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Knowledge and self-perceived competence about cardiopulmonary resuscitation among youths: a cross-sectional study in a sample of Italian undergraduates

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Abstract

Introduction. *Cardiopulmonary resuscitation is fundamental to improve the outcomes of a life-threatening event. The correct knowledge of first aid actions to provide may guarantee the victim's survival. This study was aimed at evaluating the competence about cardiopulmonary resuscitation and its predictors in a sample of Italian undergraduate students.*
Methods. *Information on socio-demographic characteristics, first aid training, knowledge of stroke and heart attack symptoms and perceived ability to provide first aid, were collected through a web-based questionnaire.*
Results. *On a total of 744 respondents (mean age 23.9±5.4 years, 62.5% female), 71.4% identified correctly first aid actions, 59.9% and 60.8% showed a good knowledge of stroke and heart attack symptoms, respectively. However, only 39.0% of them declared their ability to intervene in case of emergency. Attending a healthcare degree course and having had first aid training were associated with knowledge of symptoms and perceived ability to provide first aid. Female gender was negatively related with perceived ability to intervene.*
Conclusions. *In spite of the satisfactory level of knowledge, these findings highlight the need to enhance the competence about cardiopulmonary resuscitation in the lay population, especially among females.*

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Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally, sustaining 31% of all global deaths. Overall, 85% of cardiovascular deaths are due to heart attack and stroke (1, 2). In particular, the incidence rate of heart attack was calculated as 40.6 per 100,000 person-years in Europe, 47.3 in North America, 45.9 in Asia, and 51.1 in Australia (3-5). A quarter of patients affected by this disease have an initial ventricular fibrillation, which evolves into asystole before extra-hospital rescuers arrive (6). Thus, shortening the time before resuscitative manoeuvres is crucial to improve outcomes in cardiac arrest cases (7-11). Indeed, if the resuscitation actions are performed within the first minute, the chances of success are up to 98%, while from the fifth minute on, the chances drop to 25%, and survival rates drop to 1% if the resuscitation manoeuvres are performed after ten minutes (12). However, in most developed countries, it takes at least 8-12 minutes to emergency medical services to reach the location after a victim's collapse, making immediate relief impossible (13). In these situations, each spectator, also any lay rescuer, can play a key role, providing first aid (14, 15). The critical lifesaving steps are i) prevention, ii) immediate recognition of the clinical signs of cardiac arrest (loss of consciousness, abnormal breathing patterns and no pulse) and iii) activation of the emergency response system, iv) early high-quality cardiopulmonary resuscitation, and rapid defibrillation for shockable rhythms (16). Three of these actions can also be performed by lay people (17). Some factors, such as an available telephone guide, educational training, or the presence and use knowledge of an automated external defibrillator (AED) may be helpful in increasing survival, supporting the resuscitator (14-17). In support of the importance of these factors, especially the presence of an AED, Okabayashi et al. (18) found significant differences in the outcomes of an out-of-hospital cardiac arrest based on where it occurs. In particular, cardiac arrests occurring in public showed the best outcomes respect to those occurring in residential area or nursing facilities, probably due to the presence of other people who intervene for resuscitation and the increased availability of public-access automatic external defibrillators.

Governments and health authorities have developed laws and guidelines to improve training of lay people in cardiopulmonary resuscitation (19-21). However, the literature shows that the general population and even the medical students seem not to be sufficiently prepared to face such emergencies (22-25).

The objective of this study was to evaluate the competence about cardiopulmonary resuscitation among Italian undergraduate students attending healthcare and other degree courses. To this aim their knowledge of stroke and heart attack symptoms and their perceived ability to provide first aid were evaluated. Furthermore, possible predictors of these variables were also investigated.

Materials and Methods

Study design and participants

The present cross-sectional study was nested in the "Study on undergraduates Preparation on cardiovascular Events and Risks" – SPERi – conducted among undergraduate students from three universities located in central and southern Italy by using a web-based questionnaire. Students from the Universities "Sapienza" and "Foro Italico" of Rome and "Parthenope" of Naples participated in the study and data were collected between January 2021 and December 2022. Participation was voluntary and anonymous. The survey was performed according to the principles of the Declaration of Helsinki. Ethical approval was obtained from the Research Committee of the University of Rome "Foro Italico" (approval n CAR 80/2021).

Questionnaire

A questionnaire was adapted for the purposes of this investigation from tools used in previous studies (26-29). The following topics were investigated: socio-demographic information (age, gender, university, degree course attended, educational level of parents), attendance of a first aid and basic life support/defibrillation training courses, ability to identify normal blood pressure values, correct order of first aid actions, symptoms of stroke/TIA (trouble speaking, sudden weakness or loss of vision, sudden and severe headache, sudden numbness, weakness or paralysis in the face, arm, or leg, especially in one side of the body, unexplained dizziness) and of heart attack (chest pain, fatigue, nausea, pain or discomfort in neck, arm, or shoulder, chest tightness, shortness of breath), and a self-evaluation about how competent they feel to act in an emergency situation or in the event of a cardiac arrest on a scale from 1 to 10, with 1 representing the lowest level and 10 representing the highest level. The questionnaire was preliminary validated by its administration to 20 participants

with similar age and education level of the study population to identify any critical issues (such as structure, clarity and comprehensibility of questions and answers). Subsequently, the questionnaire was modified according to the comments and suggestions of the respondents who participated in the validation. The validity of the tool was also assessing by using Cronbach's alpha statistical index. The questionnaire was administered through Google modules platform.

Statistical analysis

Statistical software STATA® (STATA 17.0, Stat-aCorp LLC, College Station, TX, USA) was used to conduct statistical analyses. First of all, a descriptive analysis was performed on collected data. The sample's age distribution had an appreciable skewness; therefore, we determined the median age (22 years) and dichotomized the age variable into two groups: those aged 19 to 22 and those older than 22. The number of correct answers regarding knowledge of stroke/TIA and heart attack symptoms was quantified, and the median of correct answers was calculated: 4 out of 5 for stroke/TIA and 5 out of 6 for heart attack. Participants were then classified as those who provided at least as many correct answers regarding both stroke/TIA and heart attack symptoms equal or higher than the median value and those who did not. A further dichotomic variable was created, indicating the participants' perceived ability to provide first aid, based on their self-evaluation score: not enough, with a score from 1 to 5, and enough, with a score from 6 to 10.

The Chi-squared test was used, in univariate analyses, to assess potential variations in participants' characteristics for each of these dichotomous variables.

Multiple logistic regression analyses were performed by considering knowledge of stroke symptoms, knowledge of heart attack symptoms, and ability to provide first aid as outcome, and considering variables that showed significant differences in the univariate analyses for each outcome as possible predictors. Odds Ratios and corresponding 95% Confidence Intervals (OR 95%CI) were reported. The significance level assumed was $p<0.05$.

Results

A total of 744 complete questionnaires were obtained. Table 1 shows the socio-demographic characteristics of the sample.

Table 2 shows the proportions of participants with correct knowledge of normal blood pressure values and sequence of first aid actions, good or poor knowledge of symptoms associated with stroke and heart attack, and the perceived ability to provide first aid to a victim of one of these events. The majority of the sample showed good levels of knowledge about the items proposed. However, only the 39% of

Table 1 - Socio-demographic characteristics of the sample (n=744).

Variable	Value
Age, mean±SD	23.9±5.4
median (IQR)	22 (3)
Gender, n (%)	
female	465 (62.5)
male	279 (37.5)
Mother's educational level, n (%)	
mandatory	149 (20)
high school	351 (47.2)
degree	244 (32.8)
Father's educational level, n (%)	
mandatory	183 (24.6)
high school	346 (46.5)
degree	215 (28.9)
Educational area	
healthcare	434 (58.3)
other	310 (41.7)
First aid training	
no	291 (39.1)
yes	453 (60.9)

Table 2 - Participants' knowledge of stroke and heart attack symptoms and perceived ability to provide first aid.

Variable	Participants n (%)
Correct knowledge of normal blood pressure values	
no	300 (40.3)
yes	444 (59.7)
Correct knowledge of first aid actions	
no	213 (28.6)
yes	531 (71.4)
Knowledge of stroke symptoms	
poor	298 (40.1)
good	446 (59.9)
Knowledge of heart attack symptoms	
poor	292 (39.2)
good	452 (60.8)
Ability to provide first aid	
not enough	454 (61.0)
enough	290 (39.0)

respondents perceived themselves as able to provide first aid, if needed. Table 3, 4 and 5 show the results of the comparison of socio-demographic characteristics performed through chi-squared test between subgroups defined by knowledge of stroke symptoms, knowledge of heart attack symptoms and perceived ability to provide first aid. Higher age was more represented among participants with better knowledge of heart attack symptoms and with a lower perceived ability to provide first aid. Female participants showed better symptoms knowledge but lower perceived ability to provide first aid. Parents' educational level did not differ between the subgroups, while those with better symptoms knowledge included higher proportions of students who attended healthcare degree courses. Those who received first aid training exhibited better symptoms knowledge and higher ability to provide first aid. A good knowledge of both stroke and heart attack symptoms is more common among those who reported higher confidence in their ability to provide first aid.

The results of the regression analyses are reported in Table 6. Good knowledge of stroke symptoms was found to be positively related with (a) female gender, (b) attending a healthcare degree course and (c) having had a first aid training, while good knowledge of heart attack symptoms was associated with higher age, better healthcare education and first aid training. Perceived ability to provide first aid was positively related with higher age, healthcare educational area, first aid training and good symptoms knowledge, and negatively related with female gender.

Discussion

The first relevant finding of the present study is related to the percentage of the sample with correct knowledge about normal blood pressure values, first aid actions order, and symptoms associated with stroke and heart attack: most of the participants showed good levels of knowledge about the items proposed. This result is in line with those reported previously by other studies. For example, a cross-sectional study conducted among students of the National Polytechnic Institute of Côte d'Ivoire evidenced that, overall, the majority of the participants were aware of hypertension, its causes and consequences (30). Another study performed to evaluate the awareness of university students toward strokes demonstrated that the participants presented an adequate knowledge on the main risk factors and warning symptoms of this syndrome (31). Besides, a research carried out to assess university students' level of knowledge and awareness on some medical conditions including hypertension, stroke, and myocardial infarction, showed that more than 80% of the participants correctly identified symptoms and complications of

Table 3 - Differences in characteristics of participants grouped by level of stroke symptoms knowledge.

	Knowledge of stroke symptoms		*p* value
Variable	Poor n=298	Good n=446	
Age			
≤22 years	164 (42.0)	226 (58.0)	0.243
>22 years	134 (37.8)	220 (62.2)	
Gender			
female	168 (36.1)	297 (63.9)	0.005
male	130 (46.6)	149 (53.4)	
Mother's educational level			
mandatory/high school	210 (42.0)	290 (58.0)	0.121
degree	88 (36.0)	156 (64.0)	
Father's educational level			
mandatory/high school	224 (42.3)	305 (57.7)	0.046
degree	74 (34.4)	141 (65.6)	
Educational area			
other than healthcare	155 (50.0)	155 (50.0)	<0.001
healthcare	143 (32.9)	291 (67.1)	
First aid training			
no	136 (46.7)	155 (53.3)	0.003
yes	162 (35.8)	291 (64.2)	

Table 4 - Differences in characteristics of participants grouped by level of heart attack symptoms knowledge.

	Knowledge of heart attack symptoms		p value
Variable	poor n=292	good n=452	
Age			
≤22 years	177 (45.4)	213 (54.6)	<0.001
>22 years	115 (32.5)	239 (67.5)	
Gender			
female	167 (35.9)	298 (64.1)	0.016
male	125 (44.8)	154 (55.2)	
Mother's educational level			
mandatory/high school	198 (39.6)	302 (60.4)	0.778
degree	94 (38.5)	150 (61.5)	
Father's educational level			
mandatory/high school	208 (39.3)	321 (60.7)	0.950
degree	84 (39.1)	131 (60.9)	
Educational area			
other than healthcare	158 (54.1)	152 (45.9)	<0.001
healthcare	134 (30.9)	300 (69.1)	
First aid training			
no	136 (46.6)	155 (53.4)	0.001
yes	156 (34.4)	297 (65.6)	

Table 5 - Differences in characteristics of participants grouped by level of perceived ability to provide first aid.

	Perceived ability to provide first aid		
Variable	not enough n=454	enough n=290	*p* value
Age			
≤22 years	266 (68.2)	124 (31.8)	<0.001
>22 years	188 (53.1)	166 (46.9)	
Gender			
female	316 (67.9)	149 (32.1)	<0.001
male	138 (49.5)	141 (50.5)	
Mother's educational level			
mandatory/high school	314 (62.8)	186 (37.2)	0.154
degree	140 (57.4)	104 (42.6)	
Father's educational level			
mandatory/high school	330 (62.4)	199 (37.6)	0.233
degree	124 (57.7)	91 (42.3)	
Educational area			
other than healthcare	194 (62.6)	116 (37.4)	0.461
healthcare	260 (59.9)	174 (40.1)	
First aid training			
no	230 (79.0)	61 (21.0)	0.001
yes	224 (49.4)	229 (50.6)	
Knowledge of stroke symptoms			
poor	202 (67.8)	96 (32.2)	0.002
good	252 (56.5)	194 (43.5)	
Knowledge of heart attack symptoms			
poor	202 (69.2)	90 (30.8)	<0.001
good	252 (55.8)	200 (44.2)	

Table 6 - Results of the regression analyses performed on symptoms knowledge and perceived competence as outcomes.

	Outcome OR (CI95%) p value		
Variable	Stroke symptoms knowledge	Heart attack symptoms knowledge	Perceived ability to provide first aid
Age (>22 years)	1.19 (0.87-1.62) 0.300	1.77 (1.29-2.43) <0.001	1.44 (1.04-1.99) 0.027
Gender (female)	1.44 (1.05-1.98) 0.023	1.35 (0.98-1.87) 0.064	0.44 (0.32-0.61) <0.001
Father's educational level (degree)	1.21 (0.86-1.72) 0.300	n. s.	n. s.
Educational area (healthcare)	1.83 (1.34-2.51) <0.001	2.29 (1.67-3.13) <0.001	n. s.
First aid training (yes)	1.53 (1.12-2.10) 0.007	1.51 (1.10-2.07) 0.011	3.30 (2.34-4.70) <0.001
Knowledge of stroke symptoms (good)	n. s.	n. s.	1.44 (1.03-2.04) 0.036
Knowledge of heart attack symptoms (good)	n. s.	n. s.	1.52 (1.07-2.15) 0.019

the investigated disorders (32). Probably, the great relevance of cardiovascular diseases has made them very popular and general population received much information from various sources, such as other persons and media. In this regard, a systematic review on knowledge of the symptoms of acute myocardial infarction evidenced a moderate - good knowledge of classic symptoms like pain or discomfort in arms or shoulders, chest pain or discomfort, shortness of breath. However, the results of the same review showed an insufficient knowledge of less obvious symptoms such as feeling of anxiety, headache, stomach or abdominal discomfort and nausea or vomiting (33), highlighting the need of disseminating information about lesser-known symptoms and signs of cardiovascular diseases and acute events.

Another relevant result of our study is related to the participants' perceived ability to provide first aid to a victim of acute cardiovascular events. Indeed, even if the overall knowledge of the appropriate sequence of first aid actions was "good" in the most part of the sample, only slightly more than a third of participants consider themselves sufficiently prepared to act adequately in the face of a subject with an acute life-threatening event. This result agrees with those found previously (34). A study investigating the level of first aid knowledge among university students revealed the inability of the majority of them to provide competent first aid in an emergency situation (35). Besides, another study in this field reported that about 20% of the students had met cases in which cardiopulmonary resuscitation was required and about 65% of them had not provided first aid due to the nervousness, lack of knowledge, and other issues (36).

As regard to the factors influencing the knowledge of stroke symptoms, of heart attack symptoms and the perceived ability to provide first aid, as expected, having had a first aid training were significant predictors in all cases. Moreover, attending a healthcare degree course was a significant predictor of the knowledge of stroke symptoms and of heart attack symptoms. Comparable results were found by Abdela et al. (37): students attending the college of medicine and health sciences were more knowledgeable about cardiovascular diseases respect to students from other colleges (37, 38). Similarly, other studies reported a significant higher knowledge of first-aid management in medical, respect to non-medical students (39).

Other significant predictors were age and gender. In particular, higher age was positively correlated with the knowledge of heart attack symptoms and the perceived ability to provide first aid.

Regarding to the gender difference, being female was positively correlated with the knowledge of stroke, but negatively associated to perceived ability to provide first aid. Overall, as demonstrated by a systematic review, female population seems to be more prepared in terms of knowledge in risk factor and in warning signs of stroke respect to male populatin (40). Despite of this evidence, we found a greater

perceived ability in males compared to females. The reasons behind these contrasting results should be further investigated. Indeed, in case of emergency, persons more knowledgeable could not intervene and, conversely, individuals less knowledgeable could intervene inappropriately.

This study presents some limitations. First of all, this is a cross-sectional study and the study population was selected by convenience. These two limitations reduce the generalizability of the results. However, the sample was composed with comparable proportions of participants of each gender and different educational areas, which allowed to highlight some differences between groups that need to be further explored.

Conclusions

The findings of this study show a satisfactory level of knowledge about blood pressure and cardiovascular first aid in the majority of the sample examined. However, a low proportion declared a perceived ability to provide first aid in case of emergency, notwithstanding the training received. Given the importance to act immediately in front of an acute life-threatening event, it is essential to enhance the people's competence about cardiopulmonary resuscitation, especially among young individuals and those attending non-medical courses. Besides, females showed better knowledge but less confidence in their own ability to act in an emergency situation respect to males. This finding deserves to be investigated with further studies.

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Ethical approval: The research protocol was approved by the Research Committee of the University of Rome "Foro Italico" (approval n CAR 80/2021) and was in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments.

Riassunto

Conoscenze e competenze percepite dai giovani sulla rianimazione cardiopolmonare: uno studio trasversale su un campione di studenti universitari italiani

Premessa. La rianimazione cardiopolmonare è fondamentale per migliorare gli esiti di un possibile evento avverso. La corretta conoscenza delle azioni di primo soccorso da fornire può garantire la sopravvivenza della vittima. Lo scopo di questo studio è stato quello di valutare la competenza sulla rianimazione cardiopolmonare e i suoi determinanti in un campione di studenti universitari italiani.

Metodi. Le caratteristiche socio-demografiche, la formazione sul primo soccorso, la conoscenza dei sintomi di ictus e infarto e la capacità percepita di fornire il primo soccorso sono informazioni che sono state raccolte attraverso un questionario online.

Risultati. Su un totale di 744 intervistati (età media 23,9±5,4 anni, 62,5% donne), il 71,4% ha identificato correttamente le azioni di primo soccorso, il 59,9% e il 60,8% hanno mostrato una buona conoscenza rispettivamente dei sintomi di ictus e infarto. Tuttavia, solo il 39,0% ha dichiarato di sentirsi competente ad intervenire in caso di emergenza. La frequenza di un corso di laurea in ambito sanitario e l'aver seguito una formazione di primo soccorso sono fattori che risultano associati alla conoscenza dei sintomi e alla capacità percepita di fornire il primo soccorso. Il genere femminile è stato correlato negativamente con la capacità di intervenire.

Conclusioni. Nonostante il livello soddisfacente di conoscenza, questi risultati evidenziano la necessità di migliorare le competenze sulla rianimazione cardiopolmonare nella popolazione laica, soprattutto tra le donne.

References

1. World Health Organization (WHO). Cardiovascular diseases (CVDs). Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) [Last accessed: 2024 Feb 3].
2. Rubbi I, Lapucci G, Bondi B, Monti A, Cortini C, Cremonini V, et al. Effectiveness of a video lesson for the correct use in an emergency of the automated external defibrillator (AED). Acta Biomed. 2020 Jun; **91**(6-S): 71-78. doi: 10.23750/abm.v91i6-S.9589.
3. Gräsner JT, Lefering R, Koster RW, Masterson S, Böttiger BW, Herlitz J. EuReCa ONE-27 Nations, ONE Europe, ONE Registry: A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. Resuscitation. 2016 Aug;**105**:188-95. doi: 10.1016/j.resuscitation.2016.06.004. Epub 2016 Jun 16.

Wnent J, Tjelmeland IB, Ortiz FR, Maurer H, Baubin M, Mols P, et al.EuReCa ONE-27 Nations, ONE Europe. ONE Registry: A prospective one-month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. Resuscitation. 2016 Aug; **105**: 188-195. doi: 10.1016/j.resuscitation.2016.06.004. Epub 2016 Jun 16.

4. Berdowski J, Berg RA, Tijssen JG, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: systematic review of 67 prospective studies. Resuscitation. 2010 Nov; **81**(11): 1479-1487. doi: 10.1016/j.resuscitation.2010.08.006. Epub 2010 Sep 9.
5. Latest AHA Statistics on Cardiac Arrest Survival Reveal Little Progress. Sudden Cardiac Arrest Foundation. Available from: https://www.sca-aware.org/sca-news/latest-aha-statistics-on-cardiac-arrest-survival-reveal-little-progress [Last accessed: 2024 Feb 3].
6. Thomas A, Sanseau E, Uspal N, Burns R, Auerbach M, Caglar D, et al. Pediatric Emergency Medicine Simulation

Curriculum: Submersion Injury With Hypothermia and Ventricular Fibrillation. MedEdPORTAL. 2017 Oct 17; **13**: 10643. doi: 10.15766/mep_2374-8265.10643.
7. Weaver WD, Cobb LA, Hallstrom AP, Fahrenbruch C, Copass MK, Ray R. Factors influencing survival after out-of-hospital cardiac arrest. J Am Coll Cardiol. 1986 Apr; **7**(4): 752-757. doi: 10.1016/s0735-1097(86)80332-1.
8. Cummins RO, Eisenberg MS, Hallstrom AP, Litwin PE. Survival of out-of-hospital cardiac arrest with early initiation of cardiopulmonary resuscitation. Am J Emerg Med. 1985 Mar; **3**(2): 114-119. doi: 10.1016/0735-6757(85)90032-4.
9. Lorensini S, Prakash S, McNeill D, Spencer N, Bihari S. A Pilot Study to Examine the Effect of Passive Straight Leg Raise Performed During Cardiopulmonary Resuscitation on Cerebral Perfusion Measured by Noninvasive Cerebral Oximetry. Crit Care Explor. 2023 Mar 27; **5**(4): e0880. doi: 10.1097/CCE.0000000000000880.
10. Obermaier M, Katzenschlager S, Kofler O, Weilbacher F, Popp E. Advanced and Invasive Cardiopulmonary Resuscitation (CPR) Techniques as an Adjunct to Advanced Cardiac Life Support. J Clin Med. 2022 Dec 9; **11**(24): 7315. doi: 10.3390/jcm11247315.
11. Tiwari L, Lockey A, Böttiger BW, Rott N, Hoover AV, Chakra Rao S, et al. More than 302 million people reached and over 2,200,000 trained in cardiopulmonary resuscitation worldwide: The 2021 ILCOR World Restart a Heart initiative. Resusc Plus. 2023 Mar 22; **14**: 100375. doi: 10.1016/j.resplu.2023.100375.
12. Holmberg MJ, Granfeldt A, Guerguerian AM, Sandroni C, Hsu CH, Gardner RM, et al. Extracorporeal cardiopulmonary resuscitation for cardiac arrest: An updated systematic review. Resuscitation. 2023 Jan; **182**: 109665. doi: 10.1016/j.resuscitation.2022.12.003. Epub 2022 Dec 12.
13. Latsios G, Leopoulou M, Synetos A, Karanasos A, Papanikolaou A, Bounas P, et al. Cardiac arrest and cardiopulmonary resuscitation in "hostile" environments: Using automated compression devices to minimize the rescuers' danger. World J Cardiol. 2023 Feb 26;**15**(2):45-55. doi: 10.4330/wjc.v15.i2.45.
14. Travers AH, Perkins GD, Berg RA, Castren M, Considine J, Escalante R, et al. Part 3: Adult Basic Life Support and Automated External Defibrillation: 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Circulation. 2015 Oct 20; **132**(16 Suppl 1): S51-83. doi: 10.1161/CIR.0000000000000272.
15. Glass GF, Brady WJ. Bystander intervention in out-of-hospital cardiac arrest. JAMA Netw Open. 2019 Mar 1; **2**(3): e191008. doi: 10.1001/jamanetworkopen.2019.1008.
16. Hölzing CR, Brinkrolf P, Metelmann C, Metelmann B, Hahnenkamp K, Baumgarten M. Potential to enhance telephone cardiopulmonary resuscitation with improved instructions - findings from a simulation-based manikin study with lay rescuers. BMC Emerg Med. 2023 Apr 1; **23**(1): 36. doi: 10.1186/s12873-023-00810-0.
17. Semeraro F, Greif R, Böttiger BW, Burkart R, Cimpoesu D, Georgiou M, et al. European resuscitation council guidelines 2021: systems saving lives. Resuscitation. 2021 Apr; **161**: 80–97. doi: 10.1016/j.resuscitation.2021.02.008. Epub 2021 Mar 24.
18. Okabayashi S, Matsuyama T, Kitamura T, Kiyohara, K, Kiguchi T, Nishiyama C, et al. Outcomes of Patients 65 Years or Older After Out-of-Hospital Cardiac Arrest Based on Location of Cardiac Arrest in Japan. JAMA Netw Open. 2019 Mar 1; **2**(3): e191011. doi: 10.1001/jamanetworkopen.2019.1011.
19. American Heart Association. Impact-map 2021. Available from: https://www.heart.org/en/impact-map [Last accessed: 2024 Feb 3].
20. British Hearth Foundation. Government confirms plans to teach CPR in schools 2020. Available from: https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2019/january/government-confirms-plans-to-teach-cpr-in-schools [Last accessed: 2024 Feb 3].
21. Kane AD, Nolan JP. Changes to the European Resuscitation Council guidelines for adult resuscitation. BJA Educ. 2022 Jul; **22**(7): 265-272. doi: 10.1016/j.bjae.2022.02.004. Epub 2022 Apr 30.
22. Marcori S, Pezzato A, Hinojosa AK, Gant A, Uliana A, Koni M, et al. [Out-of-hospital cardiac arrest: University of Trieste students' skills on resuscitative maneuvers and automated external defibrillator]. G Ital Cardiol (Rome). 2023 Apr; **24**(4): 310-317. Italian. doi: 10.1714/4004.39822.
23. Chaudhary GP, Sah K, Malla J, Das N, Chaudhary S, Chaudhary I, et al. Knowledge regarding Basic Life Support among Health Care Workers of the Hospital of Nepal. J Healthc Eng. 2023 Jan 5; **2023**: 9936114. doi: 10.1155/2023/9936114.
24. Suppan L, Herren T, Taramarcaz V, Regard S, Martin-Achard S, Zamberg I, et al. A Short Intervention Followed by an Interactive E-Learning Module to Motivate Medical Students to Enlist as First Responders: Protocol for a Prospective Implementation Study. JMIR Res Protoc. 2020 Nov 6; **9**(11): e24664. doi: 10.2196/24664.
25. Junli A, Isa SNI, Ibrahim FS. Factors of cardiopulmonary resuscitation skills retention among healthcare providers: A scoping review. Nurse Educ Pract. 2023 May; **69**: 103617. doi: 10.1016/j.nepr.2023.103617. Epub 2023 Mar 25.
26. Reiner Ž, Sonicki Z, Tedeschi-Reiner E. The perception and knowledge of cardiovascular risk factors among medical students. Croat Med J. 2012 Jun; **53**(3): 278-284. doi: 10.3325/cmj.2012.53.278.
27. Badir A, Tekkas K, Topcu S. Knowledge of cardiovascular disease in Turkish undergraduate nursing students. Eur J Cardiovasc Nurs. 2015; **14**(5): 441-449. doi: 10.1177/1474515114540554.
28. Dadda F, Cofano R, Marzano V, Tortorano AM. [Learning how to face emergencies. A project dealing with first aid aimed at primary and secondary school students]. Ann Ig. 2008 Sep-Oct); **20**(5): 465-475. Italian.
29. Mosca L, Hammond G, Mochari-Greenberger H, Towfighi A, Albert MA; American Heart Association Cardiovascular Disease and Stroke in Women and Special Populations Committee of the Council on Clinical Cardiology, Council

on Epidemiology and Prevention, Council on Cardiovascular Nursing, Council on High Bloo. Fifteen-year trends in awareness of heart disease in women: results of a 2012 American Heart Association national survey. Circulation. 2013 Mar 19; **127**(11): 1254-1263. doi: 10.1161/CIR.0b013e318287cf2f. Epub 2013 Feb 19.
30. Zobo PC, Touré FY, Coulibaly I, Bitty-Anderson AM, Boni SP, Niangoran S, et al. Prevalence of hypertension and other cardiovascular disease risk factors among university students from the National Polytechnic Institute of Côte d'Ivoire: A cross-sectional study. PLoS One. 2023 Jan 5; **18**(1): e0279452. doi: 10.1371/journal.pone.0279452.
31. Mohammad Morshad A, Shajeda Akter N, Saifur R, Abdul H, Muhammad Musfiqur R, Muzahidul I. Awareness of university students towards strokes: a cross-sectional study. J Biomed Pharm Res. 2017 May-Jun; **6**(3): 35-42.
32. Yahia N, Brown C, Rapley M, Chung M. Assessment of college students' awareness and knowledge about conditions relevant to metabolic syndrome. Diabetol Metab Syndr. 2014 Oct 15; **6**(1): 111. doi: 10.1186/1758-5996-6-111.
33. Birnbach B, Höpner J, Mikolajczyk R. Cardiac symptom attribution and knowledge of the symptoms of acute myocardial infarction: a systematic review. BMC Cardiovasc Disord. 2020 Oct 14; **20**(1): 445. doi: 10.1186/s12872-020-01714-8.
34. Batais MA, Alzahrani SA, Alzahrani NA, Alsolimi AF, Khan AA, Aldossari KK, et al. Knowledge and Practice of Burn First Aid Among Saudi Arabian Medical and Non-Medical University Students. Int Q Community Health Educ. 2021 Jul; **41**(4): 405-410. doi: 10.1177/0272684X20972644. Epub 2020 Nov 11.
35. Khatatbeh M. First Aid Knowledge Among University Students in Jordan. Int J Prev Med. 2016 Jan 22; **7**: 24. doi: 10.4103/2008-7802.174772.
36. Halawani LM, Alghamdy SD, Alwazae MM, Alkhayal WA. Knowledge and attitude of Saudi female university students about first aid skills. J Family Community Med. 2019 May-Aug; **26**(2): 103-107. doi: 10.4103/jfcm.JFCM_92_18.
37. Abdela OA, Ayalew MB, Yesuf JS, Getnet SA, Biyazin AA, Lemma MY, et al. Ethiopian university students' knowledge and perception towards cardiovascular disease risk factors: a cross sectional study. Am J Cardiovasc Dis. 2019 Feb 15; **9**(1): 1-7.
38. Scapigliati A, Giampaoli S, Marsili A, Valeriani F, Romano Spica V. Cardiopulmonary Resuscitation Training in Sport Universities: An Italian Survey. Adv Phys Educ. 2013 Aug; **3**(3): 131-135. doi: 10.4236/ape.2013.33022.
39. Basuhail S, Al Hammad BK, Aldhafeeri BG, Alquhayz MF, Alqahtani MS, Alkharboush HF, et al. Knowledge and management of first-aid skills between medical and non-medical students at King Saud University. J Family Med Prim Care. 2022 Dec; **11**(12): 7635-7639. doi: 10.4103/jfmpc.jfmpc_773_22. Epub 2023 Jan 17.
40. Stroebele N, Müller-Riemenschneider F, Nolte CH, Müller-Nordhorn J, Bockelbrink A, Willich SN. Knowledge of risk factors, and warning signs of stroke: a systematic review from a gender perspective. Int J Stroke. 2011 Feb; **6**(1): 60-66. doi: 10.1111/j.1747-4949.2010.00540.

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