






# Development of First Aid Self-learning Web Application for Road Accident Victims

Chatkhane Peakao<sup>1</sup> , Wiphawadee Potisopha<sup>1</sup> , Kamonwon Ienghong<sup>2</sup> , Lap Woon Cheung<sup>3,4</sup> , Korakot Apiratwarakul<sup>2\*</sup> 

<sup>1</sup>Department of Adult Nursing, Faculty of Nursing, Khon Kaen University, Khon Kaen, Thailand; <sup>2</sup>Department of Emergency Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand; <sup>3</sup>Department of Accident and Emergency, Princess Margaret Hospital, Kowloon, Hong Kong; <sup>4</sup>Emergency Medicine Unit, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Pokfulam, Hong Kong

## Abstract

**BACKGROUND:** Knowledge of prehospital scene care for injured person in road accidents is essential for improving outcome and saving lives of traffic accident victims. However, the situation of the COVID-19 pandemic may cause people's inability to access in-person first aid training.

**AIM:** This study aimed to determine the effect of first aid self-learning web application for road accident victims on the knowledge and satisfaction of the web application users.

**METHODS:** A prospective, single-arm, and educational cohort study was conducted among second-year physical education participants at Khon Kaen University attending first aid self-learning web application for road accident victims in July 2021. All participants were attended ten lessons covering important content of first aid for an injured person in road accidents. Each lesson includes reading texts, 3-min animation videos, and pre-test and post-test. Data analysis includes a comparison of the pre-test and post-test knowledge scores using the paired t-test. The participant's satisfaction was analyzed using descriptive statistics.

**RESULTS:** The 42 participants were participated in this study. Sixty-two percent of the participants had no previous first aid experience for an injured person in road accidents. The mean pre-test and post-test scores were  $25.31 \pm 3.87$  and  $27.50 \pm 2.91$ , respectively. There was a significant difference between the pre-test and the post-test scores ( $p < 0.001$ ). The participant's level of satisfaction score was very good ( $4.25 \pm 0.95$ ).

**CONCLUSIONS:** The first aid self-learning web application significantly improved the first aid knowledge of the web application users. Moreover, most participants reported good level of satisfaction for using this tool. This emphasized that the first aid self-learning web application was the great tool in COVID-19 learning.

**Edited by:** Sasho Stoleski  
**Citation:** Peakao C, Potisopha W, Ienghong K, Cheung LW, Apiratwarakul K. Development of First Aid Self-learning Web Application for Road Accident Victims. Open Access Maced J Med Sci. 2022 May 15; 10(E):746-751. https://doi.org/10.3889/oamjms.2022.9608  
**Keywords:** First aid; Web-based learning; Prehospital; Traffic accidents; Injuries  
**\*Correspondence:** Korakot Apiratwarakul, Department of Emergency Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand. E-mail: korakot@kku.ac.th  
**Received:** 15-Mar-2022  
**Revised:** 28-Apr-2022  
**Accepted:** 05-May-2022  
**Copyright:** © 2022 Chatkhane Peakao, Wiphawadee Potisopha, Kamonwon Ienghong, Lap Woon Cheung, Korakot Apiratwarakul  
**Funding:** This study was supported by Khon Kaen University, Thailand. It is under the research project entitled development of a nursing system for trauma patients in the digital era in 2021.  
**Competing Interests:** The authors have declared that no competing interests exist  
**Open Access:** This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

## Introduction

Road accident injuries are a major cause of death and disability for many people worldwide. It is said that approximately 1.3 million people around the world die from road accidents every year, and about 20–50 million are injured yearly. According to these numbers, more than 93% of the people who died in road accidents came from low-income and middle-income countries [1]. The Global Situation of Road Safety reports that the mortality rate from road accidents in Thailand is as high as 83%. It is also found that the ages of the casualties between 10 and 29 years old are ranked first, whereas the estimated number from the World Health Organization is 32.7 people per 100,000 population. Thailand's mortality rate from road accidents is ranked ninth in the world and the first in The Association of Southeast Asian Nations: ASEAN member countries [2]. In terms of expenditures, more than 500 million Thai baht, or about 6% of gross domestic product: GDP, are spent on road accident casualties

and injured people [3]. The statistical reports of road accident injuries from the Information Technology for Emergency Medical System during the past 3 years in 2018, 2019, and 2020 suggest the number of injured people from road accidents was 10,526, 10,836, and 9,094/year, respectively [4].

Injured people from road accidents can be either more or less dangerous depending on the severity of the collision [5]. Major injuries are defined as internal bleeding of the lungs or abdomen, torn brain tissues or blood vessels, a large amount of external blood loss, arm or leg bone fractures, broken spines, damaged spinal cords, and sudden cardiac arrest caused by a collision. Minor injuries include abrasions, lacerations, and sprains [5], [6]. The injured person must be assisted with first aid regardless of the severity level of the accident in order to relieve symptoms and reduce the increasing severity that may occur, which can be life-threatening if not assisted in a timely manner [7]. The "bystander" is a great helper to the injured person in a car accident. Therefore, the bystander needs to have first aid knowledge and skills [8], [9]. First aid

knowledge and skills can be obtained through both formal training and self-learning [7], [10], [11]. People will gain a better understanding of preventing road accidents and assisting the injured if they are given first aid training [10]. Therefore, it is necessary to integrate an age-appropriate first aid intervention into the general population, especially in schools or colleges [11].

The previous studies [12], [13], [14] demonstrated the importance of first aid training especially for injured patients; however, those studies conduct as in-person training. At present, the information system has been developed to operate on mobile phones, facilitating individuality and convenience for people learning on their own. Furthermore, the Coronavirus disease-19 (COVID-19) pandemic situation has obstructed in-person training. As a result, the team created self-learning media in the form of a web application about first aid for people injured in car accidents which users can study the first aid knowledge by themselves. The long-term goal of this web based first aid learning is that people will be able to access the primary sources of first aid knowledge in anytime, anywhere, and conveniently refresh their knowledge. To the best of our knowledge, no prior studies in Thailand have evaluated this self-learning media. This study aimed to determine the impact of implementing this web application on the knowledge of university participants and evaluated their satisfaction.

## Methods

### Study design

A prospective, single-arm, and educational cohort study was conducted at Khon Kaen University, Thailand in July 2021. At present, Khon Kaen University is one of the leaders in academic training aiming at education transformation and centering sustainable development goals.

### Participants

Participants were 50 2<sup>nd</sup> year of physical education participants at Khon Kaen university who attended the first aid self-learning web application for road accident victims during July 1–31, 2021. Participants who did not attend this course were excluded from this study.

### Sample size

The sample size was calculated based on the following formula [15]. Based on the single arm study, we hypothesized that the difference of the pre-test scores and the post-test scores was moderate degree

following the previous study [15]. Hence, we determined at least 40 subjects would be required.

### Study protocol

The primary investigator explained the instructions for using the web application for first aid for an injured person in a road accident to the participants. The participants who were interested in participating in this study completed the consent form. Then, they completed the registration process for the web application and the pre-test of 33 items. The participants attended all ten lessons, equipped with 3D-animated videos by themselves. They were free to study independently for a period of 2 days. On completion of each lesson, the participants had to take the post-test for that lesson before moving on to the next lesson. Finally, the participants completed the evaluation survey about their satisfaction with using this web application.

In terms of pre-test and post-test, the questions consisted of 33 items covering the relevant content of ten lessons: (1) First aid for an injured person, (2) life and driving, (3) assessment of the injured person, (4) hemostasis, (5) resuscitation cardiopulmonary, (6) arm fractures and splints, (7) leg fractures and splints, (8) injured person with helmet, (9) transferring injured person, and (10) first aid for sprains.

The tests were in a multiple-choice format with four choices. Each correct answer was counted as one point, and the score ranged from 0 to 33. The higher scores indicated the high knowledge level of first aid for an injured person in road accidents. The tests were validated by the experts and revised accordingly to their comments.

In terms of an evaluation of the web application satisfaction, the survey consisted of 13 questions, including usability (4 items), suitability of design (4 items), beneficence (4 items), and overall satisfaction (1 item). The five-Likert scale was used, with "1" meaning the least satisfied and "5" meaning the most satisfied. At the end of the survey, an open-ended question was given for the participants to add comments and other suggestions regarding the web application.

### Data collection

Age, gender, first aid training experience, and first aid experience with an injured person in road accidents of participants were included in this study. Data from the web application were collected including pre-tests, post-tests, and satisfactory score of participants. Data were stored on the primary investigator's server with the secure network and password. The research team was extracted and reviewed these data from this web based.

### Data analysis

The STATA program version 15.1 was used to analyze the data. Descriptive statistics such as mean and standard deviation (SD) were used for the participants' characteristics and the level of satisfaction with using the web application. A paired T-test was used to compare the mean pre-test and post-test scores of knowledge's of first aid for an injured person in road accidents. The statistical significance was set at 0.05 (p-value).

### Ethical considerations

Ethical approval was provided by the Khon Kaen University Ethics Committee for Human Research (HE642064). The written inform consents were obtained from the participants before data collection. The participants were informed that participating in this study had no effect on their grades in the Basic First Aid Course and other courses at both faculty and university levels that they were enrolled in.

### Development of first aid self-learning web application for road accident victims

The researcher team and the programmer co-developed online learning media through a web application. It is a self-learning model of first aid for an injured person in road accidents. The domain name is "https://xn--h3cubnohw6hb.net/home" which consists of six parts as follows (Figure 1):

- 1) Registration: The registration and the pre-tests included in each lesson allow participants to regulate their self-learning pace without a time limit.
- 2) Lessons: The learning content was compiled from reviewing previous literature and validated by experts in the field. The ten lessons consist of 3D animations illustrating knowledge of performing first aid with the injured person in

road accidents. The ten lessons include first aid for an injured person, life and driving, assessment of the injured person, hemostasis, resuscitation cardiopulmonary, arm fractures and splints, leg fractures and splints, injured person with helmet, transferring injured person, and first aid for sprains.

- 3) Test: The post-tests were provided at the end of each lesson. As a requirement, participants have to pass the post-test before moving on to the next lesson.
- 4) Certificate: Participants will receive a certificate after learning about first aid techniques for an injured person in road accidents. Participants must complete all the post-tests for each lesson with a minimum grade requirement of 80% pass.
- 5) Satisfaction evaluation: The evaluation form for satisfaction with the web application contains multiple choices and open-ended responses for additional descriptions.
- 6) Other information: News and information about accidents, the question-and-answer board, and the hotline number 1669 of the Emergency Medical Service (EMS) are provided.

The electronic devices for accessing this web application must support the website with high-speed internet since the web application contains graphics and animations using HTML5 technology. Learners were able to obtain a certificate when they had learned first aid techniques for injured people in road accidents and passed the post-tests for each lesson with a minimum requirement of 80% (Figure 2).

### Results

A total of 50 2<sup>nd</sup> year of physical education participants were registered in the basic first aid course.

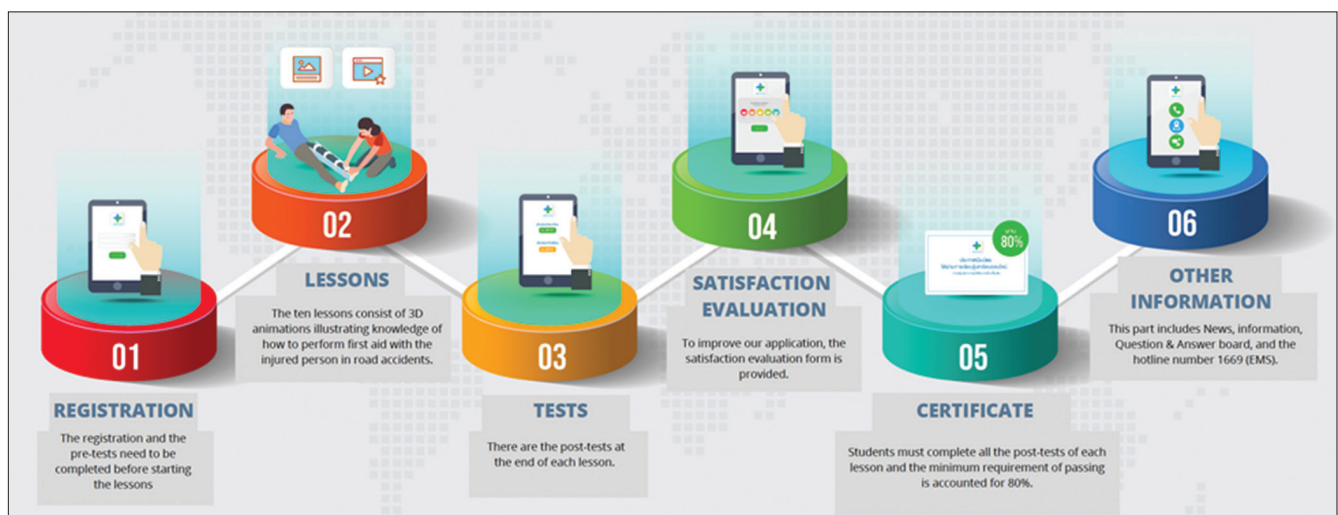


Figure 1: The six components of first aid self-learning web application for road accident victims

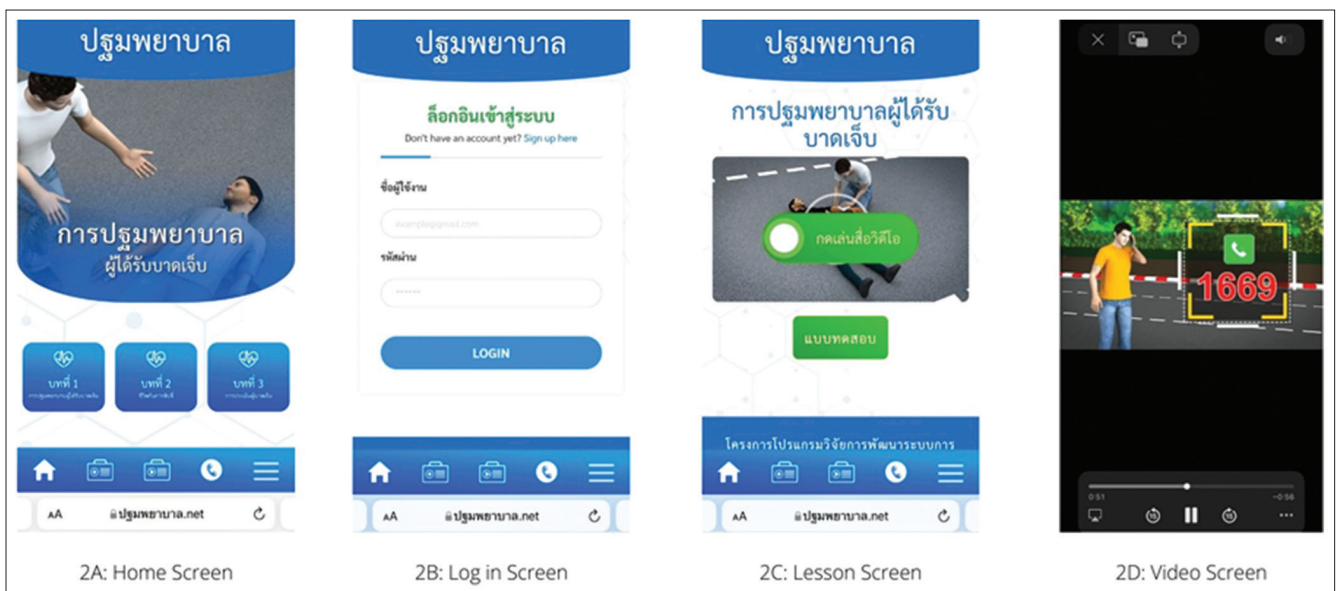


Figure 2: Screen of first aid self-learning web application for road accident victims

Of these, 42 participants volunteered to participate in this study and completed the first aid self-learning course. The characteristics of which are shown in Table 1. The sample group consisted of 71.43% males and 28.57% females. The average age of the participants was 20.68 years. About 52.38% of the voluntary participants had experience in first aid training for an injured person in road accidents, and 28.57% had first-hand experience in assisting an injured person in road accidents.

Table 1: The general information of study participants (n = 42)

General information	Number	Percentage
Age, average (year)	20.68	(0.53)
Gender		
Male	30	71.43
Female	12	28.57
Experience in first aid training for injured person in road accidents		
Experienced	22	52.38
Inexperienced	16	38.10
Not specified	4	9.52
First-hand experience in assisting injured person in road accidents		
Experienced	12	28.57
Inexperienced	26	61.90
Not specified	4	9.52

The participants' pre-test mean scores were  $25.31 \pm 3.87$ . After the participants conducted self-learning processes through web application of first aid for an injured person in road accidents, the post-test mean score increased to  $27.25 \pm 2.91$  (Table 2).

Table 2: Comparison of the pre-test and post-test mean scores of the knowledge on first aid for an injured person in road accidents (n = 42)

Group	Mean (SD)	SD error	95% CI		t	df	p-value
			Lower	Upper			
Pre-test	25.31 (3.87)	0.60	24.10	26.52	-3.77	41	<0.001
Post-test	27.50 (2.91)	0.45	26.59	28.41			

The results of the participant's level of satisfaction with the web application are reported in Table 3. An overall satisfaction score of 4.25 was interpreted as meaning a high level of satisfaction. To examine each questionnaire item, the highest average score of 4.30 was the item "the web application is useful for learners." This was

followed by the item "images and videos for illustration on web applications are beautiful and suitable for the contents," having the second-highest average score of 4.29. The results from the open-ended question suggested the participants' positive feedback, such as "gaining knowledge and correct ways of how to implement first aid in real practice," "concise contents and inviting texts to read," "the length of the videos is appropriate so you can watch them without getting bored," and "very good."

Table 3: The web application satisfaction level reported by the participants (n = 42)

Evaluation item	Satisfaction		
	X	SD	Satisfaction level
Web application is user's friendly	4.18	1.00	High
Web application can be used at anytime	4.08	0.99	High
Web application can be used anywhere	4.23	0.99	High
Web application can be accessed by computers, tablets, and smartphones	4.25	1.00	High
Images and videos illustration on web application are beautiful and suitable for the contents	4.29	0.99	High
The fonts and colors of the alphabets used on web application are appropriate and clear	4.24	1.00	High
The layout of the contents on web application is appropriate	4.20	0.96	High
The length of learning time on web application is appropriate	4.20	0.96	High
The web application is useful for learners	4.30	0.96	High
Web application allows me to self-learn about first aid for injured person in road accidents	4.20	0.96	High
I gain more knowledge about first aid for injured person in road accidents through this web application	4.26	0.98	High
I gain more confidence in implementing first aid for injured persons in road accidents through this web application	4.20	0.96	High
An overall satisfaction	4.25	0.95	High

## Discussion

The developed web application of first aid for an injured person in road accidents aims to promote a self-learning media for all people. The web application contains useful lessons of first aid and learning model via a web application which is a vital platform, especially during the time of the COVID-19 pandemic situation.

The results of this study demonstrated that the post-test mean scores of the participants who participated in the self-learning process through web application of first aid for an injured person in road accidents were statistically significantly higher than the pre-test's mean scores which was consistent with previous studies [1], [16].

The study by Garces and Lojo [16] in the Philippines compared the scores of first aid treatments between the experimental group who learned about first aid for patients' illness or health problems via an application on mobile phones and the controlled group which revealed the mobile phone application helped the participants in the experimental group score statistically significantly higher than before using the mobile phone application.

Similarly, the study by Dando *et al.* [17] applied a game-based study of first aid skills with university participants. The application emphasizes first aid guidelines and knowledge through games as a learning approach. In this previous quasi-experimental research, the mean scores after learning from the application statistically significantly increased. The participants gained knowledge about first aid at an excellent level and also strongly agreed with an implementation of the application in teaching and learning.

In our study, the overall satisfaction of the participants with self-learning media through web application of first aid for an injured person in road accidents was considered satisfactorily high. The result reflected the advantages and applicability of the web application as well as the benefits of using attractive 3D animations. These results were consistent with similar research from the United States [18] which compared the traditional first aid and resuscitation courses to the same courses conducted online. Even though there was no difference in the satisfaction level among the participants who took both traditional and online courses, the results revealed the participants' preference for online learning and video content the most, because online courses were beneficial, convenient, flexible, and short quizzes at the end of each chapter helped with reviewing the lesson [18].

In the current study, the participants showed a high level of satisfaction regarding usability, suitability of design, and beneficence with an online platform. It can be implied that the web application can possibly be used by other people as well. Similarly, the study in Taiwan investigated the feasibility of using an application of first aid for emergency patients from 113 volunteers. It was found that applicability and frequency of application use were positively correlated with the perceived user-friendly application ( $r = 0.76$ ;  $p < 0.001$ ) and the perceived benefit ( $r = 0.88$ ;  $p < 0.001$ ) [19]. In addition, a web-based intervention for parents whose children experienced injuries was related to high levels of satisfaction and provided useful guidance to enhance parent understanding when their children experience injuries [20].

After completely evaluating the knowledge and satisfaction in this study, the web application has been publicly opened. There were 1098 users enrolled in this web application from August to October 2021. The majority of the users evaluated their highest level of satisfaction in using the first aid web application. Almost 90% agreed that the ten-lessons of first aid could increase their knowledge and could be useful for their lives. For future implementation, this web application should be promoted among a variety of laypersons and the learning outcomes should be investigated after the public implementation.

This study demonstrated Universities which was the academic center of higher education should strengthen the training for undergraduates to improve first-aid skills. This is a viable strategy for increasing public awareness about first aid.

This study has several limitations. Accessing the content on the web application requires smartphones or computers that can connect to the internet. In addition, an unstable internet signal may interfere with learning processes due to the intermittent playback of video clips. This study's sample group consisted of university-level participants who had access to technology and the know-how to use the devices. Therefore, the findings from this study may not be generalized to public use among all citizens, particularly those who may have restrictions on using or accessing smartphones, computers, and the internet. In addition, this study could not execute the designed in-person train due to COVID-19 pandemic which could not demonstrate the first aid practice skill.

## Conclusions

The development of self-learning media through web application of first aid for an injured person in road accidents is considered to be an accessible educational method for people living in the COVID-19 pandemic situation that obstructs face-to-face training in the community. The web application we created is a convenient platform for people to self-learn and gain knowledge about first aid for injured people in road accidents. An investigation of the effectiveness of the self-learning application reveals statistically significant higher scores on the post-test than on the pre-test scores. The participants' satisfaction in using the web application was also found to be at a high level.

## References

1. World Health Organization. Road Traffic Injuries. Geneva: World Health Organization. Available from: <https://www.who.int/>

- news-room/fact-sheets/detail/road-traffic-injuries [Last accessed on 2022 Jan 05].
2. World Health Organization. Global Status Report on Road Safety. Geneva: World Health Organization; 2018. Available from: <https://www.who.int/publications/i/item/9789241565684>. [Last accessed on 2022 Jan 05].
  3. O-Charoen N. Flirting with Road Risk a Fatal Pursuit. Available from: <https://tdri.or.th/en/2017/09/flirting-road-risk-fatal-pursuit>. [Last accessed on 2022 Jan 05].
  4. The Thailand National Institute for Emergency Medicine. Information Technology for Emergency Medical System. Available from: [https://ws.niems.go.th/items\\_front/index.aspx](https://ws.niems.go.th/items_front/index.aspx). [Last accessed on 2021 Nov 20].
  5. Giummarra MJ, Beck B, Gabbe BJ. Classification of road traffic injury collision characteristics using text mining analysis: Implications for road injury prevention. *PLoS One*. 2021;16(1):0245636. <https://doi.org/10.1371/journal.pone.0245636>  
PMid:33503030
  6. Alharbi R, Mosley I, Miller C, Hillel S, Lewis V. Factors associated with physical, psychological and functional outcomes in adult trauma patients following road traffic crash: A scoping literature review. *Transp Res Interdiscip Perspect*. 2019;3:100061. <https://doi.org/10.1016/j.trip.2019.100061>
  7. Kureckova V, Gabrhel V, Zamecnik P, Rezac P, Zaoral A, Hobl J. First aid as an important traffic safety factor-evaluation of the experience-based training. *Eur Transp Res Rev*. 2017;9(1):1-8. <https://doi.org/10.1007/s12544-016-0218-4>
  8. Larsson EM, Mårtensson NL, Alexanderson KA. First-aid training and bystander actions at traffic crashes-a population study. *Prehosp Disaster Med*. 2002;17(3):134-41. <https://doi.org/10.1017/s1049023x00000352>  
PMid:12627916
  9. Van de Velde S, Heselmans A, Roex A, Vandekerckhove P, Ramaekers D, Aertgeerts B. Effectiveness of nonresuscitative first aid training in laypersons: A systematic review. *Ann Emerg Med*. 2009;54(3):447-57. <https://doi.org/10.1016/j.annemergmed.2008.11.005>  
PMid:19157654
  10. Ndile ML, Lukumay GG, Bolenius K, Outwater AH, Saveman BI, Backteman-Erlanson S. Impact of a postcrash first aid educational program on knowledge, perceived skills confidence, and skills utilization among traffic police officers: A single-arm before-after intervention study. *BMC Emerg Med*. 2020;20(1):21. <https://doi.org/10.1186/s12873-020-00317-y>  
PMid:32188402
  11. Wilks J, Pendergast D. Skills for life: First aid and cardiopulmonary resuscitation in schools. *Health Educ J*. 2017;76(8):1009-23. <https://doi.org/10.1177/0017896917728096>
  12. Olumide AO, Asuzu MC, Kale OO. Effect of first aid education on first aid knowledge and skills of commercial drivers in South West Nigeria. *Prehosp Disaster Med*. 2015;30(6):579-85. <https://doi.org/10.1017/S1049023X15005282>  
PMid:26507384
  13. Fonrouge J, Fraile V, Petit P. Assessment of the teaching of first-aid practices. *Prehosp Disaster Med*. 1997;12(1):39-40. <https://doi.org/10.1017/S1049023X00047075>
  14. Arbon P, Hayes J, Woodman R. First aid and harm minimization for victims of road trauma: A population study. *Prehosp Disaster Med*. 2011;26(4):276-82. <https://doi.org/10.1017/S1049023X11006522>  
PMid:22008363
  15. Cheng YH, Yeung CY, Sharma A, So KY, Ko HF, Wong K, et al. Non-resuscitative first aid training and assessment for junior secondary school students: A pre-post study. *Medicine (Baltimore)*. 2021;100(34):27051. <https://doi.org/10.1097/MD.00000000000027051>  
PMid:34449493
  16. Garces AF, Lojo JP. Developing an Offline Mobile Application with Health Condition Care and First Aid Instruction for Appropriateness of Medical Treatment. *IEEE Integrated STEM Education Conference (ISEC)*; 2019. p. 13-4.
  17. Dando MF, Tamos E, De Guzman PK, Balahadia FF. First Aid Mobile Application for University Clinic Using Predictive String Search Algorithm. *IEEE 11<sup>th</sup> International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM)*; 2019. p. 1-6.
  18. Cason CL, Stiller J. Performance outcomes of an online first aid and CPR course for laypersons. *Health Educ J*. 2011;70(4):458-67. <https://doi.org/10.1177/0017896910379696>
  19. Chien SC, Islam MM, Yeh CA, Chien PH, Chen CY, Chin YP, et al. Mutual-aid mobile app for emergency care: Feasibility study. *JMIR Form Res*. 2020;4(3):15494. <https://doi.org/10.2196/15494>  
PMid:32191212
  20. Marsac ML, Kassam-Adams N, Hildenbrand AK, Kohser KL, Winston FK. After the injury: Initial evaluation of a web-based intervention for parents of injured children. *Health Educ Res*. 2011;26(1):1-12. <https://doi.org/10.1093/her/cyq045>  
PMid:20858769