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## CRITICAL CARE & EMERGENCY MEDICINE | RESEARCH ARTICLE

# College students' knowledge and attitudes toward bystander cardiopulmonary resuscitation: A cross-sectional survey

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**Abstract:** *Background:* Sudden cardiac arrest attracts global attention because it is a fatal public health concern. Early implementation of high-quality cardiopulmonary resuscitation (CPR) can significantly improve chances of survival. The significance of CPR training is well recognized by the American Heart Association. College students are potential bystanders who could perform CPR in the community. *Aim:* This study purpose is to explore college students' knowledge and attitudes toward CPR. *Methods:* A cross-sectional survey with convenience sampling was conducted in a tertiary college. From September to October 2015, 506 hard-copies of a well-validated questionnaire were distributed. *Results:* Of 351 respondents, 73 (21.8%) were male and 278 (79.2%) were female. The mean knowledge score was 4.97 out of 10 with a standard deviation of 1.61. Over half of the respondents ( $n = 194$ , 55.3%) had attended a CPR course before. The mean attitude score was 26.53 out of 30, and the standard deviation was 2.68. Most of the respondents (87.0%) showed a willingness to perform CPR. The reasons for attending CPR training were mainly "interest" ( $n = 106$ , 46.5%), followed by "extra-curricular activity" ( $n = 37$ , 16.2%), "to help

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### PUBLIC INTEREST STATEMENT

Sudden cardiac arrest attracts global attention because it is a fatal public health concern worldwide. Early implementation of cardiopulmonary resuscitation (CPR) is vital to increase the survival chances and improve the neurologic and health outcomes for out-of-hospital cardiac arrest victims. This positive association among bystander CPR and beneficial functional outcomes enhances the significance of promoting community CPR programs. Colleges and Universities have been shown to be ideal settings for CPR training, and their students are one of the most suitable potential bystanders trained for CPR in the community. This study explored Hong Kong college students' knowledge, attitudes and related factors affecting bystander CPR, and compared CPR knowledge and attitudes between students who have and have not been trained in CPR. The results provide directions for future planning and training. Incorporation of CPR training into the tertiary education curricula could be a long-term strategy to expand CPR benefits to the wider community.

family and friends in need” ( $n = 37$ , 16.2%) and “others” ( $n = 29$ , 12.7%) such as to fulfill job or academic requirement. The most frequently reported inhibitors of performing bystander CPR were a lack of confidence due to forgetting CPR procedures (28.8%) and lack of confidence due to not having received any CPR training (19.1%). *Conclusions:* Although students had a positive attitude toward CPR, inadequate knowledge and training were found. Incorporation of CPR training into the college curricula could be a long-term strategy to enhance CPR benefits to the wider community. Maintaining better knowledge and skills retention, regular and refresher training for students are recommended.

**Subjects:** Death and Dying; Nurse Education & Management; Public Health Policy and Practice; Accident & Emergency Nursing

**Keywords:** resuscitation; students; knowledge; attitude; Hong Kong

### 1. Introduction

Sudden cardiac arrest attracts global attention because it is a fatal public health concern around the world. Out-of-hospital cardiac arrest (OHCA) usually refers to sudden cardiac arrest incidents occurring in a non-clinical area, such as at home, in the street (Cardiovascular Disease, 2016; Ma, Wong, Tou, Vyas, & Wilks, 2015). Early implementation of cardiopulmonary resuscitation (CPR) is vital in the “chain of survival” after OHCA. The efficient and effective hands-on responses of bystanders to cardiac arrest are crucial to increase the survival chances and improve the neurologic and health outcomes for OHCA victims (Graham, McCoy, & Schultz, 2005). This positive association among bystander CPR and beneficial functional outcomes further enhances the significance of promoting community CPR programs (Graham et al., 2005).

Nowadays, the significance of CPR promotion is widely recognized and highlighted. It is hard to access the whole population without adequate promotion and mandatory programs, although studies have shown that people who have had previous training are more willing to conduct CPR than those who have not. CPR promotion to students has been a focus in recent years as students are potential bystanders to CPR in the community (Lešnik et al., 2011). The AHA has advocated CPR and automated external defibrillator (AED) training not just for the public but also integrated into secondary school curricula to foster the success of CPR promotion (Cave et al., 2011). Thus, promoting CPR in school and teaching CPR to school students is highly recommended (Ma et al., 2015). As they get older, teenagers gain better skills (Lieberman, Golberg, Mulder, & Sampalis, 2000). Some pilot studies have been done to explore the feasibility of teaching life-supporting skills to primary school children (Fleischhackl et al., 2009; Uray et al., 2003). Fleischhackl and colleagues (Fleischhackl et al., 2009) found that students as young as 9 years are able to learn basic life support (BLS) skills but have physical limitations in performing adequate depth of chest compressions and ventilation volumes. In recent decades, several studies have revealed the CPR knowledge, attitudes and effectiveness of CPR training among students of high school or secondary school (Kanstad, Nilsen, & Fredriksen, 2011; Ma et al., 2015; Omi et al., 2008; Zinckernagel et al., 2016). Studies that investigated high school students’ knowledge and skills of BLS in Korea, German and Denmark reported that after training, there were significant improvement in knowledge level, confidence and willingness to participate (Aaberg, Larsen, Rasmussen, Hansen, & Larsen, 2014; Min, 2015). The studies showed that confidence in resuscitation skills was positively related to the knowledge and willingness to participate. Secondary school students in Norway demonstrated adequate knowledge and overall willingness about bystander CPR (Zinckernagel et al., 2016), yet some young Norwegians had barriers such as fear of disease transmission that cause hesitation in their actions. A qualitative study exploring school leadership and teachers’ perceptions about barriers to implementation of CPR training were conducted in eight Danish secondary schools (Aaberg et al., 2014). Participants perceived that CPR training involving life and death issues was different from other teaching

subjects. External instructors with specialized skills were preferred for teaching due to insecurity about the school teachers' own CPR skills.

In contrast, colleges and universities have been shown to be ideal settings for CPR training. College and university students are sufficiently physically and psychologically mature to study and perform CPR (Lieberman et al., 2000). Another study concluded that the older the youngster, the better their performance in BLS skills (Lešnik et al., 2011). In recent years, an increasing number of studies have investigated CPR knowledge, attitudes, skills and training of college and university students, in particular medical, nursing or healthcare students, and their participation in CPR or BLS in various countries (Bogle, Mehrotra, Chiampas, & Aldeen, 2013; Hamasu et al., 2009; Lu et al., 2016, 2017; Min, 2015). The findings suggest that college students recognized the significance of CPR training and were willing to participate although they had low level of knowledge (Min, 2015). Most study findings showed that students' willingness, knowledge and self-efficacy increased after training (Bogle et al., 2013; Hamasu et al., 2009). A recent study conducted by Lu and colleagues (Lu et al., 2017) in Tianjin universities in China indicated that university law students and students of medical-related programs were more willing than other university students. The respondents who were unwilling to perform bystander CPR gave reasons of lack of confidence, feeling embarrassed, fear of legal consequence and disease transmission.

The rate of receiving training and knowledge of CPR is relatively inadequate. Around 12.0% of randomly selected respondents from the general public have been trained on CPR and among the respondents, only 6.0% would start external chest compressions (Cheung et al., 2003). Other local studies also reported similar low attempt CPR rates that ranged from 1.6 to 15.6% (Lau, Lai, Hung, & Kam, 2005; Leung, Wong, Tong, Lo, & Kan, 2001). Although a recent telephone survey showed a slight increase in public awareness, with 21.0% of public respondents had attended CPR training, overall CPR knowledge was still inadequate (Chair et al., 2014). These local studies reflect the insufficient knowledge, training and willingness of the public in responding to OCHA despite promotion efforts and activities of the Hong Kong Government and healthcare organizations in the past decade. Only one recent survey has explored CPR knowledge and attitudes among secondary school students who were aged 15–16 years (Ma et al., 2015). Surprisingly, the majority of these respondents (87.7%) had not received CPR training due to lack of time, lack of interest or being unsure where to attend a course and their overall CPR knowledge was inadequate. However, the secondary school respondents had positive attitudes toward bystander CPR and would try to perform CPR in a sudden cardiac arrest situation even without relevant training.

According to the above literature, college and university students are the most suitable potential bystanders for CPR in the community, yet no previous study has investigated their knowledge and attitudes in the local context. To identify appropriate actions to promote CPR, the present situation should be understood. This preliminary survey study aimed to explore Hong Kong college students' knowledge, attitudes and related factors affecting bystander CPR, and to compare CPR knowledge and attitudes between students who have and have not been trained in CPR. The results not only inform society regarding college students' preferences in responding to bystander CPR, but also provide directions for future planning and training.

## **2. Methods**

### **2.1. Study design**

This study design was a cross-sectional survey to collect data about the respondents' knowledge and attitudes toward CPR at one time point.

### **2.2. Setting and sample**

The target population was Hong Kong tertiary students studying in a college or university and a local self-financing tertiary institution was conveniently selected for recruitment of participants. The inclusion criteria were tertiary students of all ages who were able to read and understand Chinese.

### **2.3. Ethical consideration**

Prior to data collection, ethics approval was received from the Research Ethics Committee of the selected tertiary college. Information about the purpose, procedure, potential risk and benefit of the study was fully explained to respondents verbally by our research team members and a supplementary information sheet was provided before obtaining a written consent. Respondents were allowed to withdraw from the study at any time.

### **2.4. Instruments**

The knowledge and attitudes of college students were explored through a self-report questionnaire. This well validated questionnaire was developed locally (Ma et al., 2015) and adopted for use with approval. The questionnaire had been reviewed by an expert panel, which included three cardiologists, two registered nurses and a health educator and the content validity index (CVI) was 0.945 (Ma et al., 2015). The structured questionnaire was written in traditional Chinese and consisted of five parts: personal information, information related to CPR training, CPR knowledge, attitudes toward CPR and factors which might affect CPR practice. There were 10 questions each on CPR knowledge and attitudes. One mark was assigned for each correct answer for knowledge questions resulting in a possible total score ranged from 0 to 10. For the part on attitudes toward CPR, each item in this scale scored between 1 “strongly disagree” and 5 “strongly agree”. Scores for each question with negative statements were reversed. The scores from the individual items were totaled, with potential scores ranging from 10 to 50. Higher scores represented more positive attitudes toward CPR. Questions on factors which might affect CPR mainly focused on barriers to performing CPR. Most of the questions required one answer but some questions allowed multiple responses. A pilot test was successfully conducted with eight college students and it required not more than 15 min for them to complete the questionnaire.

### **2.5. Data collection**

The questionnaires were distributed after class with prior consent of the respective program or course coordinators. The respondents returned the completed questionnaire and signed consent form by putting them into a drop-box provided by the research team. The data were confidentially kept in an encrypted file in a computer and questionnaires were stored in a locked cabinet. Raw data will be destroyed 3 years after completion of study.

### **2.6. Data analysis**

From late September to mid October 2015, 506 questionnaires were distributed and 430 anonymous questionnaires were returned with a response rate of 85%. However, 79 returned questionnaires were incomplete or invalid and thus only 351/430 (81.6%) of the returned questionnaires were included in the data analysis. The collected data was analyzed using IBM SPSS Statistics for Windows Version 23.0 (IBM Corp, Armonk, NY). Descriptive statistics were used to describe the characteristics of the respondents, and  $p$ -value < 0.05 indicated statistical significance. Independent samples  $t$  test was used to identify significant differences in the CPR knowledge and attitude scores between respondents who had and those who had not been trained in CPR, and between respondents with a valid and those with an expired CPR certificate.

## **3. Results**

According to the 351 valid questionnaires, 79.2% ( $n = 278$ ) of the respondents were female. Most respondents' age ranged from 15 to 20 ( $n = 210$ , 59.8%) and 21–25 ( $n = 133$ , 37.9%). Majority of the respondents were studying bachelor's degree program in college ( $n = 310$ , 88.3%).

### **3.1. CPR training experience**

Over half of the respondents ( $n = 194$ , 55.3%) had attended a CPR course before. Among these 194 respondents, majority ( $n = 158$ , 81.4%) were still holding a valid certificate. About three quarter of them ( $n = 144$ , 74.2%) received their last training at Hong Kong St. John Ambulance and one-tenth (9.3%) had training at Hong Kong Red Cross. Two-third of respondents were trained 1–2 years ago ( $n = 90$ , 46.4%) or less ( $n = 52$ , 26.8%). Twenty (10.3%) respondents had their training completed

4 years ago. The reasons for attending CPR training were mainly “interest” ( $n = 106, 46.5\%$ ), followed by “extra-curricular activity” ( $n = 37, 16.2\%$ ), “to help family and friends in need” ( $n = 37, 16.2\%$ ) and “others” ( $n = 29, 12.7\%$ ) such as to fulfill job or academic requirement. Among the untrained respondents ( $n = 157, 44.7\%$ ), the common reasons for not taking any CPR training were “no time” ( $n = 85, 45.0\%$ ), “not sure where to attend a course” ( $n = 37, 19.6\%$ ), and “not necessary” ( $n = 29, 15.3\%$ ). Table 1 showed the demographics and details of CPR courses attended by the respondents.

### 3.2. CPR knowledge

The respondents’ theoretical grasp of CPR knowledge was assessed using 10 MCQ-based test. A large proportion of students scored between 4 and 6 (Figure 1). The mean score was 4.97 out of 10 with a standard deviation of 1.61. A normal distribution was present in MCQ scores and hence, parametric tests such as independent samples t test were used for further analysis. Table 2 showed the respondents’ correct responses to the CPR knowledge items.

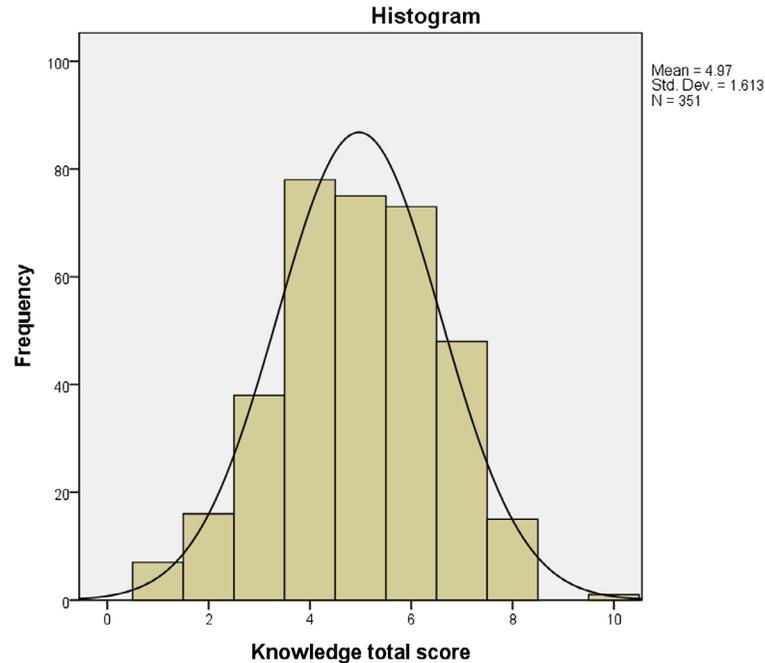
The three questions with the highest correct responses were:

- Q20. How do you open the casualty’s airway? (Correct: 80.3%)
- Q16. What is the compression rate per minute when performing adult CPR? (Correct: 68.4%)
- Q15. When should we start CPR? (Correct: 65.8%)

**Table 1. Demographics and information of CPR courses attended by the respondents ( $n = 351$ )**

Characteristics	No. of respondents (%)
<i>Gender</i>	
Male	73 (20.8)
Female	278 (79.2)
<i>Age (years)</i>	
15–20	210 (59.8)
21–25	133 (37.9)
26–30	8 (2.3)
>30	0 (0)
<i>Program of study</i>	
Diploma	26 (7.4)
Associate degree	13 (3.7)
Bachelor’s degree	310 (88.3)
Others	2 (0.6)
<i>Attended CPR course (<math>n = 351</math>)</i>	
Yes	194 (55.3)
No	157 (44.7)
<i>Hold a valid CPR certificate (<math>n = 194</math>)</i>	
Yes	158 (81.4)
No	36 (18.6)
<i>Time since last CPR training (<math>n = 194</math>)</i>	
1 year or less	52 (26.8)
>1 to 2 years	90 (46.4)
>2 to 3 years	32 (16.5)
>3 to 4 years	20 (10.3)

**Figure 1. Distribution of respondents' CPR knowledge score.**



**Table 2. Respondents' correct responses to CPR knowledge items**

No. of correct responses to CPR knowledge items	No. of respondents (%)		
	All (n = 351)	Attended CPR course (n = 194)	Not yet attended CPR course (n = 157)
0	0	0	0
1	7 (2.0)	0	7 (4.5)
2	16 (4.6)	2 (1.0)	14 (8.9)
3	38 (10.8)	13 (6.7)	23 (14.6)
4	78 (22.2)	34 (17.5)	44 (28.0)
5	75 (21.4)	49 (25.3)	26 (16.6)
6	73 (20.8)	45 (23.2)	28 (17.8)
7	48 (13.7)	38 (19.6)	10 (6.4)
8	15 (4.3)	12 (6.2)	3 (1.9)
9	0	0	0
10	1 (0.3)	1 (0.5)	0

The following three questions had the lowest correct responses:

Q18. What is the sequence of CPR? (Correct: 11.7%)

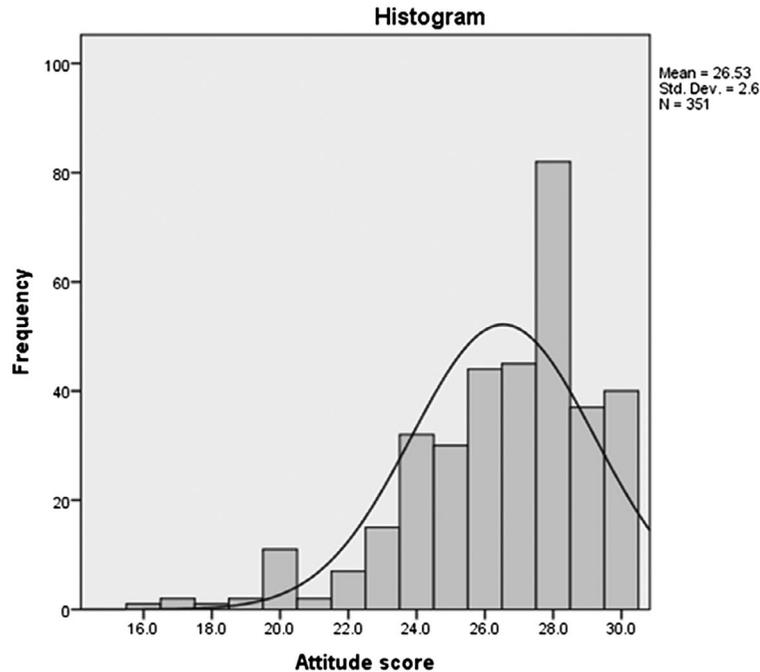
Q23. If a bystander is untrained or not familiar with CPR, which of the following actions can increase the survival rate? (Correct: 12.0%)

Q17. What is the depth of chest compression for adult CPR? (Correct: 34.2%)

### 3.3. Attitudes toward cardiopulmonary resuscitation

The respondents' attitudes toward CPR was overall positive with maximum at 30 and minimum at 16 for the 10 items. The mean score and standard deviation were 26.53 and 2.6 respectively. Figure 2 showed that the attitude scores were approximately normally distributed, with a skewness of  $-1.08$  ( $SE = 0.13$ ) and a kurtosis of  $1.28$  ( $SE = 0.26$ ).

**Figure 2. Distribution of respondents' attitudes toward CPR scores.**



Using Pearson's correlation to examine the relationship between CPR knowledge and attitudes toward CPR, we found a significant positive correlation between them ( $r = 0.16, p < 0.05$ ). Besides, independent samples t test was used to explore if there were any differences among CPR knowledge, attitudes and specific demographic characteristics. Results showed that respondents who had been trained in CPR had significantly higher CPR knowledge ( $t = 7.21, p < 0.001$ ) and more positive attitudes ( $t = 4.27, p < 0.001$ ) than those who had not been trained. When knowledge scores were compared between respondents who held a valid and those who held an expired CPR certificate, the former had significantly higher CPR knowledge than the latter ( $t = 2.75, p < 0.01$ ). However, no significant differences were found when the attitude scores were compared between these two groups ( $t = -0.75, p > 0.05$ ).

### **3.4. Factors affecting bystander CPR practice**

The facilitating factors for bystanders to do CPR were their perception that CPR could increase survival rate before an emergency medical service provider arrived ( $n = 278, 79.2\%$ ), their belief that life is precious ( $n = 173, 49.3\%$ ), holding a valid license ( $n = 110, 31.3\%$ ) and having been trained in CPR ( $n = 78, 22.2\%$ ). The most frequently reported inhibitors of performing CPR were lack of confidence due to forgetting CPR procedures (28.8%) and lack of confidence due to not having received any CPR training (19.1%). Thus, lack of confidence was a significant barrier that affected nearly half of the respondents in performing CPR (47.9%). The other barriers included being afraid of making mistakes during practice that might harm the victim (26.4%), being afraid of legal disputes (16.8%) and fear of being infected (7.8%).

Majority of respondents indicated their willingness to perform CPR in a cardiac arrest event ( $n = 304, 87.0\%$ ). Three hundred respondents (85.5%) would attempt CPR for anyone in need and 217 (61.8%), 212 (60.4%) and 175 (49.8%) respondents would attempt CPR for family members, friends and pedestrians, respectively.

## **4. Discussion**

As mentioned, early initiation and effective bystander CPR significantly increase the survival chance and improve the neurologic and health outcomes of OHCA victims (Graham et al., 2005). In this study, about half of the students (55.3%) had received CPR training, which is lower than those in

other developed countries such as Washington of the United States (79.0%) (Sipsma, Stubbs, & Plorde, 2011), Japan (70.0%) (Taniguchi, Omi, & Inaba, 2007) and Western Australia (64.1%) (Jelinek et al., 2001). However, the training rate was much higher than 21.0 and 12.0% that were reported in previous local studies (Chair et al., 2014; Cheung et al., 2003). It was also higher than those reported in studies with university student respondents in Chicago (28.5%) (Bogle et al., 2013) and China (31.9%) (Lu et al., 2017) and secondary students in Hong Kong (12.3%) (Ma et al., 2015). The main reasons for attending CPR training were related to interest, extra-curricular activity and fulfilling job and academic requirement, which are similar to those found in other local and overseas studies (Chair et al., 2014; Ma et al., 2015). The common reasons given by those who had not taken any CPR training were lack of time, a belief that it was not necessary and uncertainty about where to attend a course, that are also in line with other local studies. The authors of local studies believe that these operational challenges can be easily overcome if CPR training is incorporated into the school curriculum or extra-curriculum activities for all students as in other countries such as Taiwan and the United States (Chair et al., 2014; Ma et al., 2015). The implementation of school-based CPR and AED training programs has been endorsed by the American Heart Association, the World Health Organization, and other renowned professional health-care organizations (Graham et al., 2005). Certainly, schools are suitable places for repeated training of students leading to better retention of CPR knowledge and skills. Though school-based CPR and AED training program might not boost bystander CPR rates immediately, students could share their learning materials, knowledge and skills with their adult family members, which could further increase the number of individuals able to perform CPR (Graham et al., 2005). Communities in Denmark, Norway, the United States, Japan and Singapore are successful in incorporating CPR education in schools. Subsequently improvement in OHCA outcomes has been reported because of increased rates of bystander CPR (Chair et al., 2014; Graham et al., 2005). The Education Bureau of the Hong Kong SAR Government may consider establishing a similar health and education policy for CPR and AED training in schools. Through school-based CPR programs to prepare students for performing CPR and AED, the overall local community response to OHCA and hence the survival rate may be improved.

In this study the respondents supported the need to attend CPR courses and demonstrated a high intention to perform CPR in emergency situations. Traditional method of face-to-face instructor-led skills training is not the only way to learn CPR. Self-directed online learning enhanced with demonstration video is another suggested method for addressing the lack of time for CPR training (Blewer et al., 2012). This could be efficient and effective, as only a short amount of time is required and nowadays mobile electronic devices are commonly used by college or university students.

In the past decades, the American Heart Association updated the guidelines for CPR and emergency cardiovascular care every 5 years based on scientific evidence and experts' opinions (American Heart Association, 2015). The AHA guidelines are the most commonly used teaching materials for CPR training locally. The 10 CPR knowledge items in our questionnaire were developed based on the AHA guidelines published in 2010. The data of this study was collected from September to October in 2015. The average CPR knowledge level in this study was inadequate (majority of the respondents scored 4–6 out of 10). Although it was slightly higher than the level reported in a previous study conducted in 2013 using the same questionnaire (majority of the respondents scored 3–4 out of 10) (Ma et al., 2015), some questions which were related to major changes in the AHA 2010 guidelines were answered incorrectly. For example, the CPR sequence was updated to “C–A–B” (Chest compression–Airway–Breathing) from “A–B–C” (Airway–Breathing–Chest compression) (American Heart Association, 2010). Most respondents (68.4%) wrongly selected to open the victim's airway as the first action instead of chest compression. Another misconception was on the depth of chest compression for adult CPR, which has been changed from 1.5 to 2 inches to at least 2 inches. In this study, three quarters of the respondents had received CPR training more than one year ago. They might be not aware of changes in the AHA guidelines or might have forgotten the correct answer. Hence frequent and regular refresher courses are recommended to help them keep abreast of and reinforce their CPR knowledge.

Majority of the students showed positive attitudes toward performing CPR in a cardiac arrest situation, with attitude scores higher (between 24 and 30) than those reported in a local study of secondary students (between 24 and 26) (Ma et al., 2015). Respondents who had been trained in CPR had better attitudes and confidence to perform CPR, which were similar to other studies (Chair et al., 2014; Sipsma et al., 2011). In fact, there might be multiple factors that facilitated respondents to or inhibited them from performing CPR. Consistent with the findings of other studies, lack of confidence, and fear of disease transmission and legal disputes were the main reasons for being unwilling to perform CPR (Chair et al., 2014; Lu et al., 2016; Ma et al., 2015; Sipsma et al., 2011).

In line with previous studies in Hong Kong, China and Japan, lack of confidence was a foremost barrier to performing CPR (Lu et al., 2016; Ma et al., 2015; Omi et al., 2008). Forgetting the technique when performing CPR was another major concern of respondents in this study. This barrier was related to knowledge and skill retention. Several studies have reported that confidence could be built or enhanced through acquiring knowledge and skills (Aaberg et al., 2014; Chair et al., 2014; Ma et al., 2015; Sipsma et al., 2011). After training, university students with higher self-perceived ability indicated that they were able and willing to perform bystander CPR (Lu et al., 2016, 2017). Among American university students, recently trained respondents were more comfortable to perform CPR (Bogle et al., 2013). Indeed, school is an ideal place for conducting regular teaching and training that lead to better knowledge and retention of CPR skills (Graham et al., 2005). As lack of confidence due to not receiving the training, forgetting the technique and being afraid of making mistakes are common major barriers (Graham et al., 2005), it is beneficial to our society if CPR and AED training are incorporated in the local college or university curriculum.

Another significant barrier associated with college students' willingness to perform CPR is fear of being infected (Hamasu et al., 2009; Lu et al., 2016). In Western Australia, people were more willing to perform CPR for friends or relatives than strangers due to health and safety concerns (Jelinek et al., 2001). This finding is consistent with a study in Japan, in which 1,132 (47.0%) randomly selected respondents completed a questionnaire and 13.0% of them indicated that they were willing to attempt CPR for their families and friends but only 7.0% of them were willing to do it for strangers (Kuramoto et al., 2008). It was reported that even nursing and medical students were afraid of mouth-to-mouth disease transmission (Taniguchi et al., 2007). To relieve the bystander worries and hesitation about provision of mouth-to-mouth rescue breathing, AHA has developed new compression-only CPR guidelines in addition to traditional CPR in the past decade. Interestingly, "afraid of being infected" was the least frequently reported concern among Hong Kong students (Ma et al., 2015). Knowing the compression-only concept might be one of the reasons for this, as the respondents learned the 2010 AHA protocol. The simpler and efficient AHA new compression-only guidelines may encourage bystander CPR. Urban and her colleagues (Urban, Thode, Stapleton, & Singer, 2013) noted that having received compression-only CPR training, most of the lay respondents expressed that they were willing to perform CPR for a stranger in an emergency.

Psychological consequences of performing CPR have also been reported in the literature. Mathiesen, Bjørshol, Braut, and Sørøide (2016) conducted a qualitative study to understand, in-depth, the reactions and coping strategies of 20 lay rescuers who provided CPR to 18 OHCA victims in Norway. Lay rescuers experienced certain emotional and social challenges that had consequences in their coping with work and family life afterwards. Persistent negative consequences such as reduced work capability, weight loss, nightmares, flash-backs and guilty feelings for unknown or fatal outcomes were reported. Some rescuers required professional advice and assistance to manage their situation. Psychological preparation and training for handling emotional challenges after performing bystander CPR should not be neglected for lay rescuers. Lay rescuers who were well prepared in this aspect were found to have better coping strategies and experience less emotional challenges after performing bystander CPR (Mathiesen et al., 2016).

Besides the above mentioned psychological barriers and consequences of performing CPR, fear of legal disputes was another significant reason for not performing bystander CPR. Though a bystander

has no legal liability to rescue, he or she may be sued for providing inappropriate CPR (Lešnik et al., 2011). Lu and colleagues (2017) found that university law students had less anxiety on legal disputes as they were more knowledgeable in legal liability of bystander CPR than students of other disciplines. The findings suggest that related legal knowledge could be included in training to relieve anxiety and increase participation in bystander CPR. Furthermore, laws or legal policy statements to minimize the legal liability for good-faith action in emergencies should be established to encourage and protect bystanders who offer assistance (Graham et al., 2005).

Nowadays, AEDs are readily available in many public locations such as airports, shopping malls, exercise facilities, schools, and university campuses locally or in other developed cities. Such an arrangement raises the possibility that a bystander can have direct access to an AED from a nearby location and bring it to the side of a cardiac arrest victim for immediate use. Bystanders, on the other hand, should be well trained in CPR and use of AED. Active promotion and organization of CPR and AED training, in particular at school level, will benefit the community in the long run.

There were several limitations of this study. Convenience sampling with a self-reported questionnaire was used for reasons of convenience and economy. Besides, participants were mainly recruited from one large self-financed tertiary institution with medical sciences and nursing programs. These factors might lessen the generalizability of the results. Regarding the study design, fixed choice questions in the self-reported questionnaire lacked flexibility and forced respondents to answer that might lower validity. Mixed method which integrates a self-reported survey with individual or group interviews to clarify issues or enrich data is recommended for future studies.

## 5. Conclusion

Although the overall knowledge level was inadequate, and nearly half of them were untrained in CPR, the students had positive attitudes and were willingness to perform CPR. Despite the lack of time to attend CPR course and confidence to perform CPR, and the fear of possible legal disputes, the students believed that CPR could increase survival rates. Incorporation of CPR training into the tertiary education curricula could be a long-term strategy to expand the CPR benefits to the wider community. For better knowledge and skills retention, it is recommended to organize regular CPR training workshops and refresher courses to students.

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### Competing Interests

The authors declare no competing interest.

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