



## Simulation and education

The effects of the new CPR guideline on attitude toward basic life support in Japan<sup>☆</sup>Miki Enami, Yutaka Takei, Yoshikazu Goto, Keisuke Ohta, Hideo Inaba<sup>\*</sup>

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## ABSTRACT

**Background:** There is no study regarding the influence of cardiopulmonary resuscitation (CPR) guideline renewal on citizen's attitude towards all basic life support (BLS) actions.

**Methods and results:** We conducted a questionnaire survey to new driver licence applicants who participated in the BLS course at driving schools either before (January 2007 to April 2007) or after (October 2007 to April 2008) the revision of the textbook. Upon completion of the course, participants were given a questionnaire concerning willingness to participate in CPR, early emergency call, telephone-assisted chest compression and use of an automated external defibrillator (AED). After the revision, the proportions of positive respondents to use of AED as well as to all the four scenarios significantly increased from 2331/3564 to 3693/5156 (odds ratio (OR) = 1.34) and from 1889/3443 to 3028/5126 (OR = 1.18), respectively. However, the new guideline slightly but significantly augmented the unwillingness to make an early call (236/3568 vs. 416/5283, OR = 0.83). Approximately 95% of respondents were willing to follow the telephone-assisted instruction of chest compression, while approximately 85% were eager to perform CPR on their own initiative. Multiple logistic regression analysis confirmed the results of mono-variate analysis, and identified previous CPR training, sex, rural area and student as other significant factors relating to attitude.

**Conclusions:** Future guidelines should emphasise the significance and benefit of early call in relation to telephone-assisted instruction of CPR or chest compression. The course instructors should be aware of the backgrounds of participants as to how this may relate to their willingness to participate.

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In a situation where basic life support (BLS) is indicated, a bystander should activate the emergency response system and initiate the 'chain of survival' promptly.<sup>1</sup> Early bystander cardiopulmonary resuscitation (CPR) significantly increases survival rates in out-of-hospital cardiac arrest.<sup>2,3</sup> Among the four links in the 'chain of survival', the initial three links (early access, early CPR and early defibrillation) have potential effects on the survival.<sup>4,5</sup>

Various attempts have been made to improve the rate of bystander CPR.<sup>6–9</sup> Although not all the callers accept the assistance, telephone-assisted CPR was recommended to increase the rate of bystander CPR and survival.<sup>10,11</sup> Early defibrillation is achieved by the introduction of public access to automated external defibrillator (AED).<sup>12</sup>

Not only citizen's attitude towards CPR and AED but also the reasons why they are reluctant to initiate CPR and use the AED have been reported.<sup>13–16</sup> However, their willingness to make early emergency calls and to accept the telephone-assisted CPR remains to be studied.

Various educational courses conformed to Guidelines 2000 for CPR and cardiovascular care: international consensus on science were held, including mass CPR training events<sup>6</sup> and targeted CPR training of family members of patients suffering from cardiovascular disease.<sup>7</sup> In Japan, new driver licence applicants have been obligated to take the 3-h BLS training course at driving school since 1995. The course fee is 3500 yen and paid to the driving school. The number of participants is less than 10 per one instructor.

The International Consensus on Cardiopulmonary Recommendations (CoSTR)<sup>17</sup> was announced in November 2005. The main characteristic of the new consensus is simplification of its procedures. A preferred increase in the rate of survival has been reported after the guideline renewal.<sup>18</sup> The textbook of BLS training course at driving school was revised in July 2007 according to the changes in Japanese guidelines based on CoSTR. Since the textbook revision included the requisition of practical training for AED, more

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time was spent for practical AED education. The simplification of the BLS algorithm may reduce the unwillingness to perform BLS. However, no study regarding the influence of guideline renewal on citizen's attitude towards all BLS actions has been reported. In the present study, we studied whether the implementation of the new guideline could alter the attitudes of course participants to the BLS actions, and identified the factors that influence these attitudes.

## 1. Methods

The present study was approved by a committee of Ishikawa Designated Driving School Association.

### 1.1. Respondents and setting

Respondents were new driver licence applicants who participated in BLS training courses at 17 authorised driving schools in Ishikawa prefecture, Japan. The questionnaire was collected from all participants. Ishikawa prefecture has a population of 1.17 million residents and covers 4185 km<sup>2</sup>. The prefecture is divided into central (urban) and other three rural or semi-rural regions. Approximately 60% of the population is in the central region with an area of 1432 km<sup>2</sup>. All the fire departments have a dispatch system, which provides a telephone-assisted instruction of CPR (chest compression). The BLS courses are held systemically by fire departments, the Japanese Red Cross Society, high schools and the driving schools.

### 1.2. Questionnaires

We distributed questionnaires upon completion of the course. The questionnaires included age group of respondents, sex, residential area, occupation, experience of previous BLS training and the duration between present and the most recent BLS training courses. We asked questions regarding their willingness to perform BLS actions in four hypothetical scenarios of emergency scenes related to the initial three links in the 'chain of survival' (Table 1). Respondents were instructed to choose one of the four options if actually faced with the situation. The multiple choices included both positive and negative actions. When they selected negative actions, they were instructed to select the multiple choices for reason or to write free comments. The questionnaires were made in accordance with the guidelines for the Law Concerning the Protection of Personal Information.

**Table 1**  
Scenarios and choices.

Scenarios	Choices
1. A 30-year-old woman collapsed in front of you. She has no breathing and appears to be in cardiac arrest. She has blood on her face. What do you do after calling an ambulance?	(a) Chest compression and mouth-to-mouth ventilation <sup>a</sup> (b) Chest compression only <sup>a</sup> (c) Do nothing (d) Other
2. You found an unknown man collapsed on the floor. He had no response. He was abnormally breathing. When you called 119, commander assisted you to keep on pushing the center of chest. What do you do?	(a) Compress the center of chest <sup>a</sup> (b) Do not compress (c) Other
3. One of your families complained of a sudden chest pain and became unresponsive. He or she is breathing. What do you do first?	(a) Call 119 <sup>a</sup> (b) Call family, friend or neighbors (c) Call his or her home doctor (d) Other
4. There is a man with cardiac arrest. AED is in the neighborhood. What do you do?	(a) Use the AED <sup>a</sup> (b) Do not use the AED (c) No idea

<sup>a</sup> Choice(s) for positive attitude or willingness.

### 1.3. BLS course revision and study period

The study period consists of the first term of January 2007 to April 2007 before the revision of the textbook and the second term of October 2007 to April 2008 after the revision. The revision of the textbook included an immediate initiation of chest compression after two rescue breathings and a requisition of practical training for AED. A face-shielding device and the textbook were provided to all attendants at the beginning of the course. In some schools, a video instruction programme was introduced. The BLS course in the driving school is guaranteed by the Japanese Red Cross Society and the Japan Foundation for Emergency Medicine.

### 1.4. Statistical analysis

We analysed the data using JMP ver. 6 for Windows (SAS Institute Inc., Cary, NC, USA). Chi-square test was applied for mono-variate analyses. We used multiple regression analysis to confirm the effect of guideline renewal and to elucidate the factors relating to attitude. We considered the difference or effect to be significant when *p*-value was less than 0.05.

## 2. Results

### 2.1. Number of respondents

The total numbers of respondents were 3580 before revision of the textbook and 5310 after the revision. However, not all the respondents answered to all questions we asked. When the data were analysed, we excluded the respondents who gave no answer to a scenario or information we needed.

### 2.2. Comparison of backgrounds and characteristics of respondents between the two terms (Table 2)

The majority of the participants were aged between 17 and 29 years in both terms. There were significant but small differences in age, residential area and occupation between the two terms. The knowledge of how to use the AED increased from 40.3% to 50.5% after the textbook's revision. There was no significant difference in the experience of BLS training between the two terms. However, when analysed only in the respondents with experience of previous BLS training, a higher proportion of the respondents had participated in the other BLS training courses within 3 years in the pre-revision term, compared with the post-revision term.

### 2.3. Comparison of willingness to perform BLS actions between the two terms (Table 3)

There was no significant difference in the proportion of respondents who were willing to perform, on their own initiative CPR between pre-revision and post-revision terms. The proportions of respondents who selected the chest compression only CPR were 14.3% before the revision and 14.3% after the revision. The proportion of respondents who were willing to perform chest compression following telephone-assisted instruction was approximately 95% in both terms. The proportion of respondents taking other actions than emergency call was slightly but significantly higher in the post-revision term than in the pre-revision term. The major action that these respondents volunteered to take was calling their neighbors, friends or family doctor. After the revision, the proportions of positive respondents to the AED use and all the four scenarios increased significantly.

**Table 2**  
Characteristics and backgrounds of respondents.

Characteristics and backgrounds	Term		p-Value	Odds ratio
	Before revision, % (n)	After revision, % (n)		
Age				
17–29 years	96.4 (3444)	95.4 (5058)	0.014	1.313
30–69 years	3.6 (127)	4.6 (245)		
Gender				
Male	52.2 (1863)	53.7 (2849)	0.16	
Female				
Residential area				
Urban area	48.0 (1687)	58.6 (3084)	<0.001	
Rural area	37.5 (1317)	33.5 (1764)		
Other	14.5 (508)	7.9 (416)		
Previous BLS training				
None	48.0 (1706)	48.9 (2584)	0.343	
Once	36.4 (1296)	36.5 (1925)		
Twice	10.8 (384)	9.6 (509)		
Three times or more	4.8 (171)	5.0 (262)		
Years after the last BLS training course				
Within 3 years	81.9 (1385)	77.1 (1953)	<0.001	1.346
Over 3 years	18.1 (306)	22.9 (581)		
Occupation				
Student	86.8 (3066)	80.7 (4252)	<0.001	1.571
Non-student	13.2 (468)	19.3 (1020)		
Knowledge of how to use the AED				
Yes	40.3 (1402)	50.5 (2616)	<0.001	1.514
No	59.7 (2080)	49.5 (2563)		

BLS, basic life support; AED, automated external defibrillator.

**Table 3**  
Comparison of respondents' attitude toward the 4 scenarios between the two terms.

Scenarios	Term		p-Value	Odds ratio
	Before renewal	After renewal		
1. One's own initiative CPR, % (n)				
Do	86.3 (3076/3563)	84.9 (4485/5280)	0.073	
Do not	13.7 (487/3563)	15.0 (795/5280)		
2. Telephone-assisted chest compression, % (n)				
Do	94.8 (3374/3556)	94.7 (4996/5275)	0.877	
Do not	5.1 (183/3556)	5.3 (279/5275)		
3. Early call, % (n)				
Do	93.5 (3338/3568)	92.0 (4867/5283)	0.02	0.827
Do not	6.4 (236/3568)	7.8 (416/5283)		
4. Use of AED, % (n)				
Do	64.4 (2331/3564)	71.5 (3693/5156)	<0.001	1.340
Do not	35.6 (1233/3564)	28.4 (1457/5156)		
All scenarios, % (n)				
Positive	54.9 (1889/3443)	59.1 (3028/5126)	<0.001	1.178
Negative	45.1 (1543/3443)	40.9 (2098/5126)		

CPR, cardiopulmonary resuscitation.

#### 2.4. Characteristics and backgrounds of respondents relating to attitudes to BLS actions (mono-variate analysis)

We totalled the respondents of two terms and performed mono-variate analysis to elucidate the factors relating to attitude towards the four scenarios (Table 4). At least in one of the four scenarios, all the factors regarding characteristics and backgrounds of participants were significantly associated with a positive attitude.

#### 2.5. Factors relating to the attitudes (multivariate analysis)

We performed a multiple logistic-regression analysis to confirm the effect of textbook revision and to identify other independent factors relating to attitude or willingness (Table 5). The indepen-

dent factors associated with the positive attitudes to the all four scenarios were revision of the guideline, BLS training experience and students. Renewal of guideline was an independent factor associated with positive attitude to AED use and negative attitudes to early call. Increased experience of previous CPR training was an independent factor associated with willingness to perform CPR on one's own initiative and use the AED. Female sex was an independent factor associated with willingness to perform telephone-assisted chest compression and unwillingness to make early emergency call and use the AED. The respondents living in rural area was an independent factor relating to willingness to perform CPR on their own initiative. The student as occupation was an independent factor associated with willingness to perform CPR on their own initiative and use the AED.

**Table 4**

Characteristics and backgrounds of respondents relating to positive attitude (mono-variate analysis).

Characteristics and backgrounds	Scenarios								All scenarios ( $n^* = 8362$ )	
	One's own initiative CPR ( $n^* = 8617$ )		Telephone-assisted chest compression ( $n^* = 8607$ )		Early 119 call ( $n^* = 8623$ )		Use of AED ( $n^* = 8412$ )			
	Do (%)	<i>p</i> -Value	Do (%)	<i>p</i> -Value	Do (%)	<i>p</i> -Value	Do (%)	<i>p</i> -Value	Do (%)	<i>p</i> -Value
Age										
17–29	85.5	0.116	94.8	0.980	92.6	0.121	68.9	0.198	57.4	0.723
30–69	82.5		94.8		94.8		65.3		56.4	
Gender										
Male	85.9	0.170	93.7	<0.001	93.4	<0.01	70.1	<0.01	57.9	0.310
Female	84.9		96.2		91.9		67.1		56.8	
Residential area										
Urban	84.2	<0.001	94.8	0.841	92.5	0.089	66.4	<0.001	55.2	<0.001
Rural	87.4		94.8		92.5		71.6		59.4	
Other	85.5		95.2		94.5		71.3		61.3	
Previous BLS training										
None	77.6	<0.001	94.7	0.183	92.3	0.611	63.6	<0.001	53.2	<0.001
Once	87.0		95.4		92.3		71.3		59.1	
Twice	88.0		94.3		92.7		76.3		62.6	
Three times or more	92.1		93.3		94.0		83.8		74.0	
Occupation										
Student	86.0	<0.001	95.0	0.194	92.6	0.521	69.7	<0.001	58.0	<0.01
Non-student	82.5		94.2		93.1		63.8		53.9	

\* Number of respondents analysed.

**Table 5**

Factors associated with positive attitude to BLS actions (multiple logistic regression analysis).

	Odds ratio (CI)				All scenarios (n <sup>a</sup> = 8362)
	Scenario				
	One's own initiative CPR (n <sup>*</sup> = 8617)	Telephone-assisted chest compression (n <sup>*</sup> = 8607)	Early 119 call (N: 8623)	Use of AED (n <sup>*</sup> = 8412)	
Guideline renewal	0.929 (0.819–1.052)	0.982 (0.804–1.196)	0.753 (0.631–0.896)	1.422 (1.291–1.564)	1.233 (1.126–1.349)
Times of previous BLS training	2.105 (1.663–2.680)	0.833 (0.595–1.177)	1.132 (0.884–1.623)	2.732 (2.277–3.278)	2.092 (1.776–2.457)
Female	0.891 (0.789–1.006)	1.712 (1.402–2.100)	0.805 (0.682–0.949)	0.843 (0.767–0.926)	0.943 (0.864–1.030)
Rural area	1.265 (1.038–1.540)	0.911 (0.667–1.242)	0.820 (0.620–1.078)	1.112 (0.955–1.297)	1.008 (0.876–1.160)
Student	1.229 (1.034–1.445)	1.226 (0.928–1.599)	1.013 (0.788–1.289)	1.320 (1.150–1.515)	1.201 (1.053–1.370)

CI, confidence interval.

\* Number of respondents analysed.

## 2.6. Reasons for unwillingness

Practical skill evaluation followed by advice for further improvement was provided in the BLS course. Nevertheless, the major reasons for unwillingness or reluctance to perform CPR on their own initiative were fears regarding their insufficient knowledge and imperfect performance of CPR, which may reflect, at least in part, their intention that they would not like to take responsibility for their actions in those practical scenes. The major reason for reluctance to perform telephone-assisted chest compression was lack of confidence for cardiac arrest; for unwillingness to make an early call was lack of confidence; and for unwillingness to use the AED were no experience in its use and fear of imperfect performance of the AED use.

## 3. Discussion

One of the characteristics of the new guideline based on the CoSTR is simplification. A recent study from Oslo, Norway reported a predominant increase in the rates of survival after guideline renewal.<sup>19</sup> However, no study regarding the influence on citizen's attitude towards all BLS actions has been reported. The simplifica-

tion of the CPR algorithm may reduce the unwillingness to BLS and CPR.

We elucidated a proportional increase in respondents with positive attitude to all the four scenarios and the AED use after the renewal of the guideline. However, we did not find any proportional change in the attitude to CPR on one's own initiative or telephone-assisted chest compression. Approximately 15% of respondents were unwilling to perform CPR on their own initiative even though questionnaires were given immediately after the BLS training course. Unfortunately, the proportion of respondents taking other actions than early emergency call slightly but significantly increased after the revision.

In coincidence with previous reports from Michigan and Japan,<sup>15,16</sup> the main reasons why the respondents were reluctant to perform CPR were fears of poor knowledge and imperfect performance of CPR. In contrast to reports from Singapore, Los Angeles and Arizona,<sup>6,20,21</sup> fear of contracting an infectious disease was not the major reason. In the present study, only 14% of respondents selected chest compression as a resuscitation method to a stranger polluted with blood. Although a face-shielding device was provided in the BLS training course, this finding may reflect the lack of fear of contracting an infection in Japan that has been reported

previously.<sup>16</sup> The main reason why the respondents are reluctant to make an early call was lack of confidence for providing first aid for cardiac arrest, which may reflect their intention that they would like to entrust the judgement to senior persons.

Approximately 95% of respondents answered that they would follow the telephone-assisted instruction of CPR, while approximately 85% of respondents were willing to perform CPR on their own initiative. It has been reported that the implementation of telephone-assisted chest compression is effective to increase the rate of bystander CPR.<sup>11</sup> The result of the present study may support the usefulness of dispatch-assisted CPR in Japan. The early call may augment the effect of telephone-assisted chest compression, since the interval of collapse to initiation of CPR is largely prolonged by the delayed emergency call. In the present study, the proportion of respondents taking other actions than early call was shown to increase slightly after the revision. The significance of early call should be emphasised in relation to the telephone assistance in the BLS training course.

The proportion of respondents who are willing to use AED was obviously increased (from 64.4% to 71.5%). In Japan, the citizens have been legally allowed to use AED without training since July 2004. The number of AED installed in public facilities has increased (URL: <http://mhlw-grants.niph.go.jp/niph/search/NIDD00.do>). The number of reports for successful resuscitation by citizens who use the AED has been increasing. Because the textbook revision included the requisition of practical training for AED, more time was spent for practical AED training after the revision. After the revision, the respondents might have had more chances to have the benefit of the AED training in the previous BLS course at high school. However, approximately 30% of the respondents retained negative attitudes towards the use of AED. These negative attitudes may be attributed to several causes including lack of enforcement of 'good Samaritan law', differences in operation among the AED equipments commercially available and few chances to touch the AED. It may be necessary to spend sufficient time for the driver's licence applicants to be aware of use of AED.

We elucidated independent factors related to these attitudes. It is interesting that female sex was negative to early call and the use of AED but they were more obedient to telephone-assisted chest compression, compared with male sex. The global gender gap report by World Economic Forum (Hausmann R, Tyson LD and Zahidi S) shows that Japan has a large gender gap in society (URL: <http://www.weforum.org/pdf/gendergap/report2009.pdf>). A gender gap in attempting CPR has been reported from Japan.<sup>14,19</sup> The instructors in the BLS course should be aware of this gender gap. As reported previously,<sup>15,16,18</sup> the experience of BLS training is one of the independent factors relating to willingness to perform CPR on their own initiative. However, it is not an independent factor relating to positive attitude to early call, telephone-assisted CPR or AED use. This may reflect the problem of the BLS course where a major portion of the time is spent to teach how to perform CPR.

This study is based on the survey for new driver licence applicants who participated in compulsory BLS courses. The compulsory education of BLS is conducted in high schools.<sup>19</sup> These educational systems were introduced in Japan because of persuasive arguments by several associations related to resuscitation. These systems have been generally accepted on humanitarian grounds in Japan. However, it remains to be clarified whether these systems are effective to improve the rate of bystander CPR and the outcome of out-of-hospital cardiac arrests.

### 3.1. Limitation

In the present study, we did not analyse the parameters for participants' attainment of BLS actions or skills since the attainment was comprehensively evaluated in a non-quantitative manner (as it

was accepted or not) in this BLS course. Thus, it is unclear if the quality of BLS actions was improved by the guideline revision. However, this study is based on a large survey with more than 8000 respondents. We believe that the obtained results are reliable and helpful for the future revision of guidelines.

Most of respondents were in an age bracket of 17 years (the youngest age at the driving school) to 29 years. Approximately 83% of the respondents were high school or college students, who might have had a chance to receive BLS training during school. Thus, the results of the present study may not reflect the entire population of Ishikawa prefecture or Japan.

We did not evaluate the quality of instruction in BLS training programme. However, new instructors of BLS course in driving school are certified after they take lectures provided by emergency medical directors for 3 days and practical training given by BLS directors of Japan Red Cross Society for 3 days and then pass both written and practical examinations. When the guideline was changed, the instructors took the lecture and practical training of new guideline for 6 h. They were re-qualified after passing the written and practical examinations. Therefore, the quality of instruction seemed to be maintained during the study period.

## 4. Conclusion

We showed that the renewal of guideline increased the proportion of positive respondents to AED use and all the BLS actions. However, it failed to improve the unwillingness to early call, CPR on one's own initiative or telephone-assisted chest compression. The future revision of the guideline and the textbook should emphasise the significance and benefit of early call associated with telephone-assisted instruction of CPR. The course instructors should be aware of the backgrounds of participants relating to their willingness.

## Conflict of interest

We have no conflicts of interest to disclose.

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