ORIGINAL RESEARCH

Knowledge and attitudes towards cardiopulmonary resuscitation and defibrillation amongst Asian primary health care physicians

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Objective: To assess the knowledge and attitudes of local primary health care physicians in relation to cardiopulmonary resuscitation (CPR) and defibrillation.

Methods: We conducted a survey on general practitioners in Singapore by using a self-administered questionnaire that comprised 29 questions.

Results: The response rate was 80%, with 60 of 75 physicians completing the questionnaire. The average age of the respondents was 52 years. Sixty percent of them reported that they knew how to operate an automated external defibrillator (AED), and 38% had attended AED training. Only 36% were willing to perform mouth-to-mouth ventilation during CPR, and 53% preferred chest compression-only resuscitation (CCR) to standard CPR. We found those aged <50 years were more likely to be trained in basic cardiac life support (BCLS) ($P < 0.001$) and advanced cardiac life support ($P = 0.005$) or to have ever attended to a patient with cardiac arrest ($P = 0.007$). Female physicians tended to agree that all clinics should have AEDs ($P = 0.005$) and support legislation to make AEDs compulsory in clinics ($P < 0.001$). We also found that a large proportion of physicians who were trained in BCLS ($P = 0.006$) were willing to perform mouth-to-mouth ventilation.

Conclusion: Most local primary care physicians realize the importance of defibrillation, and the majority prefer CCR to standard CPR.

Keywords: general practitioners, cardiac arrest, resuscitation, defibrillation, attitude, knowledge

Introduction

General practitioners (GPs) can play an important role in the management of out-of-hospital cardiac arrest (OHCA).[1,2] OHCA is an international health issue, and the reported survival rates after OHCA vary greatly.[3] The 'chain of survival' concept[4] states that the survival of patients with OHCA can be improved by early access, early cardiopulmonary resuscitation (CPR), early defibrillation, and early advanced care. Current research indicates that shorter response times,[5] early CPR,[6,7] and early defibrillation do indeed improve patient survival.[8,9] GPs may witness a cardiac arrest in primary health care clinics or during a home visit, and early defibrillation by GPs has been shown to improve the outcomes of OHCA.[10] Programs have been created to teach GPs to use defibrillators and actively participate in resuscitation.[10]

Singapore is a multicultural city-state that has a population of 4.6 million[11] and is situated in southeast Asia. The island's emergency medical services system is primarily a single-tier system that is equipped to provide basic life support and defibrillation with automated external defibrillators (AEDs). Singapore's primary health care system

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is composed of both public and private sectors. The public sector comprises 18 government-related polyclinics, with 4–10 doctors in each clinic. In contrast, the private sector consists of mostly single-doctor clinics, with family as well as corporate practices. The survival rate after OHCA in Singapore has been reported to be 2.0%.[12]

Although several studies have been conducted on public knowledge regarding and attitudes towards CPR and defibrillation,[13–15] very little is known about physicians' attitudes towards resuscitation. We conducted a self-reported survey to assess the experience, knowledge, and attitudes of local primary health care doctors towards resuscitation. On the basis of the knowledge obtained, we hope to propose a program to encourage the active participation of GPs in the management of OHCA.

Methods

We conducted an 'opportunistic' survey of primary healthcare doctors working in both the private and public sectors. This survey was conducted in conjunction with a symposium organized for GPs on 'Common Pitfalls When Dealing with Medical Emergencies in Family Practice'. The survey questionnaire consisted of 29 questions and was self-administered (Appendix 1). This questionnaire had been designed by the study team and had been validated in a pilot study. It was divided into four sections: demographics, knowledge, attitudes, and chest compression-only resuscitation (CCR) versus CPR.

Besides questions on the background characteristics of the doctors, the respondents were also asked if they had attended to any patient with cardiac arrest and if they had access to a defibrillator in their area of practice.

In the knowledge section, respondents were asked to answer a series of five questions regarding defibrillation. Respondents were also asked if they had attended any training on AEDs and whether they knew how to operate an AED.

The attitudes section determined the following: (1) whether or not the respondents would use an AED, if available, to treat a patient with cardiac arrest; (2) the respondents' confidence level in using AEDs; (3) whether the respondents agreed that all primary health care clinics should be equipped with AEDs; (4) whether they would support legislation to make AEDs compulsory equipment in all clinics; and (5) whether they would consider buying AEDs and at what cost.

In the last section (CCR vs CPR), respondents were asked if they were willing to perform mouth-to-mouth ventilation during CPR and which method of resuscitation they preferred, CCR or standard CPR.

Descriptive statistics with frequency tables were computed using SPSS software (v. 17.0 SPSS Inc., Chicago, IL, USA). To determine the association between the demographics of the study population and their knowledge and attitude, continuous variables and multinomial variables were recoded into two groups according to the following standard cut-off points. Age groups were created according to the median age ('below 50 years' and '50 years and above'); the level of confidence in using AEDs was grouped as 'below and equal to score 5' and 'above 5'; specialist training was re-categorized into 'family medicine' and 'other', and the type of practice, into 'family practice' and 'other'. A contingency coefficient which indicated the level of association, such as the Pearson correlation coefficient, and the P-values for Fisher's exact test (because the sample size was small) were calculated. Statistical significance was set at $P < 0.05$.

Results

We issued a total of 75 forms to all the attendees of the symposium. Of these, 60 responded, giving a response rate of 80%. The demographic characteristics of the respondents are shown in Table 1. The average age of the respondents was 52 years, and 43% of them were male. The mean duration for which the physicians had been in practice was 28 years. Further, 29% had a valid basic cardiac life support (BCLS) certificate, and 21% had a valid advanced cardiac life support (ACLS) certificate. We found that 27% of the respondents had defibrillators in their clinics.

With regard to the knowledge about defibrillation, only 37% of the respondents correctly answered all five questions on defibrillation (Table 2). We found that 92% correctly identified defibrillation as one of the most important interventions in cardiac arrest. Sixty percent reported that they knew how to operate an AED, and 38% had attended training on AEDs. However, only 42% of the respondents knew what 'AED' stood for.

The responses to questions regarding attitudes towards resuscitation are shown in Table 3. Of the respondents, 93% reported that if an AED were available, they would use it to treat cardiac arrest. Forty-six percent were willing to purchase an AED, and 62% agreed that all clinics should have defibrillators. However, only 36% would support legislation to make defibrillators compulsory in clinics. The confidence levels of the respondents in using AEDs are shown in Figure 1.

As shown in Table 4, only 36% would perform mouth-to-mouth ventilation during CPR, and 53% preferred

Table 1 Characteristics of respondents

Characteristics	
Mean age (SD) (n = 59)	52 (10.9)
Male	73% (43/59)
Race	
Chinese	92% (54/59)
Indian	3% (2/59)
Others	5% (3/59)
Mean years of practice (SD) (n = 59)	27.9 (10.6)
Specialist training	
Family medicine	55% (33/60)
Internal medicine	3% (2/60)
Nil	42% (25/60)
Type of practice	
Family	86% (52/60)
Company	12% (7/60)
Industrial	2% (1/60)
Trained in BCLS	6% (36/60)
Valid BCLS certificate	29% (10/34)
Trained in ACLS	32% (19/60)
Valid ACLS certificate	21% (4/19)
Ever attended patients with cardiac arrest	63% (38/60)
No. of cardiac arrest cases attended	
1	18% (7/38)
2	21% (8/38)
3	5% (2/38)
4	3% (1/38)
5	5% (2/38)
≥10	13% (5/38)
Unknown	34% (13/38)
Has an AED in clinic	27% (16/59)
Used clinic's AED on cardiac arrest patient (%) (n = 16)	6% (1/16)

Abbreviations: ACLS, advance cardiac life support; AED, automated external defibrillator; BCLS, basic cardiac life support; SD, standard deviation.

Table 2 Respondents' knowledge in defibrillation

Knowledge	% (n)
Obtained correct answer to the following questions:	
Q1. What does the abbreviation 'A' in "AED" represent?	67% (40/60)
Q2. What does the abbreviation 'E' in "AED" represent?	50% (30/60)
Q3. What does the abbreviation 'D' in "AED" represent?	93% (56/60)
Q4. AED operator is not required to interpret ECG rhythm	85% (51/60)
Q5. Defibrillation is the most important intervention in cardiac arrest	92% (55/60)
Total score (full score = five questions answered correctly):	
1	2% (1/60)
2	10% (6/60)
3	25% (15/60)
4	27% (16/60)
5	37% (22/60)
Know how to operate AED	60% (36/60)
Attended AED training	38% (23/60)

Abbreviations: AED, automated external defibrillator; ECG, electrocardiogram.

CCR to standard CPR. The reasons given for preferring CCR were that (1) CCR was, in the respondents' opinion, as effective as CPR (77% agreed), (2) easier to learn (35% agreed), and (3) the respondents were unwilling to perform mouth-to-mouth ventilation (31% agreed).

The associations between the demographics of the study population and their knowledge and attitudes are summarized in Tables 5 and 6.

We found that the responses to the items 'trained in BCLS,' 'trained in ACLS,' and 'ever attended to patients with cardiac arrest' significantly differed with age. We found that 90% of those aged less than 50 years were trained in BCLS, whereas only 31% of those aged 50 years or more had undergone BCLS training (contingency coefficient = 0.517, $P < 0.001$).

Further, 50% of the doctors who were aged <50 years were ACLS certified vs 32.2% of the doctors who were aged ≥50 years (contingency coefficient = 0.361, $P = 0.005$). Finally, 80% of the doctors in the younger group had attended to a patient with cardiac arrest vs 44.8% in the older group (contingency coefficient = 0.342, $P = 0.007$).

The responses to the questions 'Do you agree that all clinics should have an AED?' ($P = 0.005$) and 'Would you support legislation to make AEDs compulsory in all clinics?' ($P < 0.001$) significantly differed with gender. The female GPs tended to agree that all clinics should have an AED (93% women vs 50% men; contingency coefficient = 0.360, $P = 0.005$). Similarly, more women than men (80% women vs 20% men; contingency coefficient = 0.486, $P < 0.001$) said that they would support legislation to make AEDs compulsory in all clinics. In addition, fewer women (63% women vs 95% men; contingency coefficient = 0.392, $P = 0.003$) practiced in a family medicine setting rather than a company or an industrial setting.

Fifty percent of those trained in BCLS and 14% of those not trained in BCLS (contingency coefficient = 0.345, $P = 0.006$) were willing to perform mouth-to-mouth ventilation.

Further, 70% of those with a valid BCLS certificate and 22% of those without a valid BCLS certificate said that they would support legislation to make AEDs compulsory in all clinics (contingency coefficient = 0.419, $P = 0.016$). Similarly, 70% of the GPs who practiced family medicine

Table 3 Respondents' attitudes towards defibrillation

Attitudes	
Willing to use AED to attend to cardiac arrest patient if it is available	93% (53/57)
Reasons for not using AED:	
Don't know what an AED is	0
Don't know how to use AED	100% (4/4)
Fear of legal liability	0
Not confident	0
Willing to purchase AED	46% (26/56)
Willing to pay:	
<$1,000 (<US dollar 695)[a]	44% (10/23)
$1,000–2,999 (US dollar 695–2,078)[a]	30% (7/23)
$3,000–4,999 (US dollar 2,080–3,465)[a]	22% (5/23)
>$5,000 (>US dollar 3,465)[a]	4% (1/23)
Not willing to purchase AED because:	
Expensive	69% (20/29)
Not useful	0
Difficult to maintain	3% (1/29)
Unsure how to use	3% (1/29)
Others	24% (7/29)
Would be encouraged to purchase AED if:	
Reasonable price	89% (48/54)
Easy to use	32% (17/54)
Easy to maintain	30% (16/54)
Others	4% (2/54)
Willing to attend AED course at own expense	52% (28/54)
Agreed that all clinics should have AED	62% (34/55)
Would support legislation to make AED compulsory equipment in all clinics	36% (20/56)
Would support/participate in community CPR/AED project	75% (38/51)

Note: [a]Amount in Singapore dollars.
Abbreviations: AED, automated external defibrillator; CPR, standard cardiopulmonary resuscitation.

and 30% of those who practiced in other settings (contingency coefficient = 0.317, $P = 0.019$) said that they would support the above legislation.

Discussion

This study was an opportunistic survey on resuscitation in the primary health care setting. We found that most primary care physicians realized the importance of defibrillation. However, only 27% had defibrillators in their clinics, and 38% had attended training on AEDs. The commonest reason for not purchasing an AED was the perception that it was expensive (65%). Further, only 36% of the GPs said they would perform mouth-to-mouth ventilation during CPR, and 53% preferred CCR to standard CPR.

We found that those aged <50 years were more likely to be trained in BCLS ($P < 0.001$) or ACLS ($P = 0.005$) and to have ever attended to a patient with cardiac arrest ($P = 0.007$). This finding might be related to the introduction of BCLS training for medical students in the 1980s and ACLS for residents in the 1990s. We also found that a large proportion of doctors who were trained in BCLS ($P = 0.006$) were willing to perform mouth-to-mouth ventilation. It is not surprising that BCLS or ACLS training did not have any effect on the respondents' confidence in handling an AED because in Singapore, AED training was only recently incorporated into BCLS training.

The female respondents tended to agree that all clinics should have AEDs ($P = 0.005$) and to support legislation to make AEDs compulsory ($P < 0.001$). This is an interesting finding that we cannot fully explain.
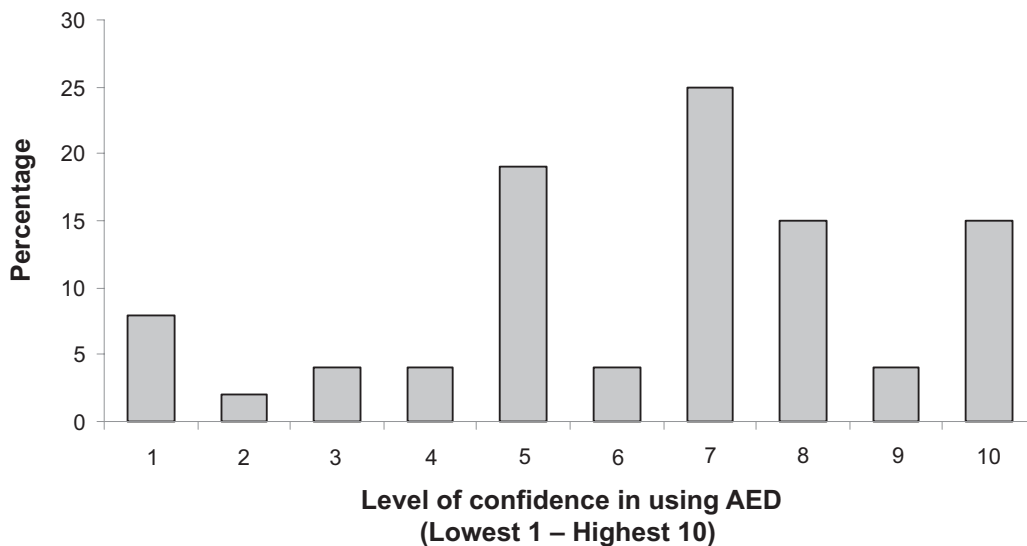
Figure 1 Level of confidence in operating an automated external defibrillator (AED).

Table 4 Comparison between chest compression-only resuscitation and standard cardiopulmonary resuscitation

CCR vs. CPR	
Would perform mouth-to-mouth ventilation during CPR	36% (21/60)
Preferred method of resuscitation	
CCR	53% (27/51)
CPR	47% (24/51)
Preferred CCR because:	
As effective as CPR	77% (20/26)
Easier to learn	35% (9/26)
Unwilling to do mouth-to-mouth	31% (8/26)
Preferred CPR because:	
More effective	70% (16/23)
Confident of CPR technique	9% (2/23)
Recommended by National Resuscitation Council	39% (9/23)

Abbreviations: CCR, chest compression-only resuscitation; CPR, standard cardiopulmonary resuscitation.

GPs play an important role in managing OHCA. In a previous study, we found that the incidence of cardiac arrest in primary health care facilities in Singapore was 1.12 per 100,000 people per year, and these arrests constituted 6.0% of all OHCAs in the country.[16] GPs may witness an arrest in their clinic or during a house call, or they may be called upon to attend to a patient with cardiac arrest.[1] Thus, it is possible for GPs to initiate CPR, defibrillation, or advanced life support before ambulance crews arrive and thereby improve the patient's chances of survival.[10,17]

The majority of GPs in Singapore work in a private practice, in a 'for profit' setting. Only 10% of primary health care providers in the country work in a public, subsidized care setting. This might explain the gap in the respondents' attitudes towards defibrillation and the low take-up of defibrillators by GPs. Current local regulations require all clinics to be equipped with drugs required for resuscitation (eg, epinephrine and atropine). However, there is currently no specification regarding defibrillators or airway equipment (eg, bag-valve mask devices). We found that cost and lack of confidence in using AEDs were the main reasons why GPs did not have defibrillators in their clinics. With the advent of low-cost defibrillators (less than $3000 Singapore dollars, approximately $2,070 US dollars), this barrier can possibly be overcome. The invention of AEDs has also simplified the technique of external defibrillation.[18] These devices have been shown to be accurate and effective,[19] and even nonmedical personnel can be successfully trained to use them.[20,21] We propose that legislation to make defibrillators mandatory clinic equipment, similar to emergency drugs, be introduced.

Table 5 Results from cross-table (contingency coefficient, *P*-value of Fisher's exact test)

	Age*	Gender
Trained in BCLS	0.517, <0.001	0.096, 0.556
Valid BCLS certificate	0.234, 0.225	0.105, 0.692
Trained in ACLS	0.361, 0.005	0.069, 0.755
Valid ACLS certificate	0.258, 0.530	0.073, 1.000
Specialist training (family medicine vs internal medicine/general surgery/others)	0.183, 0.195	0.201, 0.147
Type of practice (family vs company/industrial)	0.188, 0.254	0.392, 0.003
Ever attended cardiac arrest cases	0.342, 0.007	0.158, 0.241
Know to operate AED	0.083, 0.601	0.116, 0.552
Level of confidence in using AED	0.035, 1.000	0.090, 0.547
Willing to buy AED	0.269, 0.058	0.252, 0.071
Willing to use AED if available	0.020, 1.000	0.173, 0.315
Agreed that all clinics should have AED	0.021, 1.000	0.360, 0.005
Would support legislation to make AED compulsory in all clinics	0.183, 0.262	0.486, <0.001
Would support/participate in community CPR/AED project	0.102, 0.529	0.081, 0.730
Obtained total score	0.083, 0.596	0.076, 0.763
Would perform mouth-to-mouth ventilation during CPR	0.179, 0.266	0.050, 0.767
Preferred method of resuscitation (CCR vs CPR)	0.125, 0.407	0.025, 1.000

Note: *Comparison between age group <50 years and age group ≥50 years.
Abbreviations: ACLS, advance cardiac life support; AED, automated external defibrillator; BCLS, basic cardiac life support; CCR, chest compression-only resuscitation; CPR, standard cardiopulmonary resuscitation.

Table 6 Results from cross-table (Contingency coefficient, *P*-value of Fisher's exact test)

	Trained in BCLS	Valid BCLS certificate	Trained in ACLS	Valid ACLS certificate	Type of practice
Level of confidence in using AED	0.131, 0.382	0.272, 0.141	0.005, 1.000	0.126, 1.000	0.208, 0.232
Willing to buy AED	0.055, 0.785	0.273, 0.141	0.089, 0.578	0.225, 0.582	0.228, 0.127
Agreed that all clinics should have AED	0.049, 0.779	0.253, 0.245	0.175, 0.248	0.015, 1.000	0.111, 0.696
Would support legislation	0.038, 0.781	0.419, 0.016	0.095, 0.561	0.325, 0.262	0.317, 0.019
Would perform mouth-to-mouth ventilation during CPR	0.345, 0.006	0.038, 1.000	0.160, 0.254	0.225, 0.582	0.093, 0.698
Preferred method of resuscitation	0.120, 0.558	0.266, 0.220	0.243, 0.136	0.119, 1.000	0.146, 0.425

Abbreviations: ACLS, advance cardiac life support; AED, automated external defibrillator; BCLS, basic cardiac life support; CPR, standard cardiopulmonary resuscitation.

We believe that with education and voluntary programs to subsidize purchase costs, more primary care physicians will support this move.

Recently, CCR without ventilations has been proposed as an alternative to standard CPR for bystanders.[22] Proponents of CCR argue that it overcomes bystander reluctance to perform mouth-to-mouth ventilations[23–31] and is simpler to teach,[32–34] especially when giving instructions to an untrained bystander over the telephone.[35–38] It may also result in fewer interruptions to chest compressions.[39–42] Our study seems to indicate that the majority of GPs prefer CCR to standard CPR.

The limitations of this study include the small sample size and possible lack of a representative sample, which is attributable to the sampling method. Because this was an opportunistic survey, a systematic bias may have been introduced owing to the inherent interest of the physicians who attended the symposium in emergency medicine. However, it must be noted that defibrillation and CPR were not the focus of the symposium.

We intend to follow up this study with a national, population-based survey to determine the knowledge and attitudes of the public in relation to CPR and defibrillation. This survey will be linked to the national census process and will include a substudy on the knowledge and attitudes of medical practitioners.

Conclusion

In this study, we found that the majority of primary care physicians in Singapore realize the importance of defibrillation. Further, most physicians prefer CCR to standard CPR. This information will be useful in planning subsequent educational activities to encourage CPR and defibrillation by GPs.

Disclosures

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Appendix 1
General practitioners' attitudes and knowledge towards defibrillation

Dear Colleagues,

Of the approximately 15 000 deaths that occur in Singapore every year, about 25% will be from a cardiac cause, of which, some 12%–16% will occur suddenly, outside of a hospital. The purpose of this survey is to find out your opinions regarding certain aspect of managing an out of hospital cardiac arrest. We hope to partner with you to save more of these patients in the future.

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Demographics

1. Age: _____

2. Gender: ☐₁ Male ☐₂ Female

3. Race: ☐₁ Chinese ☐₂ Malay ☐₃ Indian ☐₄ Others, specify_____

4. Year obtained MBBS? Year_____

5. Specialist Training

   ☐₁ Family medicine ☐₂ Internal medicine ☐₃ General Surgery

   ☐₄ Others, specify_____

6. Type of practice?

   ☐₁ Family practice ☐₂ Company practice ☐₃ Industrial practice

7. Are you BCLS trained?

   ☐₁ Yes. **If yes, certification still valid? Yes/No** ☐₂ No

8. Are you ACLS trained?

   ☐₁ Yes. **If yes, certification still valid? Yes/No** ☐₂ No

9. Have you ever attended to cardiac arrest cases?

   ☐₁ Yes, how many? _____ ☐₂ No

10. Does your clinic have any defibrillator?

    ☐₁ Yes ☐₂ No

11. **If your answer is 'YES' to Qn. 10,** was the defibrillator being used for any cardiac arrest cases that were attended by you?

    ☐₁ Yes ☐₂ No ☐₃ NA

Knowledge

12. What do the abbreviations of "AED" represent?

    A is for _____

    E is for _____

    D is for _____

13. AED requires the operator to be able to intepret ECG rhythms. **True/False**

14. Do you know how to operate an AED?

    ☐₁ Yes ☐₂ No

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15. Have you attended any AED training?

☐₁ Yes ☐₂ No

16. Besides CPR, which intervention do you think is the most important in saving lives?

☐₁ Intubation ☐₂ Giving resuscitation drugs

☐₃ Defibrillation ☐₄ Not sure

Attitudes

17. If an AED is available, would you use it to attend to your cardiac arrest patient?

☐₁ Yes, go to **Qn. 18** ☐₂ No, go to **Qn.19**

18. Using the scale of 1 to 10, 1 being the least and 10 being the most, what is your confidence level in using AED? _____ **[Then go to Qn.20]**

19. You would not use the AED because …….

☐₁ Do not know what is an AED ☐₂ Do not know how to use an AED

☐₃ Fear of legal liability ☐₄ Not confident

20. Are you willing to buy an AED?

☐₁ Yes, go to **Qn. 21** ☐₂ No, go to **Qn. 22**

21. How much are you willing to pay for an AED?

☐₁ <$1,000 ☐₂ $1,000–$2,999

☐₃ $3,000–$4,999 ☐₄ Above $5,000 **[Then go to Qn.23]**

22. Why are you not willing to buy an AED?

☐₁ Too expensive ☐₂ Not useful

☐₃ Difficult to maintain ☐₄ Unsure of how to use

☐₅ Others, please specify, _____

_____

23. What would encourage you to purchase an AED?

☐₁ Reasonable price ☐₂ Easy to use ☐₃ Easy to maintain

☐₄ Others, specify _____

24. Are you willing to attend an AED training course, at your own expense?

☐₁ Yes ☐₂ No

25. Do you agree that all clinics should be equipped with an AED?

☐₁ Yes ☐₂ No

26. Would you support legislation to make defibrillators compulsory equipment for all clinics?

☐₁ Yes ☐₂ No

27. Would you support/participate in community CPR/AED project?

☐₁ Yes ☐₂ No

Chest compression-only resuscitation vs. cardio-pulmonary resuscitation

28. Would you perform mouth-to-mouth ventilation during CPR?

☐₁ Yes ☐₂ No

29. Which method of resuscitation would you prefer?

☐₁ **Chest compression-only.** Reason:

☐ₐ As effective as CPR ☐ᵦ Easier to learn

☐ᵤ Unwilling to do mouth-to-mouth

☐𝒹 Others, specify_____

☐₂ **Both ventilation and chest compression.** Reason:

☐ₐ More effective ☐ᵦ Confident of CPR techniques

☐ᵤ Recommended by National Resuscitation Council

☐𝒹 Others, specify_____