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Role of Debriefing in Trauma Simulation Training to Improve Trauma Team Performance in Emergency Department

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ABSTRACT

Incorporating trauma simulation training into team-based learning is crucial for enhancing trauma case management services. Debriefing is an effective intervention that improves the quality of teamwork and accelerates patient care completion. This study aimed to identify the impact of debriefing on trauma team performance during simulation-based training. The research was conducted as a quasi-experimental study with two groups of interprofessional medical staff in the Emergency Room at Dr. Cipto Mangunkusumo National General Hospital (RSCM), Jakarta, using a pre- and post-test design. The participants were divided into control and intervention groups, distinguished by a debriefing process after the trauma simulation training. Trauma team performance was assessed before and after debriefing using a modified global rating scale (GRS) specific to trauma cases. The GRS scores in the first simulation were equal between the intervention and control groups (median scores: 37 and 34, respectively). In the second simulation, the intervention group showed a higher and statistically significant GRS score ($p < 0.001$) than the control group (median scores of 47 and 41, respectively). These results show that debriefing played a role in improving the performance of teams in trauma simulation training. This positive outcome was attributed to the effective use of the STOP5 debriefing form, which has been previously shown to improve team cohesion, patient service quality, and patient safety.

Keywords: *Debriefing, Simulation, Trauma training, Emergency, Teamwork*

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INTRODUCTION

Simulation-based learning (SBL) is a popular and effective technique used in medical education to teach clinical skills. This method involves the creation of realistic clinical scenarios, allowing medical students to gain practical experience in a safe and controlled environment (1). It enhances learners' confidence and cognitive abilities, making it an essential training tool for medical professionals (2,3). Simulation-based learning can be conducted individually or in teams, depending on the clinical scenario (1).

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Murphy et al. (4) asserted that team learning is an effective approach for training teams, particularly those involved in trauma and resuscitation. Furthermore, studies have indicated that simulation-based learning significantly enhances team performance (5). This approach aims to improve patient safety and deliver high-quality care globally through team-based simulation learning, thereby providing experience in managing patient care without risking patient safety (6). Simulation-based learning involves three main stages: a thorough pre-briefing session, the application of newly acquired skills in scenario-based environments where students actively solve problems, and debriefing sessions to reflect on their experiences and identify areas for improvement (6).

Debriefing, an intervention known to enhance teamwork quality and expedite patient care, is a reflective process crucial for continuing education. Interactive reflection between facilitators and learners is integral to simulation-based learning (7). Levett-Jones and Lapkin (8) reported a substantial improvement in both technical and non-technical skills among healthcare workers following a debriefing. Furthermore, post-resuscitation debriefing has recently become standard practice owing to its considerable benefits for patient outcomes (9).

Debriefing has become increasingly important and popular in emergency medicine. Several emergency-related debriefing models have been developed, including Debriefing In Situ Conversation after Emergent Resuscitation Now (DISCERN), STOP5, and TALK (10–12). DISCERN model is used for in-situ debriefing following high-acuity resuscitations, typically involving relevant personnel and lasting less than 10 min (13). The TALK model guides structured team self-debriefing in four steps: T = target; A = analysis of what helped or hindered in achieving the target; L = learning points; K = key actions to improve. TALK promotes a supportive culture of learning and patient safety (12). The STOP5 debriefing process is completed within 5 minutes, following the STOP framework: S = summarise the case; T = things that went well; O = opportunities to improve; and P = points to action and responsibilities. This study employed hot-type debriefing using the widely accepted STOP5 form developed by Walker et al. (14). This model was chosen for the current study because it can be completed quickly, making it well-suited for emergencies. They are widely used in emergency medicine (8).

To accurately measure team performance, it is crucial to have an objective and reliable assessment tool. The Objective Structured Assessment of Technical Skills (OSATS) is a tool commonly used for assessing the technical skills of individuals in surgical procedures. However, when evaluating simulation-based learning that involves emergency scenarios, OSATS may not be the most appropriate assessment tool because it lacks a validated assessment of technical skills. Therefore, in 2021, Zoller et al. (15) developed a new validated scoring system, the global rating scale (GRS), to conduct an objective and structured assessment of technical skills during team-based emergency simulation training. Previous studies have used indicators such as the length of time to complete assignments and level of self-confidence, or questionnaires, to assess technical skills after emergency simulation training (8). Although these strategies are valid, a more objective and structured assessment tool for evaluating team performance, such as a scoring system, is required to collect appropriate clinical performance data from teams performing simulation training. Social science researchers believe that debriefing is crucial in clinical simulation experiences, providing constructive critiques, and fostering performance reflection (16). Therefore, this study aimed to evaluate the impact of debriefing on the overall team performance using a scoring system specifically modified for trauma simulation training, namely, the GRS.

METHODS

Study Design and Setting

This quasi-experimental study involved two groups, a pre-test and post-test, with a control group design. This study was conducted at the Emergency Department Dr. Cipto Mangunkusumo National General Hospital (RSCM), Jakarta.

Participants

The study population included doctors with a maximum of two years of working experience in the emergency room and clinical nurses with a minimum of Level II in Clinical Nursing and a maximum of four years of working experience in the emergency room. The participants, consisting of 12 doctors and 105 nurses, were recruited through a total sampling method, as they comprised the entire staff assigned to the day shift. Pregnant women were excluded because our trauma simulation might require standing or walking for long periods, which could cause pregnancy complications or preterm labour.

Instruments

The instrument used in this study was the GRS developed by Zoller et al. (15) which consists of 10 scoring points rated on a 5-point Likert scale ranging from 10 to 50 (Table 1). The GRS is notable for its ability to differentiate between teams effectively, has good inter-rater reliability, provides flexibility in assessment timing, and does not require additional resources (17). The GRS combines diagnostic, therapeutic, and patient-safety aspects (15).

Table 1: Modified global rating scale

1. A systematic examination based on ATLS	1 Incomplete assessment	2	3 Inadequate assessment	4	5 Complete and structured examination
2. Physical examination and trauma identification (*Secondary survey*)	1 Incomplete assessment	2	3 Inadequate to identify the trauma	4	5 Complete assessment of physical examination and trauma identification
3. Vital sign monitoring	1 Not installed and reported	2	3 Vital sign monitoring tools were well installed but incomplete	4	5 Vital sign monitoring tools were properly installed and complete
4. Patient's position	1 The patient was not positioned according to the trauma they experienced	2	3 The patient was changed to the anatomical position after a while (> 1 minute)	4	5 The patient was immediately positioned into the anatomical position (< 1 minute)

(*Continued on next page*)

Table 1: (*Continued*)

5. Temperature management	1 Incomplete	2	3 Not done properly and/or incomplete	4	5 Well done and precise
6. Use of stabilisation devices (including neck collars, suction, splints)	1 Incomplete	2	3 Used properly, but incomplete (a maximum of two tools were missing)	4	5 Used properly and nothing was missing
7. Emergency management/ intervention (intubation, needle decompression)	1 Incomplete	2	3 Performed all emergency actions but something was lacking (maximum of 1 item)	4	5 Performed all emergency actions needed
8. Post-resuscitation care (Insertion of Foley catheter, NGT, and X-ray)	1 Incomplete	2	3 Post-resuscitation care has been carried out, but one was missing	4	5 Complete actions needed
9. Patient safety evaluation	1 Incomplete	2	3 Done but incomplete	4	5 Done properly
10.Overall performance	1 Not good	2	3 Good	4	5 Very good

This GRS was translated into Indonesian, adjusted according to the specific trauma simulation scenario used in this study (Figure 1), and validated by an expert panel consisting of four emergency physicians and one nurse specialising in medical surgery.

In addition, a debriefing process was conducted using the STOP5 model, which was translated into Indonesian and validated by experts. According to these guidelines, the STOP5 model facilitates the debriefing session for 5 minutes (Figure 2) (14).

Data Collection

Before commencing the simulation, a scenario was devised and validated by emergency care experts. Improvements were made to both scenario and technical assessment aspects based on expert feedback. Additionally, the GRS assessment form was translated and adjusted to align with an impending scenario. An expert board validated these changes. In addition to the development of the GRS assessment tool, a GRS assessment dictionary was created using an expert board.

Initial Assessment Scenario (for the participant)

Case:

You work in a Level 2 hospital with 24-hour laboratory and radiology facilities. A general practitioner and four nurses per shift staff the Emergency Room. A pickup truck arrives, driven by residents transporting the victim of a head-on car collision. The 28-year-old male driver was not wearing a seatbelt. The car was traveling at 70 km/hour, and the driver was found hugging the steering wheel at his chest. The front of the car is dented.

Residents report:

The driver was not wearing a seatbelt.

The driver was found wedged in the driver's seat, hugging the steering wheel.

There was a large amount of blood in the driver's mouth.

Scenario Information (for the assessor)

Physical Findings:

- Partial airway obstruction due to blood; fast breathing with gurgling sounds.
- Patient responds to pain; GCS 7 (E2, V1, M4).
- Hematoma on the left chest with crepitation on palpation.
- Deformity of the right femur.

Injuries:

- Inadequate airway due to blood.
- Multiple facial lacerations.
- Left tension pneumothorax.
- Open fracture of the right femur.

Figure 1: Simulation scenario of tension pneumothorax.

Thank the teams for appreciation and ask if they are OK
If all is well, continue with the statement:
1. In 5 minutes, we will start the debriefing session
2. The purpose of debriefing is to improve the quality of patient care and not to blame each other
3. All team members are expected to participate
4. All information provided is confidential

Hot debrief	**Cases type**	**List all the members present:**
Date: Time: Location:	- Medical - Code Red Trauma Call - Death in Resuscitation - Staff triggered	**This form completed by:**

Case summary

Things that went well

Opportunities to improve

If the same cases happen again, what will you do in the future to make it even better?

Debriefer:
1.
2.

Figure 2: Modified STOP5 debriefing form.

All participants obtained introductory material before the first simulation to equate their perceptions related to simulation using the learning management system (LMS) method. The materials included lectures on early trauma management and a video demonstration of the implementation of trauma simulations. They were collaboratively developed and approved by the researchers and experts.

The study was conducted in a double-blind manner to ensure that neither the GRS assessor nor the simulated participants were aware of their assigned control or intervention groups. Trauma simulation training utilised a pre-validated scenario involving a simulated patient. Eight groups underwent a 20-minute simulation on the same day. The sequence of the groups was randomised, and the researchers and assessors were blinded to the sequence.

Following the simulation, a debriefing process was conducted in the intervention group by a nurse specialising in medical surgery using the STOP5 debriefing form. In contrast, the control group engaged in unstructured discussions guided by the same debriefers and held within the same period. This step was done to ensure impartiality of the results by disguising the intervention. Following these discussions, an assessor evaluated the team's performance using the GRS.

A second training session was conducted one week after the first trauma simulation training. The second session replicated the same scenario and time frame as the first but included random and blinded sequences for the participants. After the second simulation, the group's GRS scores were re-evaluated to assess their progress and improvement (Figure 3).

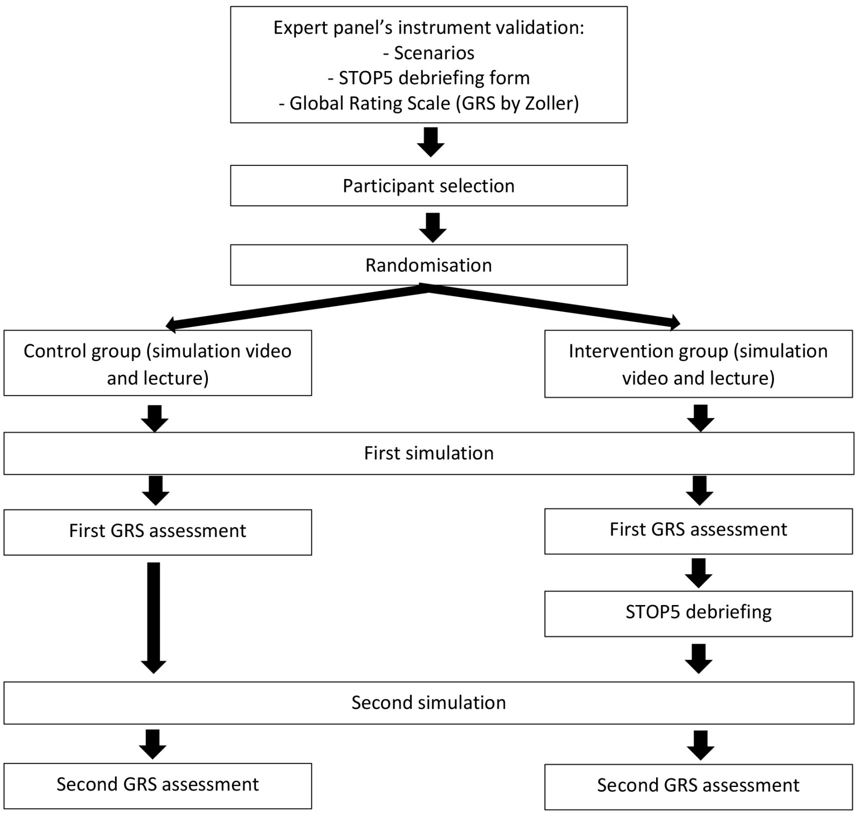

Figure 3: Study flow diagram of trauma simulation training and debriefing intervention.

Statistical Analysis

The data obtained were analysed using SPSS version 23. Differences between groups were analysed using the chi-square test, Mann-Whitney U test, and multivariate linear regression analysis. Statistical significance was set at $p < 0.05$. The profile data are descriptively displayed in the form of tables and graphs.

RESULTS

This study was conducted at the Training and Learning Centre of the Emergency Department, RSCM, Jakarta, from March to May 2023. The participants included doctors and nurses actively working in the emergency rooms. Of those selected, 40 individuals met the inclusion criteria and were enrolled in the study.

A total of 8 doctors and 32 nurses were selected. These participants were then divided into eight groups, each comprising one doctor appointed as the leader of the group and four nurses. All groups were then randomised into either control or intervention groups.

Demographic analysis showed that both groups had a higher proportion of female participants and individuals with prior life support training. Among the 40 participants, 23 were female, and 38 had received prior life support training. The basic characteristics of the participants in each group are presented in Table 2. No significant differences were found in gender, work experience, or history of participating in life support training between the two groups.

The GRS scores in the intervention and control groups were not normally distributed; therefore, the Mann-Whitney U test was used for comparison (Table 3). Initial GRS scores before the intervention were comparable between the two groups ($p = 0.31$). This finding indicated that randomising the research subjects was effective. Based on the bivariate analysis of each independent variable with the dependent variable, age and post-intervention GRS score yielded a $p < 0.25$ and were therefore included in the multivariate linear regression analysis.

In the complete multivariate linear regression model, age was not a confounder affecting the relationship between debriefing and simulation scores ($p = 0.109$; B coefficient = –0.272). Removing age from the complete model changed the B coefficient for the debriefing variable by less than 10% ($p < 0.001$; B coefficient = –6.497). Thus, the median final simulation score of the debriefing group was 7 points higher than the median final simulation score of the control group. The differences were considered statistically significant.

Table 2: Characteristics of research participants

Variables	Total	Control group	Intervention group	*p*
Sex, n (%)	40 (100)			0.99*
Men		8 (47.1)	9 (52.9)	
Women		12 (52.2)	11 (47.8)	
Age (year), median (Q1–Q3)	28 (27–30)	29 (28–31)	28 (26–29)	0.04**
Profession, n (%)	40 (100)			0.99*

(*Continued on next page*)

Table 2: (*Continued*)

Variables	Total	Control group	Intervention group	*p*
Doctors		4 (50)	4 (50)	
Nurses		16 (50)	16 (50)	
Work experience, median (Q1;Q3)	2 (1;5)	2 (1;5)	2 (1;4.75)	0.83**
History of previous life support training participation, n (%)	40 (100)			0.99*
Yes		19 (50)	19 (50)	
No		1 (50)	1 (50)	

Notes: * Chi-square test; ** Mann–Whitney U test

Table 3: GRS scores in intervention and control groups

GRS score	Control	Intervention	*p*
Pre-debriefing, median (Q1; Q3)	34 (25.5; 38)	37 (27; 41)	0.31**
Post-debriefing, median (Q1; Q3)	41 (35.5; 43.5)	47 (44; 0)	< 0.001**

Note: ** Mann–Whitney U test

DISCUSSION

This interventional study was conducted to analyse the effect of debriefing on the technical and non-technical performance of trauma teams following simulation-based training in emergency medicine, using the STOP5 debriefing model. The debriefing process has been reported to increase learning effectiveness. Kiessling et al. found that simulation-based learning in emergencies can boost confidence, improve interprofessional communication skills, and enhance medical and clinical competence (18).

Previous studies have also shown that post-resuscitation debriefing improves adherence to best resuscitation practices. These benefits include higher rates of return of spontaneous circulation, improved neurological outcomes, reduced interruptions during chest compressions, and earlier initiation of chest compressions (19). Post-resuscitation debriefing is recommended to be conducted as per the resuscitation guidelines. This practice is recommended by emergency medicine organisations in the United States, Canada, and Europe (20–22). From a non-technical perspective, post-resuscitation debriefing can reduce the level of stress in medical staff, making them more comfortable and enhancing their competency in performing their duties during resuscitation (23).

Female and male participants were equally distributed (57.5% and 42.5%, respectively). This distribution is consistent with a comparable study conducted by Yii et al. (24) involving 65% female and 35% male participants(24). However, this contrasts with a study conducted by Abelsson et al. (25) on nursing competence through simulation trauma, in which men dominated 77.7% of the research participants. Another study by Abelsson et al. (26) concerning the simulation effect on the ability to handle trauma in a prehospital emergency unit was also dominated by men (70%), while the percentage of female participants was 30%.

This study included medical personnel aged 27–30 years. This demography differs from the study conducted by Abelsson et al. (25), in which the participants' ages ranged from 25 to 63 years. Another study related to high-energy trauma learning through simulation methods by

Abelsson et al. (26) involved nurses aged between 25 and 52 years. Lai et al. (27) conducted a study regarding simulation training for residents in crisis resource management, involving participants aged 26 to 43 years. According to social identity theory, a training group with high age diversity may hinder participants' learning outcomes because individuals are less likely to share knowledge than in age-homogeneous groups (28).

Work experience among our participants ranged from 1 to 5 years. Abelsson et al.'s (26) study involved nurses with 1–11 years of experience in the emergency department. In contrast, Yii et al.'s (24) study involved paramedics with 6–20 years of work experience. Li et al. (29) found that senior physicians with more than 10 years of experience demonstrated greater clinical efficiency, effective use of emergency department resources, better patient outcomes, and accurate disposition. However, Li also found that senior doctors took longer to dispose (transfer of patient care) to other departments associated with the patient's condition, so they were less likely to provide high-quality treatment (29, 30).

Both age and work experience were limited in this study because of the following inclusion criteria: doctors with a maximum of two years of experience and nurses with a minimum Level II of Clinical Nursing experience. According to the regulations of the Indonesian Ministry of Health (Permenkes No. 40 Year 2017), nurses who are allowed to independently provide nursing care and determine specific nursing interventions for trauma cases must have a minimum Level III of Clinical Nursing (31). Therefore, the nurses included in our sample had limited experience in trauma patient care, which avoided the risk of performance bias among the groups. In addition, including participants with minimal experience means that the performance scores in this study can be used as a baseline for future evaluations. Moreover, participants' performance evaluations can be used as a guide when placing nurses in the most appropriate emergency department zones.

The trauma simulation conducted in this study involved interprofessional medical personnel, namely doctors and nurses, in the Emergency Room at RSCM, Jakarta. This study aligns with Beaven et al.'s (32) exploration of ultra-high-fidelity simulations of military medical teams encompassing 23 personnel, including doctors, nurses, physician assistants, and paramedics. Furthermore, it parallels Fitzgerald et al.'s (33) study regarding a trauma simulation programme that involved doctors and nurses specialising in emergency medicine, anaesthesia, intensive care, trauma, and surgery.

The benefits of interprofessional collaboration are well-documented. Studies show that such collaboration enhances satisfaction among medical personnel, improves patient satisfaction, reduces the risk of patient mishandling, and decreases mortality rates. Notably, a study by Liu et al. (34) corroborated these findings, indicating that interdisciplinary collaboration in assessing Emergency Department patients leads to expedited assessment times compared with individual assessments by each discipline.

In this study, most participants were medical personnel who had attended life support training. This finding was in accordance with prior research conducted by Bingham et al. (35) regarding simulation training to test knowledge retention and ability of advanced cardiac life support, which found that the achievement of treatment outcomes was 37% higher among teams that had received previous training. In our study, the number of participants who attended life support training was equivalent between the two groups; hence, no risk of bias in team performance existed.

Several educational centres have developed and published special debriefing frameworks for emergency settings, such as DISCERN, STOP, and TALK (10–12). However, no universally accepted standardised method has yet been adopted. Debriefing can serve various purposes, such as providing psychological defusion, enhancing the quality of the learning process, or enabling self-reflection on learning outcomes in an educational context (36).

One method tailored for emergencies is STOP5. This debriefing is conducted within 5 minutes, following the STOP5 framework. Although 5 minutes may seem brief, Zinns et al. (37) found that even a short debriefing substantially improved team perception in a simulation setting. Further, Cincotta et al. (36) found that the immediacy and brevity of debriefing (< 5 min) after an event were critical components of effective debriefing. This framework also includes three main phases that must be included in a debriefing: reaction, understanding, and summarising (38).

This study employed a hot-type debriefing format utilising the widely accepted STOP5 form, first introduced by Walker et al. (14). This method was selected because it can be completed quickly, making it ideal for emergencies. STOP5 debriefings are widely used in emergency medicine (19). A systematic review of post-resuscitation debriefing, which is a crucial aspect of emergency medical care, revealed that five of the six debriefing methods analysed were hot debriefing types (22). This finding underscores the utility of this method in the context of real emergency scenarios, which are characterised by unpredictability and where everything must be done quickly.

Debriefing strategies can be divided into two types: hot and cold. A study of clinical nurses in Korea revealed that both hot and cold debriefing improved clinical competence. However, when evaluating learner satisfaction with simulation learning and the debriefing process, groups experiencing hot debriefing expressed higher satisfaction levels than those experiencing cold debriefing (39). The STOP5 model aims to minimise negative authority influences, creating a psychologically safe environment where participation is valued, and team members can speak honestly. It allows equal participation, focuses on team-oriented feedback, and emphasises action points and responsibilities (14, 40). Surveys from a study on emergency department staff at a tertiary centre in Edinburgh showed that this model improves staff morale, technical skills, communication, team cohesion, and decision-making in resuscitation cases, ultimately enhancing patient care and safety (14).

In 2021, the special assessment modality used in this study, the GRS, was published by Zoller et al. (15) to assess team performance in trauma simulations. The assessment used in this study was more objective because it evaluated both technical and non-technical abilities. In this study, the GRS scores did not differ significantly between the two groups in the first simulation; however, in the second simulation, a significant difference was found in the GRS scores (Mann–Whitney U test, $p < 0.05$). Concerning the characteristics of the participants' data, a significant age difference existed between the control and intervention groups, which biased the interpretation of the differences in GRS scores in the second simulation. To confirm that age did not affect the relationship between debriefing and simulation scores, a retest was conducted using multivariate linear regression analysis. This retest was done to ensure that age was not a confounding factor. Therefore, a higher GRS in the intervention group during the second simulation was considered significant.

These findings indicated that the intervention group achieved significantly higher GRS scores, which supported the research hypothesis. This positive outcome can be attributed to the effective use of the STOP5 debriefing form, which has been shown to enhance team cohesion, improve patient service quality, and promote patient safety. As a result, the teams' performance improved after the debriefing session, resulting in better patient outcomes (14). The impacts of the study on team training simulations in the emergency room included increased interprofessional education, improved patient safety practices, and reduced communication gaps between doctors and nurses.

However, this study has some limitations. First, the sample size used in the study was relatively small, which may have affected the statistical power and the ability to detect small but potentially important effects. Second, the study was conducted in a single hospital, which may limit the generalisability of the findings to other hospitals with different patient populations, resources, and care practices. Third, this study only assessed the effects of debriefing in a simulated learning environment, leaving unexplored implications for routine clinical practice. Research on the effects of debriefing in real emergency trauma cases is necessary to gain a comprehensive understanding of its benefits for healthcare professionals. Conducting further research with larger and more diverse sample sizes, as well as in real-world clinical settings with a hot debrief framework, STOP5 models could provide valuable insights into the potential benefits of debriefing for healthcare professionals and patient outcomes.

CONCLUSION

This study demonstrated that the STOP5 debriefing model fosters significantly better team performance after trauma simulation training. The debriefing, conducted immediately after the simulation and lasting only 5 minutes, proved effective in enhancing team cohesion, communication, and task performance. The achievement of better performance or higher GRS scores in the intervention group is in accordance with the previously stated research hypotheses. Future research with larger, more diverse sample sizes and real-world clinical settings is recommended to validate the effectiveness of the STOP5 framework further and assess its broader implications for clinical practice and patient care.

ETHICAL APPROVAL

The study commenced upon receiving ethics review approval and an RSCM research permit dated February 20, 2023, with protocol number 23-02-2315.

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