ORIGINAL ARTICLE

Comparing the effectiveness of video self-instruction versus traditional classroom instruction targeted at cardiopulmonary resuscitation skills for laypersons: a prospective randomised controlled trial

CH Chung 鍾展鴻
Axel YC Siu 蕭粵中
Lucia LK Po 浦麗君
CY Lam 林祖怡
Peter CY Wong 王祖耀

Objective To determine whether in the local lay Hong Kong population, video self-instruction about cardiopulmonary resuscitation has comparable results to traditional classroom instructions.

Design Prospective randomised single-blind controlled trial.

Setting A first-aid training organisation in Hong Kong.

Participants Cantonese applicants for cardiopulmonary resuscitation courses aged between 18 and 70 years were recruited into the study. They were randomised into two groups. Those selected for self-learning were given a kit (consisting of a mini-manikin, a video compact disc, and an instruction manual) and sent home. The other group underwent usual classroom training. Both groups were examined together; the examiners remained blinded to the background training of the subjects. Those who passed were asked to come back for re-examination after 1 year.

Main outcome measures The examination passing rates initially and after 1 year.

Results During a 1-year period between 1 April 2007 to 31 March 2008, 256 subjects were recruited into this study, 124 for self-learning and 132 for classroom training. The age range was 18 to 62 (mean, 39; standard deviation, 10) years. There was no significant difference in passing rate between the two groups at the initial examination or at the re-examination after 1 year. Notably, 28 (23%) of the participants of the self-learning group taught cardiopulmonary resuscitation to relatives and friends.

Conclusion Video self-learning resulted in cardiopulmonary resuscitation performance as good as traditional classroom training.

Introduction

Bystander cardiopulmonary resuscitation (CPR) can improve survival after out-of-hospital cardiac arrest by 2 to 3 folds. Despite the proven efficacy of CPR for cardiac arrests, only a small proportion of the population knows how to perform it. Consequently, rates of bystander CPR and survival from out-of-hospital cardiac arrest remain low. Lack of training, lack of confidence, and fear of infections through mouth-to-mouth ventilation are the main deterrents. Widespread CPR training might be one of the solutions to build confidence and dispel misconceptions. In order to reduce morbidity and mortality rates from out-of-hospital cardiac arrest, the American Heart Association (AHA) has suggested that at least 20% of adults need to be currently trained in CPR.[1] However, even when 52% of the population in Australia had been trained, only 11% were trained in CPR in the last 12 months, and only 22% of out-of-hospital cardiac arrests received bystander CPR and survival was less than 5%.[2]

The AHA, in cooperation with the International Liaison Committee on Resuscitation, published new CPR guidelines for laypersons on 13 December 2005.[3] In short, they unify the protocols for adults, children, and infants, and place more stress on chest compression and less emphasis on mouth-to-mouth ventilation, and should be easier to learn, remember, and accept by laypersons.

The need of a classroom setting, cost of qualified instructors, variability in instructor quality and content, excessive didactic information, shared manikins, limited practice

Key words
Education; Heart arrest; Learning; Public sector; Teaching

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Hong Kong St John Ambulance, St John Tower, 2 Macdonnell Road, Hong Kong
CH Chung, FHKAM (Emergency Medicine), FHKAM (Surgery)
AYC Siu, FRCSEd, FHKAM (Emergency Medicine)
LLK Po, RN, FCHSE
CY Lam, FRCSEd, FHKAM (Orthopaedic Surgery)
PCY Wong, FRCP, FHKAM (Medicine)

Correspondence to: Dr CH Chung
Email: cchchung@hotmail.com

香港非醫護人員以影碟自學形式學習心肺復甦法技能的效果跟傳統教學形式的比較：前瞻性單盲隨機對照試驗

目的 檢視香港非醫護人員以影碟自學形式學習心肺復甦法的效果是否與傳統課堂教學相若。

設計 前瞻性單盲隨機對照試驗。

安排 香港一所急救訓練機構。

參與者 研究包括18至70歲操廣東話的心肺復甦法課程參加者。他們被隨機分成兩組：自學組只獲派學習教材（包括微型人體模型、影碟和說明書），而另一組則接受傳統課堂訓練。主考官在未知參與者的訓練背景下，對他們進行評核。及格的參與者一年後再度接受有關評核。

主要結果測量 上述兩次評核的合格率。

結果 在2007年4月1日至2008年3月31日期間，參與以上研究的共有256名學員：124名為自學組，132名則為課堂組。他們年齡介乎18到62歲（平均39歲；標準差，10歲）。兩組於上述兩次評核的合格率並沒有顯著分別，而28名（23%）自學組成員曾教導親戚和朋友有關的心肺復甦法。

結論 以影碟自學形式學習心肺復甦法的效果與傳統課堂教學相若。

time, anxiety in unfamiliar environments, fixed time schedules and logistics are all unfavourable factors for the traditional classroom approach.[4-9] On the contrary, its most obvious virtue is immediate feedback from the instructor.

A simple and easily accessible CPR training programme might encourage bystander CPR and save lives. In 2005, the AHA released the Family and Friends CPR Anytime Program and kit.[10] This CPR video self-instruction (VSI) program is simple, consistent, and inexpensive. It also provides its own manikin, suitable for all ages, and suitable for home use with a digital video disc (DVD) playing set. Moreover, the retention of VSI materials permits periodic refresher (practice) sessions and continuing out-of-classroom education at no additional cost.[6,7] Training can be efficient, taken at leisure and at any time, and allows the learner to control the pace of learning in a comfortable and convenient learning environment.[8,11] In multiple studies, VSI has been shown to be at least as effective as traditional classroom instruction (TCI).[6-8,10,11]

We therefore aimed to conduct a prospective randomised single-blind controlled trial to determine whether VSI targeting CPR resulted in a comparable performance to TCI in a sample of lay Hong Kong subjects, with a view to expand training for this life-saving skill.

Methods

The study was conducted by the Hong Kong St John Ambulance Association (SJAA), which is the largest organisation for first aid and CPR training in Hong Kong. The study was approved by the Board of Ethics and Discipline of the SJAA. To begin with, all adult applicants for the CPR course at SJAA were screened for the following exclusion criteria: (1) inability to speak Cantonese and read Chinese; (2) being a health care provider (ie doctor, nurse, and paramedic); (3) having a visual, hearing, or mental disability that might affect perception of the self-learning programme; (4) having a musculoskeletal disorder that might affect performance of CPR; and (5) being younger than 18 years and older than 70 years.

Eligible applicants were invited to the study, and those who accepted the offer were exempted from paying the course fee and required to sign an informed written consent document. They were assigned to the VSI or TCI groups according to a computer-generated random number table, which involved opening sealed envelopes sequentially. Those selected for VSI were given a kit, which consisted of an inflatable Mini Anne manikin (Laerdal, Suzhou, PRC), a 5-minute DVD (filmed by SJAA), and an instruction manual (printed by SJAA). They had an obligation to return for a practical examination at mutually agreed times, to be mixed with persons receiving TCI. After the examination, all students were required to fill in a questionnaire (Appendix) regarding their demographic details, level of education, occupation, attitude on CPR, and any previous CPR training. If they passed, they were loaned the manikin for continued practice at home, and for teaching their family and friends (as a bonus or duty). Interval follow-up by telephone (with a standard form) was performed 6 months after passing the initial examination.

Students in the other group were given only a CPR instruction manual and were required to attend TCI, using the same Mini Anne manikin. They were required to take a practical examination immediately after the classroom training, while mixing with VSI group subjects. The examiners (who differed from the instructors) were fully informed of the study but blinded to the background training of the subjects, all of whom were reminded not to disclose their training mode to the examiners. After the examination, all students were also required to fill in a questionnaire for demographic and related data (Appendix).

After 1 year, all the students in both groups, who had passed the initial examination, were invited to return for re-examination.

All students were tested with the Mini Anne manikin. The examiners used a skills checklist and scoring sheet for the assessment, rated each of 20

individual CPR skill steps dichotomously as adequate (1 mark) or inadequate (0 mark). The three overall CPR skills performance were rated on a 3-point ordinal scale (0=incompetent, 1=competent, 2=good). Theoretically, the total score of any individual could range from 0 to 26. The primary outcome measure was the overall passing rate. The secondary outcome measures were mean scores of individual CPR skills, eg sequence, assessment, call for help, quality of ventilation, quality of chest compression, and attitude. Numerical data were analysed by *t* test and categorical data by Chi squared test or Fisher's exact test, with P<0.05 taken as statistically significant.

The required sample size was derived from two studies by Todd et al.[6,7] The latter work described a power calculation with a 2-sided α level of 0.05 and β level of 0.2 and found that 24 subjects per group would be required to detect a difference. Accordingly, we planned to use 1 year for initial recruitment with a minimum of 100 subjects in each group in order to allow for differences in patient populations and subsequent dropouts.

Results

During a 1-year period from 1 April 2007 to 31 March 2008, 326 candidates were recruited but 70 did not attempt any test, resulting in only 256 valid subjects fit for analysis, with 124 having VSI and 132 having TCI. The reasons given for not returning for the test were: too busy to come back, unable to match the test schedules on repeated attempts, job changed and CPR skill no longer required, address changed, and far away from the test centre. Some could not be contacted from the personal information supplied.

The male-to-female ratio was 132:124, and the age range was 18 to 62 (mean, 39; standard deviation, 10) years. Demographics of the two groups showed no significant differences (Table 1). Of the 71 replies, 53 reported previous experience in CPR, ranging from 1 to 30 years earlier (median, 3; interquartile range, 1-6 years).

After training, both groups showed a significant increase in the number of people willing to provide CPR for acquaintances or strangers (Table 2). Lack of skill (before training), followed by lack of confidence, and worry about infection were the reasons for not providing CPR. In the initial examination, there was no significant difference between the passing rates of the two groups (Table 3). However, individual skill performance by the classroom group tended to be better (significance up to P=0.01). Although statistically significant, such differences may not be 'clinically' significant as the overall passing rates showed no statistically significant difference.

Only 130 out of the 237 successful candidates returned for re-examination after 1 year (55/112 or 49% from the VSI group and 75/125 or 60% from the TCI group; Chi squared test, P=0.36). Again, there was no significant difference between the passing rates of the two groups, although there was no failure among the self-learners this time (Table 4). Even assuming all those not returning for re-examination would fail, there was no significant difference between the performance of the two groups (Chi squared test, P=0.08). For the 71 who answered the question on previous experience in CPR, only 46 returned for re-examination after 1 year. There was no significant difference in passing rates in those with and without previous CPR experience, both initially and after 1 year (Fisher's exact test, P=1.00).

TABLE 1. Demographics of the two study groups

Demographics	Self-learning (n=124)	Classroom training (n=132)	P value
Sex (M:F)	67:57	65:67	0.46*
Mean age (years)	38.9	39.1	0.90†
Education level			0.11*
Primary	9	4	
Secondary	77	86	
Post-secondary	7	17	
Tertiary	24	22	
Missing data	7	3	
Occupation			0.28*
Unemployed/retired	8	13	
Student	5	5	
Clerical	18	24	
Management	16	8	
Technician	13	21	
Professional	10	14	
Unskilled worker	7	3	
Others	15	22	
Missing data	32	22	
Previous CPR‡ training	26% (n=34)	27% (n=37)	0.74*

* Chi squared test
† Independent *t* test
‡ CPR denotes cardiopulmonary resuscitation

TABLE 2. Willingness in providing cardiopulmonary resuscitation (CPR)

	No. (%)		P value*
	Before training	After training	
CPR for acquaintances			
Self-learning (n=124)	69 (56%)	112 (90%)	<0.01
Classroom training (n=132)	84 (64%)	123 (93%)	<0.01
CPR for strangers			
Self-learning (n=124)	49 (40%)	92 (74%)	<0.01
Classroom training (n=132)	49 (37%)	109 (83%)	<0.01

* Paired *t* test

TABLE 3. Results of the initial assessment of cardiopulmonary resuscitation (CPR) [n=256]

Results	Self-learning (n=124)	Classroom training (n=132)	P value
Overall result			0.18*
Pass	112 (90%)	125 (95%)	
Fail	12 (10%)	7 (5%)	
Individual skill	(Pass)	(Pass)	
Check conscious level	117	129	0.21†
Call for help	118	128	0.53†
Open airway	115	124	0.70*
Check breathing	112	121	0.71*
Give two rescue breaths	113	121	0.88*
Check chest expansion	106	123	<0.05*
Check pulse and circulation	104	110	0.91*
Chest compression position	117	132	<0.01†
Interlocking fingers	119	129	0.49†
Keep elbow straight	106	109	0.53*
Vertical compression	106	120	0.18*
Force of compression	116	132	<0.01†
Chest compression speed	111	124	0.20*
Look at face during compression	65	80	0.19*
Give two more rescue breaths	116	129	0.13†
Look at chest while giving rescue breath	113	124	0.39*
Repeat CPR for 4 more cycles	120	127	1.00†
Finish 5 cycles within 2 minutes	117	124	0.89*
Recheck circulation	121	127	0.72†
Repeat CPR for 5 cycles	116	130	0.05†
Overall impression			
Correct and effective air opening	117	128	0.37†
Correct and effective rescue breathing	117	128	0.37†
Correct and effective chest compression	114	126	0.25*
Total marks (mean)	21.79	22.79	0.01‡

* Chi squared test
† Fisher's exact test
‡ Independent *t* test

In the interval telephone survey at 6 months, only 93 of the VSI group detailed the storage site of the manikin, being the home for 70 (75%), and the workplace for 23 (25%). By 6 months, more than 98% of the manikins were still working. Notably, 28 (23% of the 124 VSI subjects) had taught CPR to friends or relatives in the past 6 months (Table 5).

Opinions about the self-learning kit were generally very favourable; around 95% rated them as very good or good. More than 85% of the respondents would choose VSI again and recommend it to others.

Discussion

The results of our study are consistent with those of others in showing that VSI is equivalent to TCI for teaching CPR skills,[6-8,10,11] which implies that video self-learning is an effective alternative to traditional classroom training in such skills. Video self-instruction has the potential to promulgate CPR to individuals unlikely to participate in traditional classroom settings.[10] However, in contrast to the above studies, we found that TCI was slightly better initially with regard to the imparting of individual skills. The quality of the instructors and VSI materials might be confounding factors.

Einspruch et al[12] showed that CPR performance declined after a post-training interval of 2 months. Our study showed that at least 50% of the participants retained satisfactory CPR skills after 1 year, and there was no statistical difference between the two groups. More important than the immediate result is the

TABLE 4. Results of the second assessment of cardiopulmonary resuscitation (CPR) after 1 year (n=130)

Results	Self-learning (n=55)	Classroom training (n=75)	P value
Overall result			0.51*
Pass	55 (100%)	73 (97%)	
Fail	0	2 (3%)	
Individual skill	(Pass)	(Pass)	
Check conscious level	55	74	1.00*
Call for help	54	75	0.42*
Open airway	50	73	0.13*
Check breathing	52	74	0.31*
Give two rescue breaths	50	69	0.83†
Check chest expansion	48	72	0.10*
Check pulse and circulation	52	72	0.70*
Chest compression position	53	72	1.00*
Interlocking fingers	51	75	0.03*
Keep elbow straight	48	68	0.54†
Vertical compression	51	69	1.00*
Force of compression	53	75	0.18*
Chest compression speed	47	55	0.10†
Look at face during compression	35	52	0.50†
Give two more rescue breaths	55	73	0.51*
Look at chest while giving rescue breath	51	70	1.00*
Repeat CPR for 4 more cycles	54	70	0.40*
Finish 5 cycles within 2 min	50	59	0.06†
Recheck circulation	53	73	1.00*
Repeat CPR for 5 cycles	48	69	0.38†
Overall impression			
Correct and effective air opening	55	74	1.00*
Correct and effective rescue breathing	55	74	1.00*
Correct and effective chest compression	54	73	1.00*
Total marks (mean)	21.91	21.79	0.74‡

* Fisher's exact test
† Chi squared test
‡ Independent *t* test

retention of skills to be performed in subsequent emergency encounters. Tweed et al[13] showed that deliberate overtraining of police officers in a basic 8-hour CPR course resulted in satisfactory skills retention for at least 1 year. Berden et al[14] found that resuscitation skills were maintained at a stable level when associated with 3- or 6-monthly refresher courses. In addition to convenience, the VSI program has the virtue of allowing the learner more study and practice time, unlimited repeat study and practice, and the feasibility of teaching acquaintances (which might also be helpful in skill improvement and retention). Retention of VSI materials encourages periodic refresher practice and skill transfer within the community at no additional cost.

TABLE 5. Behaviour of the self-learning group (n=124)

	No. of respondents	Median (range)
Initial questionnaire survey		
No. of accompanying persons watching the DVD*	46	2 (0-8)
No. of practice before the examination	49	4 (0-20)
No. of hours of practice before the examination	48	1 (0.2-5)
6-Month telephone survey		
No. of practice after the examination	93	1 (0-10)
No. of people taught in the past 6 months	28	2 (1-10)
No. of people taught each time	27	2 (1-4)

* DVD denotes digital video disc

A very important observation was the change in attitude after both classroom training and self-learning, as there was a significant increase in the number of people willing to perform CPR on

acquaintances and even strangers. This attests to the effectiveness and necessity of promoting CPR in the general public, as a means of benefiting the community. Not only is retention of skills important, willingness to help in a cardiac emergency is also vital for the survival of patients.

Notably all our participants were motivated to learn CPR. Moreover, to eliminate confounding due to manikin unfamiliarity, we specifically chose the same manikin both before and during the examinations (instead of an electronic recording manikin).

The SJAA 3-hour CPR course fee was HK$170. The wholesale price of the Mini Anne manikin was around HK$200 and together with the charge for the DVD, manual and examination of around HK$70, self-learning implies a total cost of about 150% that of classroom training. Unless the price of the manikin can be substantially reduced, it may be difficult to popularise this form of self-learning in the Hong Kong setting.

Conclusion

Video self-learning resulted in CPR performance as good as traditional classroom training.

Appendix

Additional material related to this article can be found on the HKMJ website. Please go to <http://www.hkmj.org>, search for the appropriate article, and click on Full Article in PDF following the title.

Declaration

The Hong Kong St John Ambulance provided the funding and the Society for Prehospital Advanced Resuscitation and Kiss of Life (Hong Kong) supplied the Mini Anne manikins for this study. Both are non-profit voluntary organisations. No author has a conflict of interest that relates to the content discussed in this article.

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Appendix. Evaluation questionnaire

The information collected below will be used for research purposes only. It will be accessed only by the investigators.

Candidate No.:
Sex: Age:
Education level: Primary/Secondary/Post-secondary/Tertiary #

Profession: Unemployed/Retired/Student/Clerical/Management/Technician/Professional/
Unskilled worker/Others# (Please specify) _____
Previous CPR Experience/Training/Certification#: _____ years ago
Your reason for enrolment in the CPR course: _____
Date of examination _____

Were you comfortable in providing CPR to an acquaintance before this study project? Yes/No#
If No, the reason: ☐ Lack of training
☐ Lack of confidence
☐ Fear of infection
☐ Others (please specify): _____
Are you comfortable in providing CPR to an acquaintance after this study project? Yes/No#
If No, the reason: ☐ Lack of confidence
☐ Fear of infection
☐ Others (please specify): _____
Were you comfortable in providing CPR to a stranger before this study project? Yes/No#
If No, the reason: ☐ Lack of training
☐ Lack of confidence
☐ Fear of infection
☐ Others (please specify): _____
Are you comfortable in providing CPR to a stranger after this study project? Yes/No#
If No, the reason: ☐ Lack of confidence
☐ Fear of infection
☐ Others (please specify): _____

If you are selected as the VSI group, please answer the following additional questions:

Date you received your CPR pack _____
Date you first started practicing CPR _____
Did you view the video alone or with family members/friends#? Yes/No#
If viewed with others, please specify the relationship and number _____
The total number of practice before the examination _____
The total duration of practice before the examination _____ hours
Are you comfortable with training by the DVD only? Yes/No#

Your comment on the CPR package: (please tick)

Manikin	☐ Excellent	☐ Good	☐ Fair	☐ Bad
DVD	☐ Excellent	☐ Good	☐ Fair	☐ Bad
Manual	☐ Excellent	☐ Good	☐ Fair	☐ Bad
Packaging & Instructions	☐ Excellent	☐ Good	☐ Fair	☐ Bad

Would you select VSI if you are allowed to choose again? Yes/No#
Would you recommend VSI to others? Yes/No#

Any difficulties encountered or additional comment:

_____

_____

_____

_____

_____

_____

- Thank you –

#Circle as appropriate