The effect of simulation education in teaching senior medical students Advanced Cardiovascular Life Support at a public teaching hospital in Guatemala City, Guatemala

Zickuhr L[1], Bery A[1], Rivera-Pineda J[2], Wallendorf M[3], Murray D[4], Zajarias A[5]

[1]Washington University in St. Louis School of Medicine, Department of Medicine, [2]Hospital Roosevelt, Departamento de Medicina, Guatemala City, Guatemala, [3]Washington University in St. Louis School of Medicine, Division of Biostatistics, [4]Washington University in St. Louis, School of Medicine, Department of Anesthesia, [5]Washington University in St. Louis School of Medicine, Division of Cardiology

Barnes Jewish Hospital, Washington
University in St. Louis School of Medicine
Lisa Zickuhr, lzickuhr@dom.wustl.edu
314-362-5000

Abstract

BACKGROUND: Roosevelt Hospital in Guatemala City, Guatemala, is a public teaching hospital that treats a variety of chronic degenerative illnesses that are accompanied by cardiovascular complications. Quality Advanced Cardiovascular Life Support (ACLS) has been shown to save lives when appropriately administered. Previous research demonstrates that simulation education is effective when teaching resident physicians ACLS and improves patient outcomes.

METHODS: We investigated simulation education's effect in teaching senior medical students ACLS in a resource-poor environment through written materials and simulated workshops translated into participants' native language. Participants completed pre- and post-intervention simulated code scenarios graded against a global three-by-three score and an itemized checklist. Two evaluators graded each scenario. Students subjectively ranked their confidence with ACLS protocols pre- and post-intervention on Likert surveys.

RESULTS: Random effects linear model identified a statistically significant mean increase of 3.833 (p=0.0037) in global three-by-three scores and of 3.833 (p=0.0014) in total checklist scores after simulation education. Intra-rater and inter-rater scores correlated well for global scores (r 0.965, 95% lower bound 0.921 and r=0.914, 95% lower bound 0.715, respectively) and for total checklist scores (r=0.956, 95% lower bound 0.900 and r=0.896, 95% lower bound 0.666, respectively). Students felt more comfortable with ACLS protocols after simulation education, as seen in their Likert scale responses.

CONCLUSION: This study demonstrates that simulation education translated into participants' native language is an effective medium for teaching medical students ACLS in a resource-poor environment.

Background

- Hospital Roosevelt in Guatemala City, Guatemala, is a public teaching hospital that treats an estimated 6,000 patients annually with a 10% mortality[1].
- The most commonly treated diseases at Hospital Roosevelt are Chronic Kidney Disease, Stroke, and GI Bleed[1], conditions prone to cardiovascular complications.
- Advanced Cardiovascular Life Support (ACLS) can save lives when administered appropriately.
- In Latin Amercian medical education, senior medical students function as a combination of nurse, medical student, and intern, yet they are not ACLS-trained.
- Simulation education proves an effective medium of ACLS training[2-5].
- Simulation education has never been studied in a resource-poor environment, in a medical student population, nor in the Spanish language.

OBJECTIVE:

To assess the efficacy of simulation education in a resource-poor environment when teaching senior medical students ACLS in their native language.

Methods

Study Design:

- Voluntary, prospective, before-and-after cohort study

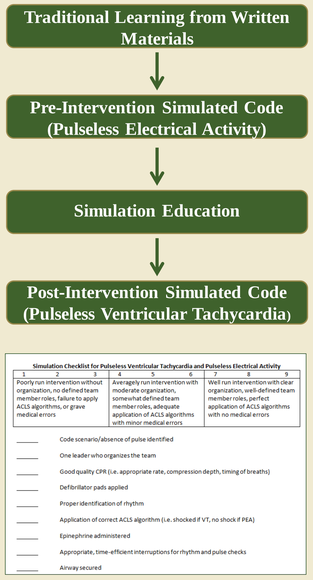
Primary Outcome:

- Increase in global three-by-three score on simulated code scenarios

Secondary Outcome:

- Increase in total checklist score on simulated code scenarios
- Subjective increase in comfort level with ACLS protocols

Methods



Traditional Education: Documents based on the American Heart Association's ACLS were written in Spanish and distributed to participants beforehand.

Simulation Education: In Spanish, a certified ACLS instructor taught the approach to an unstable patient, airway techniques, and ACLS algorithms using basic airway supplies, a Prestan adult CPR mannequin, and printed EKG rhythm strips.

Pre- and Post-Intervention Simulated Code Scenarios: In teams of two or three, participants managed either PEA (pre-intervention) or pulseless VT (post-intervention) using the above supplies. Students could verbalize use of a defibrillator. We recorded performances on a Sony Handycam HDR-CX220, and two ACLS-certified physicians graded each scenario against a global three-by-three score and an itemized checklist. Graders evaluated each code twice, at a one month interval.

Subjective Measures: Participants completed Likert surveys that ranked their comfort with ACLS protocols before and after the simulation workshop.

Statistics:

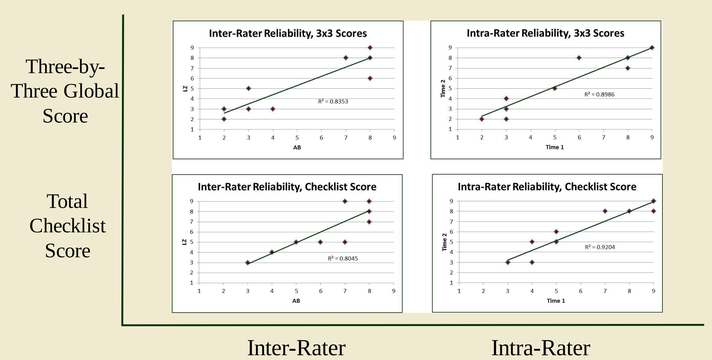
- Pearson correlation with 95% CI analyzed inter-rater and intra-rater reliability.
- Random effects linear model compared the differences between post- and pre-intervention scores (α=0.05).
- Paired t-test compared pre- and post-intervention Likert scale responses (α=0.05).

Results

Table 1: Participant Demographics

Gender	Male – 10	Female – 3
ACLS algorithms are formally taught in my medical school	Yes – 5	No – 8
Do you plan to complete residency training?	Yes – 13	No – 0
Average Age (years)	24.23	
Average number of unstable arrhythmias treated before participating in this study	0.846	

Figure 1: Inter- and Intra-Rater Reliability



Results

Figure 2: Linear Regression Model, Change in Pre- and Post-Intervention Global 3x3 and Total Checklist Scores

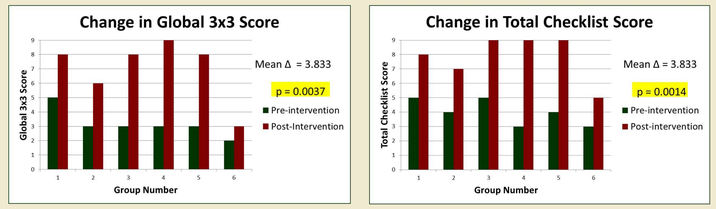


Table 2: Change in Mean Pre- and Post-Intervention Likert Scale Rankings

Likert Scale Question (Rank 1-5)	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	p-value
Indicate your familiarity with ACLS algorithms	2.384 (0.650)	3.769 (0.832)	0.0104
Rank your comfort with identifying heart rhythms	2.231 (0.439)	3.692 (0.751)	0.0018
Rank your comfort level leading a code	2.077 (0.494)	3.615 (0.650)	0.002
Rank your comfort level managing hemodynamically stable arrhythmias	1.923 (0.641)	3.769 (0.832)	0.004
Rank your comfort level managing hemodynamically unstable arrhythmias with a pulse	1.769 (0.439)	3.462 (0.776)	0.0035
Rank your comfort level managing pulseless cardiac arrest	2.077 (0.760)	4.077 (0.760)	0.0023

Discussion & Conclusions

- **Low-fidelity simulation education, taught in Spanish in a resource-poor environment, significantly improved senior medical students' overall performance of ACLS algorithms, as judged by three-by-three global scores.**
- Simulation education also improved adherence to common interventions during a code scenario, as seen in increased total checklist scores.
- Participants ranked increased confidence in ACLS protocols after the intervention.
- Weaknesses of the study include:
  - Small sample size
  - Variable review of written materials prior to pre-intervention simulated code scenario. Analyzing the differences in scores should neutralize this.
  - Selection bias; participants may have found their ACLS skills weak.

Acknowledgements

- Funding provided by Mentors in Medicine—International, private grants awarded to internal medicine residents at Washington University in St. Louis School of Medicine.
- Thank you to Dr. Carlos Mejia, MD, and Dra. Isabel Luna, MD, for their help translating and navigating Hospital Roosevelt's Internal Review Board.
- Thank you to Washington University in St. Louis' Global Health Scholars Track for providing opportunities in global health.

References

1. Mejia, CR. Roosevelt Hospital Internal Database. Internal Data. June 2013
2. Davis et al. High-Fidelity Simulation for Advanced Cardiac Life Support Training. Am J of Pharm Ed. 2012;77(3):1-7.
3. Didwania et al. Progress Toward Improving the Quality of Cardiac Arrest Medical Team Responses at an Academic Teaching Hospital. J of Grad Med Ed. June 2011;211-216.
4. Stefan et al. A Simulation-Based Program to Train Medical Residents to Lead and Perform Advanced Cardiovascular Life Support. Hosp Practice. 2011;39(4).
5. Wayne DB et al. Simulation-Based Training of Internal Medicine Residents in Advanced Cardiac Life Support Protocols: A Randomized Trial. Teach Learn Med. 2005 Summer;17(3):210-6.