Understanding the Impact of Acute Stressor During Simulation on Medical Students' Short and Long-Term Clinical Skills Retention

UNDERSTANDING THE IMPACT OF ACUTE STRESSOR DURING SIMULATION ON MEDICAL STUDENTS' SHORT AND LONG-TERM CLINICAL SKILLS RETENTION

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Abstract

Background:
Acute stressors may be beneficial when embedded in clinical simulation scenario to promote better skills retention. We aimed to establish the impact of acute stressors to medical students' short-and long-term retention of intravenous catheterization skills.

Methods:
Forty-five participants took part in the intravenous catheterization simulation using standardized patients in treatment (Stress) and control (Non-Stress) groups. Participants were asked to complete State-Trait Anxiety Inventory and assessed on their skills performance before, shortly after and twenty days after the simulation session. We continuously recorded participants' heart rate during the simulation.

Results:
No significant difference and interaction were found between pre-simulation, short-term, and long-term skills performance scores for both groups $F(2, 84) = 1.231, p = 0.297$. Analysis of average and maximum heart rate as well as anxiety scores was not statistically different between groups.

Conclusion:
Clinical simulation is inherently stressful for medical students. Future study is needed to gain insight into sufficient amount of stressors needed to impact medical students' skills retention.

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CHAPTER 1. BACKGROUND

Simulation

Clinical simulation is a technique and technology that provides learning and training for individuals and teams through realistic imitation of clinical situation (Bradley, 2006). It has been part of undergraduate and graduate medical education curricula in introducing and reinforcing clinical scenarios to a wide range of aspiring and practicing clinicians worldwide. The critical value of simulation has been well documented in various fields of medicine, including surgery, emergency, and acute care medicine (Bradley, 2003).

In the era of heightened concerns over patient safety issues, clinical simulation is regarded as a promising method for novice learners to practice integrated cognitive and psychomotor skills and to offer reflective practices for them regarding individual and team performance. However, even though it is considered safe, learning in emergency simulated environment is inherently demanding for the learners (Basu Roy & McMahon, 2012).

In a simulation, learners interact with a simulated environment. Such environment typically combines confederates or "actors" portraying health care providers and patients, as well as the associated clinical "ambience" (machine beeps, family grief, alcohol aroma, etc.). This concept seeks to immerse both physical and psychological being of the trainees into the demanding yet safe learning situation. Realism and fidelity, in addition to the case complexity, are considered as pivotal elements of simulation to impart emotionally stressful scenarios seen in real clinical setting (Hamstra, Brydges, Hatala, Zendejas, & Cook, 2014).

Being in a simulated session that imitates real-life situation, standing on the side of a human patient simulator (HPS), performing in the eye of the other learners and instructors, and responding to possibly less than helpful confederates, are stressful and not easy for novice learners. Immediately after the simulation session, the learner will have to share one's experience about mistakes, feelings, and decisions that might have led to the patient's survival or demise in a debriefing session (DeMaria & Levine, 2013).

Stress and stressor

Definition of stress has been a delicate debate among experts since decades ago. One of the definitions of stress describes it as "real or interpreted threat or psychological integrity of and individual that results in physiological and or behavioral response" (McEwen, 2000). Stressors refer to a range of emotionally arousing events that exhibit a potential threat to bodily physiological homeostasis. Lupien and her colleagues (2006) suggested two types of stress, absolute and relative. Absolute stress denotes instances in which a majority of people will respond to this stimulus or threat, such as threat induced by a natural disaster, fire, or wild animal. On the other hand, relative stressors are implied threat induced by individual perception of a particular situation as being novel, unpredictable, or uncontrollable (Lupien et al., 2006). In this type of stressor, stress response will be elicited on a certain fraction of population, while others might face mild or no threat by the stressor. Public performance tasks or job interviews are examples of relative stressors, which will induce a significant stress response for a given individual but not for another (Lupien et al., 2007). Stressors found in the simulation are likely to fall into the latter category.

Stress and learning
Ormrod (2012) briefly defines learning as "long-term change in mental representations or associations as a result of experience" (p. 4). As described by the definition, learning is not just a brief transitory use of information from memory. Therefore, we need to define memory to understand deeper the process of which it is created. From the information-processing perspective, there are three stages of memory creation: encoding, consolidation, and retrieval (Roozendaal, 2002). Stress mediators, such as cortisol, play a critical role in different phases of memory creation and also affect both quality and quantity of memory. In addition to higher level of attention devoted to the learning experience, emotionally arousing experiences have a tendency to be retained longer in the memory and easier to recall. As exemplified by the "flashbulb memory phenomenon", the majority of people who were old enough in 2001 are more likely to distinctly recall their whereabouts when they learned the news about the 9/11 attack, but less likely about the previous or later days. This phenomenon forced our attention solely to the event and optimized our memory to this particular experience, thus easier to retrieve the memory later in our life (Lupien et al., 2007). In the world of education and training, this could potentially beneficial in the reinforcement of learning. To exemplify the strong correlation between stress and learning, Joels and colleagues (2006) proposed that stress will only likely to facilitate learning and memory processes when:

"…stress is experienced in the context and around the time of the event that needs to be remembered, and…the hormones and transmitters released in response to stress exert their action on the same circuits as those activated by the situation, that is, when convergence in time and space takes place." (p. 152)

There is a complex relationship between emotional engagement and learning in general. This stressful experience should play a role in the learning process of medical students. The cognitive load theory suggests that there are different types of cognitive loads related to instructional design. These cognitive loads should be controlled to meet the capacity of working memory for learning to occur. Emotional stressors possess the risk of interfering with cognitive loads, and as a result, affect learning. Some studies have shown that the heightened emotions lead to increased cognitive load that negatively impacts students' performance. In other studies, adding stressors in simulation training has enhanced students' performance. However, to date, researchers have mainly focused on short-term learning effects, leaving the possibly more beneficial long-term impact on learning less thoroughly studied (Basu Roy & McMahon, 2012).
The current volume of literature on the effect of stress in learning provides conflicting evidence. Paramedics exposed to high-stress situation performed lower accuracy scores in calculating drug dosages than in low-stress condition. These findings suggest the importance of balancing the dosage of stressor in training so as to prevent later instances of medical errors in clinical practice (LeBlanc, MacDonald, McArthur, King, & Lepine, 2005). Cardiac arrest simulation also showed a substantial increase in perceived stress (as measured by self-report by trainees) and negative emotions amongst trainees, and subsequently negatively impacted performance (Hunziker et al., 2011).

In another study, Harvey and his colleagues (2011) found that high acuity clinical situation caused significant subjective and physiologic stress responses followed by clinical performance impairments. This trainees group showed worse overall checklist performance on the high-stress scenario. However, they advised that subsequent interventions targeting stress management skill might be beneficial because those who regarded scenarios as challenges rather than as threat experienced lower stress and better performance. LeBlanc (2009) suggested that elevated stress levels could impair performance on complex tasks that need divided attention, working memory, memory retrieval, and decision-making. Detrimental influence of stress on memory retrieval would be attenuated if the learning and retrieval (future practice) environments were matched and congruent. In their study, Schwabe and Wolf (2009) found that when the environments were incongruent, stressed subjects performed worse than non-stressed controls. However, this phenomenon disappeared when the environments were matched. This strongly advocates the realistic fidelity of any simulation room design to closely resemble the future clinical practice situation.

Kuhlmann and Wolf (2006) studied the effect of cortisol treatment on immediate and 24-hour delayed recall condition after viewing emotionally arousing or neutral pictures. Their findings suggested that although cortisol showed no effect on immediate recall, the delayed assessment revealed increased emotional memory recall. This result supports the favorable effect of cortisol on memory consolidation. In the field of medical education, a study conducted by DeMaria and his colleagues in 2010 showed that embedding emotional stressors into clinical simulation led to greater anxiety among trainees (as shown using State-Trait Anxiety Inventory). However, this group of trainees performed better in clinical skills assessment scores conducted six months after the simulation session. In another research, stressed participants showed enhanced surgical laparoscopy skills over the unstressed group of trainees. This finding translates the benefits of laboratory-based training to actual clinical practice.

The primary aim of this study was to seek further understanding of the effects of acute stressors in clinical simulation on short- and long-term retention of medical students' intravenous catheterization skills.

We hypothesized that medical students' short-term retention as shown by skills performance assessment would be more impaired in the stress group compared with the non-stress group. While the long-term retention in the stress group would be less impaired compared with the non-stress group.

CHAPTER 2. METHODS

Study Design

This was an experimental study conducted at the Clinical Skills Laboratory of the Faculty of Medicine Universitas Gadjah Mada (FM UGM) Indonesia between December 2015-March 2016. This research was approved by both the FM UGM's Medical and Health Research Ethics Committee (MHREC) and the Institutional Review Board of the Harvard University Faculty of Medicine.

Participants

Our six-year undergraduate medicine program is accredited by the Indonesian National Accreditation Agency for Higher Education. We invited second-year medical students to participate in the study on a voluntary basis. The inclusion criteria were: age over 18 years old and consented to participate. The exclusion criterion was previous experience with Intravenous Catheterization (IVC) training. A total of 45 students were enrolled in this study. Written informed consent was obtained prior to data collection from each participant. Participants were blinded in regards to the hypotheses of this study and randomly allocated to either treatment or control groups. The participants did not receive any financial compensation for their participation in the study.

Scenario and study protocol

Pre-simulation (Individual)

During the early hour of the first study visit, we recorded participants' average resting heart rate per minute using a heart rate monitor device. Shortly after that, we explained to them about State-Trait Anxiety Inventory before asking them to complete a State-Trait Anxiety Inventory for Adults Form Y-2 (STAI-AD Y2) individually.

We randomly assigned participants into ten teams, with each team consisted of five participants. We utilized Research Randomizer (www.randomizer.org) to help with the randomization assignment. The participants and skills instructors were blinded to the group assignments.

Training session (In teams of five)

An experienced clinician was assigned to each team as skills instructor. The skills instructor was responsible for teaching a 90-minute standardized intravenous catheterization (IVC) skills training session. In this study, we adapted the Modified Peyton's Approach (Nikendei et al., 2014) to train IVC skill to the participants at the Clinical Skills Laboratory. The training used FM UGM's standardized Intravenous Catheterization procedural checklist as the guideline. At the beginning of the training, the instructor demonstrated the procedure once to all participants. Every participant then had one opportunity to instruct a member the team to perform the procedure and then performed the procedure under instruction from another member of the team. Participants who were not giving the instruction nor performing the procedure were asked to wait outside the training room. Every participant had the same experience in the training, i.e. one observation of instructor's demonstration, one instruction, and one performance. The instructor was present at all time during the training.

Pre-simulation performance assessment (Individual)

A Clinical Skills Laboratory's teaching assistant assessed each participant' IVC skill using the same procedural checklist immediately after the training session. Every participant was asked to perform the same procedure that was taught during the training session. No score or feedback was provided to participants after the assessment.

Simulation session (Individual)

After the pre-simulation assessment, each participant completed a State-Trait Anxiety Inventory for Adults Form Y-1 (State) (STAI-AD Y1). Then, the participant entered the simulation room (either treatment or control group). A Clinical Skills Laboratory's teaching assistant observed the simulation and took note of the events during the simulation. He or she was not in the position to assess participant's performance during the simulation. At the beginning of the simulation, the teaching assistant attached a wrist heart rate monitor (Mio Alpha 2) on participant's non-dominant forearm to record participant's heart rate during the simulation.

Each participant underwent a clinical simulation session in the form of standardized patient encounters individually. The simulation session consisted of two consecutive cases from a pool of three cases that lasted approximately 15 minutes for both cases. In both cases, the participants were instructed to perform the intravenous catheterization procedure to the standardized patient's simulated arm (in the form of hybrid simulation). Case 1 involved additional stressors in the form of a challenging simulated patient while Cases 2 and 3 had no such stressor. A generic prompt for all case was written on a paper and attached to a table next to the standardized patient's bed (e.g., "Perform intravenous catheterization to administer saline to the patient."). The standardized patient was instructed to portray a case that corresponded to the treatment or control group in which the participant was assigned.

The clinical simulation session in this study was conducted as a standardized patient (SP) encounter with an intravenous arm trainer attached to portray standardized patient's left arm. The standardized patients were recruited from FM UGM's professional standardized patients bank. We provided the standardized patients with a written scenario for both the treatment and control groups and conducted rehearsals before the study. In this study, invited two male standardized patients from FM UGM standardized patients bank.

Simulation Treatment Group (STG)

In this group, we incorporated acute stressor into one of two cases. The stressor was a series of predetermined and standardized questions posed by the standardized patient to the participant when the IVC procedure was taking place. In the stress case (Case 1), the observer took note of the time when the standardized patient posed the questions.

Simulation Control Group (SCG)

Participants in this control group encountered cases with no additional stressor involved, i.e. no challenging question was posed during the simulation.

Immediately after the simulation session, each participant completed another set of STAI-AD Form Y-1 to capture the acute stress experienced during the simulation.

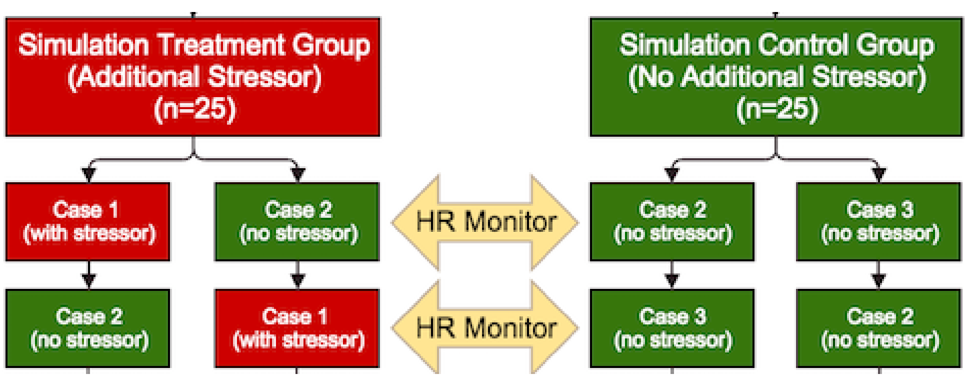

Figure 1. Flow of randomization to groups.

Post-simulation short-term performance assessment (Individual)
The participant was assessed on his or her short-term intravenous catheterization performance to measure short-term skill retention. The task and assessor in this test were the same to that on the pre-simulation performance assessment.

Post-simulation long-term performance assessment (Individual)
Twenty days after the first data collection, all participants were invited back to the Clinical Skills Laboratory to complete the last STAI-AD Form Y-1 and the post-simulation long-term performance assessment. An assessor assessed the participants on the same task as the pre-simulation performance assessment to yield the long-term skills retention score.

Material
State and Trait Anxiety Level
In this study, we utilized the State-Trait Anxiety Inventory for Adult (STAI-AD) Forms Y-1 (State) and Y-2 (Trait) to assess participants' activation of anxiety and their baseline anxiety level. This inventory was developed by C. Spielberger, R. Lushene, and R. Gorsuch that has been validated to measure both state and trait anxiety about a particular event. It consists of 20 statements for assessing state anxiety (i.e. anxiety at the given moment) (Form Y-1) and another 20 for trait anxiety (Form Y-2) (Gros, Simms, Antony & McCabe, 2007).

Physiologic Response of Stress
We used heart rate as a proxy of physiologic response of stress. The heart rate was measured using wearable heart-rate monitors MioAlpha 2 (© Mio Global) to continuously record heart rate fluctuation of participants during the simulation. A prior version of this device has been utilized in previous studies for a similar purpose (Bong, Lightdale, Fredette, & Weinstock, 2010). The heart rate was monitored in real-time using the device's app on the research team's iPad (© Apple Inc.) and downloaded from the device using Heart Rate Variability Logger app on the iPad.

Skills Performance
This performance adapted the standardized Intravenous Catheterization Checklist that was used in FM UGM's Objective Structured Clinical Examination. The checklist consisted of 26 items, step-by-step procedure that was developed by the Life Support Teaching Team at FM UGM Clinical Skills Laboratory. Each item was scored on a three-point scale, labeled as "0-not performed, 1-performed less satisfactorily, 2-performed satisfactorily".

Statistical Analysis
Sample size calculation for this study was determined by convenience. All data were analyzed with STATA/MP 14 (Stata Corp., College Station, TX) and IBM SPSS Statistics Version 23 (IBM Corp., Armonk, NY). Quantitative analysis was performed to analyze the data gathered during the study. Group characteristics and demographics was explored. Order effects of scenario presentation were tested (these were counterbalanced – see study protocol diagram in Appendix 1).

The main analyses consisted of a two-way (2x3) Mixed Analysis of Variance (ANOVA) to test for differences between the groups (treatment v. control) on skills at three intervals (pre-simulation, shot-term post-simulation, long-term post-simulation). This was intended to enable main effects of grouping and retention interval to be identified and also detect any interactions that may explain differences in the impact of acute stress on short and long term skills retention.

CHAPTER 3. RESULTS

Demographic characteristics

The two groups were matched in their demographics characteristics. Participants were 45 medical students (80% female) assigned to two groups. The control group was composed of 19 females and three males while the treatment group consisted of 17 females and six males.

	Control (n=23)	Treatment (n=22)	*p*-value
Female	20 (87%)	16 (73%)	0.25
Age (years)	19 ± 0.67	19 ± 0.58	0.81

Table 1. Comparison of demographic characteristics

Baseline data

Baseline heart rate and trait anxiety scores were similar between groups as shown in Table 2.

	Control (n=23)	Treatment (n=22)	*p*-value
Baseline heart rate (bpm)	85.7 ± 11.4	87.3 ± 10.8	0.64
Trait anxiety score (20-80)	40.6 ± 6.3	42.8 ± 6.2	0.24

Table 2. Comparison of baseline heart rate and Trait Anxiety scores.

Skills performance and anxiety scores

	Control (n=23)	Treatment (n=22)	*p*-value
Skills score, pre-simulation (0-100)	96.7 ± 2.9	95.8 ± 3.5	0.38
Skills score, short-term (0-100)	97.2 ± 3.0	97.9 ± 2.3	0.35
Skills score, long-term (0-100)	94.4 ± 3.9	93.5 ± 3.6	0.45
State anxiety score, pre-simulation (20-80)	40.8 ± 8.1	42.0 ± 8.6	0.63
State anxiety score, short-term (20-80)	40.9 ± 11.7	40.4 ± 9.4	0.85
State anxiety score, long-term (20-80)	38.7 ± 8.3	40.9 ± 8.4	0.38

Table 3. Comparison of skills performance and State Anxiety scores

Average heart rate, maximum heart rate, and time to finish.

The average heart rate and maximum heart rate for combined consecutive cases in the simulation showed no difference between treatment and control groups. Time needed to finish were also similar between groups.

	Control (n=23)	Treatment (n=22)	*p*-value
Ave. heart rate (bpm)	105.4 ± 11.5	109.4 ± 13.0	0.29
Max. heart rate (bpm)	125 ± 14.2	128 ± 13.9	0.49
Time to finish (seconds)	425.5 ± 51.6	434.8 ± 71.0	0.62

Table 4. Comparison of average heart rate, maximum heart rate, and time to finish.

Average and maximum heart rate when compared between control group, non-stress followed by stress group (NS-S), and stress followed by non stress group (S-NS).

There was a significant difference of average and maximum heart rate in those in the stress case (Case 1) of S-NS group (121.5 ± 13.7; 136.3 ± 12.6)) compared to participants in the first case of the control group (106.7 ± 10.5; 124.3 ± 13.8) (p=0.009; p=0.026).
The difference in average and maximum heart rate of the first case compared to the second case were significant in the S-NS (p=0.07; p=0.012) and control group (p=0.03; p=0.005).

Interaction between groups and skills performance score over time

We performed two-way mixed ANOVA to find interaction between groups and time on skills performance scores. There was homogeneity or variances ($p > .05$) and covariances ($p = 0.39$), as assessed by Levene's test of homogeneity of variances and Box's M test, respectively. Mauchly's test of sphericity indicated that the assumption of sphericity was met for the two-way interaction, $\chi^2(2) = 0.04$, $p = 0.98$. There was no statistically significant interaction between the intervention and time on skills performance scores, $F(2, 84) = 1.231$, $p = 0.297$. The main effect of time showed a statistically significant difference in mean skills performance scores at the different time points, $F(2, 84) = 20.5$ $p < .0005$.

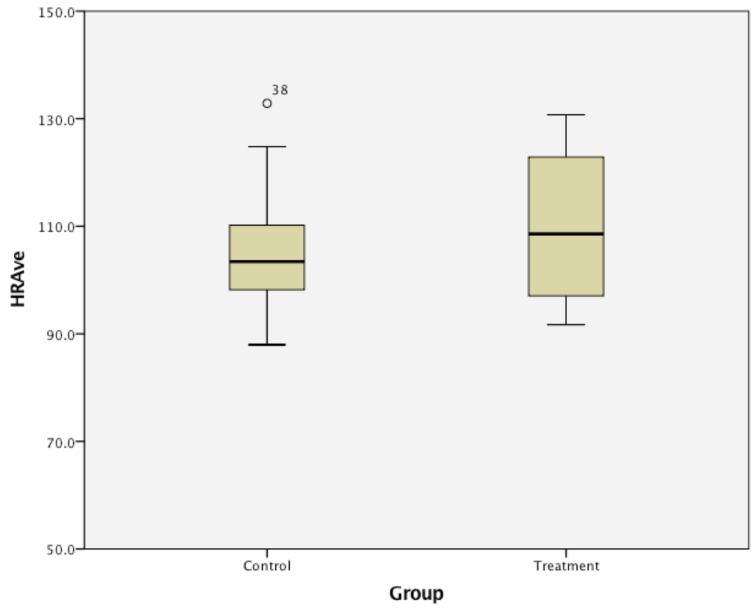

Figure 2. Average heart rate measurement between groups.

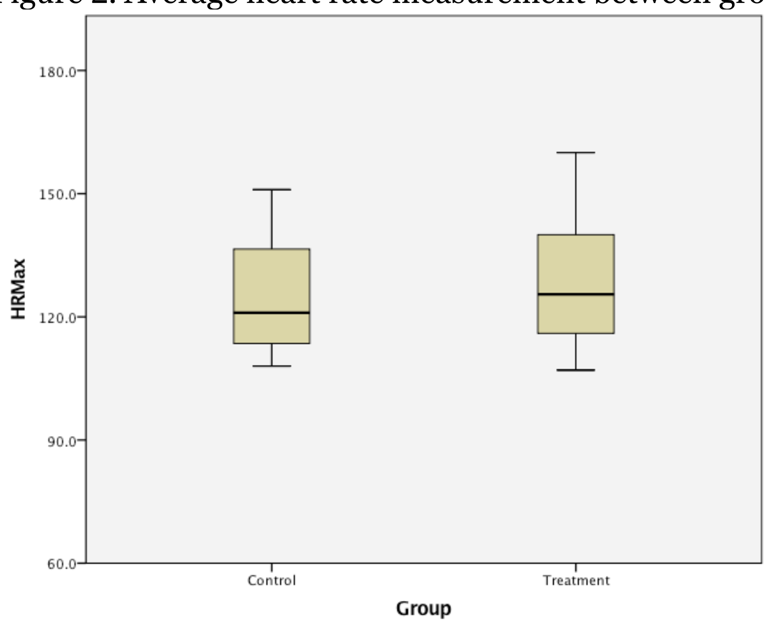

Figure 3. Maximum heart rate measurement between groups.

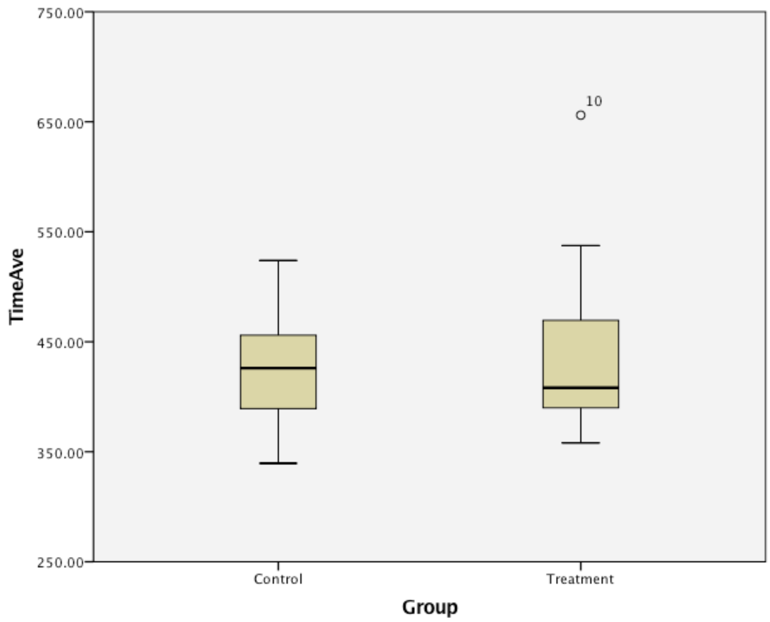

Figure 4. Average time needed to finish cases between groups.

CHAPTER 4. DISCUSSION

In this study, we sought to investigate the impact of acute stress during clinical simulation session on medical students' short- and long-term retention of intravenous catheterization skills. Psychomotor skills will decay over a progression of time as shown by several studies. However, we hypothesized that acute stressors will improve skills retention so that the skills decay would be less than those without such stressors. In this study, we were not able to prove this hypothesis.

We found no significant difference between treatment (stress) and control (non-stress) groups for both the short-term and long-term skills performance scores. Although we observed significantly higher physiological responses (as shown by average and maximum heart rate) in the Case 1 of S-NS group as compared with the control cases, we did not find any difference of skills performance scores in both short- and long-term. This significant difference might suggest participants' adaptation to the simulation environment. The use of heart rate as a proxy for physiological stress did not yield difference between both groups, as well as the State-Trait Anxiety Inventory. We deliberately did not use time pressure as part of the simulation to minimize added stressors to the participants trying to finish the task as showed in other study (van Galen & van Huygevoort, 2000). We found that the time taken to complete the task was no different between both groups.

The presence of observers during simulation session might have contributed to the anxiety level of participants. This is in line with other study that showed stress-related behaviors (Andreatta, Hillard, & Krain, 2010).

There were some limitations to this research. One limitation was the small sample size of pre-clinical medical students that might not have sufficient power to show any difference between groups. A larger sample may be required to demonstrate this difference. Another issue is that the presumed challenging questions posed by the standardized patients might have not triggered the level of stress adequate to make a difference between groups. The Modified Peyton's Approach that we used for training the skills was a novel method introduced only for this study. There was an opportunity for each participant to provide instructions to another participant. This might have served as a warm-up and provide more a vivid memory of the procedure through mental imagery process as suggested by Weller in 2016. Selection bias might be introduced by using convenient sampling method to attract voluntary participation in this study.
The use of self-administered State-Trait Anxiety Inventory may be vulnerable to error if the students fail to respond truthfully. Although we had explained to the participants about the items in the inventory, the use of English might have caused difficulties as it is not the native language of the participants.

Conclusion

In summary, our study suggests that the use of challenging questions by standardized patients as acute stressors during clinical simulation does not contribute to short-and long-term clinical skills retention as shown by participants' skills performance score. Future studies are needed to determine the benefit of using acute stressors during simulation to improve retention of novice learners such as medical students.

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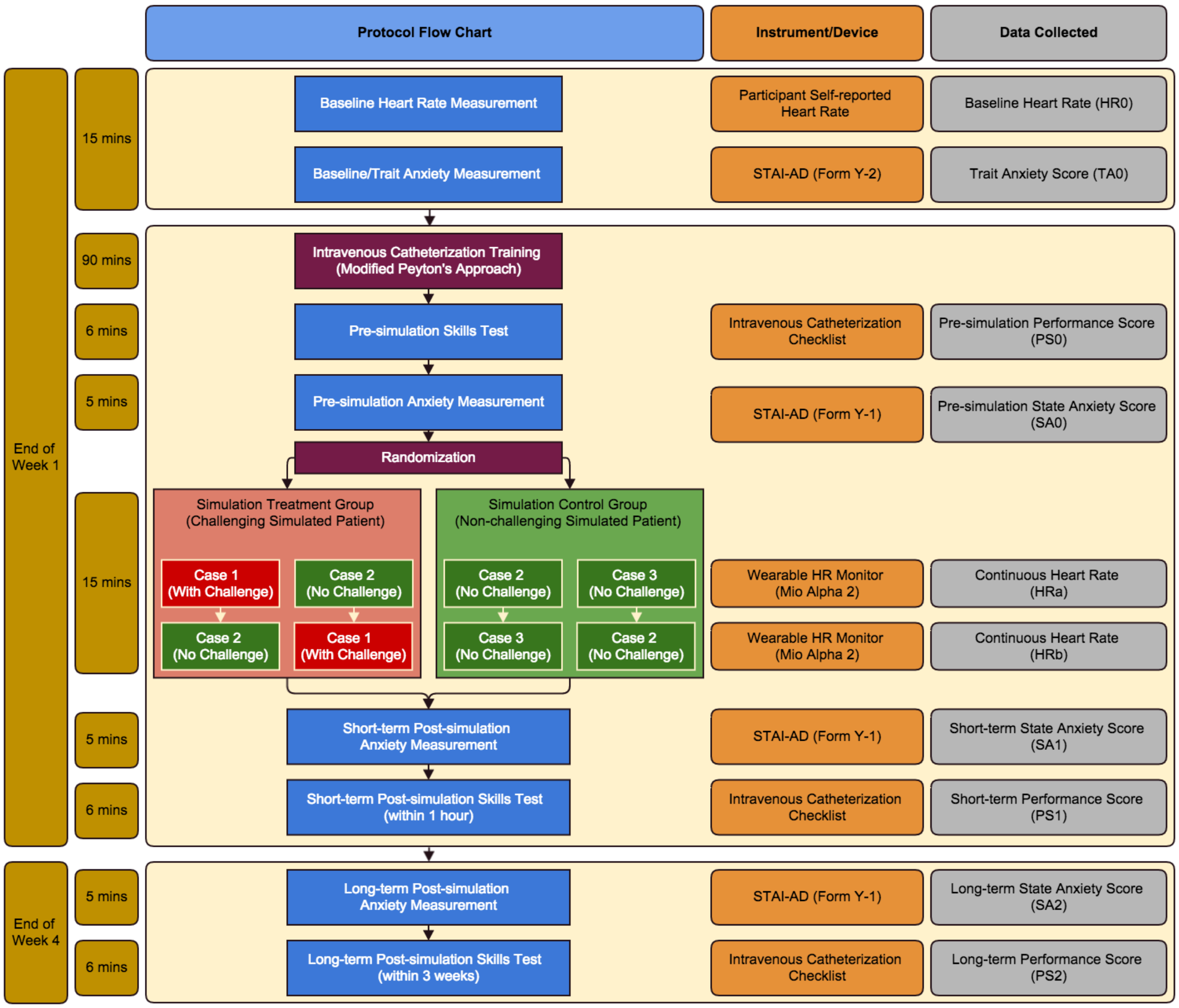
APPENDICES

Appendix 1

Study Protocol Flow Chart



Appendix 2

STANDARDIZED PATIENT INSTRUCTIONS

This instruction is a translated version from Bahasa Indonesia (the native language used in the simulation).

A research staff will inform you which case you should portray before every session starts. If you have any doubt about the scenario or see anything alarming about the participant, let the observer know by waving your hand.

PATIENT INFORMATION:

Name : Mr. Sujono
Age : 27 y.o.
Occupation : Factory worker
Marital Status : Single
Address : Jalan Supeno No. 12, Yogyakarta
You are about to receive fluid infusion therapy. This encounter is a procedural skills simulation. No history taking will be conducted by the participant.

Do not add or remove any part of the scenario.

STRESS

NO	ASK WHEN PARTICIPANT IS...	PHRASE (Do not modify the wording)
1.	Consenting you for the procedure.	How many times have you performed this procedure doc?
2.	Attaching the tourniquet.	You need to tie my arm? It will be painful then doc? I am worried..
3.	Looking for puncture site.	Do you have trouble finding my vein? What should I do then?
4.	About to puncture your skin.	Doc, be gentle. I know it's painful. Ouch, it hurts.
5.	Connecting the tube to catheter	Why does it take you so long to finish this?
6.	Secure the tube with tape.	Are you sure it's done? Nothing else, right?

NON STRESS

NO	SAY WHEN PARTICIPANT IS....	PHRASE (Do not modify the wording)
1	Consenting you for the procedure.	Please be careful doc.
2.	About to puncture your skin.	Please be gentle doc.
3.	Secure the tube with tape.	Thank you doc.

Appendix 3

Intravenous catheterization checklist

NO	PROCEDURE	SCORE		
		0	1	2
1.	Obtain verbal consent			
2.	Position the patient in the supine position and support patient's non-dominant arm			
3.	Wash hands			
4.	Put gloves on			
5.	Open the infusion set, close the regulator			
6.	Pierce the outflow point on the plabottle's rubber cap			
7.	Hang the infusion plabottle at the infusion stand and fill half of the drip chamber			
8.	Open the regulator to allow infusion fluid to fill the tubing until no air bubble left			
9.	Identify and select the appropriate vein			
10.	Tie the tourniquet 8-10 cm proximal to the targeted insertion site			
11.	Wipe the site with alcohol swab and allow it to air dry			
12.	Stabilize the vein by applying manual traction on the skin			
13.	Insert the catheter with bevel facing upward at an angle of approx. 30° to the skin			
14.	Push the nylon part when a flashback of blood is visible within the blood chamber			
15.	Release the tourniquet			
16.	Remove the needle from infusion set			
17.	Remove the needle from intravenous catheter			
18.	Attach the intravenous fluid tubing to the catheter			
19.	Start the fluid infusion flow			
20.	Cover insertion site with gauze			
21.	Secure the catheter with tape			
22.	Loop the intravenous tubing and secure it it with tape			
23.	Adjust flow rate			
24.	Remove gloves			
25.	Wash hands			
26.	Report that the procedure is complete to the patient			
	Subtotal			
	TOTAL			

Appendix 4

Permission to use State Trait Anxiety Inventory instrument.

For use by Mohammad Adrian Hasdianda only. Received from Mind Garden, Inc. on December 18, 2015

mind garden

www.mindgarden.com

To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material;

Instrument: ***State-Trait Anxiety Inventory for Adults***

Authors: ***Charles D. Spielberger, in collaboration with R.L. Gorsuch, G.A. Jacobs, R. Lushene, and P.R. Vagg***

Copyright: ***1968, 1977 by Charles D. Spielberger***

for his/her thesis research.

Five sample items from this instrument may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any other published material.

Sincerely,

Robert Most
Mind Garden, Inc.
www.mindgarden.com