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Symposium

Pediatric Advanced Life Support (PALS) and Simulation

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ABSTRACT

Pediatric Advanced Life Support (PALS) course is a very popular course directed towards Pediatricians aimed towards improving the outcomes of sick children. However, despite the popularity of the course, translation of this knowledge to the bedside has been far from satisfactory due to variety of reasons. Few strategies have been employed to make the course more effective. Modular training by delivering PALS components in a staggered fashion over a defined time period, self-directed interactive web based learning, use of high fidelity simulators to deliver realistic scenarios, conducting the course in the provider's workplace using his resources and team and using reflective practice based debriefing technique to enhance learning from real life events have shown some promise.

Keywords: PALS, Simulation, in-situ training, modular training, reflective practice

1. Pediatric Advanced Life Support (PALS) and its limitations

PALS Course is advanced life support course developed by American Heart Association (AHA). It is typically a classroom, video-based, Instructor-led course using simulated pediatric emergencies to reinforce the important concepts of a systematic approach to pediatric assessment, basic life support, PALS treatment algorithms, effective resuscitation and team dynamics. The goal of the PALS Course is to improve the quality of care provided to seriously ill or injured children, resulting in improved outcomes[1].

PALS certification course requires participation in roughly14-hour course, typically divided into 2 days, and to pass written test and psychomotor skills test. The course includes simulation typically using low-fidelity manikin, which cannot reproduce vital signs and other clinical futures. To maintain PALS certification, PALS providers are expected to take PALS recertification every 2 years. PALS renewal training requires participation in 6-8 hours course and to pass written test and psychomotor skills test. PALS is taught in many countries, not only in north America, but also in Asia and Europe. We cannot examine overall effects of PALS on patients, but basic science and knowledge needed to take care sick children is delivered through the standardized course.

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Table 1: Benefits and Limitations of current PALS course

Benefits	Limitations
Standardized	• Not contextualized to experienced providers • May spend hours to travel the place where the course is held
Less interruption during the course	• Skill and knowledge degradation • Training with those who may not work together in their workplace • Can be redundant to very experienced learners who work in established ICUs

Table 2. Potential methods to enhance PALS training effect

• Self-directed contents
• Use of High-fidelity simulator
• In-situ simulation
• Modular training
• Debriefing of real life events by trained debriefers

However a substantial body of evidence shows that PALS skills decay rapidly after the training[2,3]. Teamwork is now recognized as a key component in clinical skills in a variety of clinical settings4,5,6. Conventional PALS courses, however, cannot allow enough time for teamwork education because of the limited time. In current PALS renewal training, providers are trained in the classroom in a setting often far from their workplace, with other providers not necessarily from the same work environment, and

frequently using content sometimes irrelevant and too easy for experienced PALS providers. In reality, however, most of healthcare providers know their work environment and work with their colleague providers on a daily basis. As a consequence, quality of the pediatric advanced life support in clinical settings is reportedly low[7, 8]. Table 1 shows summary of benefits and limitations of current PALS course.

2. Attempts to overcome PALS limitations

Self-directed vs. instructor-led training

Gerard JM, et al reported web-based PALS[9]. In their course, the lectures were replaced with interactive, case-based web modules. For each module, students select from a prehospital or hospital setting. Students must satisfactorily complete the AHA PALS pretest online before entering the modules, same as students are to complete pretest before traditional PALS course. After completing the modules, students are eligible to take a 1-day skills/testing course, which is an 8-hour onsite class formatted to meet all of the AHA requirements for instruction of the psychomotor components of the PALS course. After satisfactory completion of the course, students receive an AHA course completion card.Compared with students in the traditional course, students in the Web-based PALS scored slightly lower, but all of the students passed the written test at the first time.

Outside PALS, self-directed training for Neonatal Resuscitation was also reported to improve the educational efficiency of the neonatal resuscitation course by shifting the acquisition of cognitive and basic procedural skills outside of the classroom, which allowed the instructor to add low-fidelity simulation and debriefing while significantly decreasing the duration of the course[10].This self-directed program included a 90- minute simulation session with an instructor. There was no significant difference between the study groups in either the resuscitation skills or knowledge.

Very simple skills can be achieved through short videos. Bobrow BJ, et al reported that laypersons exposed to very short and-Only CPR videos are more likely to attempt CPR and show better CPR skills than untrained laypersons in simulated cardiac arrests[11]. If new devices, say for intubation, or line insertion, could simplify the procedures and skills, these procedures can be taught through video at home, then minor corrections, if needed, can be provided by the experienced at standardized course, or at their workplace with less time and efforts.

Use of high-fidelity mannequins

High-fidelity manikins often refer to the broad range of full-body manikins that have the ability to mimic, at a very high level, human body functions[12].

In adult Advanced Life Support, a simulation-based educational program significantly improved the quality of care provided by residents during actual critical events including cardiac arrest[13]. In addition, simulation-based education has demonstrated improvement in patient care process or patient outcome in the various clinical settings[14, 15].

A recent meta-analysis has found that the use of high fidelity manikins in advanced life support training was associated with moderate benefits for skills performance at course conclusion[16], though the use of high fidelity manikins in comparison to low fidelity manikins showed no benefit for knowledge at course conclusion, skill performance between course conclusion and one year, and skill performance at one year.

Challenges in use of high-fidelity manikins can be cost, and human resources including trained simulator operators.

In-situ simulation

According to Healthcare Simulation Dictionary[12], in situ simulation is "taking place in the actual patient care setting/environment in an effort to achieve a high level of fidelity and realism; this training is particularly suitable for difficult work environments, due to space constraints or noise. For example, *an ambulance, a small aircraft, a dentist's chair, a catheterization lab* (Kyle & Murray, 2008) "

There was report neither describing PALS course with in-situ simulation nor comparing purely in-situ simulation PALS and standard PALS.

Weinstock PH, et al, first described use of in-situ simulation in a pediatric intensive care unit[17]. Others have also reported successful use of in-situ simulation, sometimes to screen latent errors[18], or to identify suboptimal care during emergencies[19]. Though we are not sure if the observations in simulation can be seen

in real patient care.

Miller D, et al reported that teamwork and communication in real life trauma cares improved through regular in-situ simulation trainings[20]. As Weinstock PH, et al discussed, challenges of in-situ simulation include cancellation due to availability of clinical space, exposure of nearby family and staff, and so on[17].

Bolus vs. modular (or reconstructed) training

As long as the authors' search using PubMed, there was no report purely comparing standard PALS course, bolus, and modular PALS course, where the contents were divided into fragmented pieces and taught over certain period time, for example in 2 months.

There were reports examining effects of bolus vs modular type training on procedural skills. The relevant to PALS was regarding CPR retention.Sutton RM, et al reported that brief bedside booster CPR training improves CPR skill retention in simulated cardiac arrests[21]. They conducted a prospective, randomized interventional trial involving 89 providers, with the primary objective to investigate the effectiveness of brief bedside CPR booster training sessions to improve skill retention of hospital-based pediatric providers as assessed during simulated pediatric cardiac arrest.Retention of CPR skills was more likely after 3 trainings in their study.

Combination of in-situ with high-fidelity manikin and modular training

Kurosawa H, et alreported a "Pediatric Advanced Life Support–reconstructed" recertification course by deconstructing the training into six 30-minute in situ simulation scenario sessions delivered over 6 months[22]. This study was not designed to compare the relative value of each component of the training (i.e., modular vs one time, in situ with high-fidelity manikins vs class room with low-fidelity) on experienced critical care frontline providers. Instead, theyintended to develop engaging and effective PALS recertification training for frontline critical care providers in a feasible manner, contextualized to the PICU environment.They examined its effects in a prospective randomized, single-blinded trial. The participants were totally 40 of PICU-based nurses and respiratory therapists. The outcomes were skill performance and behavioral performance, almost equivalent to teamwork skills. Improvement of skill performance was significantly higher in PALS-r compared with PALS-s.Behavioral performance improved in both groups. They concluded that simulation-based "Pediatric Advanced Life Support–reconstructed" in situ training was feasible and more effective than standard Pediatric Advanced Life Support recertification training for skill performance.

The most important limitation of the studies above was that most of their effect was examined in simulation, not in real life. What we really want to do is to improve patient outcomes in real life, not in simulation.

Learning from real-life events and debriefing

A few observational studies reported that debriefing of in-hospital cardiac arrests in real life could improve patient outcomes including rate of recovery of spontaneous circulation, mortality and neurological outcome[23, 24]. These debriefings were done monthly, so-called "cold" debriefing since the timing of debriefing was not immediately after the event and the emotions of the involved healthcare professionals were somewhat settled down. On the other hand, "hot" or "hotwash" debriefing is done immediately after the event, so that what happened can be recorded without less recall bias, and emotional stress can be relieved through the process. Obviously healthcare professionals in PICU experience what is taught in PALS in their real lives. Through debriefing of real life events, performance gap between what is best and what we really did can be reviewed and learning points can be consolidated through the process. Debriefing of real life events is likely to be part of our real life in near future. If we can track which parts of PLAS materials they have experienced at bedside and have been debriefed by trained debriefers, those parts of PALS materials can be taken as completed and PALS providers can take only what they haven't completed in their real lives at PALS recertification. This can shorten the course time. Unfortunately there has been no report regarding such attempts. Practically and logistically this would be challenging, but really efficient and meaningful for patients and frontline providers.

3. Conclusions

Table 2 summarises potential methods discussed above. Future PALS can be made by combination

of each method or new approach not discussed in this article.We know that PALS program has been contributed to improved patient outcome, but it is not enough. Further attempts with good science should be warranted to improve the meaningful outcomes for sick children all over the world.

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References

1. http://cpr.heart.org/AHAECC/CPRAndECC/Training/HealthcareProfessional/Pediatric/UCM_476258_PALS.jsp
2. Nadel FM, Lavelle JM, Fein JA, et al. Assessing pediatric senior residents' training in resuscitation: Fund of knowledge, technical skills, and perception of confidence. Pediatric Emergency Care 2000; 16(2):73-76
3. Grant EC, Marczinski CA, MenonUsing K. Pediatric Advanced Life Support in pediatric residency training: Does the curriculum need resuscitation? Pediatr Crit Care Med 2007; 8:433–439
4. Shetty P, Cohen T, Patel B, et al. The cognitive basis of effective team performance: features of failure and success in simulated cardiac resuscitation. AMIA Annu Symp Proc 2009; 2009:599-603
5. Stead K, Kumar S, Schultz TJ, et al. Teams communicating though STEPPS. Med J Aust 2009;190(suppl): S128-S132.
6. Salas E, DiazGranados D, Klein C, et al. Dose team training improve team performance? A meta-analysis. Hum Factors2008; 50: 903-933
7. Sutton RM, Niles D, Nysaether J, et al. Quantitative Analysis of CPR Quality During In-Hospital Resuscitation of Older Children and Adolescents. Pediatrics 2009;124;494-499
8. Hunt EA, Walker AR, Shaffner DH, et al. Simulation of In-Hospital Pediatric Medical Emergencies and Cardiopulmonary Arrests: Highlighting the Importance of the First 5 Minutes. Pediatrics 2008;121;e34-e43
9. Gerard JM, Scalzo AJ, Laffey SP, et al. Evaluation of a Novel Web-Based Pediatric Advanced Life Support Course. Arch Pediatr Adolesc Med. 2006;160:649-655
10. Weiner GM, Menghini K, Zaichkin J, et al. Self-directed Versus Traditional Classroom Training for Neonatal Resuscitation. Pediatrics 2011;127:000
11. Bobrow BJ, Vadeboncoeur TF, Spaite DW, et al. The effectiveness of ultrabrief and brief educational videos for training lay responders in hands-only cardiopulmonary resuscitation: implications for the future of citizen cardiopulmonary resuscitation training.Circ Cardiovasc Qual Outcomes 2011;4:220-6
12. Lopreiato, J. O. (Ed.), Downing, D., Gammon, et al. Healthcare Simulation Dictionary. Retrieved from http://www.ssih.org/dictionary
13. Wayne DB, Didwania A, Feinglass J. Simulation-Based Education Improves Quality of Care During Cardiac Arrest Team Responses at an Academic Teaching Hospital : A Case-Control Study. Chest 2008;133;56-61
14. Bruppacher HR, Alam SK, LeBlanc VR, et al. Simulation-based Training Improves Physicians' Performance in Patient Care in High-stakes Clinical Setting of Cardiac Surgery. Anesthesiology 2010; 112:985–92
15. Draycott TJ, Crofts JF, Ash JP, et al. Improving Neonatal Outcome Through Practical Shoulder Dystocia Training. Obstet Gynecol 2008;112:14–20
16. Cheng A, Lockey A, Bhanji F, et al. The use of high-fidelity manikins for advanced life support training--A systematic review and meta-analysis.Resuscitation2015;93:142-9
17. Weinstock PH, Kappus LJ, Garden A, et al. Simulation at the point of care: Reduced-cost, in situ training via a mobile cart. Pediatr Crit Care Med 2009; 10:176 –181
18. Garden AL, Mills SA, Wilson R, et al. In situ simulation training for paediatric cardiorespiratory arrest: initial observations and identification of latent errors.Anaesth Intensive Care 2010;38:1038-42.
19. O'Leary F, McGarvey K, Christoff A, et al. Identifying incidents of suboptimal care during paediatric emergencies-an observational study utilising in situ and simulation centre scenarios.Resuscitation 2014;85:431-6
20. Miller D, Crandall C, Washington C 3rd, et al.Improving teamwork and communication in trauma care through in situ simulations.Acad Emerg Med2012;19:608-12.
21. Sutton RM,Niles D, Meaney PA, et al. Low-Dose, High-Frequency CPR Training Improves Skill Retention of In-Hospital Pediatric Providers Pediatrics 2011;128:e145–e151
22. Kurosawa H, Ikeyama T, Achuff P, et al. A randomized, controlled trial of in situ pediatric advanced life support recertification ("pediatric advanced life support reconstructed") compared with standard pediatric advanced life support recertification for ICU frontline providers.Crit Care Med 2014;42:610-8
23. Wolfe H, Zebuhr C, Topjian AA, et al. Interdisciplinary ICU cardiac arrest debriefing improves survival outcomes.Crit Care Med 2014;42:1688-95
24. Rubio-Gurung S, Putet G, Touzet S, Gauthier-Moulinier H, Jordan I, Beissel A.et al.In situ simulation training for neonatal resuscitation: an RCT.Pediatrics 2014;134:e790–e797

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