

Strategy analysis of cardiopulmonary resuscitation training in the community

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Abstract: Bystander cardiopulmonary resuscitation (CPR) is a crucial therapy for sudden cardiac arrest. This appreciation produced immense efforts by professional organizations to train laypeople for CPR skills. However, the rate of CPR training is low and varies widely across communities. Several strategies are used in order to improve the rate of CPR training and are performed in some advanced countries. The Chinese CPR training in communities could gain enlightenment from them.

Keywords: Out-of-hospital cardiac arrest (OHCA); cardiopulmonary resuscitation (CPR); community; education

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Introduction

To strengthen the chain of survival in communities, one major issue that must be addressed is the active promotion of early life support among laypersons. Bystander resuscitation efforts, such as cardiopulmonary resuscitation (CPR) and the use of an automatic external defibrillator (AED), can save lives in cases of cardiac arrest. Training all persons across the entire community for CPR may bring us a great improvement in the survival rate of patients having out-of-hospital cardiac arrest (OHCA).

CPR consists of a combination of chest compressions/decompressions typically interspaced with ventilations. CPR Training programs have been implemented worldwide during the past years following guidelines from the American Heart Association (AHA) (1) and the European Resuscitation Council (2). It was calculated that a community CPR training program may, at best, reduce the community cardiac mortality rate by 7.5%, i.e., saving 24 to 56 lives per 100,000 adult populations per year (3). Unfortunately, the rate of CPR community training is very low in China (4,5). This article reviewed literatures about how to create a self-sufficient and innovative method to provide CPR education

in communities in some of advanced countries.

Prevalence of CPR training and factors associated with receiving CPR training in community

Rates of CPR training vary widely across communities in the world. In the United States, community-based educational programs of CPR training are available through organizations such as the AHA/American Stroke Association (ASA). Survey in the two sites in Minnesota USA (population of 439,692 people) showed that more than 28,000 people were trained for CPR and the use of AED from November 2005 to June 2009 (6). Another community survey of training rates and willingness to perform CPR in King County, Washington had 79% of survey respondents reporting ever attending a CPR training class. A majority of people (53%) attended the most recent class more than five years ago. People trained for CPR were older, were more likely to be men and were less likely to have at least a 2-year college degree than those who had ever been trained (7). Generally, counties located in the South, those with higher proportions of rural areas and of black and

Hispanic residents, and those with lower median household incomes have lower rates of CPR training than their counterparts. During July 1, 2010 through June 30, 2011, 13.1 million persons in 3,143 US counties received CPR training. The rate of county training ranged from 0.00% to 1.29% (median, 0.51%) in the lower tertile, 1.29% to 4.07% (median, 2.39%) in the middle tertile, and 4.07% or greater (median, 6.81%) in the upper tertile. Counties in the South, Midwest, and West were more likely to have the rate of CPR training in the lower tertile compared with the Northeast (8).

A national survey of prevalence of CPR training in Ireland in 2008 revealed that of the 974 respondents, 23.5% had undergone CPR training in the previous 5 years with lower social class and age 65 years and older significantly less likely to be trained. In the untrained group lack of awareness of the need for CPR training was the most significant reason for non-training (9). Nationwide surveys in South Korea described the proportion of the population that underwent CPR training increased from 26.9% in 2007 to 49.0% in 2011 (10). These data contribute to known geographic disparities in training of CPR and offer opportunities for the future community intervention.

To increase the number of citizens who know how to perform CPR

Prompt initiation of CPR undoubtedly saves lives. Training all the members of the community would be a major challenge. It is important to identify barriers in training and training techniques and underscore the need for a community-based approach in which optimal resuscitation is achieved. Three major barriers in learning CPR were identified and included financial, informational, and motivational factors. The financial cost of CPR training, the lack of information, and the fear of risking one's own life must be addressed when designing a community-based CPR educational program (11). Several barriers in performing CPR have been identified by the AHA, and included that the steps required for CPR are complex and difficult, or are forgotten shortly after training completed (12). Considering these barriers, professional organizations placed emphasis on the awareness, technology and retention of CPR to facilitate improving design and the implementation of CPR programs.

Public awareness

The higher the number of persons trained in CPR skills in

a given community, the more frequently it is performed. Attitudinal beliefs were most predictive of residents' intention to complete CPR training or perform CPR on a real victim. Resident who believed CPR could save a life, were employed, and had seen CPR advertised had the highest intention to receive CPR training (13). Behavioral change techniques targeting these specific beliefs are most likely to make an impact. Methods in this issue include motivating community-dwelling adults to learn CPR through reading the CPR pamphlet emphasizing learning CPR to save someone. Routinely teaching family members of people at risk for a cardiac arrest about the short window of time in which CPR must begin and encouraging them to learn about CPR to save someone they love (14). Teaching critical facts such as the low survival rate for OHCA might encourage laypersons to learn CPR.

Furthermore, early training can lay the foundation for a sense of social obligation and reinforce CPR knowledge and follow-up training, so that by the time a student graduates from high school CPR skills are well engrained and can easily called upon in an emergency situation (12).

CPR training methods and technology in the communities

In essence, one of the most effective means of improving surviving for OHCA is to attempt to train all individuals across a given community. Traditional CPR training, either voluntary or mandated as part of employment or school, will continue to be an important means to achieve early CPR, but additional approaches are needed to increase the delivery of early CPR in communities.

Strategies to teach CPR skills have now been simplified. AHA new recommendations make CPR easier to learn and to do. Abbreviated courses such as CPR Anytime reduce didactic content while enhancing hands-on practice of CPR skills. Such courses may offer real advantages because they require substantially less time than traditional courses and provide the potential for newly trained individuals to propagate the training to others (15). Moreover, the CPR kits that are currently being promoted by the AHA are designed to train individuals who are as young as 8 years old in less than a half hour. It has been demonstrated that using such a kit that contains a self-instructional video and an inflatable manikin not only promotes retention but also has a multiplier effect (16).

In addition, Advances in communication technology also encourage CPR skills. Open-access, multilingual Web sites provide straightforward explanations and demonstrations of

CPR (<http://www.learn CPR.org>). Likewise, free applications for telephone technology also provide easy-access CPR skills presentation (17).

In Singapore, The National Resuscitation Council (NRC) plans to establish Citizen Life Support Training Centres in each of the constituencies nationally recognised and certified training programmes just at people's doorstep. Two pilot centres have been established so far. Getting these projects off the ground involved active discussions with a number of community grassroot organisations in order to gain their support and patronage, so that these programmes may become entrenched in these areas. Potential resources of instructors could be medical and nursing students trained up to instructor level, graduate doctors and nurses who wish to contribute their life-saving training skills to communities to help training them, and also volunteer instructors from other training centres (18). NRC of Singapore is also looking at setting up CPR training kiosks within the constituencies. Each kiosk would consist of a training manikin mounted on a slab, with voiced step-by-step instructions to any person who visits the kiosk. Around the kiosk would be displayed step-by-step instructions on skills of CPR. The kiosk would allow any member of the public to register on the manikin, conduct his self-practice guided by the programme built inside the kiosk, take the theory and even the practical test. It would also provide feedback on the quality of CPR performed by the visitor and allow the generation of a certificate. It is hoped that the setting up of such kiosks would make CPR training more accessible to the masses and increase the numbers trained and certified in this skill (18).

Meanwhile, mass CPR events were carried out in Singapore. These events usually involved members of the public getting together and demonstrating the skill as a group. Usually, most of these events have been attendances ranging from a few hundred to a few thousand. Due to their potential for creating awareness among the masses, the NRC will continue to organise these and aim to eventually train up to 80,000 persons per annum through this mechanism (18).

Innovative strategies are needed to increase the number of trained CPR providers. It has been suggested that widespread videos based CPR instruction may be used as a simple tool to teach CPR, so as to reach a larger group of the population. In a Danish rural island community, mass education in basic life support (BLS) and a television campaign over one year lead to a significant increase of the confidence in providing chest compressions and mouth-to-mouth ventilations. The training kit consists of

a simple, personal resuscitation mannequin together with a DVD with BLS instructions. Traditional 4-hour BLS courses were offered at a modest price. The local television station presented broadcasts about resuscitation, including interviews with bystanders, how to use an AED, and how to sign up for the courses. The television campaign was broadcast in the daily local news program (19).

Pharmacy student committee in University of Tennessee developed a service-learning project that allows dissemination of the most up-to-date recommendations of CPR to members of the community. They offered training courses at senior residential living facilities, as well as to those who may not have had other opportunities to attend BLS training courses. Each service-learning project involved individuals with an assortment of interests and talents. Largest single community service event was the annual "free CPR Training and Health and Wellness Fair", where mass CPR training was provided at no charge to approximately 60 to 80 community members. Comfort and convenience were identified as key aspects for accomplishing successful community service events with optimal attendance. A central location or the common meeting place for each respective group or organization was often used for training courses (20).

Long-term retention of CPR skills

It is well known that CPR skills rapidly deteriorate after initial training. Knowledge and skills relating to CPR tend to be lost over time. However, once-only training of community residents would be inadequate to address future needs. Various strategies may be used for long-term retention of CPR skills.

Laypersons who attended a BLS course more than 10 years ago showed a significant lack of BLS knowledge and failed more often to deliver chest compressions and rescue breathing (21). These data suggest that CPR refresher courses as well as implication of CPR guidelines should be developed. Having half the populations of Singapore undergo CPR training at least five times in their lifetime (18). Additionally, most recently the AHA developed an iPhone application to review first aid procedures and details on responding to first aid situations (22). The combination of simulation sessions with online video records and online feedback allows for an enduring record of skills sessions to assist students in retaining and revising their learning (23).

The science of resuscitation is constantly evolving as new discoveries emerge. It is inevitable that CPR guidelines will

continue to change and be regularly updated and revised. It also highlights the need for currency and recertification in CPR training.

CPR-trained bystanders performing CPR

CPR training efforts have undoubtedly saved thousands of lives, and yet in many communities less than one quarter of people experiencing sudden cardiac arrest received layperson CPR. Bystander BLS is performed in only approximately one third of time when bystanders with CPR knowledge are present at OHCA though with regional variations (24,25). The factors most related with intention of bystander CPR were male gender, younger age, CPR awareness, recent CPR training, and qualified CPR learning (10). Multiple studies have examined the willingness to act when faced with an OHCA, and commonly cited reasons for reluctance are fear of harming the victim, fear of incorrect BLS performance, physical inability and concerns for liability and transmission of infectious diseases. The relative importance of the different reasons for reluctance varies between studies and countries (26-28). Considering these known factors, besides placed emphasis on reinforcing the concept of a social obligation to help others, participants are educated that in the event of witnessed sudden cardiac arrest in an adult, performing chest compressions alone can result in survival benefits. The use of chest compression-only CPR (CC-CPR) without ventilations can be an alternative to standard CPR for bystanders. It overcomes bystander reluctance to do mouth-to-mouth ventilation and may result in fewer interruptions to chest compressions. CC-CPR should be encouraged only if the rescuers are not willing to do airway or breathing maneuvers, or are untrained in CPR and are thus uncertain about how to perform CPR (29). Although this technique remains somewhat controversial, the goal is to improve both the likelihood and quality of bystander CPR.

Even with substantial efforts in which traditional and novel training approaches are used, many people who witness sudden cardiac arrest are not trained in CPR. Moreover, people previously trained may be reticent to attempt CPR. As an illustration of the interdependence of the links, early access via the emergency medical dispatcher provides an opportunity for just-in-time CPR training, whereby dispatchers instruct bystanders in CPR on the telephone when sudden cardiac arrest is suspected. First developed 25 years ago, dispatcher-assisted CPR constitutes a straightforward opportunity to

increase layperson CPR and potentially improve survival in many communities (30). Bystanders, usually family members, can perform it immediately, when it is physiologically most effective.

Implication for the Chinese community CPR training

Although the Chinese people can get the new guidelines of CPR at the same time with the other countries, there is still a big difference in those developed countries in the rate of learning and performing CPR. The reasons for the low learning and practice rate of CPR in China may mainly result from two aspects: some people are not willing to take action when faced an OHCA for the worry of taking unreasonable risk; on the other hand, the education in Chinese communities are not extensive enough and methods for training are simple or unitary. Governors, media or medical professionals should try to modify people's attitudes for helping others and increases the chance and the strategy of CPR training.

To improve survival rates in our communities, new targets are required. The challenge of optimal and integrated community resuscitation is formidable and iterative, and perhaps never ends. How to design a far-reaching community CPR training program is not well defined. Firstly, adapting the latest knowledge for local use and disseminating latest CPR guidelines in communities are very important. Secondly, each community must assess its individual strength and limitation and must generate an action plan for the improvement. Retraining rates, methods for reaching underserved populations and measures that will improve the likelihood of performing CPR by bystanders in emergencies should be considered in designing a community CPR education program. Thirdly, integration of technology is crucial to enhance the teaching effectiveness. Emphasis should be placed on the program of improving the emergency medicine knowledge, skills and the confidence of our community members to increase the likelihood to assist victims with out-of-hospital events. For example, "hands-only" CPR for rescuers who are neither trained nor confident in their abilities to provide rescue breaths can help in certain cases (31).

Finally, the consequence of a well-integrated and well-delivered community-based strategy of resuscitation can be measured directly by the rate of lives saving, and can be experienced and celebrated by individuals who live in the community.

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Footnote

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References

- American Heart Association. Available online: <https://www.heart.org/>
- European Resuscitation Council. Available online: <https://www.erc.edu/>
- Stiell I, Nichol G, Wells G, et al. Health-related quality of life is better for cardiac arrest survivors who received citizen cardiopulmonary resuscitation. *Circulation* 2003;108:1939-44.
- Huang CH, Wang WD, Yang F, et al. Status Quo of first aid knowledge of CPR in community residents and training programs. *Journal of Nursing Science* 2008;21:9-10. (in Chinese).
- Shen H, Wang YT. Development of cardiopulmonary resuscitation in China. *Chinese Journal of Emergency Medicine* 2006;15:13-4. (in Chinese).
- Lick CJ, Aufderheide TP, Niskanen RA, et al. Take Heart America: comprehensive, community-wide, systems-based approach to the treatment of cardiac arrest. *Crit Care Med* 2011;39:26-33.
- Sipsma K, Stubbs BA, Plorde M. Training rates and willingness to perform CPR in King County, Washington: a community survey. *Resuscitation* 2011;82:564-7.
- Anderson ML, Cox M, Al-Khatib SM, et al. Rates of cardiopulmonary resuscitation training in the United States. *JAMA Intern Med* 2014;174:194-201.
- Jennings S, Hara TO, Cavanagh B, et al. A national survey of prevalence of cardiopulmonary resuscitation training and knowledge of the emergency number in Ireland. *Resuscitation* 2009;80:1039-42.
- Lee MJ, Hwang SO, Cha KC, et al. Influence of nationwide policy on citizens' awareness and willingness to perform bystander cardiopulmonary resuscitation. *Resuscitation* 2013;84:889-94.
- Sasson C, Haukoos JS, Bond C, et al. Barriers and facilitators to learning and performing cardiopulmonary resuscitation in neighborhoods with low bystander cardiopulmonary resuscitation prevalence and high rates of cardiac arrest in Columbus, OH. *Circ Cardiovasc Qual Outcomes* 2013;6:550-8.
- Abella BS, Aufderheide TP, Eigel B, et al. Reducing barriers for implementation of bystander-initiated cardiopulmonary resuscitation: a scientific statement from the American Heart Association for healthcare providers, policymakers, and community leaders regarding the effectiveness of cardiopulmonary resuscitation. *Circulation* 2008;117:704-9.
- Vaillancourt C, Kasaboski A, Charette M, et al. Barriers and facilitators to CPR in an older population most likely to witness cardiac arrest: a national survey. *Resuscitation* 2013;84:1747-52.
- McDonald DD, Martin D, Foley D, et al. Motivating people to learn cardiopulmonary resuscitation and use of automated external defibrillators. *J Cardiovasc Nurs* 2010;25:69-74.
- Potts J, Lynch B. The American Heart Association CPR Anytime Program: the potential impact of highly accessible training in cardiopulmonary resuscitation. *J Cardiopulm Rehabil* 2006;26:346-54.
- Roppolo LP, Pepe PE. Retention, retention, retention: targeting the young in CPR skills training. *Critical Care* 2009;13:185.
- Rea TD, Page RL. Community approaches to improve resuscitation after out-of-hospital sudden cardiac arrest. *Circulation* 2010;121:1134-40.
- Anantharaman V. Developing resuscitation programmes in the community: the tasks ahead for the National Resuscitation Council. *Singapore Med J* 2011;52:634-41.
- Nielsen AM, Isbye DL, Lippert FK, et al. Can mass education and a television campaign change the attitudes towards cardiopulmonary resuscitation in a rural community? *Scand J Trauma Resusc Emerg Med* 2013;21:39.
- Goddard KB, Eppert HD, Underwood EL, et al. Basic life support and cardiopulmonary resuscitation training for pharmacy students and the community by a pharmacy student committee. *Am J Pharm Educ* 2010;74:100.
- Piepho T, Resch N, Heid F, et al. Lay basic life support: the current situation in a medium-sized German town. *Emerg Med J* 2011;28:786-9.
- Pocket first aid & CPR from the American Heart Association. Available online: <http://itunes.apple.com/us/app/pocket-first-aid-cpr-from/id294351164?mt=8>

23. Bowden T, Rowlands A, Buckwell M, et al. Web-based video and feedback in the teaching of cardiopulmonary resuscitation. *Nurse Educ Today* 2012;32:443-7.
24. Nichol G, Thomas E, Callaway CW, et al. Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA* 2008;300:1423-31.
25. Vaillancourt C, Grimshaw J, Brehaut JC, et al. A survey of attitudes and factors associated with successful cardiopulmonary resuscitation knowledge transfer in an older population most likely to witness cardiac arrest: design and methodology. *BMC Emerg Med* 2008;8:13.
26. Coons SJ, Guy MC. Performing bystander CPR for sudden cardiac arrest: behavioral intentions among the general adult population in Arizona. *Resuscitation* 2009;80:334-40.
27. Swor R, Khan I, Domeier R, et al. CPR training and CPR performance: do CPR-trained bystanders perform CPR? *Acad Emerg Med* 2006;13:596-601.
28. Shibata K, Taniguchi T, Yoshida M, et al. Obstacles to bystander cardiopulmonary resuscitation in Japan. *Resuscitation* 2000;44:187-193.
29. Ong EH. Improving the quality of CPR in the community. *Singapore Med J* 2011;52:586-91.
30. Rea TD, Eisenberg MS, Culley LL, et al. Dispatcher assisted cardiopulmonary resuscitation and survival in cardiac arrest. *Circulation* 2001;104:2513-6.
31. Sayre MR, Berg RA, Cave DM, et al. Hands-only (compression-only) cardiopulmonary resuscitation: a call to action for bystander response to adults who experience out-of-hospital sudden cardiac arrest: a science advisory for the public from the American Heart Association Emergency Cardiovascular Care Committee. *Circulation* 2008;117:2162-7.

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