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Willingness and obstacles of healthcare professionals to perform bystander cardiopulmonary resuscitation in China

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ABSTRACT

Background: Bystander CPR (B-CPR) is crucial to increase survival of out-of-hospital cardiac arrest (OHCA), and this study is performed to assess the willingness and obstacles of Chinese healthcare professionals (HCPs) to perform B-CPR on strangers, as well as the factors associated with the willingness.

Methods: An internet-based questionnaire surveying demographic information, CPR training, CPR knowledge, willingness, and obstacles to perform B-CPR among 10,393 HCPs. A multivariate logistic regression analysis was used to evaluate the factors associated with the willingness.

Results: Here, 73.9% of HCPs were willing to perform B-CPR on strangers in China. The factors associated with the willingness were as follows: female, senior, working in Third-class hospitals, working in Pre-hospital emergency and Cardiology or Cardiac surgery, receiving current training, having adequate CPR knowledge. The main obstacles were fear of infection via mouth-to-mouth ventilations (MMV), fear of being blackmailed and fear of legal liability.

Conclusion: About three quarters of HCPs are willing to perform B-CPR. Female HCPs, those who have more CPR experience, adequate knowledge, and recent training are more likely to perform B-CPR. Reform of the legal and credit system are needed, and recommendation of hands-only CPR is a possibility to encourage HCPs to perform B-CPR on strangers.

1. Introduction

Despite advances in prevention and treatment, mortality from cardiac arrest (CA) remains unacceptably high. In the United States, out-of-hospital cardiac arrest (OHCA) is a significant public health issue affecting approximately 326,000 people each year [1]. In Europe, OHCA is a leading causes of death and affects some 300,000 people each year [2]. In China, about 544,000 people died annually due to CA, and 80% of the people suffering OHCA have died before being treated by emergency medical service (EMS) personnel [3]. However, the survival rate for OHCA is generally low worldwide, ranging from 5% to 10% [4]. In Beijing, only 5% of patients achieve restoration of spontaneous circulation, and only 1.3% of patients are discharged alive [5].

Bystander cardiopulmonary resuscitation (B-CPR) is one of the most efficient ways to increase survival of OHCA [6]. Nevertheless, the B-CPR rate is still disappointing. In the United States, less than half of persons with cardiac arrest receive B-CPR [1]. In China, a multicenter study showed that the B-CPR rate in large or medium-sized cities was only 4.45% [7]. The data from Beijing showed that only 11.4% of patients, in all etiologies except trauma, were provided with B-CPR [5].

Many previous studies have investigated the willingness of laypersons to perform B-CPR [8–10], but few studies focus on healthcare professionals (HCPs). In fact, few laypersons in China perform B-CPR because few of them are trained. Disappointingly, less than 1% of the laypersons in China have received CPR training. [11]. Additionally, according to the Utstein-Style guidelines, HCPs may perform B-CPR even if they are not part of the EMS involved in the victim's resuscitation [12]. Thus, it is necessary to figure out the willingness of

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Table 1
Baseline characteristics in healthcare professionals by the willingness to perform bystander cardiopulmonary resuscitation in China.

	Overall (N = 10 224)	Willing (n = 7 599)	Unwilling (n = 1 514)	Uncertain (n = 1 151)	p value
Sex					< 0.001
Male	4 126 (40.4)	2987 (72.4)	731 (17.7)	408 (9.9)	
Female	6 098 (59.6)	4572 (75.0)	783 (12.8)	743 (12.2)	
Profession					< 0.001
Doctor	5 829 (57.0)	4209 (72.2)	906 (15.5)	714 (12.2)	
Nurse	4 395 (43.0)	3350 (76.2)	608 (13.8)	437 (9.9)	
Age, years					< 0.001
< 29	5 147 (50.3)	3727 (72.4)	797 (15.5)	623 (12.1)	
30–39	3 778 (37.0)	2853 (75.5)	548 (14.5)	377 (10.0)	
≥40	1 299 (12.7)	979 (75.4)	169 (13.0)	151 (11.6)	
Educational background					< 0.001
Associate's degree or below	2 299 (22.5)	1766 (76.8)	250 (10.9)	283 (12.3)	
Bachelor's degree	5 891 (57.6)	4431 (75.2)	822 (14.0)	638 (10.8)	
Postgraduate degree or above	2 034 (19.9)	1362 (67.0)	442 (21.7)	230 (11.3)	
Hospital level					< 0.001
First-class hospital	3 128 (30.6)	2376 (76.0)	555 (17.7)	197 (6.3)	
Second-class hospital	3 043 (29.8)	2197 (72.2)	501 (16.5)	345 (11.3)	
Third-class hospital	3 010 (29.4)	2277 (75.6)	301 (10.0)	432 (14.4)	
Emergency center*	1 043 (10.2)	709 (68.0)	157 (15.0)	177 (17.0)	
Specialty					< 0.001
Pre-hospital Emergency*	1 052 (10.3)	864 (82.1)	110 (10.5)	78 (7.4)	
Emergency Medicine	2 217 (21.6)	1735 (78.3)	324 (14.6)	158 (7.1)	
ICU	881 (8.6)	585(66.4)	196 (22.2)	100 (11.4)	
Anesthesia	507 (5.0)	339 (66.9)	107 (21.1)	61 (12.0)	
Obstetrics, Gynecology or pediatrics	1 265 (12.4)	982 (77.6)	177 (14.0)	106 (8.4)	
Cardiology and Cardiac surgery	735 (7.2)	599 (81.5)	80 (10.9)	56 (7.6)	
Medical Imaging	394 (3.9)	256 (65.0)	77 (19.5)	61 (15.5)	
Other Departments	3 173 (31.0)	2199 (69.3)	443 (14.0)	531 (16.7)	
CPR training					
Never trained	379 (3.7)	227 (59.9)	68 (17.9)	84 (22.2)	
< 6 months	4 366 (42.7)	3584 (82.1)	289 (6.6)	493 (11.3)	< 0.001
6 months–2 years	3 368 (32.9)	2525 (75.0)	493 (14.6)	350 (10.4)	
> 2years	2 111 (20.6)	1223 (57.9)	664 (31.5)	224 (10.6)	
CPR knowledge					
Adequate	1796 (17.6)	1332 (74.2)	127 (7.1)	337 (18.8)	< 0.001
Inadequate	8428 (82.4)	6227 (73.9)	1387 (16.5)	814 (9.7)	

Abbreviations: CPR, cardiopulmonary resuscitation; ICU, intensive care unit. *In some Chinese cities, EMS depends on the hospital's emergency department, which may biases the numbers. ICU: intensive care unit.

HCPs to perform B-CPR and the influence factors of such willingness.

This study was implemented to understand the willingness and obstacles for HCPs towards providing B-CPR to strangers in China, and assess the factors associated with such willingness.

2. Methods

2.1. Questionnaire design and distribution

Our questionnaire was designed by resuscitation experts of both the in- and pre-hospital setting, and consisted of five sections with a total of 26 questions about demographic information, CPR training, CPR knowledge, willingness and obstacles to perform B-CPR. Individual information included basic characteristics about participants such as sex, profession, age, educational background et al. The section assessing CPR knowledge included 15 multiple-choice questions and consisted of five dimensions: recognition of CA, compression, ventilation, defibrillation, and drug, while each dimension included three questions. Survey questions of CPR knowledge section are shown in Appendix 1.

The questionnaire was released on http://www.wenjuan.com for pre-survey from November 5 to 13, 2017. This website is one of the largest websites providing a platform for researchers to design and dissemination of all kinds of questionnaires in China. The questionnaire was reviewed by epidemiological, statistical, and CPR experts. Our trial survey sample was 136, and the questionnaire was reformed according to the results of the pre-survey. The internal consistency Cronbash's α coefficient was 0.817 and the test-retest reliability was 0.855.

From November 15 to December 28, 2017, questionnaire was available and formally distributed to volunteers by WeChat invitation. WeChat is the most popular social software in China, with 806 million users. The website automatically screened internet protocol address (IP addresses) to ensure that the questionnaire was answered only once from each IP address. The questionnaires could not be submitted until all the items were completed.

2.2. Data analysis

Data were analyzed using SPSS 23.0 (SPSS Inc, Chicago, IL, USA) and descriptive statistics were used to summarize the data, frequencies were calculated as percentages. Significant p-values were defined as those < 0.05. Chi-square testing was used for single factor comparison, and a multiple logistic regression analysis was performed for analyses about willingness.

2.3. Ethical considerations

This study was approved by the ethics committee of Yan An Hospital Affiliated to Kunming Medical University. Data was acquired from questionnaires distributed to Chinese HCPs via the internet. There was no conflict of interest of the volunteer members and the survey. Participants answered the questionnaires anonymously and voluntarily. It was repeatedly emphasized in the questionnaire that only HCPs could answer the questions.

3. Results

A total of 10,393 participants completed the questionnaire. Participants were from all 31 provincial administrative regions of mainland China. A total of 136 questionnaires were excluded due to incomplete data, 33 questionnaires were excluded due to provision of obviously contradictive answers, leaving 10,224 valid questionnaires included in this analysis (the percentage of complete returns that were eligible for analysis: 98.37%).

3.1. Participant characteristics

Among all the participants, 4126 (40.4%) were male, 5829 (57.0%) were physicians, and 8925 (87.3%) were aged below 40 years. About half of participants had bachelor's degree. Other participant characteristics were shown in Table 1.

3.2. CPR training

Only 4366(42.7%) participants received CPR training within the past 6 months, 2111 (20.6%) participants had no training in the past two years. See Table 1.

3.3. CPR knowledge

According to total number of correct answers, results were divided into two levels: inadequate (correct answers < 60%: 0–8 correct answers) and adequate (correct answers > 60%: 9–15 correct answers). The majority (82.4%) of participants were assessed to have inadequate CPR knowledge with only 1796 (17.6%) identified as having adequate knowledge. See Table 1.

3.4. Willingness to perform B-CPR

Fig. 1 illustrates participant willingness to performing B-CPR on strangers. Our survey posed the following question: "If you witnessed a stranger fall down and he or she required CPR, are you willing to perform B-CPR?" Only 7559 (73.9%) participants answered "yes", 1514 (14.8%) participants answered "no", and 1151 (11.3%) of participants answered "uncertain". As showed in Table 1, there were significant differences between age groups, sex, education level, hospital level employment, specialty, recent training, and CPR knowledge in terms of willingness to perform B-CPR (p < 0.001).

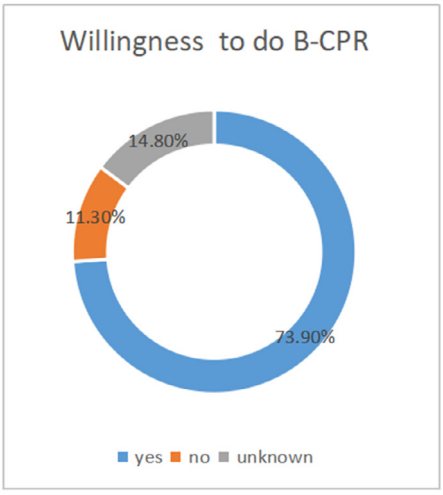

Fig. 1. Willingness among healthcare professionals to perform B-CPR.

Table 2
Factors of having a willingness to perform B-CPR in healthcare professionals in China.

	OR	95% CI	p value
Sex			
Male	1.00 (ref.)		
Female	1.31	1.14–1.51	< 0.001
Professions			
Nurse	1.00 (ref.)		
Doctor	1.10	0.95–1.27	0.189
Age, years			
< 29	1.00 (ref.)		
30–39	1.27	1.12–1.45	< 0.001
≥40	1.44	1.19–1.75	< 0.001
Education background			
Associate's degree or below	1.00 (ref.)		
Bachelor's degree	0.82	0.70–0.96	0.016
Postgraduate's degree or above	0.57	0.47–0.69	< 0.001
Hospital level			
First-class hospital	1.00 (ref.)		
Second-class hospital	1.05	0.84–1.33	0.651
Third-class hospital	1.44	1.22–1.70	< 0.001
Emergency center	1.01	0.88–1.16	0.915
Specialty			
Medical imaging department	1.00 (ref.)		
Pre-hospital emergency	1.67	1.18–2.40	0.004
Emergency department	1.24	0.92–1.67	0.159
ICU	0.94	0.68–1.30	0.690
Anesthesia	0.91	0.64–1.30	0.615
Obstetrics, Gynecology or Pediatric	1.32	0.96–1.81	0.089
Cardiology and Cardiac surgery	1.95	1.36–2.80	< 0.001
Other departments	1.14	0.86–1.53	0.361
Time since last training			
> 2 years	1.00 (ref.)		
< 6 months	5.30	4.50–6.24	< 0.001
6 months–2 years	2.47	2.15–2.84	< 0.001
Never trained	1.62	1.20–2.18	0.002
CPR knowledge			
Inadequate	1.00 (ref.)		
Adequate	1.39	1.14–1.71	0.020

Abbreviations: B-CPR, bystander cardiopulmonary resuscitation; CI, confidence interval; OR, odds ratio; ICU, intensive care unit; ref., reference.

3.5. Logistic regression analysis of willingness individuals

A multiple logistic regression analysis showed the main characteristics of HCPs who were willing to perform B-CPR were as follows: female (OR = 1.31, 95% CI: 1.14–1.51); senior (> 40 years: OR = 1.44, 95% CI: 1.19–1.75); work at a third-class hospital (OR = 1.44 95% CI: 1.22–1.70); work in a pre-hospital emergency role (OR = 1.74 95% CI: 1.22–2.47); work in cardiology or cardiac surgery (OR = 1.95, 95% CI: 1.36–2.80); recent CPR training (< 6 months: OR = 5.30, 95% CI: 4.50–6.24); and having adequate CPR knowledge (OR = 1.39, 95% CI: 1.14–1.71). There was no significant difference in willingness between doctors and nurses, but we found that educational background was a negative influence factor for B-CPR (postgraduate degree or above: OR = 0.57, 95% CI: 0.47–0.69). See Table 2.

3.6. Obstacles to perform B-CPR

Participants were required to evaluate their level of fear with a full score of 5 when they planned to do B-CPR. The first obstacle identified was fear of infection via MMV (mean ± SD: 3.96 ± 1.23); the second was fear of being blackmailed (mean ± SD: 3.9 ± 1.23), the third obstacle was fear of legal responsibility (mean ± SD: 3.76 ± 1.36) and the last obstacle was a lack confidence about CPR technique (mean ± SD: 3.59 ± 1.39). See Fig. 2.

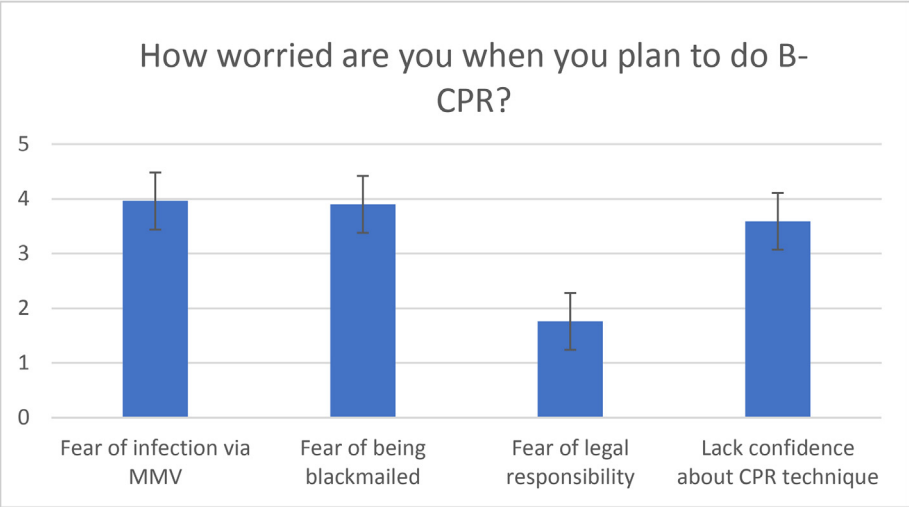

Fig. 2. Barriers for healthcare professionals in performing B-CPR.

4. Discussion

The main results of the present study can be summarized as follows. First, 73.9% of HCPs are found to be willing to perform B-CPR on strangers in China. Second, CPR experience, CPR knowledge, and recent training are beneficial for doing B-CPR. Third, fear of infection via MMV, fear of being blackmailed and fear of legal responsibility are three top obstacles.

We revealed that about three quarters of HCPs were willing to perform B-CPR. Few studies investigated the willingness of HCPs to perform B-CPR, but many previous studies investigated laypersons. In Norway, a previous study reported that 83% of students in secondary school were willing to perform B-CPR [13]. In Hong Kong, it was found that 87% of college students showed a willingness to perform CPR [14]. In China, Lu et al. [15] reported that 64.2% of college students were willing to perform B-CPR. Considering the leading role of HCPs in CPR practice and CPR training, the result we revealed was unsatisfactory.

Multiple logistic regression analysis found that senior HCPs, who worked in third-class hospitals and those who worked in pre-hospital emergency, cardiology or cardiac surgery specialties were three positive associations with B-CPR. Third-class is the highest hospital ranking in China, and third-class hospitals are responsible for the diagnosis and treatment of critical conditions. HCPs in department which are related to cardiac emergencies usually have more experience in CPR practice. Our study also found that those who had adequate CPR knowledge had more willingness to perform B-CPR. Furthermore, our results showed that recent training was the most influential factor encouraging HCPs to perform B-CPR (< 6 months OR: 5.30 CI: 4.50–6.24). This finding is highly consistent with previous studies [14,16,17]. Thus, our studies revealed that CPR experience, CPR knowledge, and recent training are beneficial for doing B-CPR.

Our study revealed that fear of infection via MMV was the first obstacle of HCPs to perform B-CPR on strangers. This finding was similar to many previous studies. Boucek et al. [18] found that many HCPR refused to ventilate patients, especially patients who are suspected of having an infectious disease. Nesreen et al. [19] showed that only 40% of nurses were willing to perform CPR that required MMV, but 92% were willing to perform hands-only CPR. A study from Japan demonstrated that more nurses and medical students would decline to perform MMV on strangers than high school teachers and students (70–77% vs 43–45%), due to a fear of infection [15]. Guidelines in 2015 recommended the untrained public to do hands-only CPR on adult CA patients, but HCPs and trained laypersons should perform traditional CPR [20]. In fact, almost all rescuers, whether they have been trained or not, are willing to do MMV for their relatives, but few rescuers had willingness to perform MMV on strangers [21–23]. 2017 international consensus on CPR recommended that laypersons who were trained, able, and willing to give rescue breaths and compressions on adults CA patients [24], but HCP were not mentioned. According to the results of our study, infection via MMV is a important obstacle for HCPs to do B-CPR when they witness strangers falling down. Thus, the recommendation of hands-only CPR should be also feasible for HCPs to encourage them to do B-CPR.

Our study revealed that fear of being blackmailed and fear of legal liability were two important obstacles for HCPs to perform B-CPR. Due to a lack of a sophisticated legal system, rescuers may be sued for some reasons in China, such as fracture caused by compression or do not performing it correctly. Our finding is consistent with previous studies investigated laypersons in China. Lu et al. [15] reported that fear of legal disputes was one of top reasons for being unwilling to perform B-CPR for university students in China. Huang et al. [9] reported that the leading obstacle of Chinese students to perform CPR on strangers was the fear of legal liability. Fear of being blackmailed is a complicated and characteristic Chinese obstacle, which is rated to credit and ethical. For example, patient's family members may accuse rescuers of being responsible for the patient's falling down for money purpose if there are no other witnesses or evidence. Although rare, negative news stories about blackmail greatly limit bystanders' willingness to engage in B-CPR on a stranger. Consequently, legal and credit system should be reformed to encourage people to assist others in distress by granting them immunity against lawsuits and blackmailed in China.

5. Limitations

There are some limitations in this cross-sectional study that should be noted. Firstly, while HCPs who answered the questionnaire usually paid more attention to the topic CPR, participants were recruited only via the internet, creating a basis against people who did not use the internet. Secondly, although we repeatedly emphasized that only HCPs could answer the questions, and participants answered the questionnaire voluntarily, it was also possible for public to answer the questionnaire. Thirdly, we did not classify differentiate B-CPR as hands-only CPR or traditional CPR, so we could not analyze the relationship between the fear of infections and the willingness to use MMV.

6. Conclusion

About three quarters of HCPs are willing to perform B-CPR. Female

HCPs, those who have more CPR experience, adequate CPR knowledge, recent training are more likely to perform B-CPR. Reform of the legal and credit system are needed, and recommendation of hands-only CPR is a possibility to encourage HCPs to perform B-CPR on strangers when they are unwilling to perform MMV.

Declaration of Competing Interest

We declared that we had no financial and personal relationships with other people or organizations that can inappropriately influence our study.

Acknowledgment

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Appendix 1

Questions about CPR knowledge

	Questions
1	If you witness a victim collapse, what is the first thing you must do?
2	What is the first thing you must do after confirming the victim's condition and the victim appears to be unconsciousness with sighing respiration?
3	What should you if you can't get a pulse for 10 s after you feel the carotid artery of a suspected CA patient?
4	What is the target frequency of chest compression for adult victims?
5	What is the target depth of chest compression on adults?
6	What is the maximum interruption among compressions?
7	What is the compression to ventilation ratio in an adult victim?
8	What is the target frequency of balloon ventilation after the clearing of the advanced airway on adults?
9	How can you confirm that the volume of balloon ventilation is adequate?
10	What measure can measure the effective termination of ventricular fibrillation?
11	What can be used to smear the electrode plate on manual defibrillators?
12	What should be done immediately after defibrillation discharge?
13	What is the time interval between adrenaline repeated injection during CPR?
14	What drug should be used on asystole patients according to current guidelines?
15	What drug should be used when an electric monitor displays a ventricular arrhythmia of 40 without carotid artery beating?

The questions are translated from Mandarin.

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