

# The Effect of a Structured Pre-Briefing Simulation Session on Medical Students' Competency

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## Abstract

**Background:** The application of medical simulation as a teaching tool in medical education is mounting. Although pre-briefing is the introductory phase of the simulation process, its structure and role in medical education have not been well studied.

**Objective:** To study the effect of a structured pre-briefing using concept mapping on medical students' competency performance and clinical judgment.

**Methods:** This study included 84 fifth-year medical students. Students were divided into two groups: the interventional group included 44 students who received structured pre-briefing (traditional pre-briefing plus concept mapping) and the control group of 40 students who received traditional pre-briefing. The students' clinical competency was assessed using the Creighton Competency Evaluation Instrument (C-CEI) in addition to the pre-briefing assessment questionnaire filled out by the students at the end of the session. The mean difference  $\pm$  SD between the two groups was assessed using a student's *t*-test. The correlation between the outcomes was calculated using Pearson's correlation coefficient analysis.

**Results:** The competency performance score and clinical judgement scores were significantly higher in the interventional group than the control group, with a highly significant *p*-value of 0.000. In addition, the interventional group had a better perception of the pre-briefing experience than the control group, with a *p*-value of 0.000. However, there was no correlation between the C-CEI score and the students' pre-briefing assessment questionnaire score.

**Conclusion:** Structured pre-briefing using concept mapping significantly enhances medical students' competency performance, clinical judgment, and perceptions of pre-briefing. It enables the learners to reflect on their previous experience and anticipate the plan of management more effectively.

**Keywords:** Pre-briefing, simulation, concept mapping, structured pre-briefing, clinical judgement, clinical competency

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## INTRODUCTION

Medical Simulation is widely used nowadays in medical education which incorporates advanced, innovative educational

technologies. It has been used as a valuable learning tool, and its significance has been widely proven through practice and research [1]. Simulation allows students to develop their own judgment and assessment skills and learn from their own mistakes, and also promotes decision-making in a safe environment [2].

The simulation learning process includes three phases: pre-briefing, simulated clinical immersion, and debriefing [3]. Each phase has

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proven its structure, importance, and efficacy in medical education. Pre-briefing is the first phase of the simulated clinical experience, and it is an independent tool for running successful clinical simulation scenarios. It is defined as anticipatory reflection and planning guided by a qualified facilitator who supports decision-making, psychological safety, and debriefing activities [4]. During pre-briefing, learners receive information about learning objectives, patient history, the learner's role, time frame, and orientation to the general environment and the simulation equipment according to the INACSL standards [5]. In addition, it goes further to set the stage for a successful simulation learning opportunity. Pre-simulation activities have been proposed as an extension of the INACSL definition of pre-briefing. They include the information and activities provided to learners before the clinical scenario based on their knowledge, learning needs, and experience level, so that pre-briefing is structured for anticipatory reflection and planning [6].

The use of a structured pre-briefing intervention was based on reflection and constructivism, as two learning theories that are widely discussed in the nursing simulation literature [6, 7]. In simulation, reflection is embedded through reflection in action, reflection on action, reflection beyond action, and reflection before action. Reflection in action occurs during the scenario, while reflection on action occurs during debriefing, while thinking back to the immersion. Reflection beyond action includes reflection that extends to post-simulation activities [8]. Furthermore, reflection before action, as it occurs during pre-briefing, necessitates anticipatory reflection of the future challenges and possible management [6, 9].

Concept mapping provides a strategy for navigating these different thought processes [4]. Joseph D. Novak created it in the 1960s as a kind of visual organized representation of knowledge. A concept map is composed of networks of concepts made up of nodes (points/vertices) that represent concepts and links representing relationships between these

concepts. The learners will make an intentional effort to link, differentiate, and relate concepts to each other in a hierarchical fashion as well as develop new concepts that will enhance their clinical judgement and critical thinking skills. [10, 11].

Structured pre-briefing using concept mapping was investigated in our study to evaluate its efficacy on medical students' competency, clinical judgment, assessment, and perception of pre-briefing.

## MATERIALS AND METHODS

This case-control study was conducted over 8 months from April 2020 to January 2021 at Arabian Gulf University, Bahrain. Eighty-four medical students were enrolled in this study. The targeted participants were recruited from fifth-year medical students during their internal medicine rotation. The age of the students was between 22–24 years. All the participants had a secondary school GPA of 85% or above to be accepted in medical school. Both the control and intervention groups had the same average in their end-of-fourth-year grades, which is B (80–89%). Experienced simulation experts, according to the internal medicine curriculum, prepared the simulated clinical experience sessions. A hypertensive emergency scenario was selected for the conduction of our study using a high-fidelity manikin iStan (CAE Healthcare, Inc., Florida, and United States), and a low-fidelity manikin.

The students were divided into two groups: intervention and control groups. A blinded third researcher allocated the students randomly through a coin toss. The control group included 40 medical students who received traditional pre-briefing according to INACSL standards, including ground rules, fiction contract, scenario review, learning objectives, their roles during simulation and time allotment, as well as orientation on the simulation environment and equipment [12]. The intervention group included 44 students who received the structured pre-briefing as an intervention. This included all the items of the traditional pre-briefing according to INACSL standards, but with the addition of concept mapping as a pre-

simulation activity.

The simulation sessions were conducted by a trained facilitator and lasted 75 minutes. The pre-briefing part lasted for 20 minutes for both groups, followed by clinical immersion for 15 minutes, then debriefing for 40 minutes. The pre-briefing for both groups was conducted by the same facilitator to avoid any bias. The investigator, during the pre-briefing session, provided the interventional group with a concept map worksheet. The participants were given an orientation regarding the structure of the concept map worksheet and how to use it prior to the simulation session. Recruitment occurred via email messaging and face-to-face announcements by the investigators during their attendance at the Medical Skills and Simulation Center (MSSC).

At the end of the simulation session, the students filled out a pre-briefing assessment questionnaire. The entire simulation session was video recorded. Two facilitators to avoid bias reviewed the recording. The facilitators assessed the students' competency performance, clinical judgement, communication, and patient safety using the Creighton Competency Evaluation Instrument (C-CEI).

### **Instruments**

**Creighton Competency Evaluation Instrument (C-CEI):** The C-CEI is a quantitative instrument used to evaluate students' performance during simulation sessions with acceptable content reliability, validity, and usability results. Assessment, communication, clinical judgment (C-CEI-CJ), and patient safety are the four subcategories of the 23-item C-CEI scale. For a maximum total score of 23 points, each item was given a score of 0 or 1, with 1 indicating competency achievement; total scores were converted to percentages [6, 13]. Training videos for using C-CEI were reviewed by the researchers prior to using the C-CEI. Two facilitators who were blinded to the briefing method used assessed the students using C-CEI. Copyright permission

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**Pre-briefing Assessment Questionnaire:** the pre-briefing assessment questionnaire was developed by the investigators due to the lack of research and tools available on this subject [6]. The questionnaire asked participants to respond to 13 items on a 5-point Likert scale, ranging from strongly agree to strongly disagree. The questions addressed the learning outcome, students' thoughts, and the facilitator's role in the pre-briefing. The students filled out the pre-briefing assessment questionnaire at the end of the session.

### **Statistical analysis**

All data were entered and analyzed using the Statistical Package of Social Sciences (SPSS) version 23.0. Data is presented as mean  $\pm$  SD. Two independent *t*-test was used to analyze the differences between the mean variables between the two groups of each domain of the structured pre-briefing and of the overall responses. Pearson's correlation coefficient analysis was used to assess the linear association between the C-CEI and the pre-briefing assessment questionnaire scores. All reported *p*-values are two-tailed, and the *p*-value was considered significant at  $<0.05$ .

The Arabian Gulf University Ethics and Research Committee approved the study. All the participants signed a consent form prior to enrollment.

## **RESULTS**

Eighty-four fifth-year medical students were enrolled, 55 females (65.5%) and 29 males (34.5%); the age of the students was between 22–24 years. All the participants had to have a secondary school GPA of 85% and above to be accepted in medical school. Both the control and intervention groups had the same average in their end-of-fourth-year grades, which is B (80%–89%). The results of the C-CEI (total and subcategories) and the pre-briefing assessment questionnaire (total and subcategories) are presented in Tables 1–2.

**Table 1: Results by Group for Creighton Competency Evaluation Instrument and Subscales**

| Instrument/subscales                 | Total Sample (n=84) |      |               | Control Group (n=44) |       |               | Interventional Group (n=40) |      |               | p-value |
|--------------------------------------|---------------------|------|---------------|----------------------|-------|---------------|-----------------------------|------|---------------|---------|
|                                      | Mean                | SD   | 95% C.I.      | Mean                 | SD    | 95% C.I.      | Mean                        | SD   | 95% C.I.      |         |
| C-CEI- Total (23 items)              | 70.2                | 15.1 | (66.9, 73.5)  | 62.6                 | 13.4  | (58.5, 66.7)  | 78.5                        | 12.3 | (74.6, 82.4)  | .000    |
| C-CEI - Assessment (3 items)         | 78.0                | 22.3 | (73.1, 82.8)  | 69.3                 | 22.7  | (62.4, 76.2)  | 87.5                        | 17.6 | (81.9, 93.1)  | .000    |
| C-CEI - Communication (5 items)      | 88.8                | 90.3 | (69.2, 108.4) | 92.9                 | 124.3 | (55.1, 130.7) | 84.4                        | 16.9 | (79.0, 89.80) | .668    |
| C-CEI - Clinical Judgement (9 items) | 64.4                | 19.4 | (960.2, 68.6) | 58.1                 | 18.2  | (52.6, 63.6)  | 71.4                        | 18.5 | (65.5, 77.3)  | .001    |
| C-CEI - Patient Safety (6 items)     | 67.3                | 24.3 | 962.0, 72.5)  | 56.3                 | 24.5  | (48.8, 63.7)  | 79.4                        | 17.6 | (73.8, 85.0)  | .000    |

M: mean; SD: standard deviation; C.I.: confidence interval

**Table 2: Results by Group for Pre-Briefing Assessment Questionnaire and its Subscales**

| Instrument/subscales                                            | Total Sample (n=84) |     |              | Control Group (n=44) |     |              | Interventional Group (n=40) |     |              | p-value |
|-----------------------------------------------------------------|---------------------|-----|--------------|----------------------|-----|--------------|-----------------------------|-----|--------------|---------|
|                                                                 | Mean                | SD  | 95% C.I.     | Mean                 | SD  | 95% C.I.     | Mean                        | SD  | 95% C.I.     |         |
| Pre-briefing Assessment (13 items, score out of 52)             | 45.0                | 8.9 | (43.0, 46.9) | 41.7                 | 9.7 | (38.8, 44.7) | 48.5                        | 6.2 | (46.5, 50.5) | .000    |
| Learning opportunity (5 items, score out of 20)                 | 17.3                | 3.6 | (16.6, 18.1) | 16.2                 | 4.0 | (15.0, 17.4) | 18.6                        | 2.6 | (17.8, 19.4) | .001    |
| Analyzing Thoughts and Feelings (3 items, score out of 12)      | 10.6                | 2.0 | (10.1, 11.0) | 10.1                 | 2.2 | (9.4, 10.7)  | 11.1                        | 1.6 | (10.6, 11.6) | .016    |
| Facilitator Role in the Pre-briefing (5 items, score out of 20) | 17.1                | 4.0 | (16.2, 17.9) | 15.5                 | 4.4 | (14.1, 16.8) | 18.8                        | 2.4 | (18.0, 19.6) | .000    |

M: mean; SD: standard deviation; C.I.: confidence interval

### **Creighton Competency Evaluation Instrument (C-CEI) results**

The C-CEI total scores were significantly higher in the interventional group ( $78.5 \pm 12.3$ ) than in the control group ( $62.6 \pm 13.4$ ) with a *p*-value of 0.000. The C-CEI is divided into four subscales: assessment, communication, clinical judgment, and patient safety. As regards the C-CEI assessment, we found a highly significant difference between the interventional group ( $87.5 \pm 17.6$ ) and the control group ( $69.3 \pm 22.7$ ) with a *p*-value of 0.000. No significant difference was

found between the groups regarding the communication subscale. The C-CEI-Clinical Judgement scores were significantly higher in the interventional group ( $71.4 \pm 18.5$ ) than in the control group ( $58.1 \pm 18.2$ ) with a *p*-value of 0.001. In addition, the C-CEI-Patient Safety score was significantly different between the interventional group ( $79.4 \pm 17.6$ ) and the control group ( $56.3 \pm 24.5$ ) with a *p*-value of 0.000.

### **Pre-briefing assessment questionnaire results**

The interventional group that received

structured pre-briefing had a better perception of the pre-briefing experience than the control group, with a  $p$ -value of 0.000. Furthermore, all the scores of the pre-briefing assessment subscales (learning opportunity, analyzing thoughts and feelings, and facilitator's role in the pre-briefing) were higher in the interventional group in comparison to the control group with  $p$ -values of 0.001, 0.16, and 0.000, respectively.

#### **Relationship between Creighton Competency Evaluation Instrument (C-CEI) and pre-briefing perception**

The correlation between the C-CEI score

and the students' pre-briefing assessment questionnaire score for both groups is summarized in Table 3. There was no significant correlation between the pre-briefing assessment score and the total C-CEI score ( $r$ : 0.227) and its subcategories ( $r$ : 0.131, 0.483, 0.520, and 0.451, respectively). The correlation for the control group is ( $r$ : 0.529) and its subcategories ( $r$ : 0.945, 0.633, 0.858, and 0.346, respectively) and the correlation for the intervention group is ( $r$ : 0.615) and its subcategories (0.740, 0.884, 0.357, and 0.646, respectively).

**Table 3: Correlation between Creighton Competency Evaluation Instrument (C-CEI) and pre-briefing assessment questionnaire**

|                                                   |                     | <b>CCEI Total</b> | <b>Assessment</b> | <b>Communication</b> | <b>Clinical Judgement</b> | <b>Pt safety</b> |
|---------------------------------------------------|---------------------|-------------------|-------------------|----------------------|---------------------------|------------------|
| Pre-briefing assessment questionnaire total score | Pearson Correlation | .133              | .166              | -.078                | .071                      | .083             |
|                                                   | Sig. (2-tailed)     | .227              | .131              | .483                 | .520                      | .451             |
|                                                   | N                   | 84                | 84                | 84                   | 84                        | 84               |
| Control                                           | Pearson Correlation | -.098             | -.011             | -.074                | -.028                     | -.146            |
|                                                   | Sig. (2-tailed)     | .529              | .945              | .633                 | .858                      | .346             |
|                                                   | N                   | 44                | 44                | 44                   | 44                        | 44               |
| Intervention                                      | Pearson Correlation | -.082             | .054              | -.024                | -.150                     | -.075            |
|                                                   | Sig. (2-tailed)     | .615              | .740              | .884                 | .357                      | .646             |
|                                                   | N                   | 40                | 40                | 40                   | 40                        | 40               |

\*\* Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed)

## **DISCUSSION**

The impact of medical simulation on learners' competency performance has been studied previously using various approaches, but the exact effect of different pre-briefing activities on promoting competency performance and clinical judgment is still unclear [6]. This study was conducted to evaluate the role of structured pre-briefing on medical students' competency performance, clinical judgement, and perception of pre-briefing.

We found that the intervention group's competency performance and clinical judgment scores were greater than the control group's scores. Furthermore, the intervention group's

perception of pre-briefing was higher than the control group's scores. There was no correlation, however, between the competency performance score and the students' perception of pre-briefing. The findings of this study are significant for a variety of reasons. First, the study assessed the application of concept mapping as a structured pre-briefing technique based on reflection theory and constructivism. Second, there are favorable benefits of structured pre-briefing on students' competency performance and pre-briefing assessment. Third, the study was conducted on undergraduate medical students who had not been studied before.

These results are in agreement with Page-

Cuttrara et al. [7], who investigated the influence of structured pre-briefing using concept mapping on nursing students' competency performance. They found that learners who received structured pre-briefing had higher competency performance and clinical judgment scores as measured by the C-CEI score than those who received traditional pre-briefing. Furthermore, the structured pre-briefing group had a better perception of the pre-briefing experience than the traditional one. However, they found no significant difference between the studied groups on the communication subscale, which contradicted our findings.

Furthermore, in accordance with our findings, Parag Rishipathak et al. studied the effect of using concept-mapping pre-briefing versus the traditional pre-briefing on emergency department postgraduate medical students' competency performance using the LAPSS survey. They found that the students pre-briefed using concept mapping had a higher competency score than their peers [14].

The development of clinical judgement and competency performance skills is essential for the delivery of high-quality patient care. Although they are clearly related to practical experience, high-fidelity medical simulation promotes the development of these skills through experiential learning and reflection in a safe, controlled environment. Clinical judgement includes four main components: noticing, interpreting, responding, and reflecting [15]. The first three components are encountered during the clinical immersion while reflecting in action, but reflecting happens after responding to the situation. Concept mapping as a graphical representation of knowledge has been found to be an effective method for promoting clinical judgement and meaningful learning experience [10]. Using concept mapping in pre-briefing can enhance learners' active engagement to use their previous knowledge and experience to organize, interpret patient data, link the available information, and assess the situation. Students can investigate the relationships being created to gain new insights and knowledge. These all help learners to develop critical

thinking and decision-making skills that will set the stage for strong clinical judgment and competence performance skills [16]. This is supported by previous studies, which evaluated the effect of various pre-briefing activities on the learners' clinical judgement, such as expert role modeling, recorded video [17], verbal articulation of thoughts, and written preparatory materials. They concluded that adding pre-briefing activities to simulation improves students' clinical judgment, better understanding, situational awareness, clinical reasoning, and decision-making [18]. In addition, it can facilitate the development of non-technical skills such as clinical reasoning and foster interprofessional teamwork, decision-making, and prioritization of key concepts [11].

Concept maps show strengths and limitations in learners' thinking patterns, and they allow them to consider the clinical scenario in a variety of ways and anticipate various clinical outcomes. Students can trace thought patterns back to the point where the mistake was made if a mistake is discovered during the evaluation and reflection phases. As a result, concept mapping allows students to look at the full clinical scenario and gain a better understanding of the contents, relationships, and patient priorities [16].

The overall perception of the pre-briefing experience in this study was better in the group that received the structured pre-briefing. Moreover, learners' assessment of the pre-briefing as a learning opportunity and helping them to analyze their thoughts and feelings was better in the intervention group in comparison to the control. Some learners wrote comments on the pre-briefing assessment questionnaire (as it was optional). In the intervention group, two learners commented, 'It was great', and another two learners commented that the pre-briefing was helpful in better understanding the case, linking our previous knowledge to the clinical scenario, and better anticipation of the plan for care. On the other hand, two students who received traditional pre-briefing commented, 'The pre-briefing was short and inadequate. We should have more time to

analyze the scenario and discuss our plans before the immersion'. This was in agreement with a previous study that evaluated students' perception of simulation as an interprofessional teaching strategy. It concluded that undergraduate students who received traditional pre-briefing (such as learning objectives, role assignment, and environmental orientations) needed more data in order to succeed in the simulated scenario [19]. Furthermore, three recent reports also match our students' feedback. They advocate adding more pre-briefing activities to improve simulation outcomes, as well as increasing the pre-briefing time to give the students a chance to ask questions and improve their learning experience [18, 20].

However, the positive influence of structured pre-briefing on learners' clinical competency and perception of pre-briefing, there was no significant correlation between them. The current literature is supportive of these insignificant links. Bambini et al. [21] and Page-Cuttrara et al. [7] found a discrepancy between learners' self-perceptions of learning and their actual performance results. To have an insight into one's abilities is essential, but on the other hand, it is a subjective measure of perceived learning, not the actual learning outcomes. Therefore, learners are relatively poor judges of their own learning and poor measures of training effectiveness [22].

Henceforth, using structured pre-briefing in medical simulation enables students to apply the knowledge and skills gained from simulation sessions to their future clinical practice, resulting in improved competency performance and clinical judgment. The results of our study, as a preliminary step in using structured pre-briefing in medical education are encouraging further

work to validate our results.

## CONCLUSION AND RECOMMENDATIONS

In summary, the intervention group that received the structured pre-briefing had statistically significantly higher competency performance and clinical judgement scores than the control group that received traditional pre-briefing. Furthermore, the perception of the pre-briefing experience was better for the group that received structured pre-briefing than for the other group. This study highlighted the effectiveness of using concept mapping as a model of structured pre-briefing model to enhance medical students' competency performance and clinical judgment. Clinical judgement and competency are actually a complex process that necessitates the development of many skills. The majority of medical student participants in this study agreed that structured pre-briefing was more effective and had better competency scores.

Our study has some limitations. Firstly, the sample size was small, and this may have influenced the quality of our work. Second, the study's participants were chosen from a single medical specialty, which may limit the study's validity to other medical fields. Thirdly, this study has achieved a short-term gain, and it is unclear whether the effect will last with the learners; this needs a further follow-up study. Finally, there are still unanswered questions about how much prior experience influences learning outcomes and the effectiveness of structured pre-briefing. Further research involving more students and multiple simulation specialties is needed to evaluate the correlation between the level of experience and concept mapping effectiveness, in addition to the best type of concept mapping to use.

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## تأثير الإحاطة المنهجية المسبقة على كفاءة طلاب كلية الطب والتقييم الاكلينيكي لديهم

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### الملخص

**الخلفية والأهداف :** يستخدم التعلم القائم على المحاكاة على نطاق واسع في الوقت الحاضر في التعليم الطبي. على الرغم من أن الإحاطة المسبقة هي المرحلة التمهيدية لعملية المحاكاة، إلا أنها لم تتم دراستها جيداً من حيث هيكلها ودورها في التعليم الطبي. وهدف هذا البحث الي دراسة تأثير استخدام الإحاطة المنهجية المسبقة على كفاءة الطلاب، والحكم السريري، بالإضافة إلى تأثيره على تصور وآراء الطلاب لمدي الاستفادة من الإيجاز المسبق على كفاءة الطلاب وتقييمهم الاكلينيكي للمرضي.

**المنهجية :** شملت هذه الدراسة 84 طالب طب في السنة الخامسة. تم تقسيم الطلاب إلى مجموعتين: تضمنت المجموعة التجريبية 44 طالباً تلقوا الإحاطة المنهجية المسبقة (إحاطة مسبقة تقليدية بالإضافة إلى رسم خرائط المفاهيم) بينما مجموعة التحكم المكونة من 40 طالباً تلقوا إحاطة مسبقة تقليدية. تم تقييم الكفاءة والتقييم الاكلينيكي للطلاب باستخدام أداة تقييم الكفاءة (C-CEI) بالإضافة إلى استبانة تقييم مرحلة ما قبل الإحاطة الذي ملأه الطلاب في نهاية الجلسة. تم تقييم متوسط الفرق  $\pm SD$  بين المجموعتين باستخدام اختبار t للطلاب. تم حساب الارتباط بين النتائج باستخدام تحليل معامل الارتباط لبيرسون.

**النتائج:** كانت درجة أداء الكفاءة ودرجات التقييم الاكلينيكي للمرضي أعلى بكثير في المجموعة التجريبية منها في مجموعة التحكم مع قيمة P ذات دلالة عالية تبلغ (0.000). كما أثبتت الدراسة أن رأي طلاب المجموعة التجريبية أكثر إيجابية عن مدي أهمية تطبيق الإحاطة المنهجية المسبقة. ( $P < 0.000$ ) على الرغم من ذلك، لم تكن هناك أي علاقة بين مجموع درجات تقييم الكفاءة ودرجات استبانة الطلاب.

**الاستنتاجات :** الإيجاز المسبق المنظم باستخدام رسم خرائط المفاهيم يعزز بشكل كبير كفاءة طلاب الطب وتقييمهم الاكلينيكي للمرضي.

**الكلمات الدالة:** الإحاطة المنهجية، كفاءة طلاب كلية الطب، التقييم الاكلينيكي.