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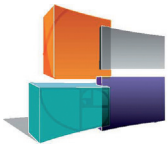

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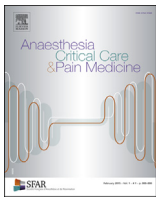

Original Article

Evolution of stress in anaesthesia registrars with repeated simulated courses: An observational study☆

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ABSTRACT

Background and objective: High-fidelity medical simulation is a source of stress for participants. The aim of this study was to assess if repeated simulated courses decrease perceived stress and/or physiological stress level and increase performance in anaesthesiology registrars.
Method: Fourteen anaesthesiology specialty registrars participated individually in three successive sessions of crisis simulation in the operating room. Participants' perceived stress levels were measured by self-assessment (simple numerical scale from 0 to 10 [0 = no stress, 10 = maximum stress]) and physiological stress was estimated via the maximal heart rate measured by a Holter system). Technical and non-technical performances were also assessed. Data are expressed as medians with interquartile ranges and extremes (median (IQR [Min–Max])).
Results: Between the first and third session, simulation repetition was associated with a decrease in perceived stress (9 (8–10 [5–10]) versus 7 (5–8 [2–9]) from session 1 to session 3 respectively, $P = 0.02$), whereas physiological stress assessed by the maximum heart rate remained unchanged (130 beats per minute (116–141 [85–170]) and 123 beats per minute (115–136 [88–166]) between sessions 1 and 3 respectively). There was also a significant inverse correlation between perceived stress levels experienced by registrars during the session and non-technical performance ($P = 0.008$).
Conclusion: We observed a reduction in perceived stress levels experienced by registrars while physiological stress was unchanged with repeating simulation sessions combining simulated practice and debriefing. Learning through simulation could improve perceived stress management in critical situations.

1. Introduction

High-fidelity simulation has experienced expansion in the training of healthcare professionals in the form of educational programs and as a complement to other teaching methods [1]. Anaesthesia is a medical specialty in which professionals are particularly vulnerable to stress, which has been the subject of increasing attention [2,3]. Repeated exposure to stress can have adverse effects on the health and well-being of practitioners [4], and it can also risk patient safety in driving doctors to adopt maladaptive behaviour [5].

Simulation sessions which seek to replicate, as closely as possible, real crisis conditions in anaesthesia, can also generate significant stress for participants. Indeed, in a large Canadian declarative survey, about 80% of anaesthetists in training felt that their perceived stress was higher during a simulation session than in a typical day in the operating room. Being observed either by their peers or by teachers raised this anxiety [6]. Residents suggested that anxiety may be increased in case of limited previous experience with simulation. The debriefing process and emotional

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management programmes have been recommended in initial training programmes to prevent relational dysfunction and stress [7]. Therefore, it is possible that repeated simulation-training sessions could help professionals to learn to manage stress and optimise behaviour when faced with similar clinical situations but few data are available so far regarding this point. In undergraduate students, Pai et al. [8] observed a decrease in perceived stress from the first to the second simulation session. However, participants were not evaluated individually but as teams of five to six students during the same session.

The main objective of our study was to evaluate the evolution of perceived stress (i.e. anxiety) and physiological stress in anaesthesiology specialty registrars by repetition of high-fidelity simulation sessions. Secondary objectives were to investigate the relationship between the intensity of perceived stress and participants' performance as well as the role of experience with the curriculum (junior versus senior registrars).

2. Material and methods

This observational study was conducted among anaesthesia registrars at the University Hospital of Rouen. In France, specialty registrars have dual expertise with a registrarship of five years shared equally between anaesthesia and critical care. All registrars enrolled acquired the basics of anaesthesia with at least two semesters in the curriculum. Prior to onset of the study, they received a theoretical session on medical high-fidelity simulation and anaesthetic non-technical skills, as well as an initial orientation session to the simulation centre. Then, they individually participated in a series of three simulation sessions in which the life prognosis of the simulated patient was engaged. Approval was obtained from the local Ethics and Evaluation Committee for Non-Interventional Research at the Rouen University Hospital (protocol n° E2012-13) and informed consent was acquired.

2.1. Material

The patient simulator used was a Sim Man® (Laerdal Medical®, Limonest, France), located in a familiar restored operating room (Emergency Care Training Centre, University of Rouen, France). The anaesthesia team was comprised of a registrar who was the subject of the study and an anaesthetist nurse blinded to the scenario. This is the usual configuration in the operating theatre in France. Other health professionals also acted as surgical room staff. Two different scenarios were enacted during three successive sessions spaced four months apart. The scenarios for the first and the second sessions were grade III anaphylactic reactions at induction for a minor surgery. The session lasted approximately 20 min and clinical signs of anaphylactic shock started during administration of neuromuscular blocking drugs. The scenario of the third session was a malignant hyperthermia crisis during an exploratory laparoscopy. The scenario lasted about forty minutes, and clinical signs were stabilized with the introduction of dantrolene. Each session was filmed and was immediately followed by individual debriefing on technical and non-technical skills. Two trained instructors led debriefings.

2.2. Methods

2.2.1. Stress measures

We measured registrars' stress levels during each simulation session in two different ways. Firstly, perceived stress was assessed by self-assessment using a simple numerical scale from 0 to 10 (0 = no stress, 10 = maximum stress) which was performed immediately at the end of the scenario [9]. Secondly, we assessed physiological stress as the haemodynamic response by continuous recording of heart rate by a Holter ECG system [10]. Prior to the sessions, we recorded each registrar's basic heart rate during a normal working day. Skilled operators performed pattern analysis (Department of Cardiology, Heart Rhythm Unit, Rouen University Hospital). Heart rate was analysed beat by beat and increased percentage was calculated using maximum compared to basis heart rate [(max HR – basis HR) × 100/basis HR].

2.2.2. Evaluation of performance

We rated non-technical performance using the Anaesthetist's Non-Technical Skills (ANTS) assessment tool [11]. It consists of five items divided into four categories (Table 1). We assessed each item using a Likert scale ranging from 1 to 4, to give a total score from 15 to 60. A score of 4 was assigned for a performance in line with standards or beneficial to patient safety and could be shown as an example to other registrars. A score of 1 was assigned if the performance posed a real or potential danger to the patient. "Satisfying performance but can be improved" received a score of 3. A score of 2 revealed deficiencies requiring improvement. Technical performance was assessed by a Likert scale reflecting the overall quality of medical care according to the recommendations of the French Society of Anaesthesia and Critical Care [12,13]. To achieve a maximum score, all corrective actions presented in these documents needed to be implemented by the registrar during the simulation session (1: inadequate measures with a risk to the patient; 4: perfect agreement with recommendations). We evaluated technical and non-technical skills with video playback to complete possible missing data from the initial assessment. The final score was determined by agreement between the four evaluators.

2.2.3. Realism of the simulation

Information on realism was collected immediately after each session using an anonymous questionnaire. A rating scale scored from 0 to 10 assessed different requirements, such as responses of the simulator to participants' actions and simulated parameters, (0 = not at all realistic, 10 = very realistic).

2.3. Statistical Analysis

Sample size was based on logistic constraints and the number of registrars available in our centre during inclusion. Data are expressed as means ± the standard error of the mean (mean ± SEM) SEM) and medians with interquartile range and extremes (median

Table 1
Anaesthetist's Non-Technical Skills (ANTS) assessment tool by Fletcher et al. [12].

Task management
Planning and preparing
Prioritising
Providing and maintaining standards
Identifying and utilising resources
Team working
Co-ordinating activities with team members
Exchanging informations
Using authority and assertiveness
Assessing capabilities
Supporting others
Situation awareness
Gathering information
Recognising and understanding
Anticipation
Decision making
Identifying options
Balancing risks and selecting options
Re-evaluating

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