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Original Article

Effect analysis of community first aid training mode based on popular science on improving first aid knowledge and skills of community residents

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Abstract: Objective: The aim of this study was to explore the effects of community first aid training mode based on popular science on improving first aid knowledge and skills of community residents. Methods: Two hundred and ninety-two residents of the two communities were selected as observation subjects. They were divided into the control group and study group, according to different communities, with 146 residents in each. Routine training was carried out in the control group, while community first aid training mode based on popular science was implemented in the study group. Awareness rate of heartbeat and respiratory arrest judging method and cardiopulmonary resuscitation (CPR) pressing method was compared between the two groups. Training satisfaction was compared between the two groups. Assessment scores of prehospitalization first-aid theory and practice were compared between the two groups. Awareness rates of burns and scalding, hemostasis and bandaging, and stampede and transfer were compared between the two groups. Scores of basic skills of self-help and mutual assistance for accidental injuries were compared between the two groups. Results: Awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method in the study group was higher than that in the control group after training ($P<0.05$). Assessment scores of prehospital first aid theory and practice in the study group were higher than those in the control group after training ($P<0.05$). Training satisfaction in the study group was higher than that in the control group ($P<0.05$). Awareness rates of burns and scalding, hemostasis and bandaging, and stampede and transfer in the study group were higher than those in the control group ($P<0.05$). After training, scores of basic skills of self-help and mutual assistance for accidental injuries in the two groups were higher than those before training. Scores in the study group were higher than those in the control group ($P<0.05$). CPR success rate of medical patient simulators in the study group was higher than that in the control group and time of CPR was shorter than that in the control group ($P<0.05$). Conclusion: Community first aid training mode based on popular science can significantly improve knowledge and skills of first aid. This method is worthy of popularization and application.

Keywords: Popular science base, community, first aid training mode, first aid knowledge and skills

Introduction

Sudden cardiac arrest and accidental injuries are common. They may occur in anyone, regardless of time or place [1, 2]. Surveys have found that the number of sudden cardiac deaths, worldwide, is as high as 4.25 million annually. According to the China Cardiovascular Disease Report 2015, nearly 42 out of every 100,000 people in China die of sudden cardiac death, with a total annual incidence of more than 540,000. Therefore, promptly responding to sudden cardiac arrest and accidental injury is the key to improving prognosis of patients and success rates of rescue [3]. When a community resident finds a sudden cardiac arrest or accidentally injured patient, even if an emergency call is made in time, it is difficult for the emergency personnel to arrive at the scene in a short time. If the surrounding people can perform self-help and mutual assistance, it is more likely that the patient will be rescued and recover [4, 5]. However, relevant studies have shown that many community residents do not fully understand first aid methods, especially in terms of operational knowledge and experience. Encountering patients with sudden cardiac arrest or accidental injuries, they are often

helpless [6-8]. Therefore, it is of great practical significance for community residents to be properly trained.

At present, mastery of the public first aid method in China is not satisfactory. The popularization of pre-hospital first aid mostly depends on publicity of the community exhibition boards, broadcast of TV missions, launch of lectures, and distribution of brochures [7, 8]. However, it is always difficult for residents to learn the first aid method because of the lack of practical experience. Taking cardiopulmonary resuscitation (CPR) as an example, although there are pictures and written instructions in the brochure, residents often only have sketchy knowledge. In practice, pressing position deviating from the heart, insufficient pressure intensity, and substandard pressing times may occur in some residents [9, 10]. Community first aid training based on popular science is carried out using the mode of theoretical explanation + video teaching + operation demonstration, which can quickly enrich theoretical knowledge and improve practical operation ability. In this study, community first aid training mode based on popular science was used to train community residents. This method was also compared with the traditional training mode, aiming to explore its effects on first aid knowledge and skills of community residents.

Data and methods

General data

The study was conducted from June 2017 to June 2018 and approved by the Ethics Committee of the Medical Emergency Center. This study conformed to ethical norms advocated delineated in the Helsinki Declaration. In this study, 292 residents without reading disorders were drawn from the community, according to the random number table method. They were randomly divided into the control group (146 cases) and study group (146 cases), according to the principle of "minimization of imbalance index". Inclusion criteria: (1) Age ≥18 years; (2) Patients in good health, with no heart, kidney, brain, and other systemic diseases; and (3) Patients that voluntarily participated in this study and signed informed consent.

Methods

The regular training mode was conducted in the control group [11]. Community health education was used as a platform to publicize first aid knowledge. Professional emergency medical personnel acted as lecturers, organized community residents to give first aid lectures, and conducted on-site CPR operation drills and training. Assessment was carried out after training, once a month. At the same time, the community service center compiled first aid knowledge leaflets to distribute to community residents. Moreover, first aid instruction manuals, including first aid methods of sudden cardiac arrest and accidental injury, were compiled and placed at the community service center for residents to read. In addition, first aid related knowledge could be broadcast via television and radio. Thus, community residents could better understand the first aid process.

Community first aid training model based on popular science was used in the study group [12]: (1) Compilation of first aid manuals: Manuals of self-help and mutual assistance were compiled for community residents, including common emergency procedures for critical care, first aid management, pre-hospital first aid methods, technical operations, and so forth. They were distributed to community residents prior to training; (2) Community residents grouping: Ten trainers were arranged to conduct group training, each of them was responsible for about 10 community residents. There should be no more than 15 residents in a single group to avoid the excessive numbers affecting training; (3) Training methods: Trainers carried out the training in combination with the manual. The theoretical explanation + video teaching + operation demonstration was adopted as the training mode and the combination of theoretical knowledge and practical skills was used as the training method. Theoretical explanation is mainly to explain the contents of the manual, helping the residents fully understand it. The main purpose of video teaching was to let the community residents have a visual impression, deepening their understanding of the first aid method. Operation demonstrations were conducted by training personnel to demonstrate the operation process and CPR method, transfer of injuries, hemostasis and bandaging, spinal fixation, and airway management, explaining precautions during the operation. After the operation demonstration, each trainee carried out the practical operation, with guidance of training personnel, until the residents fully learned. Training lasted for 2 days. Community residents were assessed after training.

Table 1. Comparison of general data between the two groups ($\bar{x}$ ± sd, n)

Groups	Study group (n=146)	Control group (n=146)	χ^2/t	P
Gender			0.343	0.558
Male	76	71		
Female	70	75		
Average age (year)	47.3±6.9	47.1±6.6	0.189*	0.850
Education level			0.927	0.819
Primary	17	13		
Junior secondary	43	40		
Senior secondary	46	49		
Diploma above	40	44		
Region			0.512	0.474
Rural	56	62		
Urban	90	84		
Previous training history			0.174	0.676
Have	35	32		
None	111	114		

Note: *was t-test, and others were χ^2 test.

Evaluation criteria

Main outcome measures: (1) Awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method. Scores ≥85 indicated awareness; (2) Assessment scores of prehospital first aid theory and practice in the two groups. Total scores were 100, with higher scores indicating better mastery of theoretical knowledge and practical operation; (3) Success rates of CPR. Assessment of CPR was conducted and success rates were calculated according to the International Cardiopulmonary Resuscitation Guidelines in 2005; (4) Scores of basic skills of self-help and mutual assistance for accidental injuries in the two groups. With a full score of 10, higher scores indicate better mastery of basic skills; and (5) Residents used medical patient simulators to conduct CPR assessment. Success rates and times were recorded, according to the standard of CPR Guidelines 2010 edition.

Secondary outcome measures: Awareness rates of burns and scalding, hemostasis and bandaging, and stampede and transfer knowledge in both groups. Scores ≥85 indicated awareness. Questionnaires, including contents of the pre-training period, training organization, training materials, training teachers, and training methods, were distributed. There were 3 answer options: satisfactory, generally satisfactory, and unsatisfactory. More than 4 "satisfactory" answers indicated very satisfactory, 3 was generally satisfactory, and 2 and below were unsatisfactory.

Statistical analysis

SPSS19.0 statistical software was used for analysis. Measurement data are expressed by mean ± standard deviation ($\bar{x}$ ± sd). Count data are expressed by the number of cases/percent (n/%) and detected by t-test. Independent sample t-test was used for group comparisons, while paired t-test was used for before and after self-comparisons. The χ^2 test was used for comparisons of rates. P<0.05 indicates statistical significance.

Results

Comparison of general data between the two groups

There were no significant differences between the two groups in general data, such as age, gender, education level, region, and previous training history (P>0.05; **Table 1**).

Comparison of awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method between the two groups

There were no significant differences between the two groups in awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method before training (P>0.05). Awareness rates in each group, after training, were significantly higher than those before training. Differences were statistically significant (P<0.001). Awareness rates in the study group were higher than in the control group, after training (P<0.001; **Table 2**, **Figure 1**).

Comparison of training satisfaction between the two groups

Training satisfaction in the study group (95.89%) was higher than that in the control group (87.67%) (P<0.001; **Table 3**, **Figure 2**).

Comparison of the assessment scores of prehospital first aid theory and practice between the two groups

There were no significant differences between the two groups in assessment scores of prehospital first aid theory and practice before training (P>0.05). Scores in the two groups,

Table 2. Comparison of awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method between the two groups (n (%))

Groups	Study group (n=146)	Control group (n=146)	χ^2	P
Heartbeat and respiratory arrest judging method				
Before training	53 (36.30)	50 (34.24)	0.135	0.713
After training	146 (100.00)###	117 (80.14)###	32.198	<0.001
CPR pressing method				
Before training	41 (28.08)	37 (25.34)	0.280	0.596
After training	138 (94.52)###	103 (70.54)###	29.103	<0.001

Note: CPR: cardiopulmonary resuscitation. Compared with before training, ###P<0.001.

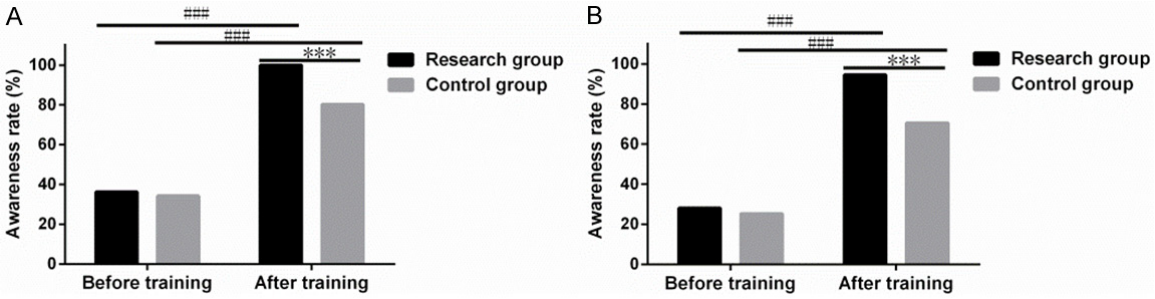

Figure 1. Comparison of the awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method between the two groups. A: Awareness rate of cardiopulmonary arrest judging method; B: Awareness rate of CPR pressing method. Compared with before training, ###P<0.001; Compared with control group, ***P<0.001.

Table 3. Comparison of training satisfaction between the two groups (n (%))

Groups	Study group (n=146)	Control group (n=146)	χ^2	P
Very satisfactory	101 (69.18)	72 (49.31)		
Generally satisfactory	39 (26.71)	56 (38.36)		
Unsatisfactory	6 (4.11)	18 (12.33)		
Satisfaction	140 (95.89)	128 (87.67)	19.183	<0.001

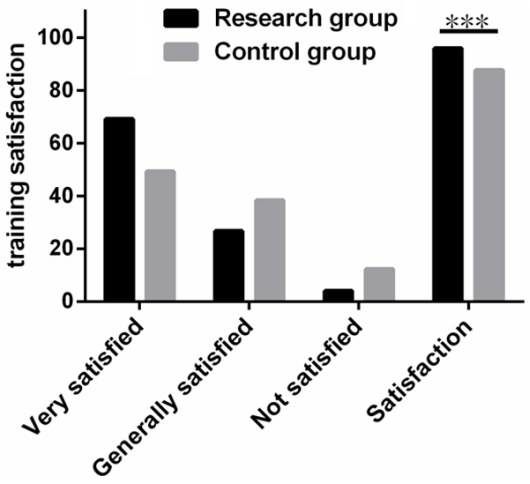

Figure 2. Comparison of training satisfaction between the two groups. Compared with control group, ***P<0.001.

after training, were significantly higher than those before training. Differences were statistically significant (P<0.001). The study group was significantly higher than the control group after training (P< 0.001; **Table 4**, **Figure 3**).

Comparison of awareness rates of burns and scalding, hemostasis and bandaging, and stampede treatment and transfer between the two groups

There were no significant differences between the two groups in awareness rates of burns and scalding, hemostasis and bandaging, and stampede and transfer before training (P>0.05). Awareness rates in each group, after training, were significantly higher than those before training. Differences were statistically significant (P<0.05). The study group was significantly higher than the control group after training (P<0.05; **Table 5**, **Figure 4**).

Comparison of scores of basic skills of self-help and mutual assistance for accidental injuries between the two groups

There were no significant differences between the two groups in scores of basic skills of self-

Table 4. Comparison of the assessment scores of prehospital first aid theory and practice between the two groups ($\bar{x} \pm sd$)

Groups	Study group (n=146)	Control group (n=146)	t	P
Pre-hospital first aid theory				
Before training	30.27±9.85	31.45±8.72	1.084	0.279
After training	87.21±10.33###	62.45±12.86###	18.137	<0.001
Practice				
Before training	50.38±5.75	51.07±6.23	0.983	0.326
After training	88.46±7.14###	72.65±6.91###	19.226	<0.001

Note: Compared with before training, ###P<0.001.

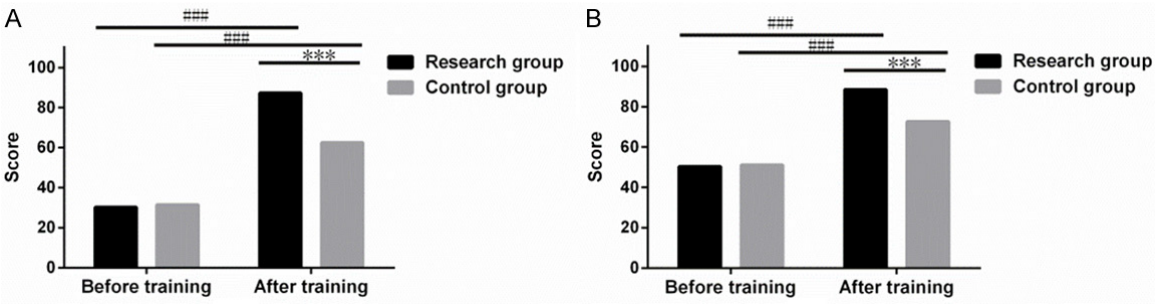

Figure 3. Comparison of assessment scores of prehospital first aid theory and practice between the two groups. A: Assessment scores of prehospital first aid theory; B: Assessment scores in practice. Compared with before training, ###P<0.001; Compared with control group, ***P<0.001.

Table 5. Comparison of awareness rates of burn and scalding, hemostasis and bandaging, and stampede treatment and transfer between the two groups (n (%))

Groups	Study group (n=146)	Control group (n=146)	χ^2	P
Burn and scalding				
Before training	101 (69.18)	98 (67.12)	0.142	0.706
After training	129 (88.36)##	115 (78.77)##	4.887	0.027
Hemostasis and bandaging				
Before training	68 (46.58)	65 (44.52)	0.124	0.724
After training	107 (73.29)##	90 (61.64)##	4.509	0.034
Stampede treatment				
Before training	105 (71.92)	102 (69.86)	0.149	0.699
After training	128 (87.67)##	114 (78.08)##	4.730	0.030
Transfer				
Before training	60 (41.09)	64 (43.84)	0.224	0.636
After training	121 (82.88)##	104 (71.23)##	5.598	0.018

Note: Compared with before training, ##P<0.01.

help and mutual assistance for accidental injuries before training (P>0.05). Scores in the two groups, after training, were higher than those before training, with statistically significant differences (P<0.001). The study group was significantly higher than the control group after training (P< 0.001; **Table 6**, **Figure 5**).

Comparison of success rates and times of CPR between the two groups

CPR success rates of medical patient simulators in the study group were higher than those in the control group and times of CPR were shorter than those in the control group (P<0.05; **Table 7**).

Discussion

The first 10 minutes after occurrence of sudden cardiac arrest and accidental injury is a precious time for patients to receive first aid. In general, brain tissues are basically dead after 10 minutes of cardiac arrest, at which time rescue is difficult [13, 14]. After a sudden cardiac arrest or accidental injury, emergency personnel are often

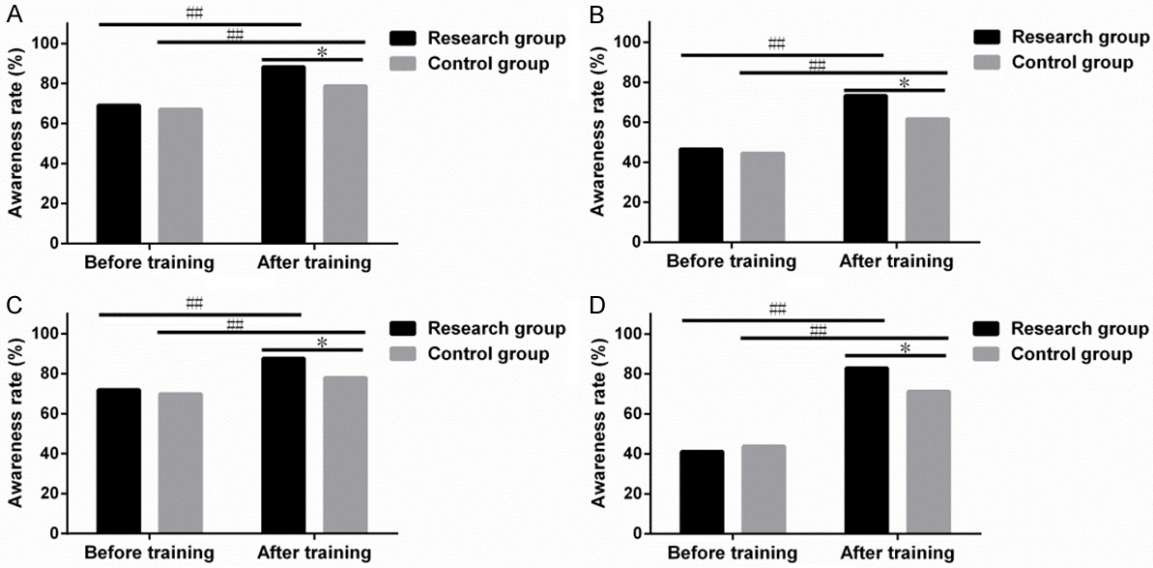

Figure 4. Comparison of awareness rates of burn and scalding, hemostasis and bandaging, and stampede treatment and transfer between the two groups. A: Awareness rate of burn and scalding; B: Awareness rate of hemostasis and bandaging; C: Awareness rate of stampede treatment; D: Awareness rate of transfer. Compared with before training, ##P<0.01; Compared with control group, *P<0.05.

Table 6. Comparison of scores of basic skills of self-help and mutual assistance for accidental injuries between the two groups

Groups	Study group (n=146)	Control group (n=146)	t	P
Before training	5.76±1.87	5.54±1.92	0.992	0.322
After training	8.69±1.22###	7.72±1.36###	6.415	<0.001

Note: Compared with before training, ###P<0.001.

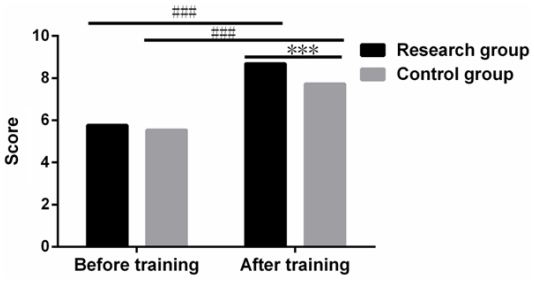

Figure 5. Comparison of scores of basic skills of self-help and mutual assistance for accidental injuries between the two groups. Compared with before training, ###P<0.001; Compared with control group, ***P<0.001.

unable to arrive at the scene in time. If self-help and mutual assistance can be carried out by the surrounding people, valuable rescue time can be gained for patients, improving their prognosis [15, 16]. However, studies have shown that many people lack first aid knowledge, pre-hospital first aid consciousness, and first aid operation ability. They often cannot participate in emergency treatment when encountering patient with sudden cardiac arrest or accidental injury [17-19].

As community medical personnel belong to primary medical institutions, they are restricted by many factors, such as limited medical resources, low educational levels, fewer training resources, and fewer opportunities to receive professional knowledge training and learning. These factors lead to low levels of first aid knowledge and skills [20, 21]. Therefore, the training that they carried out also has a certain lag. In this study, front-line emergency medical staff of the hospital entered the community to carry out teaching and theoretical explanations for community residents. The aim was to give them access to the latest and most incisive knowledge of first aid theory, which is conducive to the rapid expansion of first aid knowledge. Some scholars conducted pre-hospital first aid knowledge and teaching skills training for 24 college students that served as science knowledge popularizer, then the students taught 238 community residents with pre-hospital first aid knowledge training [22].

Table 7. Comparison of success rates and times of CPR between the two groups ($\bar{x}$ ± sd, n (%))

Groups	Study group (n=146)	Control group (n=146)	χ^2/t	P
CPR success rate	68 (46.58)	42 (28.77)	9.859*	0.002
CPR success time	21.22±10.25	26.93±11.63	4.451	<0.001

Note: CPR: cardiopulmonary resuscitation. *was χ^2 test.

Results showed that scores of first aid knowledge, attitudes, and behavior of community residents, after training, were significantly better than those before training. Assessment scores of first aid theory, practice, and teaching skills were all above 80 points. Results suggest that community first aid training mode based on popular science can effectively popularize pre-hospital first aid knowledge and improve the ability of self-help and mutual assistance of community residents. Results of this study show that, after training, the awareness rate of heartbeat and respiratory arrest judging method and CPR pressing method, assessment results of first aid theory, awareness rates of burning and scalding, hemostasis and bandaging, and stampede and transfer knowledge, and scores of basic skills of self-help and mutual assistance for accidental injuries in the study group were significantly higher than those in the control group. Results suggest that community first aid training mode based on popular science can significantly improve knowledge of first aid theory.

CPR is a first aid technique and a basic skill that requires repeated practice [23]. This research adopted the mode of video teaching + operation demonstration to carry out training. Role-playing and first aid scene simulation exercises used in this study increased training authenticity and maneuverability, enabling the masses to experience the rescue process personally. These factors greatly improved trainee enthusiasm for learning. Moreover, the performance of interactive exercises helped the masses to master the correct techniques and skills of first aid, ensuring better training effects. Side guidance for community residents during practical operations, such as CPR, hemostasis, and bandaging, could correct mistakes and enable residents to fully master the first aid method. Results of this study show that assessment results of pre-hospital first aid and success rates and times of CPR, after adopting community first aid training mode based on popular science, were significantly better than those of the control group with the traditional training method. Results suggest that community first aid training mode based on popular science can quickly and significantly improve knowledge and skills of first aid, displaying training effects superior to the traditional training method.

The current study adopted the method of group training. Each trainer was responsible for about 10 community residents, ensuring the accuracy and precision of the training. Basic skills of self-help and mutual assistance increased significantly and the residents learned first aid knowledge, naturally increasing their training satisfaction. Results showed that training satisfaction in the study group (95.89%) was higher than that in the control group (87.67%), indicating that the community first aid training mode based on popular science can improve knowledge and skills of first aid quickly and efficiently. Most residents were satisfied after its implementation. This is beneficial to the smooth popularization and development of knowledge and training. Some scholars have put the concepts of “first scene witness” and “platinum 10 minutes” into practice in the community, with the professional non-hospital first aid institution as the dominance, with the community health service center as the basis of the construction of community self-help and mutual assistance science popularization training base, and with community first aid work as the foundation of the community self-help and mutual assistance training base [24].

Sudden cardiac arrest and accidental injuries can occur at any place, time, and in any age group. Therefore, training should not be limited to community residents, but can also be extended to schools, rural areas, and people prone to accidents. Training targets should be extended to students, teachers, rural residents, and the elderly, effectively improving first aid knowledge and skills [25, 26]. There were some shortcomings to the current study, however. For example, the sample size was small. There was incomplete assessment of residents and deficient long-term follow-ups concerning resident abilities to truly cope with accidental injuries

and sudden cardiac arrest. Therefore, further research is necessary.

In conclusion, implementation of self-help and mutual assistance by on-site community residents can gain valuable rescue time for patients. Application of community first aid training mode based on popular science can quickly improve resident knowledge and skills of first aid, helping them to master the first aid method. This will enable ordinary residents to better cope with sudden cardiac arrest and accidental injuries. Therefore, this training method is worthy of promotion.

Disclosure of conflict of interest

None.

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