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Simulation and education

Differential effects of ageing and BLS training experience on attitude towards basic life support☆

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ABSTRACT

Purpose of study: To determine the effects of ageing and training experience on attitude towards performing basic life support (BLS).
Methods: We gave a questionnaire to attendants of the courses for BLS or safe driving in authorised driving schools. The questionnaire included questions about participants' backgrounds. The questionnaire explored the participant's willingness to perform BLS in four hypothetical scenarios related to early emergency call, cardiopulmonary resuscitation (CPR) under their own initiative, telephone-assisted compression-only CPR and use of an automated external defibrillator (AED), respectively.
Results: There were significant differences in gender, occupation, residential area, experience of BLS training, and knowledge of AED use among the young (17–29 y, $N = 6122$), middle-aged (30–59 y, $N = 827$) and elderly (>59 y, $N = 15{,}743$) groups. In all four scenarios, the proportion of respondents willing to perform BLS was lowest in the elderly group. More respondents in the elderly group were willing to follow the telephone-assisted instruction rather than performing CPR under their own initiative. Multiple logistic regression analysis confirmed ageing as an independent factor related to negative attitude in all scenarios. Gender, occupation, resident area, experience with BLS training and knowledge about AED use were other independent factors. Prior BLS training did not increase willingness to make an emergency call.
Conclusion: The aged population has a more negative attitude towards performing BLS. BLS training should be modified to help the elderly gain confidence with the essential elements of BLS, including making early emergency calls.

1. Introduction

The chain of survival describes the actions linked with an increased likelihood of survival following out-of-hospital cardiac arrest (OHCA).[1] The first three of four links in the chain of survival are early recognition and call for help, early cardiopulmonary resuscitation (CPR) and early defibrillation, all of which have potential effects on survival.[2–4] Bystanders should activate the emergency medical service system by making an emergency call (119 in Japan) immediately after finding the patient unresponsive[5] or requiring basic life support (BLS).[6,7] A delay in performing an emergency call has been shown to exert a negative impact on outcome following OHCA.[2,8,9] If cardiopulmonary resuscitation (CPR) is started early by bystanders, the chance of survival is significantly improved.[3,4] Telephone-assisted instruction of compression-only CPR, which is currently performed by dispatch officers in our regional fire departments, has been recommended to increase the rates of bystander CPR and patient survival.[10,11] Early defibrillation is becoming possible through the introduction of publicly accessible automated external defibrillators (AEDs).[12]

In addition to the attitude of citizens towards CPR and AED use, several reasons why bystanders may be reluctant to initiate CPR and use an AED have been reported.[13–17] We recently reported that willingness to make an early emergency call, perform CPR under one's own initiative, telephone-assisted compression-only CPR and the use of an AED were influenced by the revision of BLS guidelines, previous CPR training, gender, residential area and occupation.[18]

In Japan, new driver's licence applicants are required to take a 3-h BLS training course at their driving school[18] and compulsory BLS education is conducted in high schools.[14] Small BLS training courses are frequently conducted by fire departments and the Japanese Red Cross association. Previous BLS training has been shown to increase willingness to perform CPR.[13,14,18,19]

As in other industrialised nations, Japan has a rapidly ageing population,[20] which has lead to an increase in the number of households with elderly residents.[21] As the majority of OHCAs

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occur at the patient's home, elderly citizens may witness OHCA at home.[8,19,22] Interest in participating in a BLS course has been reported to decrease with ageing.[23] However, the effects of ageing on citizens' attitudes towards performing BLS have not been reported.

In this large questionnaire survey, we examined whether ageing influences the attitudes of the population towards performing BLS and whether the beneficial effects of increased exposure to BLS courses may differ between elderly and non-elderly citizens. Finally, we identified the factors that influence attitudes towards performing BLS.

2. Methods

This study received ethical approval by a committee of Ishikawa Designated Driving School Association and an institutional review board (#844). The questionnaires were developed in accordance with the guidelines for the Law Concerning the Protection of Personal Information.

2.1. Respondents and setting

Respondents were new driving licence applicants who participated in BLS training courses and drivers who took part in training courses for safe driving at 17 authorised driving schools in the Ishikawa prefecture, Japan. The Ishikawa prefecture has a population of 1.17 million and covers an area of 4185 km^2. The prefecture was divided into central (urban or suburban) and three other rural or semi-rural regions. All of the fire departments in the Ishikawa prefecture have a dispatch system that provides telephone-assisted instruction of compression-only CPR. The instruction is initiated when the victims are unresponsive and when their breathing is presumed to be agonal. In the study period of this questionnaire survey, the instruction was performed in 60% of OHCAs witnessed or recognized by citizens and was accepted by 68% of the citizens.

2.2. Questionnaires

We gave questionnaires to 25,922 participants at the beginning of BLS courses and to those attending safe driving training courses (also mostly at the beginning). The questionnaires included the respondent's age group, gender, residential area, occupation, previous BLS training and the time from the most recent BLS training course. We asked questions regarding willingness to perform BLS in four hypothetical emergency scenarios[18] related to the initial three links in the chain of survival. Respondents were instructed to select the option that they would choose if they would have been faced with the situation presented. The multiple choices included both positive and negative actions. When they selected negative actions, they were instructed to select the reason from the multiple choices presented or to write free comments. The time given for filling in the questionnaire was 10 min (Table 1).

2.3. Study period and grouping

The study period was from May 2007 to May 2009. The survey of BLS course participants was interrupted between October 2007 and April 2008 for another questionnaire survey. The respondents were divided into young (17–29 y), middle-aged (29–59 y) and elderly groups (>59 y).

2.4. Statistical analysis

We analysed the data using JMP ver.7 (for Windows; SAS Institute). The *chi*-square test was applied for monovariate analyses. We used multiple regression analysis to confirm the effects of ageing and to elucidate the factors related to negative attitude. In all analyses, $P < 0.05$ was taken to indicate statistical significance.

3. Results

3.1. Number of respondents

We collected all the questionnaires given to 25,922 participants without regard of blank response to some of the questions. Indeed, not all respondents answered all questions. In data analysis, we first excluded 3230 respondents who did not supply the required information about their backgrounds. When we analysed the relationship between backgrounds and willingness to perform each scenario, we further excluded the respondents who did not provide an answer for each scenario (Fig. 1).

3.2. Comparison of backgrounds and characteristics of respondents among age groups

There were significant differences in backgrounds and characteristics among the age groups. The proportions of male respondents and those who lived in urban areas were highest in the young group and lowest in the elderly group. The proportion of respondents who had had previous BLS training and knowledge about how to use an AED was highest in the young group and lowest in the elderly group. The greatest proportion of respondents who had attended a BLS course less than 3 years ago was in the young group. The majority of respondents in the young group were students and employed persons in the middle-aged group. Most of the respondents in the elderly group had no steady job (Table 2) .

3.3. Comparison of willingness to perform BLS among groups

Monovariate analysis revealed significant differences among the three groups in the proportion of respondents willing to perform BLS. In all four scenarios, the proportion of respondents with a positive attitude towards performing BLS was lowest in the elderly group and highest in the young group. More respondents in the elderly group were willing to follow telephone-assisted instruction of compression-only CPR rather than performing CPR under their own initiative. Of the respondents who were willing to perform CPR under their own initiative, 31.3% (2559/8186) in the elderly group, 21.9% (129/589) in the middle-aged group and 20.1% (965/4810) in young group selected compression-only CPR. Only 21.4% of respondents in the elderly group were willing to use an AED. Approximately 20% of respondents in the elderly group and 10% of respondents in the young and middle-aged groups were unwilling to make an early emergency call. The major action that these negative respondents chose to take was calling their neighbours, friends or home doctor (78.8%, 56.9% and 89.3% in the young, middle-aged and elderly groups, respectively) (Table 3).

3.4. Estimation of acceptance rate of telephone-assisted CPR instruction

We analysed the subgroup of respondents who were unwilling to perform CPR under their own initiative. Of these respondents, 71.1% (5451/7674) answered that they would follow telephone-assisted instruction of compression-only CPR. This acceptance rate decreased with age; 89.6% (1151/1284) in the young group, 86.9% (200/230) in the middle-aged group and 66.6% (4100/6160) in the elderly group.

Table 1
Scenarios and choices.

Summary of scenarios	Choices
1. While you are walking, a 30-year-old woman collapses in front of you. She is not 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[a] b) Chest compression only[a] c) Do nothing d) Other
2. You find an unknown man collapsed on the floor. He is unresponsive and breathing abnormally. When you call 119, the commander instructs you to keep on pushing the centre of chest. What do you do?	a) Compress the centre of chest[a] b) Do not compress c) Other
3. One of your family members complains of a sudden chest pain and becomes unresponsive at home. He or she appears to be breathing. What do you do first?	a) Call 119[a] b) Call family, friend or neighbours c) Call his or her general practitioner d) Other
4. A man in the neighbourhood is in cardiac arrest. An AED is available. What do you do?	a) Use an AED[a] b) Do not use an AED c) Other

[a] Choice(s) for positive attitude or willingness.

Table 2
Characteristics and backgrounds of respondents.

Characteristics and backgrounds	Age group			χ-square test
	17–29 y, % (n = 6122)	30–59 y, % (n = 827)	>59 y, % (n = 15,743)	p-value
Age distribution				
17–19 y	72.6 (4444)	–	–	
20–29 y	27.4 (1678)	–	–	
30–39 y	–	56.6 (468)	–	
40–49 y	–	22.7 (188)	–	<0.001
50–59 y	–	20.6 (171)	–	
60–69 y	–	–	3.5 (551)	
70 or more	–	–	96.5 (15,192)	
Type of course				
BLS	94.3 (5773)	93.1(770)	2.0 (312)	<0.001
Safe driving	5.7 (349)	6.9 (57)	98.0(15,431)	
Gender				
Male	55.5 (3399)	71.4 (584)	82.4 (12,969)	<0.001
Female	44.5 (2723)	28.6 (234)	17.6 (2773)	
Residential area				
Urban area	59.1 (3616)	52.2 (432)	49.0 (7711)	<0.001
Rural area	29.7 (1819)	35.6 (294)	51.0 (8030)	
Other	11.2 (687)	12.2 (101)	0.0 (2)	
Previous BLS training				
None	45.4 (2777)	64.7 (535)	77.9 (12,265)	<0.001
Once	39.2 (2401)	24.9 (206)	14.5 (2278)	
Twice	11.7 (718)	5.2 (43)	5.0 (785)	
3 times or more	3.7 (226)	5.2 (43)	2.6 (9233)	
Duration from most recent BLS course in respondents with training experience				
3 years or less	73.4 (2801)	60.9 (223)	55.9 (2254)	<0.001
More than 3 years	26.6 (1014)	39.1 (143)	44.1 (1779)	
Occupation				
Student	75.3 (4607)	2.1 (17)	0.0 (3)	<0.001
Employed	13.5 (827)	62.9 (520)	28.8 (4216)	
No steady job	11.2 (688)	35.1 (290)	73.2 (11,524)	
Know how to use an AED				
Yes	28.8 (1730)	20.7 (168)	8.4 (1172)	<0.001
No	71.2 (4271)	79.3 (644)	91.6 (12,808)	

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

Table 3
Differences among the three age groups in the proportion of respondents who were willing to perform basic life support (monovariate analysis).

Scenarios	Age group			χ-square test
	17–29 y	29–59 y	>59 y	
Early emergency call	91.2% (5556/6092)	91.2% (747/819)	79.4% (12,130/15,270)	p < 0.001
CPR under their own initiative	78.9% (4810/6094)	71.9% (589/819)	57.1% (8186/14,346)	p < 0.001
Telephone-assisted compression-only CPR	94.6% (5766/6098)	92.5% (757/818)	84.6% (12,112/14,316)	p < 0.001
Use of an AED	56.8% (3386/5963)	48.4% (388/801)	21.4% (2832/13,285)	p < 0.001

CPR, cardiopulmonary resuscitation; AED, automated external defibrillator.

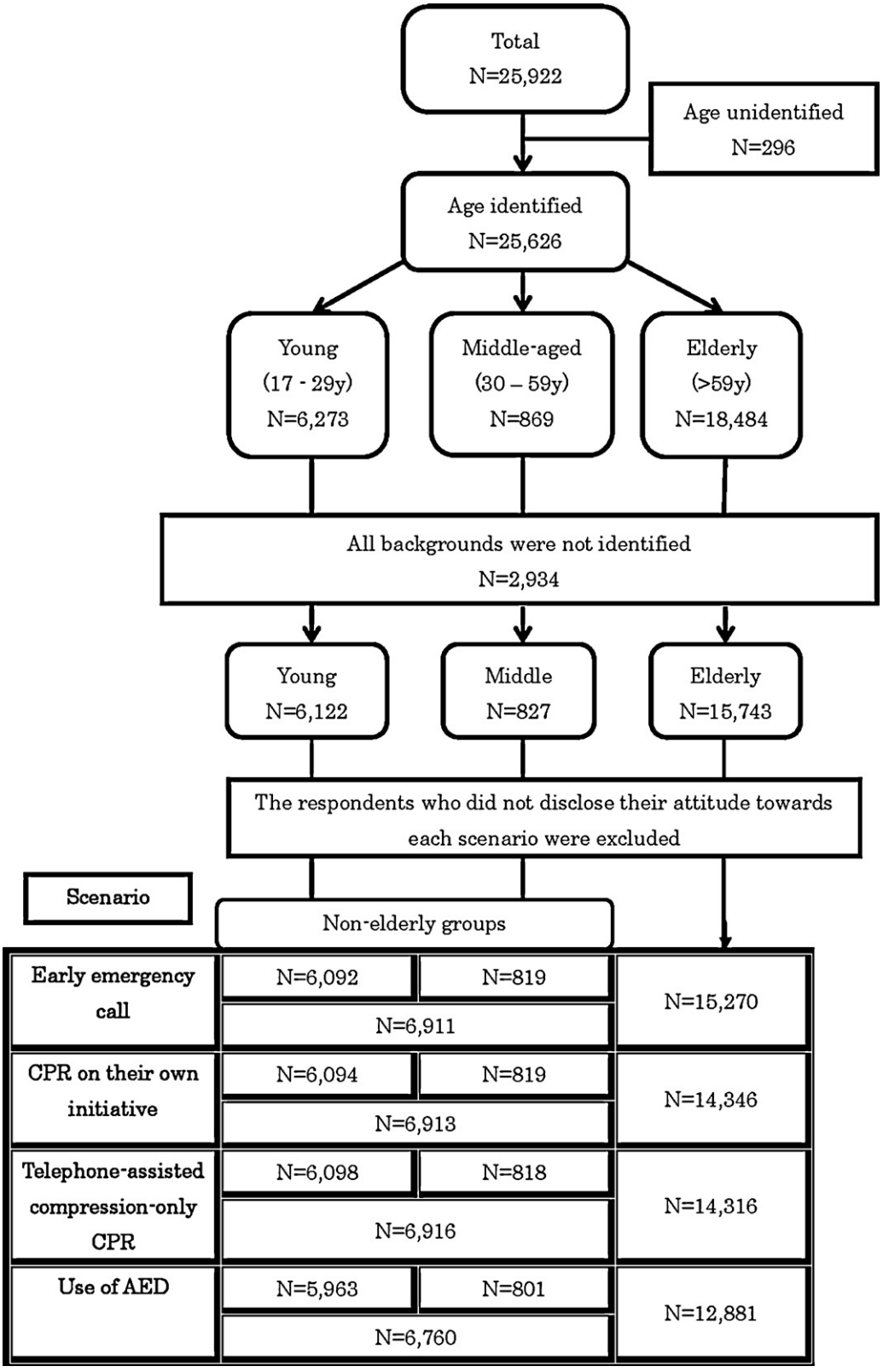

Fig. 1. Number of respondents analysed.

3.5. Reasons for unwillingness

The proportion of respondents who were unwilling to perform CPR under their own initiative and provided reasons for their unwillingness were smaller in the elderly group (67.5%) compared with the young (72.7%) and middle-aged (80.7%) groups. Major reasons for unwillingness or reluctance to perform CPR under their own initiative were fears regarding their own insufficient knowledge (65.7%, 60.6% and 56.1% in the young, middle-aged and elderly groups, respectively) and imperfect performance of CPR

(60.8%, 56.1% and 55.3% in the young, middle-aged and elderly groups, respectively). Major reasons for unwillingness to perform telephone-assisted compression-only CPR were fears regarding their own insufficient knowledge and performance (52.5%, 63.6% and 54.5% in the young, middle-aged and elderly groups, respectively) and lack of confidence to detect cardiac arrest (37.7%, 31.8% and 15.2% in the young, middle-aged and elderly groups, respectively). The main reason for unwillingness to make an early call was lack of confidence (79.2%, 70.6% and 77.3% in the young, middle-aged and elderly groups, respectively). The major reasons for unwillingness to use an AED were no previous experience (70.2%, 70.4% and 64.7% in the young, middle-aged and elderly groups, respectively) and fear of imperfect AED use (41.1%, 46.0% and 44.9% in the young, middle-aged and elderly groups, respectively).

3.6. Characteristics and backgrounds of respondents related to attitudes towards performing BLS (monovariate analysis)

As there were wide differences in willingness to perform BLS between the elderly group and the other two groups, we analysed the characteristics and backgrounds of respondents related to attitudes towards performing BLS in the elderly group and the non-elderly groups. As shown in Table 4, the factors related to attitudes towards performing BLS differed in part between the elderly and non-elderly groups. Female respondents in the elderly group were more negative to all scenarios than males, while female respondents in the non-elderly groups were more willing to follow telephone-assisted compression-only CPR compared to males in this group. Living in a rural area augmented unwillingness in all scenarios in the elderly group, while it appeared to augment willingness to perform CPR under their own initiative and AED use in the non-elderly group. The increased experience of previous training clearly augmented willingness to perform CPR under their own initiative and AED use in both groups. However, its effect on AED use was less prominent in the elderly group since approximately half of all respondents with more than three sessions of AED training were still negative towards AED use. The increased experience augmented willingness to follow the telephone-assisted compression-only CPR in the elderly (Table 4).

3.7. Independent factors related to attitude (multivariate analysis)

The results of multiple logistic regression analysis clearly showed that ageing is an independent factor related to unwillingness to perform BLS in all scenarios and that prior BLS training was the major factor associated with willingness to perform CPR under their own initiative, telephone-assisted compression-only CPR and AED use, but not performing early emergency call. Female gender, residence in a rural area and occupation were other independent factors associated with unwillingness to perform entire BLS or a part of BLS. The lack of knowledge regarding how to use an AED is a major independent factor related to unwillingness to attempt AED use in an emergency situation (Table 5).

4. Discussion

Educational interventions have been identified as essential in improving the survival following out-of-hospital cardiac arrest.[24] The present study is the first large questionnaire survey that identified ageing as a major independent factor associated with unwillingness to perform BLS.

Due to the ageing of the population, approximately half of all private households in Japan include one or more elderly (65 y or more) residents.[21] Although information about the household composition of the study participants was not collected, a large number of elderly respondents (mostly 70 y or more) in this study are assumed to live in the household composed of aged couples or aged single people.

In Japan, compulsory BLS education and/or training courses are conducted in high schools[14] and driving schools.[18] However, almost all attendees of these courses are high school and college students, who have a low probability of witnessing OHCA. Small BLS training courses conducted periodically by fire departments and the Japanese Red Cross association provide elderly citizens a chance to learn BLS. However, we found that willingness to perform BLS and previous BLS training are low in the elderly population.

As shown in Table 3, approximately 85–95% of respondents answered that they would follow telephone-assisted instruction of compression-only CPR, while approximately 57–79% of respondents were willing to perform CPR under their own initiative. These results support the usefulness of telephone-assisted instruction of compression-only CPR.[10,11] The early emergency call is necessary to augment the effect of telephone-assisted instruction. We found that the proportion of respondents who are reluctant to make an early call increases with age. We estimated the acceptance of telephone-assisted instruction to be 71.1% among all respondents and 66.6% in the elderly group. These values were close to the actual acceptance rate (68%) during the study period in our community. The significance of the early call should be emphasised in relation to the telephone-assisted instruction in BLS training courses for elderly citizens.

As reported previously,[23] elderly respondents were less willing to disclose the reasons for their unwillingness to perform BLS. In agreement with previous reports,[14,18,25] the main reasons why the respondents were unwilling to perform CPR were fears of poor knowledge and imperfect CPR performance. The main reason why the respondents were unwilling to make an early call was lack of confidence in providing first aid for cardiac arrest, which may reflect a preference to entrust judgment to qualified persons.

An interesting interaction between ageing and gender was seen in the present study. Females in the elderly group were more reluctant to perform BLS, including telephone-assisted compression-only CPR. However, as we reported recently,[18] females in the non-elderly groups are more willing to follow CPR instructions compared with males in this group. The instructors of BLS courses should be aware of this interaction between ageing and gender difference.

In accordance with many previous reports,[13,14,18,19] prior BLS training augmented willingness to perform CPR under one's own initiative, telephone-assisted compression-only CPR and AED use. However, previous BLS training failed to improve reluctance to make an early emergency call, an essential link in the chain of survival,[2,8,9] in all age groups. There may be two major reasons for this observation. First, BLS algorithm in course textbooks are derived from the standard BLS algorithm from American[5] and Japanese guidelines, which is drawn on the assumption that there are multiple rescuers at the scene. Therefore, BLS courses in Japan have provided an ideal situation for attendants where OHCA occurs in a public place and help from other citizens are easily obtained. It is common that willingness and ability of course attendants to make an early emergency call when they were alone are not evaluated. We recently reported that OHCAs at home are more frequently witnessed by a single citizen in our community (68.2% at home vs. 33.9% at other places).[8] We have identified family and aged citizen as bystander to be independent factors associated with large call delay.[8] There is a wide gap between the actual situation of cardiac arrest at home and the situation provided by the BLS courses. Second, in current BLS courses, most of the time is spent teaching how to conduct CPR effectively and how to use an AED. The attendant

Table 4
Characteristics and backgrounds of respondents relating to positive attitude in elderly and non-elderly groups (monovariate analysis).

Characteristics and backgrounds	Scenarios							
	Early emergency call (n = 6911)		CPR under their own initiative (n = 6913)		Telephone-assisted compression-only CPR (n = 6916)		Use of AED (n = 6760)	
	Do (%)	χ-square	Do (%)	χ-square	Do (%)	χ-square	Do (%)	χ-square
Non-elderly (young and middle-aged) groups								
Gender								
Male	91.9	**0.012**	77.2	0.101	93.4	**<0.001**	56.7	0.083
Female	90.2		78.8		95.6		54.6	
Region								
Urban	91.4	0.386	76.6	**0.002**	94.1	0.201	53.6	**0.036**
Rural	90.6		80.2		94.2		58.3	
Other	92.1		79.9		95.7		60.1	
Previous BLS training								
None	90.8	0.372	71.9	**<0.001**	93.8	0.369	48.0	**<0.001**
Once	91.4		82.2		94.8		59.4	
Twice	91.5		87.5		94.7		70.2	
3 times or more	93.6		88.4		95.2		74.9	
Occupation								
No steady job	91.2	0.538	75.9	**<0.001**	92.5	**0.006**	48.7	**<0.001**
Employed	90.3		70.3		94.3		43.0	
Student	91.4		80.4		94.8		60.5	
Know how to use an AED								
Yes							90.7	**<0.001**
No							42.2	
Elderly group								
Gender								
Male	80.7	**<0.001**	58.7	**<0.001**	85.3	**<0.001**	22.2	**<0.001**
Female	73.5		49.2		81.4		17.5	
Region[a]								
Urban	78.3	**0.002**	60.3	**<0.001**	85.8	**<0.001**	24.4	**<0.001**
Rural	80.5		53.4		83.4		18.5	
Previous BLS training								
None	79.8	0.263	50.9	**<0.001**	83.2	**<0.001**	17.3	**<0.001**
Once	78.3		75.6		88.9		32.7	
Twice	77.9		81.1		90.5		38.1	
3 times or more	78.3		85.3		90.8		51.5	
Occupation[b]								
Employed	79.8	0.149	56.1	**<0.001**	84.1	**0.015**	20.7	**<0.001**
No steady job	78.5		59.7		86.0		23.3	
Know how to use an AED								
Yes							86.6	**<0.001**
No							23.6	

BLS, basic life support; AED, automated external defibrillator.
[a] Group "other" is not shown as its number is very small.
[b] Group "student" is not shown as its number is very small.

Table 5
Factors associated with unwillingness to perform basic life support (multiple logistic regression analysis).

	Odds ratio (95% C.I.)			
	Scenario			
	Early emergency call (n = 22,181)	CPR under their own initiative (n = 21,259)	Telephone-assisted compression-only CPR (n = 21,232)	Use of AED (n = 19,641)
Age				
17–29	0.705 (0.612–0.812)	0.780 (0.709–0.859)	0.712 (0.604–0.840)	0.797 (0.724–0.878)
30–59	Reference	Reference	Reference	Reference
60 or more	2.042 (1.832–2.277)	1.485 (1.378–1.600)	1.681 (1.491–1.899)	1.884 (1.742–2.038)
Sex – female	1.209 (1.159–1.261)	1.154 (1.114–1.196)	1.058 (1.005–1.114)	1.107 (1.067–1.155)
Region				
Urban (Central)	Reference	Reference	Reference	Reference
Rural area	0.975 (0.882–1.077)	1.150 (1.072–1.235)	1.221 (1.078–1.396)	1.215 (1.132–1.305)
Other	1.093 (1.011–1.182)	0.864 (0.762–0.980)	1.025 (0.932–1.128)	1.149 (1.078–1.224)
Job				
Student	Reference	Reference	Reference	Reference
Employed	0.978 (0.902–1.059)	1.136 (1.071–1.205)	1.109 (1.007–1.220)	1.219 (1.142–1.302)
No steady job	1.093 (1.011–1.182)	1.046 (0.987–1.110)	1.023 (0.930–1.125)	1.149 (1.078–1.224)
Times of previous BLS training (per one-time)	1.101 (0.966–1.067)	0.508 (0.484–0.535)	0.770 (0.719–0.824)	0.778 (0.741–0.817)
Do not know how to use an AED				3.883 (3.664–4.114)

C.I., confidence interval.

may not be aware of the significance of making an early emergency call.

The BLS algorithm differs among countries and regions in terms of timing of the emergency call. In universal cardiac arrest algorithms of International Liaison Committee on Resuscitation (ILCOR)[7] and European Resuscitation Council (ERC),[6] the first action that a rescuer should take is calling for help. The emergency call is made after checking for signs of life or breathing. According to the American[5] and Japanese adult BLS algorithm, a lone rescuer should make an emergency call on finding an unresponsive adult.

The quality of chest compression has been reported to decrease due to fatigue with increasing duration of CPR.[26] Calling for help may enable CPR to be performed by 2 rescuers, which may reduce the fatigue of each rescuer and improve the quality of chest compression. However, it may also decrease the overall helping behaviour[27] and result in misjudgement and delay of emergency call when only laypeople are present. Furthermore, telephone-assisted CPR instruction may not be attempted due to poor information if a layperson who is not beside the patient makes the emergency call. Not only the advantages but also the potential disadvantages of "calling help first" should be considered in future revisions of guidelines for resuscitation.

4.1. Limitations

The proportion of middle-aged respondents was very small in this questionnaire survey as these respondents have little chance to attend BLS or safe driving courses at driving schools. Thus, the results of our study may not reflect the entire population of Ishikawa prefecture or Japan. Further study is needed to clarify the factors associated with the willingness towards performing BLS in the middle-aged population. Not all respondents answered all questions, presumably due to the time limit for the questionnaire. However, this study was based on an extremely large survey with more than 20,000 respondents, including elderly citizens.

5. Conclusions

The aged population is more negative towards performing BLS. More respondents were willing to follow telephone-assisted instruction of compression-only CPR. Prior BLS training did not reduce the unwillingness to make an early emergency call in all groups, and augmented willingness to use an AED to a lesser extent in the elderly group than in the non-elderly group. We believe that these results will be consequential in future revisions of guidelines for resuscitation. BLS training should be modified to help the elderly gain confidence and to be aware of the significance and benefits of making an early emergency call.

Conflict of interest

We have no conflicts of interest to disclose.

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