Sudan Journal of Medical Sciences
Volume 19, Issue no. 1, DOI 10.18502/sjms.v19i1.15786
Production and Hosting by Knowledge E

Research Article

The Impact of an Educational Training Program on Basic Life Support and First Aid to Manage Risk Among Mechanical Engineering Students at Sudan University

Adel Abdalla[1*], Waled Ahmed[2], Mohammed Habiballa[3], Abdelgayoom Sargidy[4], Amira Yahia Boshra[5], and Suhail Ahmed[5]

[1]Nursing Department, Prince Sultan Military College Of Health Sciences, Al Dhahran, Saudi Arabia
[2]Nursing Department, Faculty of Applied Medical Sciences, Al-Baha University, Saudi Arabia
[3]Al-Rayyan Private College of Health Sciences and Nursing, Al Madinah Al Munawarah, Saudi Arabia
[4]Ministry of Health, Saudi Arabia, Taif, Erada and Mental Health Complex, Emergency Department
[5]Department of Nursing, College of Applied Medical Sciences, Majmaah University, Al-Majmaah, Saudi Arabia

ORCID:
Adil Abdalla: https://orcid.org/0000-0002-6702-8628
Waled AM Ahmed: https://orcid.org/0000-0002-8023-1583
Mohammed Habiballa: https://orcid.org/0000-0002-8300-5119
Abdelgayoom Sargidy: https://orcid.org/0000-0003-2049-2674
Amira Yahia Boshra: https://orcid.org/0000-0003-4498-370X
Suhail Ahmed: https://orcid.org/0000-0002-5219-9010

Corresponding Author: Adel Abdalla; email: adoly25@yahoo.com

Received: 14 February 2023
Accepted: 10 June 2023
Published: 29 March 2024

Production and Hosting by Knowledge E

Abstract

Background: Mechanical engineering students spend several hours in primitive workshops and laboratories for training as part of their academic curriculum; they are exposed to various types of hazards such as machines, flammable materials, and other dangers. These machines are one of the causes of amputation, crushing, and broken bones among these students. This study aims to explore how training in first aid (FA) and basic life support (BLS) helps mechanical engineering students at Sudan University of Sciences and Technology manage risks in such situations.

Methods: The current study had a quasi-experimental design, and 100 students were chosen through stratified systematic random sampling. Data were gathered via questionnaire and observational checklist, whose content validity and reliability were confirmed (r = 0.87 and r = 0.82, respectively). Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0 for descriptive and inferential statistics. The program was delivered through a series of 13 lectures conducted over a total of 65 hr.

Results: All tests had a maximum mean knowledge score of 50 points. At the pretest, students' overall knowledge of FA and BLS was low (13.82), however, it improved to 49.87 and 48.77 at posttest one and posttest two, respectively, after the intervention. Statistically significant differences were seen between pre- and posttest one (P = 0.000) and between pre- and post-late (P = 0.000). In the pretest, the total proportion of the students' practices related to FA and BLS was low (12.87%). However, when the program was implemented, the total percentage of practices increased in posttest one (95.65%) and posttest two (95.21%). This indicates the effectiveness of training programs.

Conclusion: Students lacked knowledge and practice in FA and BLS before the intervention. The training helped enhance their skills. FA and BLS programs should be included in university curricula to help students manage risks in workshops and laboratories.

Keywords: hazard, training program, first aid, basic life support, Sudan University

1. Introduction

The global burden of injuries is probable to increase over the next 20 years. It is projected that by 2030, injuries will be the leading cause of death universally, and deaths from self-harm will be the 12th leading cause of death [1]. In Khartoum State, injuries are among the 10 leading reasons for attending outpatient clinics and formal health units [2]. Statistics show that the overall incidence of injuries among students in Khartoum state was 82.0/1000 people/years at risk of injuries [3]. A total of 441 cases of nonfatal harm arisen in 12 months. There were 28 deaths due to injuries out of 129 reported deaths over five years [4]. Student's contact with splashed chemical liquids, powders, dust, fumes, mists, gases, machine lubricants, degreasers, coolants, releasing agents, paint, fuel, cleaners, metalworking fluids, gels, or grease used around machinery could be harmful. These chemicals can burn, explode, corrode, poison, or produce irritation [5–7]. injuries play a significant role in university students' success [8]. According to a previous study, human error is responsible for 80–90% of school-related industrial injuries [9]. Globally, millions of individuals die each year as a result of accidents or serious injuries. Unfortunately, many of those deaths could have been prevented if first aid (FA) was administered at the scene immediately before the emergency services arrived [10]. For instance, it was reported that giving the patient the proper position could lower the mortality rate by as much as 10%. In addition to the lifesaving results of FA, effective and timely FA practices also prevent disabilities [11]. It is well-known that education programs are the most commonly used approach in injury prevention and management [12]. Numerous agencies, such as the American Red Cross, the American Safety and Health Institute, the American Heart Association, and other organizations, have trained millions of individuals in FA, Cardiopulmonary Resuscitation (CPR), and automated external defibrillator (AED). However, there is still a need to train more people, especially the college-age population [13]. The administration of FA and Basic Life Support (BLS) as soon as possible after an injury may help reduce the rate of morbidity and mortality from school-related industrial injuries [12, 14]. This study was conducted to emphasize the importance of FA and BLS programs in teaching students basic facts and techniques that can save lives [15].

2. Methods

2.1. Study design

This study had a quasi-experimental design. The study was conducted on a single group; pre- and posttests were followed by a posttest evaluation (late posttest) after three months to assess how well the knowledge and skills were retained.

2.2. Population and study setting

The study population comprised of bachelor's students in their second, third, and fourth years in the Faculty of Mechanical Engineering College at Sudan University of Science and Technology (SUST) in Khartoum state, the capital of Sudan. Students who were eligible to be in the study needed to be available for the duration of the 2018–2019 academic year and willing to participate in the study.

2.3. Sample size and sampling technique

The researchers used the stratified random sample method to determine the sample size, dividing the study population into three strata: second-year, third-year, and fourth-year students. The Probability Proportional to Size (PPS) technique was employed, given that the target population comprised 600 students, and each stratum contained 200 students. Therefore, with Nh1 = 40, Nh2 = 40, and Nh3 = 40, the total sample size was n = 120. To determine the necessary sample size, the researchers used the following formula $N = \{(z)^2 * (p)(q)\} / (d)^2$ [16], where P = 0.5 was assumed as the population proportion since the researchers were uncertain about the proportion. Q was calculated as (1–p), d was set as 8% for the margin of error, and Z was chosen as 1.96 to achieve a 95% confidence level. Consequently, the calculated sample size was n = 120. However, it is worth noting that 20 students dropped out of the study during program implementation, resulting in a final sample size of 100.

2.4. Data collection tools

This study used questionnaires and observational checklists to collect data and evaluate engineering students' knowledge and practice of FA and BLS in pre-training, immediate, and three-month post-training programs. Data collection tools were constructed after a literature review which helped the researchers select the best questions. The questions were chosen with the help of a committee of five experts from different fields, including medical and surgical nursing, and community health nursing. The questionnaire covered the common types of engineering students' risks and how they managed them; this included general knowledge of FA and BLS. The observational checklist covered the skills required for 10 procedures related to choking; internal and external bleeding; FA for shock; CPR; bone fracture and dislocation; sprain and strain; burns; and skills to deal with emergency medical conditions such as seizures and fainting, heart attack, hypo- and hyperglycemia; asthma; and poisoning. The total score for both knowledge and practice was categorized into three levels according to the interval 3-point Likert scale as follows [17]: Low knowledge or practice if <50%; moderate if 50–75%; and high if >75%. Before proceeding with the full study, a pilot study was conducted with 10 engineering students in Mechanical Engineering College to test the tools for clarity, organization, and applicability, and to determine the length of time needed for data collection. Based on the pilot study results, necessary modifications were made, and each item in the tool was refined and put in the appropriate setting. It took pilot participants approximately 25–30 min to complete the knowledge section of the questionnaire and 25–35 min to complete the skills-related tasks based on the criteria in the observational checklist. Pilot study participants were then excluded from the study sample. Using the Pearson's correlation coefficient and the Alpha Cronbach test, the reliability of the instrument was found to be r = 0.87 for the knowledge questionnaire and r = 0.82 for the skills checklist. This deemed the format is statistically acceptable.

2.4.1. The training program

The researchers designed the program based on a review of existing literature from textbooks, materials, periodicals, magazines, and 2015 updates from the American Heart and European Heart Associations. All sources were needed to identify salient aspects of the study problem and to develop relevant tools for data collection. The training program was presented using different teaching aids, including class lectures, audio–visual materials, demonstrations, and return demonstrations, and group discussions. In addition, many physical objects were used, such as skeletons, child and adult mannequins, AEDs, disposable CPR training barriers (masks), burn blankets, burn gels, and plasters in a variety of sizes and shapes. By the end of the training program, it was expected that students could take charge of an accident scene to stop further injury; get to the victim(s) in the easiest and safest way possible; open a victim's airway and perform rescue breathing; provide one- and two-rescuer CPR and defibrillation; control bleeding by direct pressure, elevation, and pressure points; detect and care for shock; detect and care for soft-tissue and internal injuries; perform basic dressing and bandaging techniques; detect and care for open and closed fractures; detect and care for poisoning, including alcohol or drug poisoning; detect and care for diabetic conditions, cardiovascular and stroke, respiratory emergencies, seizures, fainting, and dizziness; detect and care for superficial, partial- and full-thickness burns and smoke inhalation; and perform emergency and nonemergency moves.

2.4.2. The design and implementation of training

Phase one (preparation): After designing the study tools, official approval was obtained from Sudan University of Science and Technology to carry out the study. The study's support staff (i.e., 10 healthcare providers) were given a comprehensive brief on the research topics and tools to be used. The researcher's assistant visited students in levels 2, 3, and 4 to discuss the objectives of the training program, and written consent was obtained from students who agreed to participate. The researchers coordinated with the study participants and the college administration to determine the appropriate place and time for implementing the training.

Phase two (pretest): The researchers, together with their work team, distributed the questionnaires to all participants, who completed the questionnaire in 25–30 min to test their knowledge. Then, each participant was given one of the 10 trainees on which they tested their FA and BLS skills using the observational checklist. Each pretest took 30–35 min.

Phase three (intervention): The researchers and their work team implemented the training program to ascertain that it was implemented correctly. The program lasted a total of 65 hr and consisted of 13 lectures. There were three lectures per week, and each lecture lasted 5 hr (2 hr of theory and 3 hr of practical skills). At the end of the program, educational materials printed in English were distributed. These included booklets, posters, and videos, and were also sent to study participants via email and WhatsApp.

Phase four (posttest intervention): Evaluation of the training program began in this phase and was performed immediately using the same questionnaire and observational checklist as the pretest to compare FA and BLS knowledge and skills pre- and postintervention. Further, the same tool was used three months later to give an additional post-late test to assess knowledge gaps and retention.

2.5. Data analysis

Data were**a**nalyzed to address the study objectives. Descriptive and inferential statistics were obtained using the SPSS, version 20. Descriptive measures included frequency, percentage, mean, and standard deviation. A paired *t*-test and an interval 3-point Likert scale were used to compare the effectiveness of the program.

3. Results

The present study assessed the effect of an educational training program on the 100 engineering students – 86% were male and 14% were female. Participants' ages ranged from 18 to 37 years, with 88% of participants being between the ages of 18 and 22. Study participants were from different academic levels, and most of their parents had completed university, as indicated in Table 1.

3.1. Participants' knowledge levels

The total mean knowledge scores were 13.82 in the pretest and 49.87 in the posttest. The post-late (three-month later) test had a total mean knowledge score of 48.77 out of a possible 50-point total. As indicated in Table 2, In pair 1, the *P*-value (0.0001) is <0.05, which means there is a statistically significant difference between the mean pre- and posttest knowledge. The post sample is a beater. The *P*-value of pair 2 (0.000) is <0.05, which means there is a statistically significant difference between the mean pre- and post-late knowledge as well. The post-late sample is the beater. In pair 3, the posttest and post-late samples of the knowledge mean and paired differences had a mean of 0.18, a standard deviation of 0.07, and a standard error of 0.03. Pair 3 has a *t*-value of 6.55 with 5° of freedom, and a *P*-value of 0.501, which is >0.05, meaning there is no statistically significant difference between posttest and post-late knowledge, as indicated in Table 3.

3.2. Participants' skill level

The pretest total percentage of skills done correctly was 12.87%, the posttest total percentage of skills done correctly was 95.65%, and the post-late total percentage of skills done correctly is 95.21%. The maximum score of the total percentage of correctly answered questions is 100%, as indicated in Figure **1**.

4. Discussion

The study's findings showed that the sample comprised of males and females, mainly between the ages of 18 and 22 years, reflecting a picture of the general population distribution in most mechanical engineering schools. They were from different academic years within the engineering faculty. Furthermore, most of the students live in urban areas, and more than half of them had no previous knowledge of FA or BLS. They obtained their information from the internet and social media. This is nearly identical to results from research by Khader et al., who found that the majority of students were male (63%) and were between the ages of 18 and 22, with the majority of students being in their second year (27%) [18]. The present study's findings on demographics are also similar to the study conducted by Althubaiti et al., where participants' mean age was 21 ± 1.5 years. Many of their mothers and fathers had a university-level education (37.45–33.5%), and most of them did not have previous knowledge about FA and BLS (64.7%) and sources of knowledge from teachers (21.6%) [19]. The participants' overall knowledge of FA and BLS was low in the pretest, but improved after program implementation, as indicated by the results of posttests one and two. There are statistically significant differences between the pretest and both posttests, which

TABLE 1: Distribution of the study population by demographic characteristics (n = 100).

Characteristics		**Frequency**	**Percentage**
Gender	Male	86	86%
	Female	14	14%
Age class (yr)	18–22	88	88%
	23–27	6	6%
	28–32	2	2%
	33–37	4	4%
Academic year	Second	38	38%
	Third	36	36%
	Fourth	26	26%
Father's level of education	Elementary education	7	7%
	Secondary	21	21%
	University	71	71%
Mother's level of education	Illiterate	3	3%
	Elementary education	16	16%
	Secondary	37	37%
	University	44	44%
Residence	Rural	14	14%
	Urban	86	86%
Previous knowledge of FA and BLS	**Yes**	**34**	**34%**
	No	**66**	**66%**

FA: first aid; BLS: basic life support.

TABLE 2: The total mean of knowledge in pre-, post-, and post-late educational programs among engineering students (n = 100).

	Total means of knowledge scores		
Test sample	Pre	Post	Post-late
Percentage	28%	99.7%	98%
Mean	13.82	49.87	48.77
Maximum possible mean score	50	50	50

*low knowledge: <50%; moderate knowledge: 50–75%; high knowledge: >75 %.

TABLE 3: Total knowledge scores from students' paired sample statistics, mean standard deviation, and P-value in pre-, post-, and three-months' post-educational program (n = 100).

		Paired Differences					**t**	**df**	**P-value**
		Mean	**SD**	**SEM**	**95% CID**				
					Lower	**Upper**			
Pair 1	Pre–post	6.01	1.47	0.60	7.55	4.47	10.04	5	0.000
Pair 2	Pre–post-late	5.83	1.45	0.59	7.35	4.30	9.85	5	0.000
Pair 3	Post–post-late	0.18	0.07	0.03	0.11	0.26	6.55	5	0.501

CID: confidence level of interference differences; STD: standard deviation; N: number of knowledge groups.

indicates that the implemented program effectively enhanced students' knowledge of FA and BLS. Our

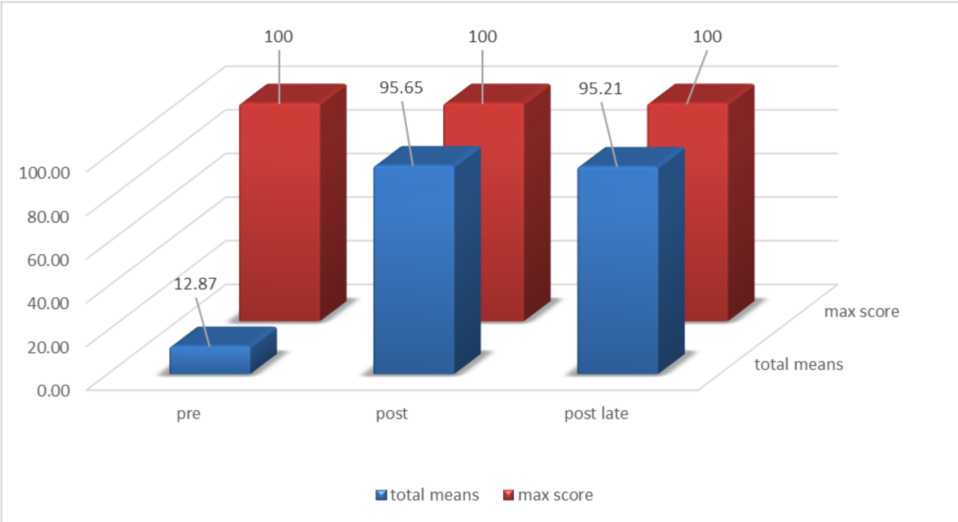

Figure 1: Study participants' overall practical score percent levels for first aid and basic life support skills in pre-, post-, and three-months post-educational programs (*n* = 100).
Low practices: <50%; moderate: 50–75%; high: >75%.

findings are consistent with the findings reported by Wagida et al., a quasi-experimental study, which found a poor understanding of roughly 99% in the pretest and a significant increase to adequate information of 100% in the posttest and a follow-up test two months later [20]. This study's findings are also consistent with the results of the study conducted by Seham et al., who assessed the impact of training programs in FA and BLS, and found very high training effects, with 86.7% of apprentices having a lower pre-programing level. An excellent average score compared to knowledge and practice of weak scores [21]. Metok studied the effectiveness of training programs regarding selected FA measures among nonmedical professional students and found that the pretest mean level of knowledge score was 18.07, and the posttest mean score was 36.13. The paired t-test results were 20.76 and 22.17, respectively, indicating a high significance level at $P < 0.001$, thereby demonstrating that training programs are beneficial [22]. The results of the present study also align with a study directed by Kose et al. (2020) at Biruni University in Istanbul, Turkey. The researchers discovered that participants' knowledge and practical skill levels had increased ($t = -12.442$, $P = 0.000$; $t = -22.899$, $P = 0.000$) [23]. Furthermore, similar to the study conducted by Bildik et al. at Gazi University with students in Ankara, Turkey, the average pre- and posttest scores were 47.89 ± 11.29 and 75.28 ± 12.62, respectively. There was a significant increase in the average scores ($P < 0.001$). Following the training, the percentage of correct answers on BLS concerns increased dramatically. Significantly, more participants (58%) thought they had sufficient FA knowledge and skills than before the training (8%) [24]. Outcomes further align with a study done by Amoura Soliman Behairy and Manal Ahamed Al-Batanony, who conducted their research in preparatory and secondary schools in Unaizah city, Qassim. They found that 98.1% of participants had poor knowledge in the pretest, which improved significantly to excellent knowledge of 100% among participants in the posttest. This research showed that the FA and BLS education programs considerably impact the quality of the trainees [25]. In addition, Kapoor et al. conducted similar research at schools in Ahmedabad city, showing that the range of knowledge about various aspects of FA ranged from 7.66% to 63.33% before training, and increased from 39% to 92.33% after the training. This difference in knowledge was highly significant [26]; students' practices relating to FA and BLS were low in the pretest and increased in posttests one and two. Our findings were virtually identical to previously released data at Gazi University by Fikre [24]. The results also aligned with a study conducted by Wafik and Tork, which found that a poor practice percentage of 99% had converted into a correct practice percentage of 88% in posttest and follow-up after an intervention. This research shows that the FA intervention program has led to considerable improvement [20], further indicating that FA and BLS education programs have significantly improved participants' knowledge and skills in these areas [25]. A study by Mohamed found that students in CPR training had mean practice scores of 3.32 ± 2.04, which increased to 10.09 ± 1.03 after one month. Following the training program, students made considerable improvements in knowledge and practices [27]. A study performed at the University of Groningen by Maass et al. found that overall CPR performance was low, with only 2% of participants achieving the criteria given by the European Resuscitation Council Strategies of 2015. After a short training session, the rise in performance was maintained over 45 min, with 96% of students meeting the performance criteria indicated in the guidelines [28].

5. Conclusion

Results from this study suggest that the training program helped students learn and practice FA and BLS better in posttests than they did before the training. An early evaluation of the post-training program test revealed significant improvements in study participants' FA and BLS knowledge and practical skills. The post-late test three months after the program completion assessed participants' knowledge and skill retention, showing only a small drop in each category.

The following are the study's limitations

The same research can be conducted in large samples to generalize the finding. A similar study can be performed with a control group. The study can be undertaken in another field. A similar study can be conducted in the school setting.

Acknowledgement

with the authors are thankful to all the staff of the University of National Ribat, the Faculty of Postgraduate Studies and Scientific Research, and the Faculty of Nursing Sciences. They are especially thankful to Dr. Mahmoud Abd Albadee for his guidance. We would also like to thank the participants for their permission, time, and cooperation in conducting this research smoothly. Lastly, the authors would like to thank their colleagues at Shaqra University for their support and encouragement.

Ethical Considerations

The Research Ethical Committee of the Faculty of Graduate Studies and Scientific Research of the National Ribat University provided written preliminary approval to the Vice-Chancellor of Sudan University of Science and Technology.

The approval letter was then forwarded to the dean of the Mechanical Engineering College. Ethical clearance from participants was obtained by written consent before data collection by giving a brief explanation, of the aim of the study. It was also pointed out to them that participation was voluntary.

Competing Interests

The authors declare that they have no conflicts of interest.

Availability of Data and Material

All data for this study that were generated and/or analyzed during the study are available upon request from the corresponding author.

Funding

This research was funded by the authors and did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] Norton, R., & Kobusingye, O. (2013). Injuries. *The New England Journal of Medicine, 368*(18), 1723–1730. https://doi.org/10.1056/NEJMra1109343

[2] El Tayeb, S., Abdalla, S., Van den Bergh, G., & Heuch, I. (2015). Use of healthcare services by injured people in Khartoum State, Sudan. *International Health, 7*(3), 183–189. https://doi.org/10.1093/inthealth/ihu063

[3] El Tayeb, S., Abdalla, S., Mørkve, O., Heuch, I., & Van den Bergh, G. (2014). Injuries in Khartoum state, the Sudan: A household survey of incidence and risk factors. *International Journal of Injury Control and Safety Promotion, 21*(2), 144–153. https://doi.org/10.1080/17457300.2013.792283

[4] El Tayeb, S., Abdalla, S., Heuch, I., & Van den Bergh, G. (2015). Socioeconomic and disability consequences of injuries in the Sudan: A community-based survey in Khartoum State. *Injury Prevention, 21*(e1), e56–e62. https://doi.org/10.1136/injuryprev-2013-040818

[5] Patrick, A. A., & Babatope, A. S. (2013). Nigerian engineering students' compliance with workshop safety measures. *International Journal of Innovation and Applied Studies, 3*(2), 425–432.

[6] El-Marakby, F., Nofal, F., Zaki, G. R., Zakaraya, A., & Deign El-Nor, Y. (2012). Occupational safety of different industrial sectors in khartoum state, sudan part 2: Analysis of occupational accidents. *Journal of High Institute of Public Health, 42*(2), 152–168. https://doi.org/10.21608/jhiph.2012.20130

[7] Thamrin, Y., Pisaniello, D., Guerin, C., & Rothmore, P. (2018). The emerging workforce of international university student workers: Injury experience in an australian university. *International Journal of Environmental Research and Public Health, 15*(3), 456. https://doi.org/10.3390/ijerph15030456

[8] Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S. J., Dick, B., Ezeh, A. C., & Patton, G. C. (2012). Adolescence: A foundation for future health. *Lancet, 379*(9826), 1630–1640. https://doi.org/10.1016/S0140-6736(12)60072-5

[9] Kang, K., & Ryu, H. (2019). Predicting types of occupational accidents at construction sites in korea using random forest model. *Safety Science, 120*, 226–236. https://doi.org/10.1016/j.ssci.2019.06.034

[10] Mohammed, A., Abdulrhman, A., Abdulaziz, A., Abdullatif, A., Abdulalbary, A., Mohammed, N., Iheb, B. (2018). Road traffic accident: What is being practiced on the scene to rta casualties in al-ahsa city, Saudi Arabia? *The Egyptian Journal of Hospital Medicine, 71*(1), 2380–2386. https://doi.org/10.12816/0045316

[11] Hassan, S. M. S. (2015). Assessment of first aid for emergency accidents in primary schools in kirkuk city Kufa. *Journal of Nursing Science, 5*(1), 83–91.

[12] Yanchar, N. L., Warda, L. J., & Fuselli, P. (2012). Child and youth injury prevention: A public health approach. *Paediatrics & Child Health, 17*(9), 511–512. https://doi.org/10.1093/pch/17.9.511

[13] Rotich, J. P., & Elliott, G. (2019). Teaching first aid, CPR, and AED using blended learning in academic settings. In *Handbook of research on blended learning pedagogies and professional development in higher education* (pp. 325–339). IGI Global. https://doi.org/10.4018/978-1-5225-5557-5.ch018

[14] Khadim, I., Marwat, M. K., Khadim, A., Tabassum, Y., Saman, S., & Afzal Virk, S. (2021). Impact of first aid training upon management skills of sports injuries in female volleyball players. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *18*(08), 3682–3689.

[15] Greif, R., Lockey, A., Breckwoldt, J., Carmona, F., Conaghan, P., Kuzovlev, A., Pflanzl-Knizacek, L., Sari, F., Shammet, S., Scapigliati, A., Turner, N., Yeung, J., & Monsieurs, K. G. (2021). European resuscitation council guidelines 2021: Education for resuscitation. *Resuscitation, 161*, 388–407. https://doi.org/10.1016/j.resuscitation.2021.02.016

[16] Cochran, W. (1977). Double sampling. Cochran WG. *Sampling techniques* (3rd ed.). John Wiley & Sons, Inc.

[17] Brown, S. (2010). *Likert scale examples for surveys*. ANR Program evaluation. Iowa State University.

[18] Khader, K. A., Al-Ghamdi, A. N., Youssef, H. A., Elryah, A. A. I., Ayasreh, I., Al-Mawajdeh, N. A., & Mohammed, A. A. (2016). Awareness and knowledge of health-college students of cardiopulmonary resuscitation at taif university, Saudi Arabia. *International Journal of Multidisciplinary and Current Research*, *4*.

[19] Basuhail, S., Al Hammad, B. K., Aldhafeeri, B. G., Alquhayz, M. F., Alqahtani, M. S., Alkharboush, H. F., & Al Turki, Y. A. (2019). Awareness, knowledge, attitude and practices of first aid skills among medical and non-medical students at taif university. *Middle East Journal of Family Medicine*, *17*(11).

[20] Wafik, W., & Tork, H. (2014). Effectiveness of a first-aid intervention program applied by undergraduate nursing students to preparatory school children. *Nursing & Health Sciences, 16*(1), 112–118. https://doi.org/10.1111/nhs.12083

[21] El-Hay, S. A., Ibrahim, N. A., & Hassan, L. A. (2015). Effect of training program regarding first aid and basic life support on the management of educational risk injuries among students in industrial secondary schools. *IOSR Journal of Nursing and Health Science, 4*, 32–43.

[22] Metok, T. (2014). *Effectiveness of training programme on knowledge and practice regarding selected first aid measures among non medical professional students*. Madha College of Nursing.

[23] Kose, S., Akin, S., Mendi, O., & Goktas, S. (2019). The effectiveness of basic life support training on nursing students' knowledge and basic life support practices: A non-randomized quasi-experimental study. *African Health Sciences, 19*(2), 2252–2262. https://doi.org/10.4314/ahs.v19i2.51

[24] Bildik, F., Kılıçaslan, i., Doğru, C., Keles, A., & Demircan, A. (2011). The need for first aid awareness among candidate teachers. *Turkish Journal of Emergency Medicine, 11*(4), 166–170. https://doi.org/10.5505/1304.7361.2011.50490

[25] Behairy, A. S., & Al-Batanony, M. A. (2015). Effectiveness of first-aid and basic life support intervention program on school health advisors. *Journal of Health, Medicine and Nursing*, *24*, 144.

[26] Kapoor, R., Vyas, S., Mashru, P., Mehta, A., Mehta, A., Mehta, S., Mehta, V. J., Dodia, T., Mehta, A., Patel, J., Solanki, K., Vajani, R. (2017). Impact of training on knowledge and attitude regarding first aid among students of schools of Ahmedabad. *Education, Medicine*, *8*, 380–384.

[27] Mohamed, E. A. (2017). Effect of cardiopulmonary resuscitation (CPR) training program on knowledge and practices of internship technical institute of nursing students. *IOSR Journal of Nursing and Health Science, 6*(3), 73–81. https://doi.org/10.9790/1959-0603037381

[28] Maaß, S. C., Sense, F., Gluck, K. A., & van Rijn, H. (2019). Keeping bystanders active: Resuscitating resuscitation skills. *Frontiers in Public Health, 7*, 177. https://doi.org/10.3389/fpubh.2019.00177