

# A Study on the Effectiveness of Advanced Life Support Education and Reeducation Program Based on High-Fidelity Simulation

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## 고충실도 시뮬레이션 기반 전문소생술 교육과 재교육 효과 연구

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**Abstract** This study was attempted to confirm the effectiveness and continuity of education by providing a simulation-based advanced life support education program to fourth-year nursing students and measuring the knowledge of professional CPR immediately after and after 5 months of training. After 5 months of conducting high-fidelity simulation-based professional CPR training, the results of knowledge measurement after retraining using video and training for team approach simulation were  $19.23 \pm 1.923$  in the experimental group and  $16.03 \pm 2.752$  in the control group ( $p < .001$ ). The effect of continuing education in the experimental group decreased from  $22.30 \pm 1.473$  to  $19.23 \pm 1.923$ . Through the research results, the effect of professional CPR education consisting of theoretical lectures, skill practice, and team-based simulation practice was confirmed. However, the effect of continuing education after 5 months decreased, confirming the necessity of regular retraining. In other words, professional CPR education based on high-fidelity simulation is a very effective teaching method, but it is difficult to expect continued effects with one-time education, so periodic retraining is required.

**Key Words** : Advanced Life Support, high-fidelity, simulation, nursing, students, education

**요약** 본 연구는 간호학과 4학년 학생에게 시뮬레이션 기반 advanced life support education program 을 제공하여 교육 직후와 5개월 후의 전문소생술 재교육 시행 후에 전문소생술의 지식을 측정하여 교육의 효과와 지속성을 확인해 보기 위해 시도되었다. 고충실도 시뮬레이션 기반 전문소생술 교육 시행 5개월 후 동영상 이용한 재교육과 팀접근 시뮬레이션 실습 교육을 한 후 지식측정을 한 결과는 실험군  $19.23 \pm 1.923$ , 대조군  $16.03 \pm 2.752$ 로 통계적으로 유의한 차이가 있었다 ( $p < .001$ ). 실험군의 교육 지속 효과는  $22.30 \pm 1.473$ 에서  $19.23 \pm 1.923$ 으로 감소하였다. 연구 결과를 통해 이론 강의와 술기 실습, 팀 기반 시뮬레이션 실습 등으로 구성된 전문소생술 교육의 효과를 확인하였다. 그러나 5개월 후의 교육 지속 효과는 감소하여 정기적인 재교육의 필요성을 확인하였다. 즉 고충실도 시뮬레이션 기반 전문소생술 교육은 매우 효과가 좋은 교수법이지만 1회성 교육으로는 지속된 효과를 기대하기는 어렵기 때문에 주기적인 재교육이 필요하다.

**주제어** : 전문소생술, 고충실도, 시뮬레이션, 간호, 학생, 교육

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## 1. INTRODUCTION

The causes of death in Korea announced by the National Statistical Office in 2022 were malignant neoplasm, heart disease, COVID-19, pneumonia, and cerebrovascular disease, of which heart disease increased by 10.8% compared to the previous year, and the mortality rate was reported to be higher with age[1]. Moreover, as Korea undergoes rapid industrialization, heart diseases continue to increase due to an aging population due to the development of westernized diet and medical technology, chronic diseases, and various accidents. This increase in heart disease and aging can increase the likelihood of unpredictable acute cardiac arrest and can cause acute cardiac death.

The incidence of cardiac arrest in Korea is gradually increasing from 21,905 (44.3 per 100,000 people) in 2008 to 30,539 (59.5 per 100,000 people) in 2018 [2]. Considering the demographic structure of Korea entering an aging society, the incidence of cardiac arrest is likely to increase further. Although 60 years have passed since modern CPR was introduced, the survival rate of cardiac arrest patients is still low. The survival discharge rate of cardiac arrest patients in Korea is increasing from 3.0% in 2008 (brain function recovery rate: 0.9%) when the national survey began to 8.6% in 2018 (brain function recovery rate: 5.1%).

Brain damage begins to occur after about 4-5 minutes or more after cardiac arrest [3]. The most important part of the treatment of cardiac arrest is rapid CPR from the first witness. Among them, nurses often take care of patients around the clock and witness cardiac arrest in hospitals for the first time, so their recognition of cardiac arrest and initial response are very important. Therefore, providing specialized cardiopulmonary resuscitation education to nursing students in the university curriculum is a process that must be completed in occupations that require prompt treatment for emergency patients, and through

this, it is necessary to develop the ability to manage emergency situations. As such, nursing students who will become nurses in the future are likely to face cardiac arrest patients for the first time, so it is important to provide advanced life support training program to them, but in the current nursing education, only fragmentary skills education and arrhythmia lecture through adult nursing subjects may lack understanding and coping with integrated cardiac arrest situations.

Therefore, in order for nursing students to learn and accurately perform advanced cardiovascular resuscitation of cardiac arrest patients, it is necessary to provide education from undergraduate courses to not only increase their knowledge and skills in advanced life support of cardiac arrest patients, but also cultivate their ability to perform accurately. In addition, it is important to maintain knowledge and skills through repeated training after advanced life support training program, given the results of previous studies that the situation of cardiac arrest patients is very sudden, and it is difficult to maintain the effectiveness with only one training [4], [5].

On the other hand, since the goal of nursing education is to cultivate professional nurses with sufficient clinical performance based on scientific nursing knowledge, clinical practice education for nursing students should be structured to experience various and qualitative nursing activities. In addition, nursing educators should provide opportunities designed for nursing students to properly assess subjects and perform effective nursing in clinical situations [6]. However, due to the recent development of advanced medical devices and the emphasis on consumers' health rights and safety and rights awareness in a complexly changing medical environment, nursing students' direct nursing activities in the clinical field have been greatly reduced, and they are operating as observation-oriented clinical practice

[7], and practice of high-risk nursing activities for patients during clinical practice is further restricted, indicating that nursing students did not have enough practical experience to perform their role as new nurses during the pre-clinical practice period [8]. This leads to a lack of insufficient practice opportunities, difficulties in adapting to a new environment, poor clinical adaptability and clinical performance, and a lack of confidence in dealing with emergencies. Recently, simulation-based education is gradually expanding in nursing student practice education as an alternative to overcoming these limitations of clinical practice and improving clinical performance [9],[10],[11].

Simulation-based education is an exercise designed to imitate real situations in the form of education that includes multimedia technologies, models, and simulators, and has recently been used in medicine or nursing as a new teaching and learning strategy that can provide opportunities for reasoning and decision-making through clinical problems without harming real patients. Through this simulation-based education, nursing students can practice repeatedly by standardizing the skills they need in real or virtual clinical situations, and it is a useful educational method because they can experience the results of the intervention of their choice and share experiences and reflect on them by discussing them with debriefing [12],[13].

On the other hand, the term "fidelity" is used depending on how much the simulator used in simulation-based education reproduces the real world, and the high-fidelity human patient simulator is an anatomically corrected human substitute that enables an immediate response to nursing intervention and is widely used in simulation-based learning programs. In addition, simulation education using high-fidelity simulators is reported to be effective in emergency management education because it can train nursing students in a safe environment that does not pose a risk

to the subject by reproducing complex clinical situations that can be directly connected to the patient's life [14],[15].

Therefore, this study aims to confirm the effectiveness and continuity of education by measuring the knowledge of advanced life support education program immediately after training and after five months of retraining by providing a simulation-based advanced life support training program to nursing students.

## 2. Materials and Methods

### 2.1 Subject of the study

This study was conducted from April 2023 to September 2023, targeting fourth-grade students taking Simulation nursing placticum classes at B University's nursing department, and 177 people. Among them, 101 people were trained in simulation-based advanced life support training program and retrained 5 months later, and 76 people were trained watching advanced life support education program videos and practicing simulation-based cardiac arrest team approaches were conducted.

### 2.2 Research design

Advanced life support training program ran for six hours, and the Review of ALS, ECG rhythm, Team work concept & Simulation checklist review were conducted as theoretical lectures, and the recognition and team activation, compression and BVM, Alternative route, Defibrillation, and medication were conducted as practice, and Simulation-based team approach practice was conducted in cardiac arrest situations.

For retraining, watching advanced life support education program videos and practicing simulation-based cardiac arrest team approaches were conducted.

Students in the experimental group were allowed

to participate in professional resuscitation education programs and retraining programs, and then knowledge was measured immediately after participation in advanced life support training program and immediately after participation in retraining. The control group students were only allowed to participate in the re-education program and then knowledge was measured (Table 1).

〈Table 1〉 Research design

	experimental group	control group
advanced life support education program	O	X
educational effect Measurement	O	X
retraining	O	O
educational effect Measurement	O	O

### 2.3 Research Tools and Analysis Methods

As an evaluation tool for measuring the effectiveness of simulation-based advanced life support education program, the knowledge measurement tool developed by the Korea Association of Cardiopulmonary resuscitation was used. It consists of 25 questions, and the higher the score with a maximum of 25 points, the higher the knowledge of advanced life support. The data collected were analyzed using the IBM SPSS statistics 29 program. Students' degree of knowledge was expressed as mean and standard deviation. To confirm the educational effect of advanced life support training program, it was analyzed by independent sample t-test, and to confirm the effect of re-education after 5 months, it was analyzed by paired sample t-test.

## 3. Results

### 3.1 Effectiveness of advanced life support (ALS) education program based on high-fidelity simulation

the experimental group that conducted

high-fidelity simulation-based advanced life support training program through lecture, skill practice, and team approach simulation practice showed statistically significantly higher knowledge measurement results than the group that conducted video education and team approach simulation practice ( $p < .001$ ) (TABLE2).

〈Table 2〉 Effectiveness of ALS education program

Group	Knowledge test	t	P
Exercise	19.23±1.923	9.108	<.001
Control	16.03±2.752		

### 3.2 Effectiveness of advanced life support (ALS) reeducation based on high-fidelity simulation

Five months after the implementation of high-fidelity simulation-based advanced life support training program, the results of knowledge measurement were statistically significant from  $22.30 \pm 1.473$  to  $19.23 \pm 1.923$  after retraining using video and team approach simulation practice training ( $p < .001$ ) (TABLE3).

〈Table 3〉 Effectiveness of ALS reeducation

Group	Knowledge test		t	P
	Pre test	Post test		
Exercise	22.30±1.473	19.23±1.923	13.243	<.001

## 4. Discussion

This study was attempted to confirm the effectiveness and continuity of education by providing a simulation-based advanced life support education program to fourth-year nursing students immediately after training and after 5 months of professional resuscitation retraining.

As a result of the study, the experimental group that conducted high-fidelity simulation-based advanced life support training program through lecture, skill practice, and team approach simulation practice showed statistically significantly higher

knowledge measurement results than the group that conducted video education and team approach simulation practice ( $p < .001$ ).

Five months after the implementation of high-fidelity simulation-based advanced life support training program, the results of knowledge measurement were statistically significant from  $22.30 \pm 1.473$  to  $19.23 \pm 1.923$  after retraining using video and team approach simulation practice training ( $p < .001$ ).

Through the research results, the effectiveness of advanced life support training program consisting of theoretical lectures, skill practice, and team-based simulation practice was confirmed. However, the continuing effect of education after 5 months decreased, confirming the need for regular retraining. In other words, high-fidelity simulation-based advanced life support training program is a very effective teaching method, but it is difficult to expect lasting effects with one-time education, so periodic retraining is needed. In addition, in this study, re-education was conducted by reducing the content and time of initial education, and research on the content and method of re-education is needed.

Based on the results of this study, I would like to make the following suggestions.

First, it is necessary to develop a tool to measure the accuracy of the technique to confirm the effectiveness of based on the results of this study.

Second, studies are needed to confirm the effective retraining cycle of high-fidelity simulation-based advanced life support training program.

Third, it is necessary to develop an effective high-fidelity simulation-based advanced life support re-training program

## 5. Conclusion

According to the research results, nursing students who participated in classes applying the Havruta learning method showed improvements

in problem-solving skills, self-directed learning skills, and critical thinking tendencies. However, there was no statistically significant difference in learning commitment before and after intervention. This study has limitations in controlling exogenous variables due to its one-group pretest-posttest design, so errors in interpretation may occur. In follow-up studies, it is recommended to conduct replication studies with varying subjects, intervention periods, and teaching models.

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