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Application of OSCE-Based Escape Room Approach in Clinical Practice of Nursing Interns in the Department of Gastroenterology

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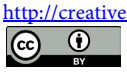

Abstract

Objective: To explore the effectiveness of OSCE-based Escape Room Approach for nursing training in the Department of Gastroenterology. **Method:** 160 nursing students who were interns in the Department of Gastroenterology of the Affiliated Hospital of Xuzhou Medical University were enrolled and randomly divided into the experimental group and the control group, with 80 participants in each group. Conventional approach and the Escape Room Approach were employed for the experimental group and the control group, respectively. **Result:** The critical thinking capability, learning engagement, scores of self-regulated learning capability of clinical nursing practice and final scores of the experimental group were significantly higher than those of the control group ($P < 0.05$). **Conclusion:** OSCE-based Escape Room Approach can effectively enhance critical thinking capability, learning engagement, scores of self-regulated learning capability of clinical nursing practice, and knowledge and skills of the nursing interns.

Keywords

Escape Room, Objective Structured Clinical Examination (OSCE), Nursing Interns, Department of Gastroenterology, Clinical Teaching

1. Introduction

Under the novel mode of medical education and training, the teaching and training tasks and standards of clinical skills have been elevated to a new level over recent years. Although relevant national education reform opinions have been

successively issued, the integration of theory with practice, poor critical thinking and the clinical comprehensive ability of medical students are urgent issues to be solved in clinical teaching under the traditional teaching mode [1]. Escape Room Approach is a game course designed around teaching objectives, requiring the participants to solve a series of puzzles consistent with the teaching objectives within a specified time, and ultimately escape from the room [2]. Since its application in nursing education in 2018, this approach has been a hit among students due to its fascinating characteristics, and its popularity has gradually increased. However, due to the rigor of medical education, this educational model still needs to gain the support of medical teaching theory and has not been widely confirmed [3]. The concept of Objective Structured Clinical Examination (OSCE) was first proposed by Harden and Stevenson in 1975 [4]. OSCE has been widely recognized in the medical education community for its reliability and effectiveness [5]. The spirit of OSCE lies in its implementation of nursing procedures at various examination stations, and the design of several hidden or prominent clinical nursing questions based on real medical records to simulate clinical practice to the greatest extent, which makes students gradually familiar with patients. Although it is beneficial for cultivating the clinical comprehensive skills and critical thinking capability of nursing students, OSCE also brings anxiety and resistance emotions to nursing students [6].

There are different approaches, but the results of OSCE and Escape Room Approach are equally satisfactory. Our study took the Department of Gastroenterology as an example and attempted to introduce the multi-site settings of the core-system of OSCE into the scenario of Escape Room. The puzzle setting was linked to the key points of OSCE assessment, which provided relevant medical theoretical support for Escape Room Approach, increased the fun of the course, and eliminated the pressure of the course, forming complementary advantages.

2. Materials and Methods

2.1. General Information

Nursing students who were interns in our department were enrolled. Inclusion criteria: 1) Nursing students had informed consent, voluntarily participated in this project, and promised to keep the research content and information confidential for one year; 2) full-time nursing interns from a training school with at least high school education and full-time undergraduate nursing interns; 3) the internship period at the Department of Gastroenterology was 4 weeks. Exclusion criteria: 1) Nursing students refused participation; 2) learners who had basically left the class system because of going abroad or participating in military activities outside of school, or in other situations; 3) foreign students; 4) nursing students did not completely fill in the questionnaire, or had regular responses ≥80%.

We included the nursing students who interned at the Department of Gastroenterology from November 2022 to February 2024. Nursing students with the same or similar internship duration and education were paired and randomly

divided into two groups based on a randomized paired design. Two independent sample means were compared for sample size calculation. According to the literature [7], the total score of critical thinking capability was used as an indicator: $\bar{x}$ experimental group = 53.73, s experimental group = 9.36; $\bar{x}$ control group = 49.53, s control group = 8.43, $\alpha = 0.05$, and $(1 - \beta) = 0.2$, considering a 10% drop-out rate. The number of nursing students in each group was 80 based on the Pass 11 calculation. This study has been approved by the Ethics Committee of the Affiliated Hospital of Xuzhou Medical University (No. XYFY2023-KL190-01).

2.2. Method

This is a single-center study using a randomized paired design, that blinded only the data collectors and analysts. Figure 1 shows technical roadmap.

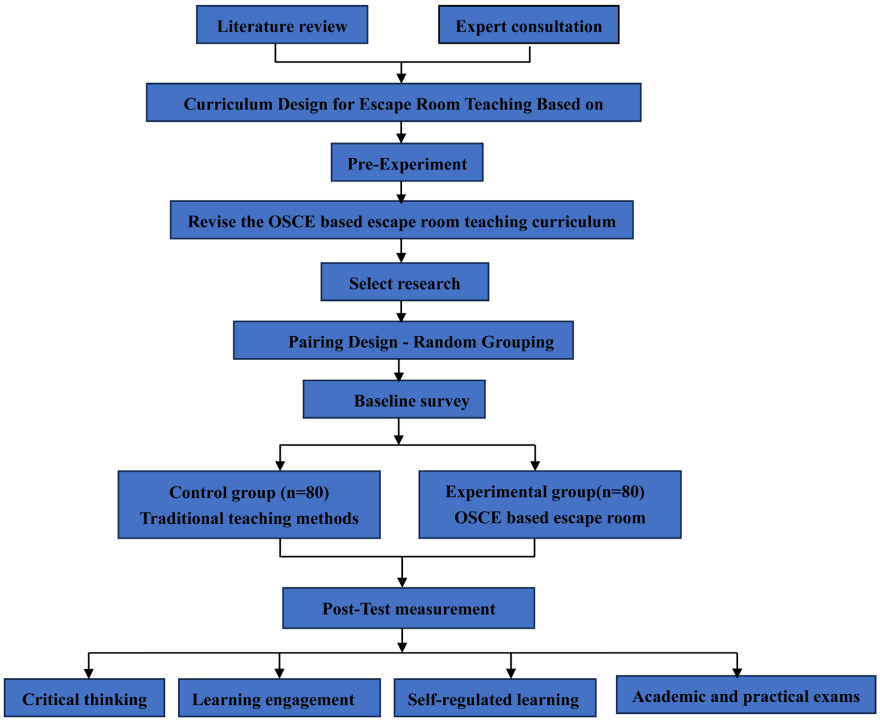

Figure 1. Shows technical roadmap.

2.2.1. Approach for the Control Group

The control group implemented a routine teaching scheme of the Department of Gastroenterology. The first week: 1) enrollment education, including tutors, departmental regulations and environment, and placement of medical supplies; 2) the introduction of the basic characteristics, commonly used drugs, characteristic surgeries, and nursing operations of common diseases in the Department of Gastroenterology; 3) OSCE lectures; 4) filling out relevant scales and questionnaires; 5) previewing knowledge related to gastrointestinal hemorrhage. The second week: 1) gastrointestinal hemorrhage lectures; 2) previewing knowledge related to pancreatitis. The third week: pancreatitis lectures. The fourth week: 1) theoretical and operational assessment; 2) filling out relevant scales and questionnaires.

2.2.2. Approach for the Experimental Group

The experimental group implemented the OSCE-based Escape Room Approach. The teaching content and methods for the first and fourth weeks were the same. The experimental group was divided into a gastrointestinal hemorrhage Escape Room (see Table 1) and an acute pancreatitis Escape Room in the second and third weeks. Before the course, students were required to preview the relevant disease knowledge of the course.

Table 1. Gastrointestinal hemorrhage escape room.

Stops and time	Scenario	Key points
Brief introduction 2 min	The gastrointestinal hemorrhage Escape Room theme was used as an example. Video and supervising teachers' voice introduction: General Zhuge has been accompanying the army for a long time, eating irregularly, enjoying drinking alcohol, and having to handle lots of paperwork. He generally feels abdominal pain late at night. When marching to Shu, his appetite was poor. After eating spicy antique soup (hot pot), he felt nauseous and uncomfortable, and then vomited bright red blood, and vomited blood continuously. The TV screen showed, "Please travel back to ancient times and bring General Zhuge back to modern times for treatment. Can you rescue General Zhuge?" Babies, please embark on your journey to Escape room now!	-
Room 1 (Evaluation Station) 15 min	1) There was only a piece of white paper on the desk (please dip a brush in phenolphthalein solution and write this task on the white paper, let it dry), and a sodium hydroxide solution spray bottle was next to it. After spraying on the paper, the task handwriting would immediately appear. 2) Task: Please make a proper nursing assessment of General Zhuge's condition, including consultation, visual examination, palpation, percussion, and listening.	a) Evaluated and cultivated the ability to collect medical history correctly. b) Evaluated and cultivated the ability to conduct targeted physical assessments. c) Cultivated critical thinking capability.
Room 2 (Diagnosis station) 5 min	1) There was a laptop on the desk. Students came to this room for clues. When they touched the laptop, the supervising teachers said provocatively, "If you want to save your general, it depends on whether you have the ability to open me! The password has 11 digits." 2) This laptop password was the temperature, blood pressure, pulse, and respiratory values from the last level. 3) The task was placed on the desk: Please answer General Zhuge's most likely diagnosis and basis; what nursing problems do you think Mr Zhuge Liang has, and what is your nursing diagnosis? 4) Each student was required to speak at this level, and team members could help each other. A pen was awarded for speaking correctly and placed in an opaque box. It could be opened when having difficulties in the next level.	a) Evaluated and cultivated the ability to diagnose diseases correctly. b) Evaluated and cultivated the ability to correctly summarize nursing diagnostic issues.

Continued

Room 3 (First-aid station) 13 min	1) The task at this level was written on a piece of paper, which had been divided into four pieces and hidden in the four pens of the previous level. Please open the pen, take out the paper strip, and assemble the tasks. 2) Task: Mr Zhuge Liang vomited much blood again and broke out in cold sweat. What can you do for him?	a) Evaluated and cultivated the ability to recognize and urgently respond to shock caused by gastrointestinal hemorrhage. b) Cultivated critical thinking capability.
Room 4 (Nursing technology station) 10 min	1) After entering this room, everyone was handcuffed together in a circle. Everyone collaborated to find the keys in this room. Four keys were placed under the treatment tray, inside the blood pressure monitor, on the back of the infusion card, and in the hands of the tool man. After being liberated, task cards would be issued. 2) Task: Mr Zhuge Liang's bleeding stopped after your rescue, but his blood pressure is low. Please intravenously administer 500 ml of balanced salt solution to Mr Zhuge Liang based on the doctor's orders now.	a) Evaluated and cultivated intravenous infusion skills.
Room 5 (Health education station) 5 min	1) The task was locked in the password box in this room, and the password was a missing number in the blending assessment form posted on the wall. 2) Task: Mr Zhuge Liang's condition has stabilized, and the front-line battle is tense. Mr. Zhuge Liang is requested to return to the ancient battlefield. You admire Mr Zhuge Liang greatly. What do you want to say to him before leaving?	a) Evaluated and cultivated the ability to provide health guidance for patients with gastrointestinal hemorrhage

1) Establishment of research plan

The Escape Room game section was introduced before each station to enhance the fun of the course [8]. The difficulty and applicability of the course were adjusted after expert consultation. 10 experts from different regions were involved in our study, including 5 provincial digestive specialty nurses who had received OSCE training and assessment. Inclusion criteria for the experts: a) experts worked in medical universities and colleges or a third-grade first-class hospital; b) intermediate or above professional title and bachelor's degree or above; c) experts had engaged in this major for at least 10 years; d) experts had enthusiasm and could cooperate with online consultation and discussion. The smoothness of the course was further ensured through pre-testing.

2) Site selection

Five rooms in the hospital skills training center were used as the base.

3) Appliance

Speakers, projectors, laptops, phenolphthalein solution, NaOH solution, pass cards, ball pens, writing brushes, opaque cards, digital cards, and bleeding assessment forms.

4) Game rules

a) The game relied on the OSCE assessment and was divided into five stops or

five levels. Two supervising teachers were responsible for guiding and ensuring the smoothness of the course. b) The entire event was limited to 50 min, and we set time for each stop. The group with the highest total score after the weight of time and score won. c) The supervising teachers should partially disclose the methods for solving puzzles when necessary, and record and grade the performance of students according to the OSCE assessment and evaluation rules. After class, 10 min should be used for summarizing and commenting. d) Each group consisted of 3 - 6 people.

2.2.3. Evaluation Method

1) Critical thinking: The critical thinking capability measurement table (CTDI-CV) was used for measurement [9]. This scale has 7 dimensions (each has 10 items, and a total of 70 items), including finding truth, open mind, analytical skill, systematic capability, confidence in critical thinking, curiosity, and cognitive sophistication. Herein, 30 positive items and 40 negative items were involved. A 6-level rating was applied to this scale, and positive items were assigned a score of 1-6 points from "strongly disagree" to "strongly agree". The assigned values for negative items were 6 - 1 points, with a total score of 70 - 420 points, with a Cronbach's α coefficient of 0.90. 2) Learning engagement: A college student learning engagement questionnaire was applied for evaluation [10]. This questionnaire included behavioral engagement (6 items), cognitive engagement (7 items) and emotional engagement (7 items), a total of 20 items. The Likert 5-point scoring method was used in this scale, with 1 - 5 points corresponding to "completely disagree" to "completely agree", and a total score of 20 - 100 points. The learning engagement was proportional to the score; Cronbach;s α coefficient was 0.923. 3) Self-regulated learning: The Scale for self-regulated learning of clinical nursing practice by nursing students was applied for measurement [11], with a Cronbach's α coefficient of 0.949. This scale options ranged from "strongly disagree" to "strongly agree", with a score of 1 - 5 points and a positive score of 16 items, with a total score of 16-80 points. Nursing students with high scores have a robust self-regulated learning capability. 4) Academic and operational exams at the end of the internship: the exam paper was self-designed and the operational exam standards were the unified assessment standards revised by the Department of Nursing.

2.2.4. Statistical Analysis

SPSS 27.0 was employed for data processing. The count data was analyzed using a chi-square test, while the quantitative data was expressed as mean ± SD ($\overline{x} \pm s$). The intergroup comparison was performed using a t-test, and the α value was 0.05 as a standard test.

3. Results

3.1. Baseline data

Age, gender, education background and internship duration of the two groups had no statistically significant differences ($P > 0.05$), as shown in **Table 2**.

Table 2. Age, gender, education background and internship duration of the two groups.

Group	Number of participants	Age (years old, $\bar{x} \pm s$)	Gender		Education		Internship duration			
			M	F	University students	Junior college students	*a*	*b*	*c*	*d*
control group	75	20.27 ± 1.018	21	54	19	56	20	21	10	24
experimental group	74	20.34 ± 1.024	21	53	21	53	19	19	9	27
t/χ^2		−0.425	0.003		0.348		0.176			
P		0.671	0.959		0.951		0.675			

Note: *a*: 3- (≤) 6 months; *b*: 6- (≤) 9 months; *c*: 9-12 (≤) 12 months; *d*: 9-12 (≤) 12 months.

3.2. Critical Thinking Capability

Table 3 shows the scores of critical thinking capability of the two groups before and after internship.

Table 3. Scores of critical thinking capability of the two groups before and after internship $\bar{x} \pm s$.

Time	Group	Number of participants	Finding truth	Curiosity	Open mind	Analytical skill	Systematic capability	Confidence in critical thinking	Cognitive sophistication	Total scores
Before internship	control group	75	38.67 ± 10.62	41.21 ± 9.75	43.44 ± 10.39	41.32 ± 10.98	42.23 ± 10.94	46.69 ± 10.32	41.76 ± 10.19	295.32 ± 60.41
	experimental group	74	39.05 ± 10.10	40.45 ± 10.31	43.26 ± 10.33	40.38 ± 10.39	41.22 ± 10.06	46.86 ± 10.28	42.03 ± 10.43	293.24 ± 58.64
	t		−0.228	0.467	0.108	0.537	0.587	−0.102	−0.158	0.213
	P		0.820	0.641	0.914	0.592	0.558	0.919	0.875	0.832
After internship	control group	75	37.97 ± 11.50	44.61 ± 10.02	41.59 ± 9.86	44.99 ± 9.56	44.04 ± 10.33	42.43 ± 10.60	44.01 ± 9.56	299.64 ± 60.01
	experimental group	74	41.68 ± 9.34	48.09 ± 8.05	45.38 ± 8.40	48.05 ± 8.59	47.46 ± 8.41	47.08 ± 8.71	45.78 ± 9.40	323.53 ± 51.50
	t		−2.156	−2.337	−2.524	−2.023	−2.214	−2.927	−1.140	−2.606
	P		0.033	0.021	0.013	0.045	0.028	0.004	0.256	0.010

3.3. Learning Engagement

Table 4 shows the scores of learning engagement of the two groups before and after internship.

3.4. Self-Regulated Learning Capability and Final Academic and Operational Scores

Table 5 shows self-regulated learning capability before and after internship and final academic and operational scores at the end of internship of the two groups.

Table 4. Scores of learning engagement of the two groups before and after internship $\overline{x} \pm s$.

Group	Number of participants	Behavioral engagement		Cognitive engagement		Emotional engagement		Total	
		Before internship	After internship	Before internship	After internship	Before internship	After internship	Before internship	After internship
Control group	75	21.51 ± 5.471	21.6 ± 5.980	25.41 ± 6.325	24.87 ± 7.095	22.57 ± 4.656	24.63 ± 8.124	69.49 ± 15.349	71.17 ± 8.124
Experimental group	74	21.76 ± 4.481	23.57 ± 4.868	25.12 ± 4.572	27.41 ± 5.640	23.91 ± 4.085	27.89 ± 5.742	70.78 ± 11.625	78.86 ± 15.314
t		−0.305	−2.111	0.323	−2.420	−1.855	−2.836	−0.579	−2.618
P		0.761	0.036	0.747	0.017	0.066	0.005	0.564	0.010

Table 5. Self-regulated learning capability before and after internship and final academic and operational scores at the end of internship of the two groups $\overline{x} \pm s$.

Group	Number of participants	Self-regulated learning		Final academic score	Final oeprational score
		Before internship	After internship		
Control group	75	69.61 ± 11.521	70.61 ± 10.436	92.23 ± 2.85	94.41 ± 1.93
Experimental group	74	67.62 ± 11.375	73.88 ± 8.604	93.22 ± 2.93	95.60 ± 1.34
t		1.062	−2.085	−2.063	−4.336
P		0.290	0.039	0.041	0.000

4. Discussion

4.1. OSCE-Based Escape Room Approach Helps to Develop Critical Thinking Capability

According to Table 3, the OSCE-based Escape Room Approach could significantly improve the score and overall score of nursing students in finding truth, curiosity, open mind, analytical ability, systematic capability, confidence in critical thinking ($P < 0.05$), which is consistent with previous studies [7]. Richards *et al.* [12] believed that critical thinking was a person's ability to engage in higher cognitive skills, such as analysis, synthesis, and self-reflection. Effective and efficient critical thinking is the core factor for accurate clinical reasoning and appropriate clinical decisions. In terms of setting up clinical cases, nursing students need to carefully evaluate and assess the patient's condition in Escape Room Approach. Through recollection, thinking, and reasoning, they systematically analyze various factors within the site, including their and other team members' thoughts and opinions, and strive to make correct assessments to form a better nursing plan, which is a critical way to cultivate the critical thinking capability of nursing students.

Nevertheless, it has been demonstrated that the heterogeneity of Escape Room Approach in the design process determined its effectiveness, and there is currently

no standardized design standard for Escape Room [13]-[15]. OSCE is widely regarded as an objective, reliable, and effective clinical competency assessment tool, which conducts multi-site clinical assessments through a series of simulated clinical scenarios. In this study, the OSCE assessment framework was introduced into the Escape Room, enhancing the objectivity, orderliness, and organization of Escape Room teaching. Clinical nursing practice teaching is essentially the sublimation of theoretical knowledge obtained from school, promoting the integration of theoretical knowledge, skills, and clinical practice mastered by nursing students in school, and cultivating their clinical thinking and comprehensive clinical nursing abilities. Tutors could evaluate the shortcomings of students in applying theory to practice based on their on-site performance, identify and fill in any gaps, and then achieve a focused teaching approach. There was no difference between the two groups in cognitive maturity ($P > 0.05$), which might be related to the particularity of clinical nursing teaching and a relatively short practical time of nursing students in various departments, which made this approach unable to be fully validated.

4.2. OSCE-Based Escape Room Approach Helps to Enhance Learning Engagement

According to **Table 4**, the OSCE-based Escape Room Approach could significantly increase scores of behavioral engagement, cognitive engagement, and emotional engagement of the nursing students ($P < 0.05$), which is consistent with previous studies [16]. Learning engagement refers to the willingness of learners to engage and put in effort during the learning process, which can effectively predict academic achievement. Students who engage more energy and time in learning, have more outstanding academic achievements [17]. Li *et al.* [18] reported that the current learning engagement of nursing students was at a moderate level. Nowadays, education and teaching have shifted towards learners as the center. Teachers should apply different teaching tools and paradigms according to students' learning styles in the teaching process to improve their learning engagement and guide them to progress at their own pace.

An excellent clinical learning environment can positively predict the learning engagement of nursing students [18]. This study was based on the assessment framework system of the OSCE scientific standard to design classroom sites, problems, and operational skills. The interesting decryption elements were interspersed in each site, making the educational process partially gamified, thereby establishing an engaging, interactive learning environment [19]. The teaching method utilized students' inner energy and enthusiasm to increase their learning engagement. During the learning process, young nursing students preferred immersive learning methods with challenges and entertainment elements [16]. After warming up through games on each site, nursing students could fully immerse themselves in problem-solving, actively seek solutions, and continuously refine and sort out the theories and skills learned through peer thinking collisions to cope with clinical difficulties. This method not only stimulated nursing students'

learning interests, but also helped to unleash their subjective initiative, greatly enhancing their engagement in self-regulated learning. Therefore, the OSCE-based Escape Room Approach could significantly improve the learning engagement of nursing students.

4.3. OSCE-Based Escape Room Approach helps to Improve the Self-Regulated Learning Capability of Clinical Nursing Practice and Final Scores

The clinical nursing practice self-regulated learning scores and final scores of the nursing students in the experimental group were significantly higher than the control group ($P < 0.05$). The concept of self-regulated learning was proposed by Zimmerma based on reciprocal determinism. Self-regulated learning requires learners to awaken metacognition, generate motivation, and act positively to achieve learning goals, continuously monitor learning status, systematically regulate learning behavior, and periodically achieve personal goals [20]. Salamonson *et al.* [21] claimed that nursing students who could not realize learning management could barely adapt to changes in the healthcare field, and educators should pay attention to the cultivation of self-regulation ability when teaching nursing students. Currently, domestic teaching relies mainly on teacher instruction, and nursing students have dependent psychology on the tutors [11]. Besides, they are not good at reflection and lack self-regulation. Moreover, due to the limitations of knowledge and skills learned in school, there is a disconnect between the theories and skills mastered by nursing students during school and clinical practice, which requires nursing students to have the capability of self-regulated learning [19].

First, self-regulated learning involves learning interaction between teachers, students, and nursing students [11]. The proposed approach encouraged nursing students to listen actively, communicate collaboratively, and share leadership, which fully mobilized their knowledge reserves and integrated knowledge and resources in an urgent environment, conducive to stimulating the development of meta consciousness and learning motivation. Meanwhile, the OSCE-based Escape Room Approach took the game as the starting point and used the "Escape Room" as the teaching implementation area. The teaching content was presented through a combination of historical adaptations of stories, physical phenomena, authentic medical equipment, and digital games. The addition of OSCE elements made the teaching objectives more apparent. Nursing students need questions, exploration, discovery, creation, and evaluation to cope with dynamic and flexible teaching modules [22]. Moreover, they reflected on themselves through game feedback, and constantly adjusted their goals, strategies, and actions. Solid theories and skills were critical to achieving success in games, and they were beneficial for nursing students to have a deeper understanding of the knowledge points, thereby improving their academic performance.

5. Conclusion

The OSCE-based Escape Room Approach introduced the multi-site setting

elements of the OSCE system into the Escape Room teaching scenario, linking puzzle settings with the key points of the OSCE assessment, providing relevant medical theoretical support for Escape Room Approach, and effectively improving critical thinking, learning engagement and self-regulated learning of nursing students, which is worth promoting in clinical nursing teaching. Nevertheless, due to time, personnel, space and other limiting factors, this study only constructed courses with two themes and only was practiced in a single department. Future research requires multi-center, large-sample studies to investigate more prosperous OSCE-based Escape Room Approaches.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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