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# High Fidelity Simulation Improves Provider Confidence During ACLS Training Even Among Experienced Staff: Are We Missing an Opportunity?

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## ABSTRACT

**Background:** Advanced Cardiac Life Support (ACLS) resuscitation requires rapid assessment and intervention. It is unclear, however, whether high fidelity simulation improves confidence in providers who are experienced as most simulation training focuses on new graduates or hires. We tested the hypothesis that practicing providers undergoing high-fidelity simulation of cardiopulmonary arrest scenarios will express greater confidence in ACLS skills. **Methods:** We conducted a prospective cohort study at an urban level 1 trauma center from January to October, 2011 with a convenience sample of nurses, nurse practitioners, and physicians. They participated in high-fidelity (Laerdal 3G) simulation sessions of cardiopulmonary arrest about 3 months apart. Each session included two scenarios and lasted 30 minutes, including debriefing. We recorded demographics and confidence on a validated 5 point Likert scale confidence measurement tool before and after each session. Responses ranged from not at all confident (1) to very confident (5) in: recognizing signs and symptoms, appropriately intervening, and evaluating intervention effectiveness in cardiac and respiratory arrests. Descriptive statistics, paired t-tests, and ANOVA were used for data analysis. Sensitivity testing evaluated subjects who completed their second session at 6 months rather than 3 months. **Results:** Sixty-five subjects completed consent, 35 completed 1 session and 23 completed at least 2 sessions with no missing data. Ninety-two percent were registered nurses, median clinical experience was 11-15 years, and 59% were from an intensive care unit. Provider confidence increased significantly after a single session. There was a trend for further increased confidence with an additional session and the increased confidence was maintained for at least 3-6 months given the sensitivity analysis. The number of cardiopulmonary arrests directly participated in

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during the past year and the years of clinical experience in their current role did not influence confidence scores.

**Conclusion:** High fidelity simulation significantly increases provider confidence even among experienced providers. Further study of the link between provider confidence in ACLS skills and resuscitation quality measures is needed.

**KEYWORDS:** Simulation; Confidence; Experience; Advanced Cardiac Life Support (ACLS).

## INTRODUCTION

Confidence, while poorly understood, may be a key ingredient in time critical resuscitation situations. For example, the American Heart Association (AHA) recently revised their guidelines to minimize pulse checks because they found significant delays in starting chest compressions as providers lacked confidence in their ability to determine the presence of a pulse.[1] Even if the correct decision to start cardiopulmonary resuscitation (CPR) is eventually made (knowledge), the delay (poor confidence) may influence outcomes. What is unclear is how simulation training impacts the confidence of providers with variable levels of experience since most simulation research focuses on new hires or new graduates.

Simulation allows practice and learning in a safe and structured environment.[2,3] The Critical Care Societies Collaborative (CCSC) recommends examining the value and effective use of simulation in the education of critical care providers as part of its agenda to establish critical care research priorities across diverse specialties.[4] While simulation can be exciting, interactive and collaborative learning, we sought to determine whether this translates into increased confidence.

It seems clear that simulation can increase knowledge. Although studying students, both Bruce and Corbridge found simulation improved management scores.[3,5] Nevertheless, there is an impression among some experienced providers that simulation is only useful for novices who lack clinical familiarity. Simulation technology may be accepted variably based on generational differences.[6,7]

Confidence may be different from knowledge. When Alinier et al studied the effects of scenario-based simulation training on nursing student's clinical skills, they found that mean performance scores in the simulation training group were higher than the control group with no simulation training.[8] However, there was no statistical difference in the student's perception of confidence in working in a technical environment.

Conversely, Mould et al used a before and after test design to measure nursing student's self-reported confidence after a series of simulation sessions and found that the scenarios were effective in improving student's confidence in handling critical care situations.[6] Perhaps, whether simulation training specifically improves, confidence, knowledge, skill, or empowerment depends on how coaching/punitive the teaching environment remains.[9,10]

Confidence, technical skill and leadership may not be equivalent and might require different education. Hunziker et al found greater CPR quality as measured by delays to initiation and hands off time in medical students who received leadership education compared to CPR technical skills education.[11] Similarly, Yeung et al found improved team CPR quality in teams led by more experienced providers and those with specific leadership training.[12] Wallace et al showed that CPR quality is associated has been associated with actual patient outcomes.[13] Buckley et al showed that during post training clinical care, graduate nurses reported the most useful aspects of simulation training were scenario debriefing and assertiveness training.[14] Perhaps most importantly, Andreatta et al showed that simulation correlated with improved pediatric cardiopulmonary arrest survival rates.[15]

There is limited research regarding experienced health care provider confidence and the use of simulation. Rather than a defense of high-fidelity simulation, this research study sought to fill the knowledge gap by specifically examining the relationship between simulation and experienced health care provider confidence. We hypothesized that practicing health care providers who undergo high fidelity simulation will express greater confidence during cardiopulmonary arrest training.

## METHODS

### Study Design, Setting and Population

This was a prospective cohort study conducted at a tertiary care Level 1 Trauma Center October 2010 and October, 2011. Physicians and nurses (Registered, Licensed or Advanced Practice) were included if willing to participate in at least one of four thirty minute simulation sessions held about three months apart, although participation in two was preferred. Subjects were excluded if they did not plan to be at the hospital for the duration of the study.

### Study Procedures

Subjects were recruited *via* hospital broadcast email, flyers, and word of mouth and scheduled to simulation sessions in half hour blocks to minimize crowding, keep the number of subjects per scenario similar, and allow those coming from units to arrange temporary cross coverage. Sessions were held quarterly and subjects were asked to attend two of them. During sessions, participants used the high fidelity Laerdal 3G simulator to work through two standardized American Heart Association (AHA) Advanced Cardiac Life Support (ACLS) scenarios of either cardio or pulmonary distress. Scenarios were changed for each session day. Study investigators created a supportive learning environment during sessions that included an orientation to the simulator and after-action debriefs that were educational/

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coaching rather than punitive. The debriefing style encouraged critical reasoning and was similar to that already incorporated by the Clinical Nurse Educators at the institution. The same investigators administered all sessions. Subjects had to attend a minimum of one session to be included in data analysis. Subjects were not paid for participation. The study was Institutional Review Board approved and participants completed written informed consent.

### Outcome Measures

Before and after each session, participants completed the Health Care Provider Confidence During Cardiopulmonary Arrest Scale, modified with permission from the validated critical care Self-Confidence Scale to measure confidence specifically during cardiopulmonary resuscitation situations.[16] The modifications were assessed for clarity and content validity by a panel of critical care, emergency medicine and nursing educators (see Table 1). Participants could write free text comments. The study team did not track the clinical success of each resuscitation scenario. The primary outcome was the impact of high fidelity simulation on provider confidence measured before and after each session. The secondary outcomes were provider confidence associations between sessions and subject demographics.

### Data Analysis

Descriptive statistics were used to evaluate demographics. Paired t-tests and analysis of variance (ANOVA) were used to compare means where appropriate. Sensitivity testing was used to evaluate the impact of subjects who completed their second session at six months rather than three months. Data was analyzed using Statistical Package for the Social Sciences (IBM, Armonk, New York, USA).

## RESULTS

Thirty-five participants fully completed at least one session, 23 completed at least 2 sessions, 5 completed three sessions, and one completed all four sessions. The convenience sample was 95% female with a median age range of 41-50 years. The median range of clinical experience was 11-15 years, with 6-10 years in their current role and 97% worked with adults. Ninety-two percent were RNs, and there were one each NP, MDs, and LPNs. All were basic life support (BLS) certified and 2 were BLS instructors. Eighty percent were ACLS certified and 1 was an ACLS instructor. Seven (19%) were trauma nurse core course (TNCC) certified and 2 were advanced trauma life support (ATLS) certified; two were pediatric advanced life support (PALS) certified. None were PALS instructors.

Most study participants, 20 (59%), worked primarily in an intensive care unit (ICU); 6 (16%) worked in the emergency department (ED) while medical, surgical, telemetry, med/surgical, peri-operative, maternal/child locations accounted for the rest. Subjects reported the median number of cardiopulmonary arrests they directly participated in during the past year was 1-5.

Mean provider confidence increased significantly during a single session for each element of resuscitation queried ($p$ range<0.001-0.023) (Table 2). There was a trend for further, although smaller, increased provider confidence for those who attended a second session (Figure 1).

A sensitivity analysis found no difference for those who returned at 6 months for their repeat session rather than at 3 months. Returnees for their second session had mean before-test confidence scores that were similar to their first session after-test scores, possibly indicating that the increased confidence was maintained for 3-6 months. No association between the number of cardiopulmonary arrests subjects directly participated in during either the 3 months or year prior to their first session confidence scores was detected. Participants provided a number of qualitative comments that were positive.

## DISCUSSION

Many prior studies of simulation have focused on new learners. Most subjects in this study were experienced, from critical care areas, and had actively participated in several cardiac arrests in the

| | Not at all confident | Somewhat not confident | Somewhat confident | Moderately confident | Very confident |
|---|---|---|---|---|---|
| 1. How confident are you that you can recognize signs and symptoms of a cardiac arrest? | 1 | 2 | 3 | 4 | 5 |
| 2. How confident are you that you can recognize signs and symptoms of a respiratory arrest? | 1 | 2 | 3 | 4 | 5 |
| 3. How confident are you that you can appropriately intervene for an individual with a cardiac arrest? | 1 | 2 | 3 | 4 | 5 |
| 4. How confident are you that you can appropriately intervene for an individual with a respiratory arrest? | 1 | 2 | 3 | 4 | 5 |
| 5. How confident are you that you can evaluate the effectiveness of your interventions for an individual with a cardiac arrest? | 1 | 2 | 3 | 4 | 5 |

**Table 1:** Health Care Provider Confidence During Cardiopulmonary Arrest Scale: The six item confidence measurement tool used before and after each simulation session.

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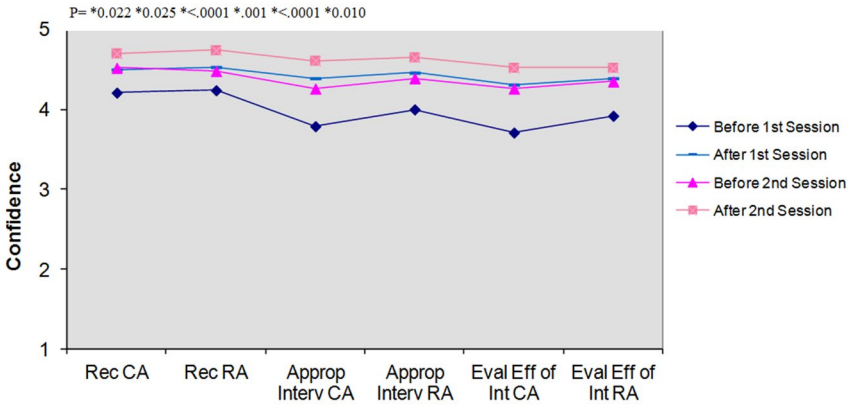
| Item | First visit (N=35) | | Over first and second visits (N=23) | |
|---|---|---|---|---|
| | Mean change (95% CI) | *p*-value | Mean change (95% CI) | *p*-value |
| 1 | 0.31(0.08, 0.55) | .0095 | 0.43(0.07, 0.80) | 0.0216 |
| 2 | 0.25(0.03, 0.48) | .0268 | 0.39(0.05, 0.73) | 0.0254 |
| 3 | 0.51(0.29, 0.74) | <.0001 | 0.83(0.52, 1.14) | <.0001 |
| 4 | 0.41(0.15, 0.67) | .0028 | 0.57(0.25, 0.88) | .0012 |
| 5 | 0.54(0.33, 0.75) | <.0001 | 0.83(0.49, 1.16) | <.0001 |
| 6 | 0.43(0.20, 0.65) | .0005 | 0.57(0.16, 0.97) | .0089 |

**Table 2:** Mean change in confidence before and after sessions.




X-Axis Key: Confidence in your ability to: recognize signs & symptoms of cardiac arrest (Rec CA); recognize signs & symptoms of respiratory arrest (Rec RA); appropriately intervene in cardiac arrest (Approp Interv CA); appropriately intervene in respiratory arrest (Approp Interv RA); evaluate the effectiveness of your interventions in cardiac arrest (Eval Eff of Int CA); evaluate the effectiveness of your interventions in respiratory arrest (Eval Eff of Int RA).

**p* values refer to the difference in confidence scores between before 1st session and after 2nd session.

**Figure 1:** Confidence results from two sessions: before and after each.

past year. While confidence may be difficult to measure, the fact that staff volunteered to participate in the un-paid high-fidelity ACLS simulation sessions may indicate its import. Perhaps, the supportive coaching rather than punitive environment played a role. Several authors have described debriefing as a key part of simulation learning, and an area we believe confidence may be gained or lost.[17-19]

We focused on confidence rather than knowledge. Benner notes that memorization is frequently used by early learners but doesn't necessarily translate to clinical judgment in new and difficult clinical situations.[20] Confidence may be the bridge between competence and application during actual clinical care. Despite the limits of self-report intervention assessments, it may seem surprising that such a group improved. Despite high baseline confidence scores, levels still increased. This can be useful in recruiting experienced staff for simulation training by demonstrating that they can take something tangible ( improved confidence) back to their daily clinical practice.

As more institutions make simulation training available, many focus on new graduate nurses. While this may be due to costs limitations, our study suggests more experienced staff should not be excluded. Our qualitative comments suggest subjects may have more confidence in applying equipment themselves, being a team leader during the critical time it takes the code team to respond, or even developing the confidence to prompt a young resident, all of which may translate into improved patient care.

In our study, confidence increased after just one session and was retained for at least 3-6 months between sessions. Other authors have found learning persistence in the 4-6 month time frame.[11,21-23]

## LIMITATIONS

We note several limitations, primarily those associated with a self-report intervention assessment. The modified confidence scale was explored for content validity with local nurse educators and physicians and thus may not be generalizable. The Satisfaction with Simulation Experience Scale and the Student Satisfaction and Self-Confidence in Learning Scale were just becoming available when this study was conceived.[24,25]

While there are critical thinking scales available, our focus was confidence. This voluntary study was also limited by relatively small convenience sample size. While some may view the high participation of experienced providers as a limitation, we view this as a unique window through which to view the possible benefits of broadly offering high-fidelity simulation education, even to experienced providers.

## CONCLUSION

High fidelity simulation is associated with increased health care provider confidence, even with experienced staff. Training should not be limited to new graduates or hires. Further study of the relationship between provider confidence and quality metrics during resuscitation is necessary.

**CONFLICTS OF INTEREST:** None.

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