Knowledge, Attitude, Willingness and Barriers in Performing Cardiopulmonary Resuscitation among Malaysian Undergraduates

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Abstract: Bystander Cardiopulmonary Resuscitation (CPR) serves as a significant determinant in enhancing the survival rate of Out-of-hospital cardiac arrest events. This study aimed to assess university students' knowledge towards CPR, and identify factors that may influence their attitude, willingness and barriers in performing CPR and determine the differences between the demographic profiles of the students. A cross-sectional study was carried out among a public university in Selangor. Respondents answered an online questionnaire comprising knowledge, attitude, willingness, and barriers to performing CPR. To assess differences among the demographic profiles regarding the knowledge, attitude, willingness and barriers towards CPR, Multivariate Analysis of Variance (MANOVA) was conducted. Of the 273 respondents (male = 23.4%), 48.7% reported experiencing an emergency event, 37.4% had attended a First Aid Course in the past 6 months, and 76.2% have never been licensed in CPR. Most respondents demonstrated positive attitudes and strong willingness to perform CPR in emergency situations, but a significant obstacle was the lack of training. Results of the MANOVA analysis showed that male students' willingness to perform CPR was significantly higher than females, students from the Faculty of Medicine possessed the highest knowledge scores on CPR, and those who attended a CPR course in the past 5 years exhibited higher knowledge than those who did not. Individual skill development and increasing the prevalence of bystander-initiated CPR usage in critical situations are important public health initiatives.

Keywords: Attitude, Barriers, CPR, Knowledge, Willingness

1. Introduction

Out-of-hospital cardiac arrest (OHCA) is a critical global health concern, with significant implications for public health systems (Baig et al., 2025). A comprehensive meta-analysis, incorporating data from 67 studies conducted across diverse geographical regions, reveals that the

global incidence of OHCA ranges from approximately 20 to 140 cases per 100,000 individuals. Furthermore, the reported survival rates for OHCA vary considerably, with estimates ranging from 2% to 11% (Berdowski et al., 2010). Sustainable Development Goal 3 (SDG-3) focuses on promoting healthy lives and well-being across all age groups. As part of this objective, one of the key targets is to enhance the capacity of nations worldwide to mitigate risks and effectively manage global health challenges, including out-of-hospital deaths (Villiani & Winkler, 2020).

Malaysia's national strategy to address out-of-hospital deaths caused by cardiac arrest incorporates a multifaceted approach. Central to this effort are widespread public education and awareness campaigns designed to improve the public's ability to recognize cardiac arrest symptoms and respond promptly (Ong et al., 2015). A key component is the implementation of CPR training programs, which empower individuals with essential life-saving skills. Additionally, community engagement initiatives are being promoted to cultivate a culture of preparedness and rapid response. Concurrently, emergency medical services are being strengthened to ensure efficient and effective pre-hospital care. The integration of technology and ongoing research plays a pivotal role in refining interventions and assessing their outcomes (Hamidizadeh et al., 2024). Collectively, these initiatives aim to markedly enhance survival rates for cardiac arrest cases occurring outside healthcare settings (Daud et al., 2023).

Research has consistently shown that bystander Cardiopulmonary Resuscitation (CPR) is a critical factor in improving survival rates among out-of-hospital cardiac arrest (OHCA) patients. Studies indicate that the rate of return of spontaneous circulation (ROSC) is significantly higher in patients who receive bystander CPR compared to those who do not (Doan et al., 2020; Yatimi et al., 2024). The effectiveness and quality of CPR are strongly influenced by the bystander's level of CPR knowledge and prior training experience (Chen et al., 2020). Among various occupational groups, such as workers, farmers, and freelancers, college students demonstrate a higher level of CPR knowledge and a greater willingness to perform bystander CPR (Qin et al., 2024). Globally, the primary strategy to increase bystander CPR rates has been to train as many individuals as possible. Introducing CPR training programs in schools and universities has been widely advocated as a sustainable, long-term approach to equipping the broader population with life-saving skills (Mozaffarian et al., 2015). However, fostering the willingness of students to initiate bystander CPR may present a greater challenge than simply disseminating CPR knowledge and techniques (Lu et al., 2017).

Research conducted in Malaysia has revealed that possessing the knowledge to perform CPR does not inherently translate into a willingness to execute it in real-life situations (Mokhtar & Abdul-Razak, 2024). Similarly, studies across Asia (Chiang et al., 2014; Lu et al., 2015) have highlighted that individuals' attitudes toward bystander CPR are influenced by a complex interplay of factors. This is because initiating bystander CPR not only requires theoretical knowledge and technical skills but also depends on psychological readiness and social participation (Lu et al., 2015; Wen-Chu et al., 2014). Adequate CPR knowledge and skills have been identified as critical determinants for performing CPR effectively (Riggs et al., 2015). Expanding CPR training programs has been shown to be an effective strategy for increasing bystander CPR rates (Tanigawa et al., 2011). Disseminating CPR knowledge and skills among students is a vital approach to improving access to bystander CPR (Mao et al., 2021). University students represent a key demographic with the potential to perform bystander CPR and propagate CPR knowledge and skills within their communities. Therefore, this study aims to evaluate university students' knowledge of CPR, identify factors influencing their attitudes, willingness, and perceived barriers to performing CPR, and examine differences based on students' demographic profiles.

2. Methodology

2.1 Population and Study Design

A descriptive research design took place from September 2024 to December 2024 with a sample of undergraduate university students from a public university in Selangor State, Malaysia.

2.2 Sample Size

The estimated sample size was determined using Krejcie and Morgan's (1970) sample size table within a total undergraduate's population (S = 15,000), assuming a 95% confidence level, a 5% margin

of error, and a population proportion of $P = 0.5$. A 5% dropout rate was also accounted for resulting in a selected sample of ($N = 393$) (September 2024) (Morgan, 1970). Using stratified random sampling, a total of 273 respondents consented to the research study with the inclusion of all undergraduate students from 24 faculties and institutes from the university. The study excluded individuals who did not provide consent for participation and those who are international and postgraduate students.

2.3 Instrumentation

A self-administered questionnaire, shown to be valid and reliable, was compiled based on multiple studies and consisted of five sections: (a) demographics, (b) knowledge of CPR (comprising 10 multiple-choice questions) (Fariduddin et al., 2022), (c) attitude towards CPR (6 items) (Mansour et al., 2019), (d) willingness to perform CPR (13 items) (Sanela Pivec et al., 2020), and (e) barriers to performing CPR (11 items) (Ravindra et al., 2024). In section (b), each correct response to the multiple-choice questions was assigned a score of 1 point, and each incorrect response received 0 points, yielding a maximum possible score of 10. Section (c) included single-choice items, a 5-point Likert scale, and dichotomous Yes/No questions to assess the participants' attitudes towards CPR. Sections (d) and (e) utilized a dichotomous Yes/No scale for all items. In these sections, each affirmative response (Yes) was awarded 1 point, with the total score reflecting the participants' willingness (section d) and barriers (section e) to performing CPR. A higher score indicated greater willingness or more perceived barriers. The questionnaire was developed in English and first subjected to face validity assessment to ensure its clarity and relevance. This was followed by content validation conducted by public health physicians and health educationists. The Content Validity Index (CVI) achieved was 1.00, reflecting unanimous agreement. All sections of the instruments were pre-tested on 30 university students from different states, resulting in the KR_{20} of 0.83 (section b) and α value of 0.80 – 0.90 (section c-e).

2.4 Data Collection Procedures

The Research Ethics Committee of UiTM granted ethical approval under referral number REC/10/2024 (ST/MR/232). The questionnaire was distributed and collected from undergraduate students across faculties using the Google Form link. The front page of the questionnaire included a concise study overview along with a consent form, ensuring voluntary participation devoid of any pressure or coercion. A period of 3 weeks was given for the data collection. A reminder was sent once during the final week to ensure all the respondents completed the form. All the information collected was then kept anonymous and confidential by the researcher.

2.5 Data Analysis

The data collected were analysed using IBM Statistical Package for Social Science (SPSS) for Windows, Version 28. Descriptive statistics were employed to evaluate frequency distribution, mean, and standard deviation for the knowledge score of CPR, attitude towards CPR, willingness and barriers towards performing CPR. To assess differences among the demographic profiles regarding knowledge, attitude, willingness and barriers towards CPR, Multivariate Analysis of Variance (MANOVA) was utilized. Tests to ensure underlying assumptions were conducted: the Shapiro-Wilk test confirmed univariate normality, no multivariate outliers were detected, the correlation between dependent variables was within acceptable limits, and Box's M test signified homogeneity of variance-covariance matrices. Statistical significance was predetermined at a probability value of 0.05 or lower, two-tailed.

3. Results

The study included a total of 273 participants, of which 64 (23.4%) were male and 209 (76.6%) were female. The age distribution revealed that the majority of participants were aged between 18-22 years (217, 79.5%), followed by 23-27 years (53, 19.4%), and only a small proportion were aged 28 and above (3, 1.1%). In terms of educational background, 145 participants (53.1%) had completed STPM, STAM, or Matriculation/Foundation, while 128 (46.9%) had attained a Diploma level education. The participants were from a diverse range of faculties, with the Faculty of Applied Sciences

having the highest representation at 37 (13.6%), followed by the Faculty of Business Management with 52 (19%) participants. Other faculties included the Faculty of Education (47, 17.2%), Faculty of Art and Design (16, 15.9%), and Faculty of Computer Science and Mathematics (9, 3.3%), among others. Regarding experience with emergencies, 133 participants (48.7%) reported having such an experience, while 140 (51.3%) did not. Additionally, 102 participants (37.4%) had attended a First Aid Course in the past five years. Of those who had CPR certification, 18 (6.6%) had been certified for less than six months, 12 (4.4%) between 7-12 months, and 35 (12.8%) for over a year (Table 1).

Table 1

Demographic Profile

Demographics	Descriptions	N (%)
Sex	Male	64 (23,4%)
	Female	209 (76.6%)
Age (years)	18-22	217 (79.5%)
	23-27	53 (19.4%)
	28 above	3 (1.1%)
Highest level of education	STPM / STAM / Matriculation /Foundation	145 (53.1%)
	Diploma	128 (46.9%)
Faculty (current study)	Faculty of Art and Design	16 (15.9%)
	Faculty of Computer Science and Mathematics	9 (3.3%)
	Faculty of Accounting	17 (6.2%)
	Faculty of Civil Engineering	6 (2.2%)
	Faculty of Electrical Engineering	1 (0.4%)
	Faculty of Mechanical Engineering	6 (2.2%)
	Faculty of Chemical Engineering	2 (0.7%)
	Faculty of Applied Science	37 (13.6%)
	Faculty of Business Management	52 (19.0%)
	Faculty of Health Sciences	19 (7.0%)
	Faculty of Education	47 (17.2)
	Faculty of Information Management	6 (2.2%)
	Faculty of Medicine	3 (1.1%)
	Faculty of Pharmacy	8 (2.9%)
	Faculty of Law	4 (1.5%)
	Faculty of Language Studies	2 (0.7%)
	Faculty of Film, Theatre, and Animation	1 (0.4%)
	Faculty of Sports Science and Recreation	7 (2.6%)
	Faculty of Communication and Media Studies	2 (0.7%)
	Faculty of Public Business and Management	8 (2.9%)
	Faculty of Architecture, Planning, and Surveying	4 (1.5%)

Demographics	Descriptions	N (%)
	Academy of Contemporary Islamic Studies	6 (2.2%)
	Faculty of Engineering Technology (FTK)	1 (0.4%)
	Faculty of Hotel and Tourism Management	9 (3.3%)
Experienced dealing with emergencies	Yes	133 (48.7%)
	No	140 (51.3%)
Attended the First Aid Course for the past five years	Yes	102 (37.4%)
	No	171 (62.6%)
Last CPR Course Certification	Never	208 (76.2%)
	Less 6 months	18 (6.6%)
	7-12 months	12 (4.4%)
	Above 1 year	35 (12.8%)

The participants' knowledge on CPR was assessed through a series of questions. Regarding the number of chest compressions recommended per minute during CPR, 182 participants (66.7%) correctly identified the range as 100-120 compressions, while 75 (27.5%) believed it to be less than 90 compressions. The correct positioning of palms during compressions was known by 204 participants (74.7%), who indicated the middle of the chest. When asked about the recommended depth for chest compressions, 124 participants (45.4%) correctly selected 5 cm. In response to the first action to take if a teacher suddenly falls unconscious, 101 participants (37%) identified checking whether the victim is breathing normally as the correct step. When asked about when CPR can be stopped, 229 participants (83.9%) correctly answered that it can be stopped when the victim begins to regain consciousness. For the role of an AED machine, 174 participants (63.7%) correctly answered that it gives a shock to the victim. Regarding the correct sequence for performing CPR, 141 participants (51.6%) correctly chose the option that starts with checking the environment for safety. When applying an AED to a victim, 139 participants (50.9%) identified the correct sequence involving pressing the "ON" button and following the instructions issued by the machine (Table 2).

Table 2

Knowledge on CPR

Knowledge on CPR	Descriptions	N (%)
How many chest compressions should be given to the victim during CPR in 1 minute?	Less than 90 compressions	75 (27.5%)
	100 – 120 compressions	182 (66.7%)
	121 - 140 compressions	21 (7.7%)
	More than 150 compressions	7 (2.6%)
Where are your palms positioned when doing chest compressions?	Middle of the chest	204 (74.7%)
	Stomach	10 (3.7%)
	Left chest	46 (16.8)
	Right chest	13 (4.8%)
When you do chest compressions, what is the recommended depth?	3 cm	94 (34.4%)
	5 cm	124 (45.4%)
	6 cm	20 (7.3%)
	4 cm	35 (12.8%)
If you are faced with a situation where your lecturer suddenly falls unconscious, what is the FIRST action you should take?	Checking whether the victim is breathing normally or not	101 (37.0%)
	Make sure you're and the victim's environment are safe	71 (26.0%)
		84 (30.8%)

Knowledge on CPR	Descriptions	N (%)
	Try to get a response from surrounding Reach out to others for help	17 (6.2%)
For this question, you can mark more than one answer. Mark the correct answer. When can CPR be stopped?	You are too tired to perform CPR	53 (19.4%)
	When environmental conditions become unsafe	94 (34.4%)
	The victim began to regain consciousness	229 (83.9%)
	When CPR has been given for 3 minutes	125 (45.8%)
The short form for AED is?	Auto Extension DEfibril	13 (4.8 %)
	Automated External Defibrillator	210 (76.9%)
	Anterior External Devices	35 (12.8%)
	Auto Extension Devices	15 (5.5%)
What role does an AED machine play?	Reduce the victim's heart rate	32 (11.7%)
	Inserting medicine into the victim's chest	16 (5.9%)
	Giving a shock to the victim	174 (63.7%)
	Pressing the victim's chest	51 (18.7%)
Based on the answers below, choose the correct sequence to perform CPR.	Ensure the level of consciousness, call for help, obtain an AED (if available), check the environment for safety, check if the victim is breathing or not, reassess the victim, press the chest at the correct location.	39 (14.3%)
	Check the environment for safety, check if the victim is breathing or not, ensure the level of consciousness, call for help, obtain an AED (if available), reassess the victim, press the chest at the correct location.	141 (51.6%)
	Check if the victim is breathing or not, check the environment for safety, call for help, obtain an AED (if available), ensure the level of consciousness, reassess the victim, press the chest at the correct location.	87 (31,9%)
	Reassess the victim, press the chest at the correct location, call for help, obtain an AED (if available), ensure the level of consciousness, check if the victim is breathing or not, check the environment for safety.	6 (2.2%)

Knowledge on CPR	Descriptions	N (%)
Where is the correct location when performing an AED PAD on a victim?	On the left chest, on the stomach	56 (20.5%)
	In the middle of the chest, behind the body	55 (20.1%)
	On the stomach, behind the body	14 (5.1%)
	Above the right chest, below the left chest	148 (54.2%)
What is the correct sequence when applying an AED to a victim?	Allow the AED to analyze the victim -> press the 'shock' button if necessary -> press the "ON" button on the AED -> follow the instructions issued by the machine -> stick the pad to the victim's body	54 (19.8%)
	Press the "ON" button on the AED -> follow the instructions issued by the machine -> stick the pad to the victim's body -> allow the AED to analyze the victim -> press the 'shock' button if necessary	139 (50.9%)
	Press the 'shock' button if necessary -> follow the instructions issued by the machine -> stick the pad to the victim's body -> allow the AED to analyze the victim –> press the "ON" button on the AED	24 (8.8%)
	Stick to the victim's body -> press the "ON" button on the AED -> allow the AED to analyze the victim -> follow the instructions issued by the machine -> press the 'shock' button if necessary	56 (20.5%)
Total Score	Mean (SD)	
	5.37 (2.50)	

The survey results reveal a strong consensus on the importance of CPR training among the respondents. A majority (63%) believed CPR training should be mandatory for all students as a graduation requirement, with an additional 21.6% supporting its mandatory inclusion for specific majors. While 13.2% felt it should remain optional, only a small minority (2.2%) opposed the implementation of such courses. To enhance public awareness of CPR's importance, over half of the respondents (56.4%) suggested offering free training courses, while others recommended increased publicity (22.3%), providing information about existing courses (15.8%), and expanding the number of courses (5.5%). The perceived benefits of CPR training were overwhelmingly positive, with 71.8% strongly agreeing and 22.7% agreeing that it helps students save lives. Despite only 35.2% having taken a CPR course, there was substantial interest in learning, as 92.7% expressed a desire to do so, driven primarily by mandatory requirements (51.8%) and personal interest (31.1%). This underscores the widespread recognition of CPR training's value and its potential life-saving impact (Table 3).

Table 3

Attitude towards CPR

Attitude towards CPR	Descriptions	N (%)
Do you think CPR training course should be:	Mandatory for all students (graduation requirement)	172 (63.0%)
	Mandatory for some majors	59 (21.6%)
	Optional	36 (13.2%)
	Don't support the implementation of training courses	6 (2.2%)
What is the BEST method-in your opinion to increase public awareness of the importance of CPR?	Increased publicity	61 (22.3%)
	Inform people of the training courses currently available	43 (15.8%)
	Free training courses	154 (56.4%)
	Increase the number of course	15 (5.5%)
Do you think CPR training is a benefit for students to save the lives of the public?	Strongly agree	196 (71.8%)
	Agree	62 (22.7%)
	Neutral	13 (4.8%)
	Disagree	0
	Strongly disagree	2 (0.7%)
Have you ever taken a CPR training course?	Yes	96 (35.2%)
	No	177 (64.8%)
What encouraged you to take the course?	Work or graduation requirement (Mandatory)	86 (31.5%)
	Personal benefit (Optional)	145 (53.1%)
	Previous experience proved the importance of CPR	42 (15.4%)
Do you want to learn CPR?	Yes	253 (92.7%)
	No	20 (7.3%)

The data on willingness to perform CPR demonstrates a high level of readiness among respondents to provide assistance in emergencies. An overwhelming majority (97.4%) indicated they would help if someone fell in front of them, and an even higher percentage (98.9%) would assist a friend who lost consciousness. Similarly, 94.9% expected help when they are in need, reflecting a reciprocal attitude toward emergency aid. The ability to recognize a person not showing signs of life motivated 86.8% to help, and 97.8% express a general inclination to assist others in need. The willingness extended to noticing when friends and classmates need help (92.9%), and 98.5% actively consider how they can help when someone needs assistance. Additionally, 93.9% would start providing help immediately upon observing a victim not showing signs of life, with 87.9% being confident that their intervention can save lives. A significant proportion (66.3%) felt confident enough to begin CPR immediately due to self-belief, and 97.1% responded promptly when friends ask for help. While 60.5% would dare to provide CPR even before receiving formal training, this figure jumps to 93.4% after training, highlighting the impact of CPR education on confidence and willingness to act (Table 4).

Table 4

Willingness in performing CPR

Willingness in performing CPR	Descriptions	N (%)
If someone fell in front of me, I would help them.	Yes	266 (97.4%)
	No	7 (2.6%)
If my friend lost consciousness, I would help them.	Yes	270 (98.9%)
	No	3 (1.1%)
I would also expect help when in need.	Yes	259 (94.9%)
	No	14 (5.1%)
I help because I can recognize a person who is not showing signs of life.	Yes	237 (86.8%)
	No	36 (13.2%)
I like to help others when they are in need.	Yes	267 (97.8%)
	No	6 (2.2%)
I notice when my friends and classmates need help.	Yes	252 (92.3%)
	No	21 (7.7%)
When I notice that someone needs help, I ask myself how I can help them.	Yes	269 (98.5%)
	No	4 (1.5%)
If I noticed a group of people only observing a victim not showing signs of life, I would start providing help immediately.	Yes	258 (94.5%)
	No	15 (5.5%)
I am aware that by helping a victim not showing signs of life, I can save their life.	Yes	240 (87.9%)
	No	33 (12.1%)
If I noticed a victim who was not moving or showing signs of life, I would begin CPR immediately, because I believe in myself.	Yes	181 (66.3%)
	No	92 (33.7%)
When friends ask for my help, I don't hesitate and help them right away.	Yes	265 (97.1%)
	No	8 (2.9%)
I would dare to provide CPR before receiving training.	Yes	107 (39.2%)
	No	166 (60.8%)
I would dare to provide CPR after receiving training.	Yes	256 (93.8%)
	No	17 (6.2%)
Total score	Mean (SD)	
	11.45 (1.58)	

The survey results on barriers to performing CPR highlight several concerns among respondents. The most commonly cited barrier was the fear of harming the patient, with 74.7% expressing this concern. Lack of prior training was another significant barrier, mentioned by 64.1% of respondents. The spread of infections, such as COVID-19 or influenza, was a concern for 51.3%, while 34.8% feared harming themselves during the process. Religious or cultural barriers were noted by 33%, and 37% feared legal repercussions such as being sued. Concerns about the risk of disease were raised by 63.7% of participants. Additionally, the fear of performing CPR when unnecessary or incorrectly was prevalent, with 82.4% and 87.9%, respectively, indicating these fears. Interestingly, a minority (17.2%) believed CPR might not be useful, indicating a need for better education on the effectiveness of CPR in saving lives. These findings underscore the importance of addressing these barriers through comprehensive training and public awareness initiatives to improve CPR performance rates (Table 5).

Table 5

Barriers in performing CPR

Barriers in performing CPR	Descriptions	N (%)
No prior training.	Yes	175 (64.1%)
	No	98 (35.9%)
May harm the patient	Yes	204 (74.7%)
	No	69 (25.3%)
Gender barrier	Yes	140 (51.3%)
	No	133 (48.7%)
Spread of infections such as COVID / Influenza and any infectious disease	Yes	178 (65.2%)
	No	95 (34.8%)
May harm myself	Yes	101 (37%)
	No	172 (63%)
CPR will not be useful	Yes	47 (17.2%)
	No	226 (82.8%)
Religious or cultural barriers	Yes	90 (33%)
	No	183 (67%)
Fear of being sued	Yes	174 (63.7%)
	No	99 (36.3%)
Risk of disease	Yes	174 (63.7%)
	No	99 (36.3%)
Fear about hurting a person if I do CPR when it is unnecessary	Yes	225 (82.4%)
	No	48 (17.6%)
Fear about hurting a person if I do CPR incorrectly	Yes	240 (87.9%)
	No	33 (12.1%)
Total Score	Mean (SD)	
	7.07(2.79)	

A one-way MANOVA analysis was conducted to examine the differences in the level of knowledge, willingness and barriers in performing CPR towards the demographic profiles. The findings indicated a notable impact of the respondents' gender F (3,269) = 3.11, p = .027, faculties F (3,269) = 1.32, p = .047, experienced in dealing with emergencies F (3,269) = 2.79, p = .041, attended CPR course in 5 years F (3,269) = 3.56, p = .015 and last CPR certification F (3,269) = 3.36, p = .019 on the combined dependent variables. The analysis of the dependent variables individually showed significant differences for both knowledge and willingness. Specifically, the knowledge and willingness variables demonstrated statistical significance at a Bonferroni-adjusted alpha level of .017, for faculties F (3,269) = 1.94, p = .007, attended CPR course in 5 years F (2,382) = 6.79, p = .010 and gender F (3,269) = 6.46, p = .012 respectively. The male students' willingness to perform CPR was higher as compared to female (M = 11.89 vs F = 11.32) and the students from the Faculty of Medicine possessed the highest knowledge (M = 9.67) followed by Sport Science students (M = 8.29) and the rest were below average and those who attended the CPR course in the past 5 years exhibited higher knowledge (M = 5.87) as to those who did not (M = 5.06).

Table 6

Multivariate test of knowledge, towards CPR among age, gender, level of education, faculties, experience with emergencies, attended CPR course in 5 years and last CPR certification

Source	Value	F	Hypothesis *df*	Error *df*	Sig	Partial η^2
Pillai's Trace (Age)	.017	.762	6	269	.276	.014
Pillai's Trace (Gender)	.034	3.11	3	269	.027*	.034
Pillai's Trace (Level of Education)	.014	1.26	3	269	.289	.014
Pillai's Trace (Faculties)	.326	1.32	23	249	.047*	.109
Pillai's Trace (Experience Dealing with Emergencies)	.030	2.79	3	269	.041*	.030
Pillai's Trace (Attended CPR course in 5 years)	.038	3.56	3	269	.015*	.038
Pillai's Trace (Last CPR certification)	.037	3.36	3	269	.019*	.036
Variables	Type III Sum of Squares	*df*	Mean Square	F		Sig
Gender (Willingness)	15.92	1	15.92	6.46	.012**	
Faculties (Knowledge)	260.36	23	11.32	1.94	.007**	
Attended CPR course in 5 years (Knowledge)	41.73	1	41.73	6.79	.010**	

* Significant at the level of $p < .05$
** Significant at the level of $p < .017$

4. Discussions

This study was conducted among undergraduate students to examine their level of knowledge in CPR, as well as their attitudes, willingness, and barriers to performing CPR. Additionally, the study investigated differences in these aspects based on the demographic profiles of the students. The level of understanding of CPR techniques among students is generally high. Most students demonstrate knowledge of key aspects of CPR, including the correct compression rate, hand position, compression depth, sequence of actions, and conditions for stopping CPR. However, significant gaps remain in understanding the initial steps required when approaching an unconscious individual. Many students struggle to recognize the importance of first assessing the environment and ensuring personal safety before assisting the patient. This confusion often arises from the instinctive desire to prioritize the victim's aid over securing the scene (Baghi et al., 2024; Cheng et al., 2018; Jones & Whitfield, 2016).

Regarding Automated External Defibrillators (AEDs), most students are familiar with their purpose in resuscitation and the steps required to integrate AED usage into the CPR sequence. Encouragingly, most students can correctly identify the sequence of AED usage, which aligns with the device's intuitive, user-friendly design. However, difficulties persist in accurately identifying the correct placement of AED pads on the patient. This issue may stem from limited hands-on opportunities with AEDs, particularly among students who have not attended formal training. Research supports the notion that minimal training is sufficient to teach AED usage effectively, even to school-aged children (Jones & Whitfield, 2016; Bohn et al., 2015). Despite this general understanding, formal training participation and CPR knowledge levels remain concerningly low. According to this study, respondents scored an average of just 5.37 (out of 12) in CPR knowledge assessments, with only 37.4% having undergone formal training. These rates are markedly lower than those in developed countries, such as Norway (89%) and the United Kingdom (90%). Limited access to training and a perceived disconnects between theoretical learning and practical application were known to be one of the major barriers (Willmore et al., 2019; Kanstad et al., 2011).

When it comes to attitudes towards CPR, most undergraduate students recognize its importance and strongly support the idea of mandating CPR training as part of graduation requirements. This idea aligns with initiatives in certain states in America, where high school students are required to complete CPR training as part of their curriculum (Wilks & Pendergast, 2017; Jones & Whitfield, 2016). While Malaysia's schooling system has not yet adopted a similar approach, implementing such training at the university level could be a promising step forward (Fariduddin et al., 2022; Daud et al., 2023). Most students believe that offering CPR courses free of charge across universities would be the best way to raise awareness. They feel that such training would empower them to act as bystanders in public emergencies (Bogle et al., 2013; Owaid-Alsharari et al., 2018). Despite the low percentage of students who have previously taken CPR courses, many recognize its personal benefits and express enthusiasm for learning CPR if given the opportunity. These findings highlight the overwhelmingly positive attitudes of students towards CPR training in university settings (Mohammed et al., 2020).

When it comes to willingness to perform CPR, most students express a readiness to help an unconscious person immediately, driven by the expectation of similar assistance if they were in need. They believe they can recognize when someone is unresponsive and actively consider how to assist a friend or victim. Many students feel confident about performing CPR in emergencies, viewing it as a life-saving act. However, without prior training, hesitation arises. With proper training, confidence increases significantly, underscoring the importance of CPR education (Mohammed et al., 2020). Additionally, 93% of students expressed willingness to perform CPR if receive training. This willingness may reflect adequate awareness of the importance of bystander CPR, as most of respondents are aware of its life-saving potential (Zhou et al., 2019; Urban et al., 2013).

Despite students' positive attitudes and strong willingness to perform CPR in emergency situations, several barriers hinder their ability to do so effectively. One of the most significant obstacles is the lack of proper training. A study by Kozlowski et al. (2024) found that even medical students report barriers to performing CPR, with inadequate training being a key factor. This lack of preparation may lead to incorrect CPR techniques, potentially harming the patient (Kozlowski et al., 2024). Another concern is the fear of cross-infection during CPR, especially when mouth-to-mouth resuscitation is involved. However, this is generally unfounded, as layman CPR courses emphasize "hands-only" CPR, reducing the risk of infection (Kozlowski et al., 2024; Chong et al., 2021). A study during the COVID-19 pandemic showed that fear of infection, though significant, could be mitigated by proper training that focuses on chest compressions alone (Chong et al., 2021).

Furthermore, students may worry about legal repercussions if they perform CPR incorrectly or fail to recognize whether a victim needs CPR. Legal concerns, including the fear of being sued, are another common barrier, though public awareness of Good Samaritan laws can reduce such anxieties (Huang et al., 2016; Chen et al., 2017; Matsumoto et al., 2024). Interestingly, factors like gender, culture, or religion were not found to significantly affect students' willingness to perform CPR, suggesting that practical concerns like training and fear of infection are more prevalent (Kozlowski et al., 2024). On a positive note, most students recognize that CPR is a valuable skill and do not see acquiring the knowledge and techniques as a barrier. This highlights the importance of addressing the key barriers such as lack of training and fear of legal or infection risks while also reinforcing the necessity of CPR training for all students (Ajlouni et al., 2024).

When assessing the differences between knowledge, willingness, and barriers to performing CPR according to students' demographic profiles, notable differences were discovered in the level of knowledge and willingness to perform CPR. In terms of knowledge, differences were observed between students from different faculties and those who had attended CPR courses in the past few years. Students from the medical school exhibited the highest level of knowledge, followed by students from the faculty of sport sciences. This finding is consistent with the expectation, as students from both faculties include CPR knowledge as a compulsory subject in their curriculum. As a result, it is easier for these students to score higher in knowledge assessments compared to students from other faculties, who generally scored below average or low in their CPR knowledge (Kozlowski et al., 2024; Lu et al., 2015). As for willingness, males were willing to perform bystander CPR which is consistent with previous studies (Coons et al., 2009). In Malaysian settings, several studies also indicated that females were more unwilling to perform bystander CPR for a victim who was of different gender (Chew and Yazid, 2008; Chew et al., 2009). This phenomenon may be related to psychological and social factors and needs further study.

To improve CPR knowledge and empower students, universities can implement a multi-step approach. First, integrating CPR training into the curriculum for all faculties, especially those outside of medical and sport sciences, would ensure that all students gain foundational knowledge and skills. Students in these faculties, who already receive CPR training as part of their coursework, demonstrate higher knowledge levels, and expanding this requirement to other faculties could provide similar benefits (Jones & Whitfield, 2016). Additionally, universities can offer free or low-cost CPR courses, making training more accessible to all students. Incorporating technology through online learning platforms and apps also allows students to access CPR resources at their convenience, reinforcing key techniques and procedures. Partnering with resuscitation-accredited centres, such as those affiliated with the American Heart Association and based in local universities integrated into the simulation centre of the medical faculty's emergency department, would provide students with affordable opportunities to learn CPR techniques (Bohn et al., 2015). Moreover, using simulation-based learning within the simulation centre itself is an effective way to bridge knowledge gaps, particularly in initial actions such as scene assessment and ensuring personal safety before performing CPR. This hands-on practice can enhance students' confidence and preparedness for real-life situations (Fenzi et al., 2024).

Furthermore, educating students about Good Samaritan laws can alleviate legal concerns by ensuring they understand their rights when performing CPR in emergency situations. Establishing a culture of CPR advocacy through student-led initiatives, awareness campaigns, compelling success stories and comparative data, skill-focused education and peer training will encourage wider participation in CPR training and inspire students to act confidently in emergencies (Chong et al., 2021). Finally, offering periodic refresher courses will help maintain students' CPR skills and ensure they remain current with evolving guidelines, making them better equipped to respond in critical situations. These combined strategies will empower students to confidently perform CPR and contribute to a safer, more prepared campus community ensuring more students with both knowledgeable and confident in responding effectively during emergencies

5. Limitations & Future Research Design

The study has several limitations that could impact its findings. First, the reliance on a student population, particularly those from medical and sport sciences faculties, may skew results and limit generalizability to other demographics. Self-reported data on CPR knowledge and willingness could be influenced by social desirability bias, while the lack of objective assessments, such as simulated CPR performance, makes it difficult to validate students' claimed competencies. Additionally, many participants had limited or no formal training, restricting insights into the effectiveness of training programs. The study's focus on a specific cultural and regional context may also limit its applicability elsewhere. Furthermore, psychological barriers like performance anxiety, fear of harming the victim, or the bystander effect were not deeply explored. To address these issues, future research could broaden its scope to include diverse demographics, conduct experimental studies to evaluate training interventions, and explore long-term retention of CPR skills through longitudinal studies. Investigating psychological and legal barriers, such as the fear of infection or concerns about legal repercussions, could help design more targeted educational strategies. Additionally, comparing findings across

cultures and regions, incorporating technology like apps or VR simulations, and assessing the impact of public awareness campaigns and policy initiatives could provide a more comprehensive understanding of how to improve CPR knowledge and participation rates.

6. Conclusions

The findings of this study reveal both encouraging progress and critical gaps in students' knowledge, attitudes, and practices regarding CPR and AED usage. While the general level of understanding is relatively high, particularly among students with access to formal training, significant deficiencies remain in foundational aspects such as scene safety assessment and AED pad placement. Additionally, the low rates of formal CPR training and willingness to participate in such programs highlight systemic barriers, including limited access, lack of awareness, and psychological concerns such as fear of infection and legal repercussions. These issues are exacerbated by a disconnection between theoretical knowledge and practical application, as well as disparities in training opportunities across academic disciplines. To address these challenges, a multi-faceted approach is essential. Integrating CPR training into university curricula for all faculties, providing free or low-cost training opportunities, and utilizing innovative teaching tools such as simulation-based learning and online platforms can enhance knowledge and confidence. Public awareness campaigns and education about Good Samaritan laws can further mitigate legal concerns and inspire greater participation. Future research should expand on these findings by including more diverse populations, assessing the effectiveness of various training interventions, and exploring long-term skill retention. Additionally, cross-cultural comparisons and studies focusing on psychological barriers can provide deeper insights into global best practices. By tackling these limitations and building on the positive attitudes students already demonstrate, institutions can empower students to become confident and effective bystanders in emergencies. Such efforts not only contribute to individual skill development but also enhance public health outcomes by increasing the prevalence of bystander-initiated CPR and AED usage in critical situations.

7. Co-Author Contribution

The authors affirmed that there is no conflict of interest in this article. Author[1] carried out the fieldwork, prepared the literature review, carried out the statistical analysis, interpretation of result and overlook the writeup of the whole article. Author[2] wrote the discussion of the article. Author[3] carried out the statistical analysis, interpretation of results and overlook the writeup of the whole article.

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