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RESEARCH ARTICLE

Assessment of the Effectiveness of Simulation and Recitation Training for Traffic Control Volunteers (Supeltas) on Cervical Spinal In-Line Position Stabilization with Helmet Removal Maneuvers

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Abstract

Motor vehicle traffic accidents are a leading cause of death for an individual in Indonesia. This study aimed to evaluate the effectiveness of training using simulation and recitation models focusing on the achievement of the pre-hospital performance of traffic-control volunteers (*Supeltas*) in stabilizing cervical spinal in-line position in helmet removal maneuver. This study applied pre-test and post-test design with 248 respondents. Data were collected using questionnaires and evaluation papers to assess volunteers during practical tests. Data statistical analysis procedures included One-Way ANOVA, Wilcoxon-signed rank test, and N-gain score test. Differences were noted in the demographic data with significant findings and effects associated with age (p= 0.041) and education (p= 0.046) of *Supeltas* in stabilizing the cervical spine. The intervention group exposed to SMT training model showed a difference in the average scores of knowledge (mean 60.85 to 85.67; p= 0.010) and skills (mean 59.80 to 86.81; 0.002), which were greater than the scores of the group receiving RMT (mean 53.65 to 65.06; p = 0.028) and skills (mean 59.20 to 84.73; p= 0.043). The knowledge (N-gain score = 61.35%) and skills (N-gain score= 61.41%) of the group receiving a role-playing model (SMT) increased more effectively, compared to the increase experienced by the group receiving an assignment (RMT) (N-gain score knowledge= 23.57%; skills= 17.29%). This study suggests that the simulation model is more effective than the recitation model in improving the ability of *Supeltas* in stabilizing the cervical spinal in-line position for helmet removal in trauma situations.

Keywords: *Recitation, Simulation, Stabilization, Training.*

Introduction

Increasing traffic density on Indonesia's highways is directly associated with an increase in motor vehicle traffic accidents involving motorbikes, buses, pick-up trucks, commercial semis, and public transportation. World Health Organization in 2018 reported 1.35 million are killed annually in motor vehicle accidents [1]. In other words, one person dies in a motor vehicle accident every 24 seconds. Furthermore, in Indonesia, highway traffic accidents are the leading causes of death for individuals between 5 years and 29 years of age. The Ministry of Health identified factors contributing to the high rate of motor vehicle accidents; specifically, human factors (61%), driver's capacity and character, vehicle malfunction (9%), and environmental infrastructure (30%) [2]. A study by Saputra in 2017 explained that the highest incidence of road traffic accidents in Indonesia occurred in West Java with 22 deaths (34.4%, followed by East Java with 13 deaths (20.3%), and then Central Java with 6 deaths (9.4%). The majority of motor vehicle accidents (80%) took place among adolescents and young adults between 15 years and 30 years [3].

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Singh, Singh, Gupta, and Kumar in 2014 reported the pattern and severity of injuries due to traffic accidents, revealing that men were more often victims of accidents than women and the majority of victims were in the age group of 20-30 years [4]. The area of the body most frequently injured was the extremity, followed by the maxillofacial region. Of the total types of injuries, the most common were laceration, abrasion, and bruising. The upper torso (head, neck, spinal column) were the most commonly impacted (41.1%) followed by fractures in the lower extremity (tibia, fibula) [5.8%]. Subsequently, deaths occurred with 17 victims (4.7%) while 46 patients (12.7%) were discharged from the medical facility [5].

Following the initial preliminary assessment, first responders should complete and administer measures to implement the ABCs of emergency care (airway, bleeding, and circulation). Successively, the victim must be stabilized before being transported to the nearest emergency center. The first responder has an important role in the response time of fewer than 10 minutes in providing basic life support and pre-hospital first aid to motor vehicle accident victims on the road [6].

Recommended the importance of having community-based first responders who are properly educated and trained to effectively provide basic life support and first aid to victims of motor vehicle accidents. The time limit in pre-hospital care of injured patients is 10 minutes from the time of injury to receive definitive treatment [7].

Supeltas (traffic control volunteer) is a volunteer from the community who helps the police as the first responder who often finds victims of motor vehicle accidents, then provides first aid to stabilize the victims before being transported to the emergency center. *Supeltas* play an important role in assisting police officers to regulate traffic at pedestrian crossings and other heavy traffic areas [8]. They have a vital role in starting first aid measures before an ambulance or medical team arrives at the site.

In the case of a motorcycle accident, the proper and urgent helmet release procedure is one of the most important first aid measures undertaken by *Supeltas*. However, community volunteers must be educated and trained with practical skills to become proficient in performing a safe maneuver in a trauma situation [9].Recommends that if there is no pre-hospital trauma care system, the first and most basic level of the system can be determined by teaching community members interested in basic first aid techniques. They can be taught to recognize emergencies, ask for help, and provide care until formally trained.

Updating learning resources and applying appropriate knowledge transfer methods through training can create a fun and effective learning process to achieve the expected goals. The results of previous studies have suggested that the manikin simulator algorithmic simulation model can improve practice or skills and assess accordingly in an emergency.

This method is suitable for educating people about basic life support techniques in emergency management of trauma [10]. Other results suggest that the recitation model is effective in cooperative learning groups with instructors for working participants [11].

This study compares the effectiveness of simulation models (the method of presenting training materials using artificial situations/role-playing to understand certain concepts, principles, or practice/skills); versus the recitation (assignment) training model (a method of presenting training materials where the trainer assigns scenarios so that participants perform good learning activities in the classroom, schoolyard, laboratory, library or workshop, wherever the assignment is carried out.

Materials and Methods

Design

This study applied a design, in which two groups of subjects were assigned at random basis. The first group received treatment or intervention using a simulation training model with role-playing. The second group (control group) was exposed to the recitation model with an assignment. This study employed pre-test and post-test. A pre-test was carried out to measure the level of preliminary knowledge of subjects in both groups. After participants took part in a training model focusing on safe spinal stabilization and fast helmet release

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procedures, they were given a post-test to assess their levels of knowledge and practices or skills.

Protection of Human Subjects

Protection of human subjects included IRB approval from the General Hospital Health Research Ethics Committee of Dr. Moewardi Hospital, Sebelas Maret Medical School, Surakarta, No. 696/V/HERC/2019. A written consent form was obtained from all volunteers (N=240 males). Along with a detailed explanation of the methodology expectations, anonymity, and confidentiality were addressed in the written will consent.

Subject Recruitment

Subjects were recruited among *Supeltas* who had been appointed and received permission from the Surakarta City Police. Inclusion criteria included men, aged ranging from 21 to 60 years as members of Supeltas, working in the city of Surakarta in Indonesia, and were able to read and write. Using a computer-generated program, subjects were randomly divided into two groups. The first group (n = 124) participated in a training intervention on helmet removal procedures using a simulated training model (SMT) with role-playing. The second group (n = 124) took part in the recitation training model (RMT) with an assignment. The educational interventions were conducted by nurses for improving the proficiency of the participants.

The subjects participated in four-weekly training sessions. Subsequently, this was followed up by eight weeks of supervised sessions in the field of practical experience. The subject recruitment procedure is summarized in Figure 1.

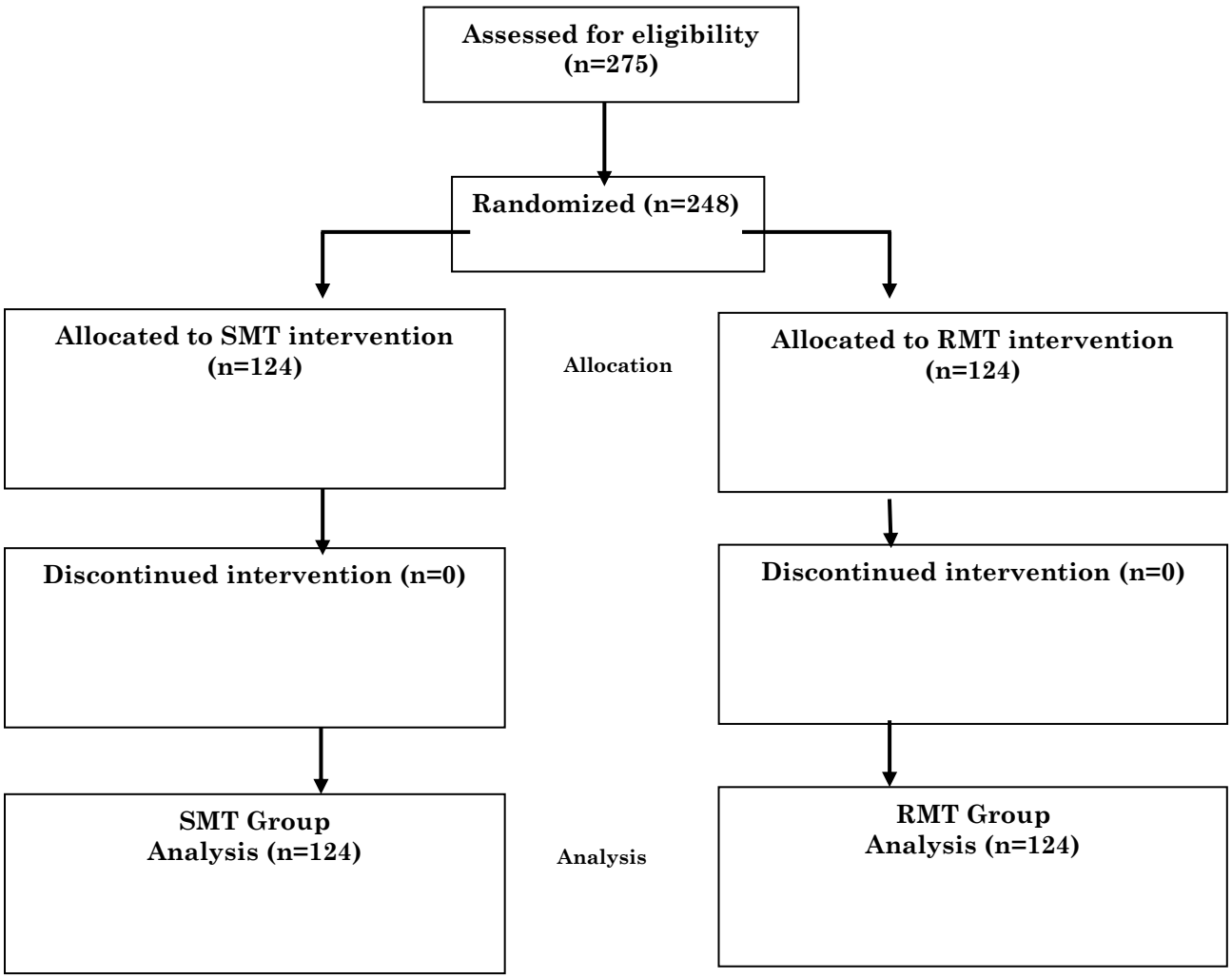

Figure.1: Subject recruitment

Description Intervention

Training content was developed according to the training objectives, training materials, and training slides for both the SMT and RMT models.

The recitation model covered the following activities: cycle I (pre-test, dividing participants into four groups, each of which was facilitated by an instructor and given a reading copy of slides about helmet removal

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maneuver, to accompany or complete each group discussion), Cycle II (reporting the results of discussions both oral and written, as well as reporting the practice of each group), and Cycle III (post testing, field practice followed up by a supervisor).

The simulation model comprised the following activities: Cycle I (pre-test, eight-hour session of didactic content in class guided by expert nurses, in which participants were given a reading copy of all for completing each goal, five interactive case studies facilitated by an instructor, simulations on high-manikin fidelity with computer-generated algorithmic scenarios, and action discussion processes), Cycle II (reporting the results of discussions both oral and written, as well as reporting the practices), and Cycle III (post-testing, field practice followed up by a supervisor).

Instrument

Data for this study were collected using evaluation instruments consisting of a questionnaire and a list of skills. The questionnaires contained 30 questions about knowledge on removing helmets developed by researchers. The questions were regarding the environmental safety, assessing awareness, assessing the victim's airway, breathing, circulation status, bleeding, positioning the victim's head, unlocking the helmet/face shield, and installing an immobilization device.

The questionnaires used the Likert scale with the following scores and categories, 5 for 'strongly agree', 4 for 'agree', 3 for 'somewhat disagree', 2 for 'disagree', and 1 for 'strongly disagree'. The instruments were tested to 30 respondents and resulted in the correlation among items of knowledge on helmet removal maneuver of 0.37 (Cronbach's alpha = 0.93).

Checklist sheets of skills consisted of 22 skills, including savior positions, neck and mandibular position of the victim, helmet unlocking techniques, stabilization, immobilization, and evaluation of the patient's condition. The skills were measured with the score 1 for 'yes' and 0 for 'no'. The helmet transfer maneuvering skill evaluation tool was adapted from [12].

Statistical Test

The statistical tests were performed using a descriptive statistical test, One-Way ANOVA, Wilcoxon-signed rank test, and N-gain score test (N-Gain score <40 is ineffective; 40-55 is less effective; 56-75 is quite effective, and > 75 is effective) with 95% significance level.

Results

Demographic Characteristics

In the simulation group, the mean age of the subjects was 2.85 ± SD 0.84 with a minimum age of 21 and a maximum age of 60 years. The average subject's level of education was 1.65 ± SD 0.86 with elementary school education at minimum and senior high school education at maximum. The subject experience as an average volunteer was 1.27 ± SD 0.44 with a minimum experience of 0-5 years and a maximum experience of 6-10 years. The average subject experience of training was 0.53 ± SD 0.50.

Meanwhile, in the recitation group, the mean age of patients was 2.71 ± SD 0.85. The average level of subject education was 1.73 ± SD 0.76. The average subject experience was 1.16 ± SD 0.36. The average experience of attending the training was 0.63 ± SD 0.48. The differences in demographic characteristics of the subjects in the intervention and control groups are summarized in Table 1.

Table 1: Demographic characteristics of the subjects in all the groups

Characteristics	SMT				RMT			
	Mean	SD	n	%	Mean	SD	n	%
Age								
21-30 years			4	3.2			8	6.5
31-40 years	2.85	0.84	42	33.9	2.71	0.85	44	35.5
41-50 years			46	37.1			48	38.7
51-60 years			32	25.8			24	19.4
Education								
Elementary school			76	61.3			58	46.8
Junior high school	1.65	0.86	16	12.9	1.73	0.76	42	33.9
Senior high school			32	25.8			24	19.4
Experience as a volunteer								

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0-5 years			90	72.6			104	83.9
6-10 years	1.27	0.44	34	27.4	1.16	0.36	20	16.1
>10 years			0	0			0	0
Experience in attending training on trauma emergency management								
Has not attended any training	0.53	0.50	58	46.8	0.63	0.48	46	37.1
Has attended training			66	53.2			78	62.9
n =248			124				124	

SD= standard of deviation; n= sample
SMT= simulation model training; RMT= recitation model training

The differences in Knowledge and Skills based on Age, Education, and Experience in Attending Training on Emergency Management

The results of a one-way ANOVA statistical test comparing the two groups have depicted significant differences between age (p= 0.046) and education (p=0.041) in the knowledge of in-line position stabilization with helmet removal procedures. However, the experience of volunteering and participating in emergency management training did not show any significant difference in the knowledge and skills of in-line position stabilization and helmet removal procedures. The differences between knowledge and skills regarding helmet removal maneuvers based on age, education, and experiences following emergency management training are presented in Table 2.

Table 2: Differences in knowledge and skills based on demographic characteristics

Field	Sum of Squares	df	Mean Square	F	p-value
Age					
* Knowledge					
Between groups	36.106	36	1.003	1.489	.046
Within groups	142.136	211	.674		
Total	178.242	247			
* Skill					
Between groups	31.391	36	.872	1.372	.089
Within groups	134.077	211	.635		
Total	165.468	247			
Education					
* Knowledge					
Between groups	36.449	36	1.012	1.507	.041
Within groups	141.793	211	.672		
Total	178.242	247			
* Skills					
Between groups	28.589	36	.794	1.224	.192
Within groups	136.879	211	.649		
Total	165.468	247			
Experience as a volunteer (in years)					
* Knowledge					
Between groups	5.295	36	.147	.840	.728
Within groups	36.947	211	.175		
Total	42.242	247			
* Skills					
Between groups	6.969	36	.194	1.158	.260
Within groups	35.273	211	.167		
Total	42.242	247			
Experience in attending training on emergency management					
* Knowledge					
Between groups	11.988	36	.333	1.452	.057
Within groups	48.399	211	.229		
Total	60.387	247			
* Skills					
Between Groups	11.914	36	.331	1.441	.061
Within Groups	48.473	211	.230		
Total	60.387	247			

DF= degrees of freedom

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Knowledge and Skills of Traffic-control Volunteers

Table 3 demonstrates the average score of knowledge of *Supeltas* assessed immediately after training. There was a significant difference in score for the SMT group, increasing from an initial average of 60.85 to 85.67 (p = 0.010). The average knowledge score for the RMT group increased from 53.65 to 65.06 (p = 0.028). The average score of *Supeltas* was assessed immediately after training. There were significant differences in scores, increasing from 59.80 to 86.81 (p = 0.002) for SMT group and increasing from 59.20 to 84.73 (p = 0.043) for RMT group. The results of this study suggested that *Supeltas* from SMT group who were exposed to simulation-based training on helmet removal procedures for motor vehicle accident victims showed a higher level of knowledge and skill scores compared to *Supeltas* from the control group (RMT).

Table 3: The differences in knowledge and skills of helmet removal maneuver based on Wilcox on-signed rank test

Field	Timepoint	SMT		RMT	
		Mean	p-value	Mean	p-value
Knowledge	Pre-test	60.85	0.010	53.65	0.028
	Post-test	85.67		65.06	
Skills	Pre-test	59.80	0.002	59.20	0.043
	Post-test	86.81		84.73	

Comparison between SMT and RMT

Table 4 demonstrates that the SMT group experienced a quite effective increase in the knowledge about the helmet removal procedures, with N-gain score = 61.35%; 15.38% at minimum and 91.94% at maximum, compared to the RMT group, which was categorized ineffective in improving, with N-gain score = 23.57%; 3.33% at minimum and 58.46% maximum. The scores of skills after training uncover that the SMT group was quite effective for improving the skills in stabilizing the position of the cervical spine with helmet removal maneuvers, indicated by N-gain score = 61.41%; 20% at minimum and 90% at maximum, compared to the RMT group, specified by N-gain score = 17.29%; 3.70% at minimum and 59.68% at maximum. Thus, SMT is quite effective in increasing knowledge and practical skills in stabilizing the position of the cervical spine with helmet removal maneuvers than RMT.

Table 4: N-Gain score effectiveness of simulation and recitation model training

Field	SMT			RMT		
	N-Gain Score	Minimum	Maximum	N-Gain Score	Minimum	Maximum
Knowledge	61.35%	15.38%	91.94%	23.57%	3.33%	58.46%
Skills	61.41%	20%	90%	17.29%	3.70%	59.68%

Discussion

The results of this study unearth significant differences between age and education dealing with the knowledge on in-line position stabilization with helmet removal procedures. One can speculate that these findings may be related to experience and have served as a longer period and the role of *Supeltas*. In other words, older age allows cognitive maturity, as well as more opportunities for experience and real-world experience. This discovery is following the findings of a previous study, which explains that older age is positively associated with first aid knowledge and positive attitude [13]. Besides, it is likely related to information previously obtained by volunteers through education. Furthermore, the higher the level of education that *Supeltas* have, the higher the knowledge of the procedure for removing the helmet they comprehend.

These findings are consistent with the result of previous research, which explicates that being a health science student and college is the only factor that has a statistically significant relationship with a better level of first aid knowledge [14]. This outcome is consistent with the finding of previous research that statistically significant differences were found between the level of education of nurses and the total average score of knowledge about basic life support. Higher levels of education and sources of knowledge about first aid are significant

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predictors of cognitive, affective, and better practices or skills. Educational status and exposure to previous information are considerably related to the knowledge of basic life support [15, 16]. This finding is corresponding to the result of previous research that education level is a major determinant of knowledge about the disease and its transmission, as well as attitudes and practices or skills, particularly those involving community efforts to control disease [17].

The results of the present study discovered that *Supeltas* from the intervention group who were exposed to simulation-based training with role-playing on helmet removal procedures showed a higher level of knowledge and skills scores compared to the control group with the reading model. We can conclude that differences in mean scores are obtained and made possible because the training of the simulation model is more interactive, emphasizes the participants' activeness in problem-solving, accentuates the problem of an event, and stimulates active involvement of participants and instructors. With training using simulation models, *Supeltas* are more motivated to relearn materials that have been obtained in class, and thus, they have more opportunities to expand and broaden their knowledge and skills.

This is in line with the result of the previous study that the simulation scenario in training increases first aid if a simulated accident occurs. Simulation-based teaching has the potential to increase students' knowledge about anatomic coronary heart disease, angiographic projections, and interpretation of real clinical cases, demonstrating better clinical skills [18, 19].

The result of another study shows that there are significant differences in the average score of knowledge, confidence in performance, satisfaction with learning methods, and ability in nursing practices or skills. Pre-education with simulations noticeably improves student's knowledge, confidence in performance, ability in nursing practices or skills, and satisfaction with learning methods [20]. We found that the SMT was quite effective in improving the knowledge and practices of stabilizing the position of the spine with helmet removal procedures compared to RMT.

This is possible because the training of the simulation model that is used mimics the real situations that are oriented to the involvement of the active role of *Supeltas* in understanding the concepts, principles, or practices/skills of maneuvering the release of helmets. This training situation becomes more interactive and interesting so they are more active and motivated to take part. These findings are consistent with the results of previous studies that teaching simulators are more effective in increasing student knowledge and skill levels than traditional teaching methods.

Teaching with a simulation model is more effective in training skills than teaching with a conventional model [21, 22]. Other previous research findings reveal that simulation-based training increases confidence, understanding, clinical skills and assessment in clinical practice and emphasizes the importance of team communication and collaboration. This training can help in the acquisition of skills and increase confidence in managing acute care conditions [23, 24].

Based on these findings, it can be summarized that simulation-based training seems to be an effective method applied for volunteers. Also, the results exhibited that *Supeltas* from the intervention group who participated in a simulation-based training on the helmet removal maneuver showed a higher level of knowledge compared to the volunteers from the control group.

Apart from the small sample, and the relatively short time included in the research, based on the results obtained, it can be concluded that this training model can have a highly pivotal effect on the acquired knowledge and skills. Therefore, it would be fit to use it repeatedly in training procedures for removing helmets of accident victims. Moreover, it will be necessary to carry out further research on this topic because there are neither theoretical bases nor studies contribute to the greater and more effective use of this training model.

Conclusion

This study suggests that the simulation (role-play) model is more effective than the recitation (assignment) model to train *Supeltas* about the cervical spinal in-line position stabilization for helmet removal in trauma situations.

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