medical education for evaluating the clinical skills and professionalism of medical students while providing timely feedback for teaching. This approach serves as an effective means of improving clinical teaching quality (Batra *et al*., 2022).

Paclitaxel and cisplatin are widely utilized chemotherapeutic agents in clinical settings, constituting a crucial chemotherapy regimen for the treatment of diverse gynecologic malignancies including cervical cancer, ovarian cancer and breast cancer (Mille *et al*., 2020). Nevertheless, their intricate pharmacological mechanisms, stringent indications and potential adverse effects impose substantial demands on physicians' comprehensive clinical capabilities (Nelson *et al*., 2023). Therefore, this study employed scenario simulation combined with the Mini-CEX teaching model to replicate real-world applications of paclitaxel and cisplatin in managing gynecologic malignancies. This approach aims to facilitate interns' profound comprehension of the drugs' mechanisms of action, mastery of usage guidelines, as well as enhancement of their clinical decision-making skills, teamwork abilities and emergency response capacity to ensure safe and effective drug administration.

MATERIALS AND METHODS

Research object

A retrospective cohort study was conducted to select 32 residents in the obstetrics and gynecology department who were trained using the traditional teaching model

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from July 2019 to June 2021 as the control group. Another 27 residents in the same department who were trained using the scenario simulation combined with Mini-CEX teaching model from July 2021 to June 2023 were selected as the observation group. Inclusion criteria: voluntary enrollment in the course and completion of systematic learning; good learning attitude; no previous participation in the learning of the scenario simulation combined with Mini-CEX teaching mode. Exclusion criteria: included non-full-time undergraduate students of clinical medicine; residents who had prior clinical experience in obstetrics and gynecology; residents whose data on specialty, leave of absence, or early termination of training, teaching records, examination results, and Mini-CEX evaluation results were incomplete during the study period; and residents who refused to participate in the study.

Teaching methods

The control group was exposed to conventional teaching methods. In accordance with the curriculum requirements, senior attending physicians systematically instructed the residents through classroom lectures on the pharmacological actions, indications, dosage, adverse reactions, and precautions of paclitaxel and cisplatin. The residents were assigned to accompany the teaching physicians for rounds, observing and participating in the application of paclitaxel and cisplatin in real cases. Regular case discussions were conducted, focusing primarily on analyzing patient conditions and formulating treatment plans. This phase of instruction lasted 1-3 weeks, with learning outcomes assessed through theoretical examinations, practical evaluations and Mini-CEX assessments upon completion.

The observational group conducted theoretical lectures, teaching rounds and case discussions, while also implementing a simulation-based combined Mini-CEX teaching model once a week for 1-2 sessions. (1) Case design: Initially, we developed highly realistic clinical case scenarios based on the application of paclitaxel and cisplatin, encompassing detailed patient history, physical examination findings and laboratory test results. (2) Role-playing: Senior resident physicians assumed the role of teachers standardized patient (TSP) and enacted simulated symptoms and physical examinations according to predefined scripts. (3) Environment setup: A simulated hospital environment was established with essential medical equipment, emergency drugs, and consumables. (4) Simulated diagnosis and treatment: The diagnostic and treatment process was divided into three steps. Firstly, interns assessed the patient's condition based on information provided by TSP to determine the use of paclitaxel or cisplatin or other suitable chemotherapy regimens. Subsequently, they elaborated on the treatment plan and rationale if necessary. Interns then communicated the chemotherapy regimen to TSP explaining potential adverse reactions along with preventive measures while addressing related queries. TSP evaluated interns' communication skills and humanistic qualities by simulating patient anxiety or non-cooperation. Finally, TSP simulated adverse reactions during treatment (allergic reactions, myelosuppression, neurotoxicity, e.g.), prompting interns to respond following pre-set emergency protocols. (5) Assessment and feedback: Teaching staff utilized Mini-CEX for immediate feedback at each stage of diagnosis and treatment. Post-simulation evaluation from teaching staff included comprehensive assessments alongside suggestions for improvement based on intern performance throughout the simulation process. (6) Discussion and summary: Interns were organized to review the benefits as well as drawbacks of the simulation process while sharing their experiences. The overall teaching supervisor summarized simulation outcomes providing recommendations for enhancement.

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Theoretical examination score: After the completion of the teaching, a theoretical examination on paclitaxel and cisplatin will be administered. This will be a closed-book assessment based on the teaching syllabus. The examination will include multiple choice questions (1 point each, total 40 points), short answer questions (10 points each, total 40 points) and essay questions (20 points each, total 20 points).

Case analysis examination score: Through a scenario-based simulated case involving paclitaxel and cisplatin. The assessment is conducted in a face-to-face question format by three examiners, and the average score is calculated. The scoring criteria encompass four aspects: patient assessment (total 20 points), drug regimen formulation (total 30 points), doctor-patient communication (total 20 points), and adverse reaction monitoring and management (total 30 points).

Clinical competence: After the instruction, the head tutor and individual tutors utilize the Mini-CEX to evaluate the clinical competence of resident physicians. The assessment scale encompasses seven dimensions: Physical examination, medical interviewing, professionalism, counseling, organizational efficiency, clinical judgment and overall clinical competence. Each dimension can be scored from 1 to 9 points; scores of 1 to 3 indicate unsatisfactory performance, scores of 4 to 6 indicate satisfactory performance and scores of 7 to 9 indicate outstanding performance.

Residents' evaluation of teaching model effectiveness: Through a proprietary survey instrument designed specifically for gauging their satisfaction with educational methodologies. This questionnaire consists of 6 items, namely: enhancing learning interest (X1), improving theoretical level (X2), enhancing the ability of induction and expression (X3), improving the ability of analysis and

problem-solving (X4), enhancing teamwork ability (X5), and cultivating the ability to deal with and handle emergencies (X6). Each item adopts a four-level scoring method, with scores ranging from 1 to 4 and the total score is 24. The grading is as follows: 9 to 24 points are considered very satisfied, 13 to 18 points are considered relatively satisfied, 7 to 12 points are considered satisfied, and 1 to 6 points are considered dissatisfied. Satisfaction rate = (very satisfied + relatively satisfied + satisfied) / total number of respondents.

Teaching doctors' evaluation of teaching model effectiveness: Through a self-designed survey questionnaire on teaching satisfaction. The questionnaire comprises 6 items: fostering learning initiative (X1), accurately summarizing key case information (X2), effectively analyzing differential diagnoses (X3), correctly formulating treatment plans (X4), actively engaging in questioning and communication (X5), and demonstrating teamwork spirit (X6). Each item is rated on a scale of excellent, good, average and poor, corresponding to 4, 3, 2 and 1 points respectively.

Ethical approval

The study was approved by the ethics committee of Second Affiliated Hospital of Naval Medical University (No.2023SL072).

STATISTICAL ANALYSIS

Data analysis and processing were conducted using SPSS 26.0 software. Descriptive statistics were used to summarize quantitative data that followed a normal distribution, including the mean± standard deviation (X ± S). Group comparisons were performed using an independent samples t-test. For quantitative data that did not follow a normal distribution, descriptive statistics presented the median and interquartile range [M(Q_{25},Q_{75})] and analysis was carried out using the Wilcoxon rank sum test. Qualitative data were summarized by the number of cases (n) and compared using the chi-square test. Categorical data were analyzed with the Wilcoxon rank sum test. When P<0.05, there was a statistical difference.

RESULTS

General information

There were no statistically significant differences in age, gender, educational level, department rotation time, basic test scores and Mini-CEX scores at pre-admission between the two groups (P>0.05) (table 1).

Theoretical examination and case analysis examination scores

The total score of the theoretical examination in the observation group was significantly higher than that in the control group (P<0.05) (fig. 1-A). Furthermore, the observation group exhibited significantly superior performance across three key domains: drug regimen formulation, doctor-patient communication, adverse reaction monitoring and handling, and case analysis examination compared to the control group (P<0.05) (fig. 1-B).

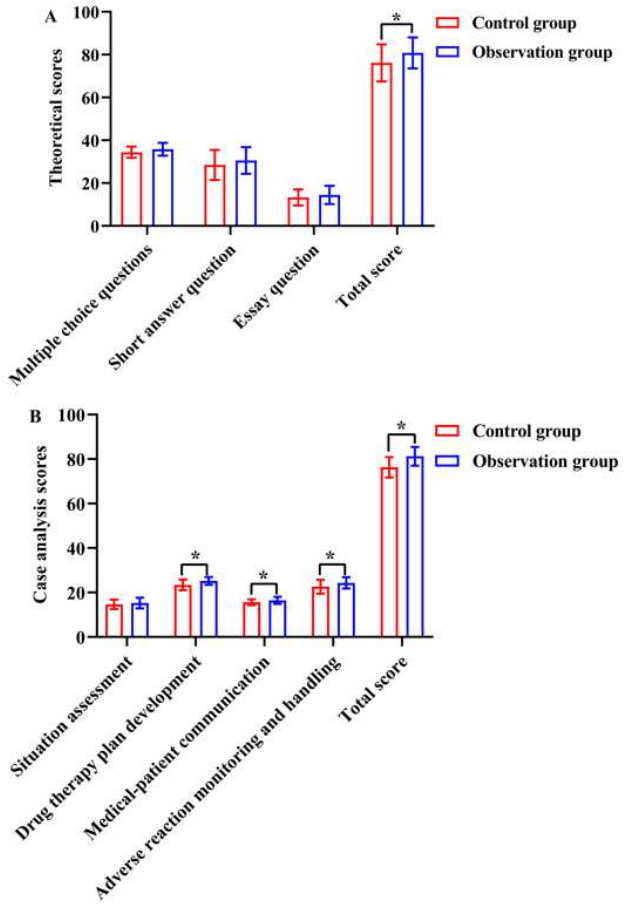

Fig. 1: Comparison of theoretical examination and case analysis examination scores between the two groups. A: Comparison of theoretical scores between the two groups; B: Comparison of case analysis scores between the two groups; *: P<0.05

Clinical competence

The scores in the observation group across 7 dimensions of physical examination, medical interviewing, professionalism, counseling, organizational efficiency, clinical judgment and overall clinical competence were significantly higher than those in the control group (P<0.05) (fig. 2).

Satisfaction with teaching methods

The teaching satisfaction survey questionnaire revealed that the observation group scored significantly higher than the control group across all 6 items and in total (P<0.05) (table 2). Furthermore, the satisfaction rates of the resident doctors in both groups towards the teaching mode were 100%. In the observation group, 15 cases were highly satisfied, while only 1 case in the control group was so.

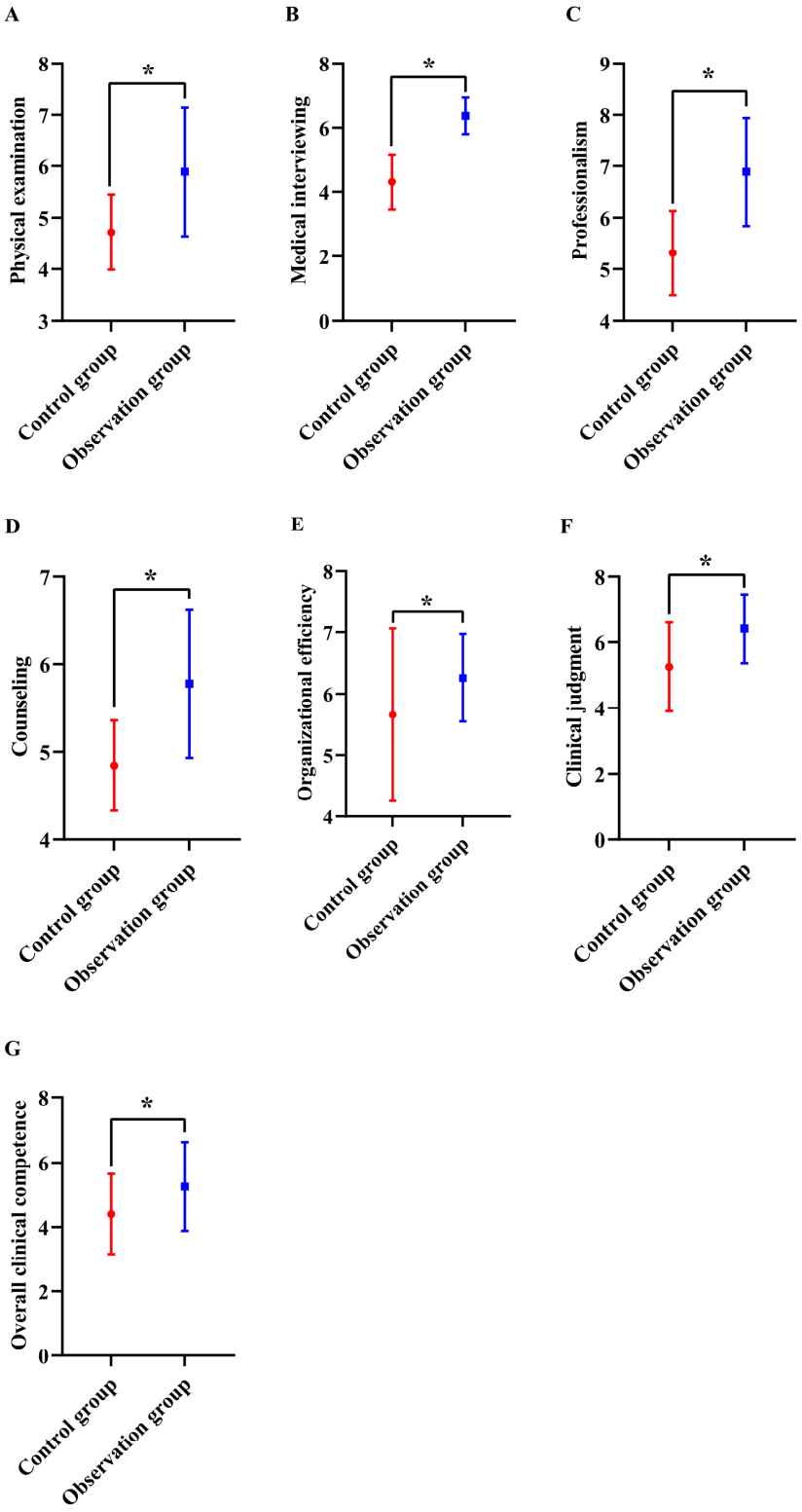

Fig. 2: Comparison of the 7 dimensions of Mini-CEX scores between the two groups. A: Comparison of physical examination between the two groups; B: Comparison of medical interviewing between the two groups; C: Comparison of professionalism between the two groups; D: Comparison of counseling between the two groups; E: Comparison of organizational efficiency between the two groups; F: Comparison of clinical judgment between the two groups; G: Comparison of overall clinical competence between the two groups; *: $P<0.05$

Table 1: Comparison of two sets of general information

Data	Control group (n=32)	Observation group (n=27)	$Z/t/\chi^2$	*P*
Age [years, M(Q_{25},Q_{75})]	24(23,25)	24(24,25)	0.463	0.643
Gender (n)			0.079	0.778
Male	13	10		
Female	19	17		
Educational level (n)			1.040	0.308
Bachelor degree	23	16		
Graduate student	9	11		
Department rotation time (months, X ± S)	9.00±2.55	9.26±1.76	0.459	0.648
Basic test scores at pre-admission (X ± S)	83.63±5.73	81.37±4.61	1.643	0.106
Mini-CEX scores at pre-admission [M(Q_{25},Q_{75})]				
Physical examination	3(3,4)	3(3,4)	1.111	0.267
Medical interviewing	3(3,4.75)	4(3,5)	1.696	0.090
Professionalism	4(3,5)	4(3,5)	0.617	0.537
Counseling	3(2,4)	3(2,3)	1.169	0.242
Organizational efficiency	4(3.25,5)	4(4,5)	0.346	0.729
Linical judgment	3.5(2,4.75)	3(2,5)	0.023	0.981
Overall clinical competence	3.5(3,4)	3(2,4)	1.319	0.187

Table 2: Comparison of scores from the teaching satisfaction survey questionnaire between the two groups of resident (scores, X ± S)

Item	Control group (n=32)	Observation group (n=27)	*t*	*P*
X1	2.66±0.79	3.04±0.65	2.003	0.051
X2	2.56±0.95	3.30±0.61	3.588	0.001
X3	2.19±0.69	3.11±0.70	5.085	<0.001
X4	2.19±0.74	3.07±0.55	2.151	<0.001
X5	2.25±0.92	3.22±0.70	4.517	<0.001
X6	1.78±0.66	3.33±0.55	9.678	<0.001
Total	13.63±2.17	19.07±1.49	11.040	<0.001

Table 3: Comparison of teaching satisfaction questionnaire scores between the two groups (score, X ± S)

Item	Control group (n=9)	Observation group (n=9)	*Z/t*	*P*
X1	1 (1,2)	3(2,3)	2.440	0.015
X2	2(2,2)	3(2,3)	2.428	0.015
X3	2(2,2.5)	2(2,3)	1.183	0.237
X4	3(2.5,3)	3(3,3)	0.615	0.539
X5	4(2.5,4)	4(3,4)	0.397	0.692
X6	2(2,3)	3(2,3)	1.093	0.274
Total	13.89±1.76	16.67±1.66	3.442	0.003

The satisfaction level of teaching in the observation group was significantly higher than that in the control group (Z=5.613, P<0.001) (fig. 3). Nine obstetrics and gynecology clinical teaching instructors participated in this survey after instructing two groups of residents. The instructors' satisfaction scores for the observation group's proactive learning approach and accurate summarization of key case information were markedly superior to those for the control group, resulting in a higher overall questionnaire score (P<0.05) (table 3).

DISCUSSION

Taxol, a plant alkaloid compound, exhibits significant anti-cancer activity primarily through the promotion of microtubule polymerization and stabilization, cell cycle blockade and inhibition of DNA synthesis in tumor cells, thereby impeding tumor cell mitosis (Ahmed *et al*., 2022, Içduygu *et al*., 2021). Cisplatin, a second-generation platinum-based anti-cancer drug with similar biochemical effects to taxol, mainly exerts its action by forming cross-links with DNA leading to structural and functional damage, consequently inhibiting the growth and division of tumor cells (Hodge *et al*., 2023, Maillard *et al*., 2020). In clinical practice, taxol is frequently administered in combination with cisplatin and has emerged as one of the standard treatment regimens for various gynecological malignant tumors (Powell *et al*., 2022). However, attention must also be directed towards monitoring

adverse reactions and drug tolerability during usage. These may include but are not limited to myelosuppression (anemia, infection, bleeding), allergic reactions (dyspnea, rash, hypotension), gastrointestinal disturbances (nausea, vomiting, diarrhea) (Yu *et al*., 2020, Geyer *et al*., 2022).Therefore, treatment regimens should be promptly adjusted according to specific patient conditions.

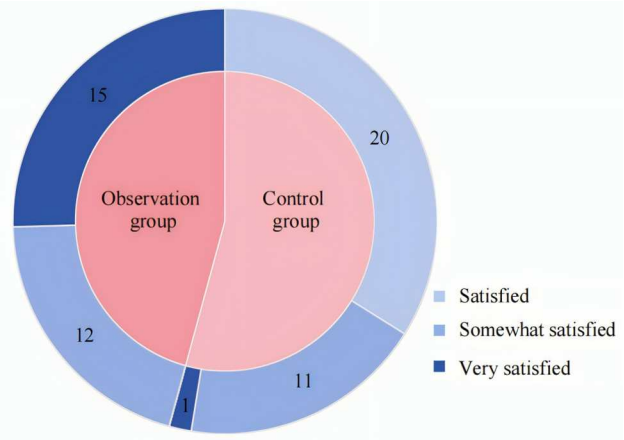

Fig. 3: Teaching satisfaction of the two groups

Residency training plays a crucial role in postgraduate medical education by cultivating physicians who embody exemplary ethical standards, possess comprehensive theoretical knowledge, and demonstrate proficient clinical skills (Okhunov *et al*., 2019). Nevertheless, recent trends such as expanded medical school enrollments and heightened patient advocacy have limited residents' opportunities for conducting patient interviews and performing procedures at the bedside. This has resulted in an overemphasis on theory at the expense of practical experience along with inadequate preparedness for managing emergent situations (Li *et al*., 2021). Furthermore, conventional didactic teaching methods often fall short in addressing the demands of real-world clinical scenarios due to insufficient hands-on exposure and predictive capabilities regarding patient risks (Xu *et al*., 2023). Consequently necessitating an exploration into novel approaches for clinical instruction.

Situational simulation teaching is a pedagogical approach that focuses on student-centered learning, wherein real medical scenarios are simulated to provide students with a safe environment for practicing clinical skills (Wu *et al*., 2024). The use of standardized patients (TSP) as an effective educational resource addresses the issue of non-cooperative patients and facilitates the integration of theoretical knowledge into practical application, thereby reinforcing proficiency through continuous practice. Furthermore, TSP serves as a guide for fostering effective doctor-patient communication and cultivating sound clinical reasoning methods among students (Yang *et al*., 2023, Zeng *et al*., 2023). Mini-CEX is an assessment method that evaluates students' clinical competence, credibility and reliability across seven dimensions within authentic clinical settings by directly observing their medical practices. It demonstrates high validity and reliability while also serving instructional and evaluative purposes. Following evaluation, it identifies students' deficiencies and informs subsequent teaching efforts to effectively achieve the objectives of education and learning (Zaki *et al*., 2023, Chen *et al*., 2023).

This study aimed to compare the effects of traditional teaching methods with scenario simulation combined with Mini-CEX teaching models in the instruction of paclitaxel and cisplatin usage in obstetrics and gynecology, revealing significant advantages of the latter in enhancing resident physicians' comprehensive abilities. The results from theoretical examinations and case analyses showed that the observation group's total scores were significantly higher than those of the control group, indicating that scenario simulation combined with Mini-CEX teaching models not only deepened resident physicians' understanding of paclitaxel and cisplatin's theoretical foundation but also effectively enhanced their application ability in actual case analysis. Scenario simulation replicates real clinical scenarios, allowing resident physicians to learn and practice in a near-real combat environment, thereby improving their memory retention and knowledge application; while Mini-CEX, as a structured clinical assessment tool, facilitates rapid improvement of resident physicians' clinical skills through immediate feedback and continuous guidance. Furthermore, across all seven dimensions of Mini-CEX, the observation group demonstrated significantly superior performance compared to the control group, thereby providing additional validation for the comprehensiveness and efficacy of this instructional model. The enhancements in physical assessment, interview skills, professionalism, and other facets reflect an augmented comprehensive capacity and humanistic concern among resident physicians in their clinical practice. Simultaneously, improvements in consultation communication skills, organizational efficiency, clinical judgment ability and overall clinical competence directly correlate with their capability to independently manage intricate cases in the future. The collective progress across these dimensions establishes a robust groundwork for resident physicians to evolve into exceptional obstetrician-gynecologists. Moreover, the findings from the teaching satisfaction survey indicated that both the residents and mentor teachers in the observation group highly appreciated the integrated scenario simulation and Mini-CEX teaching model. The residents' satisfaction with the teaching model experienced a significant enhancement, particularly in terms of their proactive engagement in learning and accurate synthesis of key case information, demonstrating that the teaching model effectively stimulated their interest and motivation for

learning, fostered independent inquiry, and facilitated profound critical thinking. The mentor teachers also accorded high praise to the teaching model, noting its positive impact on instructional efficiency, promotion of teacher-student interaction and communication, as well as its contribution to nurturing residents' capacity for critical thinking and clinical decision-making.

In summary, the application of scenario simulation combined with Mini-CEX teaching mode has a positive impact on the instruction of paclitaxel and cisplatin use in gynecology and obstetrics residents. It improved clinical competence and satisfaction, and is worth promoting.

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