



## [ORIGINAL ARTICLE]

# Changes in objectively assessed chest compression quality after a basic life support course: the fourth report

Noriko SAKODA<sup>1)\*</sup>, Mayu ONISHI<sup>2)</sup>, Hisato IKEDA<sup>3)</sup>, Takayuki KOSUGE<sup>4)</sup>,  
Kazue NARA<sup>4)</sup>

School of Nursing & Rehabilitation, Tokyo Health Sciences University, Tama, Tokyo, Japan<sup>1)</sup>

Rejoice Company, Minato-ku, Tokyo, Japan<sup>2)</sup>

Showa University Koto Toyosu Hospital, Koto-ku, Tokyo, Japan<sup>3)</sup>

Faculty of Medical Technology, Teikyo University, Itabashi, Tokyo, Japan<sup>4)</sup>

Yokohama ACLS, Yokohama, Kanagawa, Japan<sup>5)</sup>

## ARTICLE INFO

### Article history:

Received 08 June, 2018

Accepted 02 September, 2018

### Key words:

Basic life support

Nurse

Changes in the quality of CPR

## ABSTRACT

**Objective:** It was aimed to research changes in the quality of CPR directly following a BLS course and 2 years later by using the objective evaluation function targeting nurses working at hospital wards with little experience in CPR. **Materials and Methods:** Among 34 nurses who took the BLS course, 5 people who continued to cooperate in the research were examined as subjects, and their quality of CPR of right after the BLS course as well as 2 years later was assessed by using the objective evaluation function. **Results:** When compared between immediately after and 2 years after the BLS course, "CCF" increased from  $63.4 \pm 3.29\%$  to  $68.2 \pm 2.28\%$  ( $p < 0.05$ ). The "average ventilation volume" increased from  $408.6 \pm 107.9$  ml to  $636.8 \pm 198.2$  ml ( $p < 0.05$ ). The "ventilation frequency" increased from 7.2 times to 9.8 times ( $p < 0.05$ ). **Discussion:** Even a nurse with little CPR experience was considered to have had an opportunity to reacquire the necessary knowledge and skills through the clinical ladders within the facility and the training related to CPR inside and outside the hospital, which positively affected the quality of CPR.

## 1. Introduction

High-quality cardiopulmonary resuscitation (hereinafter referred to as "CPR") has become an important element of treatment in the sense that it promotes early return of spontaneous circulation while maintaining the blood flow of vital organs. According to the American Heart Association (hereinafter referred to as "AHA")<sup>1)</sup> and the Japan Resuscitation Council (hereinafter referred to as "JRC")<sup>2)</sup>, a possibility of survival of the sick or injured can be increased by the high-quality CPR.

Although the guideline has been widely established and CPR courses are held in and out of medical facilities, there were few studies that objectively investigated the assessment of the quality of CPR after taking the courses<sup>3)</sup>, and many were evaluated by checking the evaluation tables<sup>4-6)</sup> as well as the videotaped procedures<sup>7-9)</sup>. In addition, no post-course survey has been conducted after 2 years of attending since surveys are conducted before and after the course<sup>3,7-9)</sup>, monthly until 3 months after attending<sup>4)</sup>, and 1.5 years after the course<sup>10)</sup>. The AHA recommends taking the course every 2 years to maintain BLS skills; however, by clarifying changes in the quality of CPR between

\*Corresponding author. Tel. : +81-42-313-7106  
E-mail : n-sakoda@u-ths.ac.jp

**Table 1. Overview of subjects**

	Gender	Age	Nursing experience	Emergency / intensive care experience	CPR experience		Number of participants in CPR class	
					Before the course	After the course	Before the course	After the course
A	Female	30	12	no	1	0	2	2
B	Female	20	3	no	0	0	2	4
C	Female	30	13	no	1	1	0	2
D	Female	20	3	no	0	0	2	3
E	Female	20	3	no	0	1	2	3

directly after the BLS course and 2 years later, the results can be reflected to the positioning of the BLS course and the way of education within medical facilities.

From the above, the change in the quality of CPR between immediately and 2 years after participating in a BLS course was clarified by using the objective evaluation function.

### Objective

The objective was to research the transition of the quality of CPR immediately following a BLS course and 2 years later by using the objective evaluation function targeting nurses working in hospital wards with little experience in CPR.

## 2. Materials and Methods

### 1) Subjects

5 subjects cooperated in the continuous research among 34 nurses who participated in the BLS courses held at Yokohama ACLS between June and November of 2014.

### 2) Research Period

From October 2016 to December 2016, which was 2 years after taking the BLS course.

### 3) Research Method

We investigated the quality of CPR immediately after the course and 2 years later by using a training manikin that can objectively assess performance of individual's CPR skill (Laerdal Medical's Resusci Anne with QCPR®). The assessment was carried out focusing on the following research items: "Overall performance (%)," "Chest compression (%)," "Mouth-to-mouth ventilations (%)," "Chest compression fraction" (hereinafter referred to as "CCF"), "Length of interruptions of

chest compression," "Performed cycles in 2 minutes," "Correct hand position," "Chest compression frequency," "Average depth of chest compression," "Recoil," "Correct compression depth," "100-120 compressions per minute," "Average chest compression frequency," "Ventilation frequency," and "Average ventilation volume." Collected data were analyzed using a Wilcoxon signed-rank test, considering a P-value<0.05 to indicate statistical significance. Further, these data were collected without feedback on the quality of CPR before and after the assessment.

### 4) Ethical Consideration

After obtaining the approval from the Ethics Committee, the purpose of the research was explained to the research participants orally as well as in writing. They agreed to participate by answering the questionnaire. In consideration of protecting the privacy of the research participants, their personal information was coded so that they could not be identified.

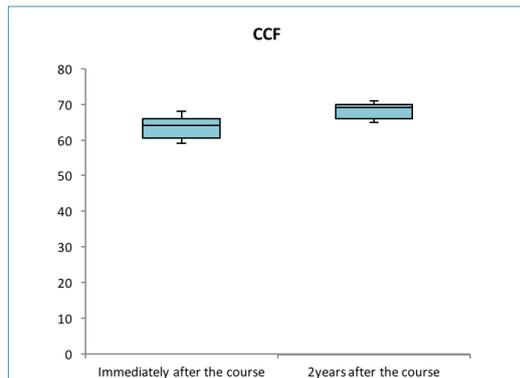
## 3. Results

### 1) Overview of Participants

There were 5 research participants. Their years of experience are 3-11 years, and the average years of experience was 7.0 years ( $\pm$  4.0). All subjects had CPR training within or outside of the medical facilities prior to the BLS course. 4 subjects were first-time attendees, and 1 subject was for retraining. All subjects worked in the area of an emergency room or an intensive care unit. 2 subjects had CPR experience before the course, and 2 subjects had CPR experience after the course. 2 subjects had no CPR experience. Every subject had participated in some training related to CPR within 2 years after taking the BLS course (Table 1). In addition,

**Table 2. Items within the standard value or rising in 2 years after attendance**

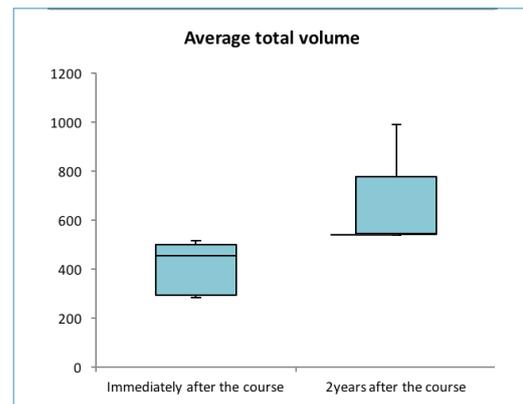
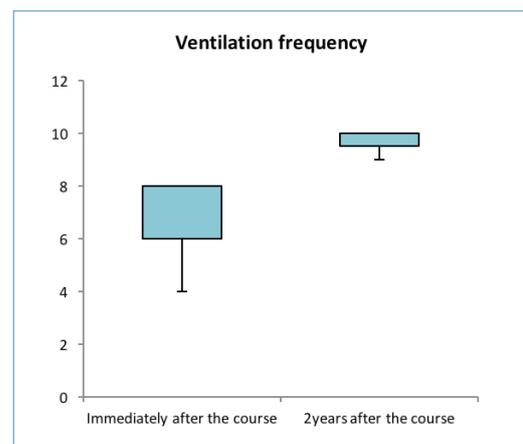
	Overall performance (%)	Average depth of compressions (mm)	Proper hand positioning (%)	Average number of compressions
Immediately after the course	69.6	49.2	80	121.8
2 years after the course	79.2	51.4	100	119.6

**Fig.1 Change in CCF immediately after attendance and two years after**

BLS was included in the items pertaining to responses to sudden changes in clinical ladders in their affiliated facilities.

## 2) Changes in the Quality of CPR Immediately After Taking the BLS Course and 2 Years Later

A significant difference was found in "CCF," "average ventilation volume" and "ventilation frequency" between immediately after the BLS course and 2 years later. "CCF" increased from  $63.4 \pm 3.29\%$  to  $68.2 \pm 2.28\%$  ( $p < 0.05$ ) (Figure 1), and "average ventilation volume" increased from  $408.6 \pm 107.9$  ml to  $636.8 \pm 198.2$  ml ( $p < 0.05$ ) (Figure 2). "Ventilation frequency" increased from  $7.2 \pm 1.79$  times to  $9.8 \pm 0.45$  times ( $p < 0.05$ ) (Figure 3). Although there was no significant difference in other items, the following changes showed that the average value of 2 years after the course increased and became in the range of baseline compared to the average taken directly after the course. "Overall performance" 69.6% to 79.2%, "Average depth of chest compressive" 49.2 mm to 51.4 mm, "correct hand position" 80% to 100%, and "Average chest compression frequency" 121.8/min to 119.6/min (Table 2).

**Fig.2 Change in average ventilation volume immediately after attendance and two years after****Fig.3 Change in the number of ventilation volume immediately after attendance and two years after**

## 4. Discussion

A way to maintain skills after taking a BLS course is left up to each individual. It has been revealed by evidence that knowledge rapidly declines after initial training<sup>11)</sup>. For this reason, the AHA recommends taking the BLS course again within two years after attending the BLS course<sup>12)</sup>. The subjects of this study had undergone basic training and CPR training in medical facilities before participating in the BLS course; therefore, it was not their first first-aid training although they had never taken a BLS course before. However, there was no major change in the quality of CPR immediately and 2 years after the course, while working in a ward where CPR is not frequently performed. In addition, the values of "CCF," "average ventilation volume," and "ventilation frequency" were higher for

2 years later than immediately after. Although this research is on 1-rescuer method, higher “CCF” is an important factor to improve the quality of CPR. In the AHA guideline 2015, as before, to minimize the length of interruptions of chest compressions is emphasized. The increased values of items related to mouth-to-mouth ventilations are deemed to have influenced the rise in “CCF” in 1-rescuer method. From these results, it seems to be necessary to investigate how it will affect in the case of 2-rescuer method in the future.

Furthermore, it was found that the reason why the subjects without much CPR experience were able to maintain the quality of CPR was that they participated in CPR training classes multiple times after taking the BLS course. From the above, it seems that motivation to maintain skills after taking the BLS course has a great influence on maintaining skills afterwards. According to one theory about the nurses’ psychological aspects pertaining to CPR outside of emergency and intensive care unit areas, nurses conduct their daily practice while worrying about when they will encounter a case of cardiopulmonary resuscitation<sup>13)</sup>. It is also said that a key for nurses who rarely encounter a scene of cardiopulmonary resuscitation to execute cardiopulmonary resuscitation assertively is to remove their anxiety<sup>14)</sup>. In addition, specific actions to prepare themselves for sudden changes are said to be individualized depending on experiences, knowledge of disease condition, support from surrounding people, and environment<sup>15)</sup>. To support this rationale, the results of the previous studies conducted by the authors indicated the increased quality of chest compressions 6 months after taking the BLS course compared to immediately after<sup>16)</sup>. As its background, it can be considered that the quality of CPR has been influenced by the motivation to take the BLS course and opportunities to update the required knowledge and skills for CPR through classes held within and outside of hospitals after attending the BLS course since the BLS course is included as a requirement in the adopted clinical ladders at the subjects’ facilities.

By assessing the quality of CPR with the objective evaluation function in this research, quantification of skills of CPR was made possible. The AHA guideline 2015 explains the need for utilizing audio-visual

feedback devices that monitor and record the quality of CPR in real time<sup>17)</sup>. It can not only assess the skills clearly but also be used as a feedback device in the CPR training. These have revealed that the device is useful as an effective educational tool when utilized in maintaining and improving the quality of CPR.

In the future, it is necessary to unveil some specific approaches to the changes and retention of the quality of CPR of the continuing research subjects. In addition, effective intervals between the courses to maintain the quality of CPR should be examined by clarifying the effective educational support system since it can also influence the quality of CPR.

## 5. Conclusions

- 1) Unlike former reported results, items related to chest compressions did not show any significant decrease in quality when the results of directly after the course and 2 years later were compared. Further, the quality of CCF, ventilation frequency, and ventilation volume increased after 2 years than immediately after the course.
- 2) It was an opportunity to reacquire knowledge and skills through the clinical ladders in the facilities and the training related to CPR inside and outside the hospital.
- 3) It became clear that the objective evaluation function is useful for grasping the transition of CPR skills over time.

## References

- 1) American Heart Association. Part 1: General concepts, BLS Provider Manual. Japanese trans; Synergy International, Tokyo: 2016.
- 2) Japan Resuscitation Council, eds. Part 1: Basic life support: JRC 2015 Guidelines on Resuscitation. Igaku-Shoin, Tokyo: 2016. p.15.
- 3) Hirose T, Iwami T, Oh Sungin, et al. A study on the effectiveness of a basic CPR course for non-medical personnel working at a university hospital (Second report): Changes in chest compressions before and after course attendance. *J Jpn Soc Emer Med* 2014;17:18-24.
- 4) Sugino Y, Ishii N, Kaku A, et al. Research on

- retention of knowledge and skills of BLS in psychiatry. The Japanese Psychiatric Nursing Society 2015; 58:194-5.
- 5) Takahashi H, Tajima K, Mizutani T, et al. Examination concerned with skills of basic life support. *Anesthesia and Resuscitation* 2003; 39: 1-5.
  - 6) Shindoh M, Nishi S, Nishikawa K, et al. Quantitative evaluation for knowledge and skill level acquired on repeated basic cardiac life support course for school teachers. *The Japanese Society of Reanimatology* 2001; 20: 149-54.
  - 7) Tago M, Kawamoto K, Oda Y, et al. Effect of the practical Basic Life Support (BLS) training at the Yuaikai Oda Regional Medical Center. *Japan Society for Health Care Management* 2016; 17:
  - 8) Lee J, Shindo M, Fukurotani K, et al. Evaluation methods for achievement of basic cardiac life support training. *The Japanese Society of Reanimatology* 2000;19: 28-33.
  - 9) Shindoh M, Nishikawa K, Asada A. Quantitative evaluation for acquired skill level on repeated basic cardiac life support course. *The Japanese society of Reanimatology* 1999;18: 117-21.
  - 10) Nagashima Y, Inoue S, Kazaoka T, et al. Acquisition status of BLS skills in basic nursing education: From research conducted 1 year and 6 months after skill practice. *Journal of Japanese Nursing Association: Adult Nursing I* 2014;44:189-92.
  - 11) Bhanji F, Donoghue A, Wolff M, et al. Part 14: education: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Japanese translation. Synergy International, Tokyo:2014. p. 267.
  - 12) Kleinman M, Brennan E, Goldberger Z, et al. Part 5: Adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Japanese translation. Tokyo: Synergy International, Tokyo:2016. p. 266.
  - 13) Sakoda N, Ikeda H. In-hospital education focused on cardiopulmonary resuscitation in an acute phase ward. *Kanto J Acute Med* 2015; 36:179-81
  - 14) Yamatani M, Saga R, Seto H, et al. Analysis of emotional changes of a nurse who encountered a scene of sudden changes. *Journal of Sendai City Hospital* 2011; 31: 79-85.
  - 15) Inoue T, Takada S, Yokoyama H, et al. Change of the lifesaving awareness of the hospital personnel by the cardiopulmonary resuscitation class enforcement. *Journal of Japanese Society for Emergency Medicine* 2012;15: 401-7.
  - 16) Sakoda N, Ikeda N, Kosuge T. Changes in the objectively assessed quality of chest compressions after a BLS course (Initial report). *Kanto J Acute Med* 2016;37: 239-41
  - 17) Bhanji F, Donoghue A, Wolff M, et al. Part 14:education: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Japanese translation. Synergy International, Tokyo; 2016. p. 266.

## 要 旨

### 客観的評価機能を用いたBLSコース受講後の胸骨圧迫の質の推移について（第4報）

迫田 典子<sup>1)</sup>, 大西 真裕<sup>2)</sup>, 池田 尚人<sup>3)</sup>, 小菅 宇之<sup>4)</sup>, 奈良 和恵<sup>5)</sup>

東京医療学院大学 保健医療学部 看護学科<sup>1)</sup>

株式会社リジョイスカンパニー<sup>2)</sup>

昭和大学 江東豊洲病院 脳血管センター 脳神経外科<sup>3)</sup>

帝京大学 医療技術学部 スポーツ医療学科<sup>4)</sup>

一般社団法人 横浜 ACLS<sup>5)</sup>

【目的】 CPR の経験が少ない病棟所属の看護師を対象に、客観的評価機能を用いて BLS コース受講直後と 2 年後の CPR の質の推移について調査することを目的とした。

【方法】 BLS コースを受講した看護師 34 名中、継続して調査協力が得られた 5 名を対象として、BLS コース受講直後と 2 年後に客観的評価機能を用いて CPR の質を調査した。

【結果】 BLS コース受講直後と 2 年後で「CCF」は 63.4% から 68.2% ( $p < 0.05$ ) に上昇した。「平均換気」は 408ml から 636ml ( $p < 0.05$ ) に増加した。「換気回数」が 7.2 回から 9.8 回 ( $p < 0.05$ ) に増加した。

【考察】 CPR の経験が少ない看護師でも、施設内のクリニカルラダーの存在、院内外の CPR に関連する講習を通じて、必要な知識と技術の再習得の機会になり、CPR の質に影響していたと考えられた。

キーワード：BLS, 看護師, CPR 質の推移

*J Clin Simul Res* 2018; 8; 11 - 16