Best Achieved Performances of Rescue Breaths in PALS Classes

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Abstract

This poster reports rescue breathing performance skills on a pediatric simulator for a four month old baby of 10 – 12 pounds. Students in a regular PALS class were given training on correct protocols and given access to an accurate device with real time feedback. 133 students across multiple classes demonstrated rapid improvement; average of their best score 63.21% (mode = 60.00%; median = 63.20%). 22.56% achieved the target score of 70% or better when performing according to the AHA guidelines. A two tail t-test shows significant difference t = 20.96 (probability <0.0001) where students perform well and where they have difficulty in the performance of sub skills. Further analysis shows that 63.91% of students struggle with the rate to deliver the inhalation. This study suggest that given the current time constraints of existing PALS classes even with sophisticated detailed feedback which shows rapid dramatic skills improvement the majority of students meet a plateau which requires more time in order to master.

Introduction

There are many research on adult resuscitation regarding chest compressions and focus on quality. It is in its own right as chest compressions accounts for the major outcome of a patient. However, ventilations is also an important factor for better cerebral performance category outcome[1] and should not be overlooked[2]. Research in pediatric cardiopulmonary resuscitation (CPR) and ventilations during resuscitation is scant, but research on ventilations found hyperventilation is prevalent during performance from pediatric mock codes[3], resuscitation of older children and adolescents[4], and adults[5] despite what is believed to be adequate training.

This research initiative breaks down the subcomponents of ventilation during rescue breathing and highlight areas of great success and areas that require more attention. Currently, American Heart Association (AHA) recommends ventilation with bag-mask and intubation for an infant to deliver enough volume of air to see chest rise with about 1 second of ventilation every 3 to 5 seconds (12 to 20 breaths per minute)[6]. This study presents observational study during training with SmartMan Pediatric CPR trainer to objectively and electronically record performance to AHA guidelines for rescue breathing. Result of 1 full minute of ventilation and its subcomponent performance was recorded. Subcomponent of ventilation is broken down as volume given within range (chest rise can be seen), rate of inspiration (about 1 second of ventilation given), and interval between ventilation (ventilation every 3 to 5 seconds).

Methods and Materials

A total of 133 in-hospital infant specialists collected over two years, attended their PALS CPR refresher course based on their regular recertification cycle every two years at their respective hospital training centers. All specialists are employed in hospitals with a specialist infant care department. The instructor reviewed PALS course and AHA guidelines for CPR (including chest compression and ventilation), rescue breathing, and more with the specialists. Instructors have specialists perform on the training infant without displaying their performance to the specialists had not used the device before to establish a baseline for them. Once their baseline is established, the instructors displayed the performance and provided detail summary on all of the parameters of ventilation skills and how to improve if needed.

Specialists were asked to perform the skills again until they had achieved an overall score of at least 60% for ventilations. The score of 60% was set due to time restraint and the ability for most specialists to achieve a certain score. Specialists that did not achieve the target scores were given another try. If the specialists still did not achieve the target score, instructors reviewed how to perform the skills and allowed students to continue right away or a little time later until successful. Use of real-time audio and visual feedback was permitted. The scores analyzed were specialists' best performance.

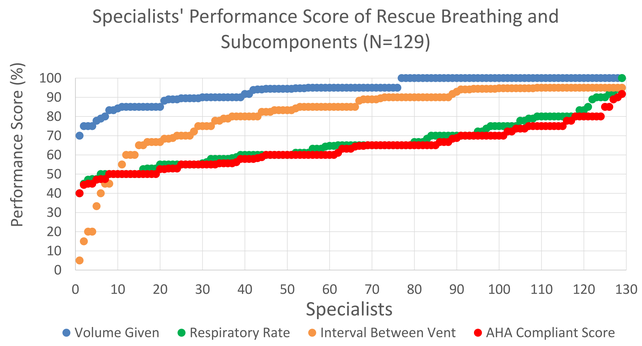
Results

The results grouped around the target score of 60% set by the instructors and on average scored about 3% above the set score. Ventilation subcomponent breaks down to an average of compliance score of 93.76% for volume given within range, 65.51% for the rate of inspiration, and 80.75% for interval between ventilations. Further statistical value can be found in **Table 1**. The three main sub-skill of rescue breathing are statistically significant between each other at $P < 0.0001$, from comparison of volume given to rate of inspiration, comparison of volume given to interval, and comparison of rate of inspiration to interval with two tailed T-test.

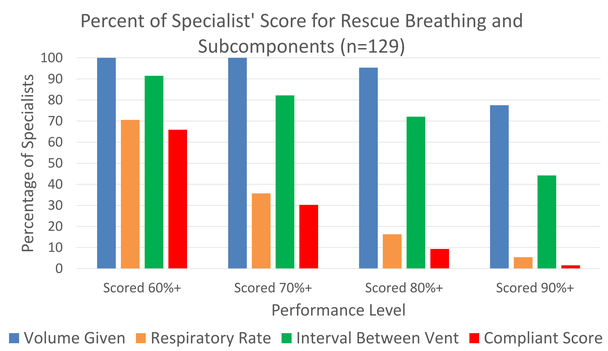
On closer examination, there were some compliant performance score that were very low and outliers were excluded using Tukey method. Four performances were excluded, two lowest compliant score and two highest compliant score. Compliant score of ventilation and its subcomponents were graphed to **Graph 1** to visualize overall performance in each category, sorted from lowest to highest in each category. All of the 129 specialists were able to score at least 60% in volume given within range. A total of 91 specialists (70.5%) were able to score at least 60% in respiratory rate. Finally, a total of 118 specialists (91.5%) were able to score at least 60% in interval between ventilation. Only 85 specialists (65.9%) scored at least 60%. **Graph 2** visualizes the percentage of specialists in each category and their overall score with the additional visualization of percentage that scored >=70%, >=80%, and >=90%.

Table 1 Ventilation Performance of 133 PALS Specialist	Compliant Vent	Volume Given within Range	Respiratory Rate	Interval Between Vent
Max / Min	100 / 15	100 / 40	100 / 21.1	95 / 5
Average	63.208	93.759	65.514	80.745
Median	63.2	95	65	85
Mode	60	100	65	95
Std Dev.	12.434	8.124	13.179	18.125

Table 1. Reports the statistical values for best score for rescue breathing ventilation activity performed by 133 PALS specialist.



Graph 1. Rescue Breathing Activity and its subcomponents score. Each category was sorted from lowest to highest score.



Graph 2. Performance of students that performed at 60%+, 70%+, 80%+, or 90%+

Discussion

The results demonstrated that given a target score to achieve, most specialists can and will achieve the goal in a regular scheduled course curriculum. There were also a surprising amount of people, about 44 (35%), who were not able to achieve the target score in the regular scheduled course. Nevertheless, the study illuminate the fact that with proper real-time feedback device, professionals can easily and effectively learn to deliver the correct volume range during the duration of the course with 100 (77%) of the professionals able to achieve at least 90% of the ventilations correct. Next sub-skill, interval between ventilations, was relatively easy and effective to perform with 93 (72%) of the specialists scoring at least 80%, but quickly tapered off when scores of at least 90% were reviewed. Lastly, respiratory rate over 1 second was the most difficult skill to learn and perform in ventilations, with 91 (70%) of the specialists scoring at least 60%, and only half of them were able to score above 70%. This finding agrees with O'Neill J's finding that poor performance of respiratory rates are far more common than incorrect volume given[7].

There were several limitations of this observational study. The performance score of each category only list whether a skill was performed correctly or incorrectly and did not have details on insufficient/excessive volume given, high/low respiratory rates, or high/low interval rate between ventilations performance. In addition, all personnel were allowed to practice until the target score of 60% or a personal score was achieved, but the number of attempts or duration of practice was not recorded.

Conclusions

This study on infant CPR and ventilation illustrates the need for high fidelity real time feedback simulator in training courses to aid improvements of performance skills and sub-skills in rescue breathing as well as establishing a goal or threshold. Guidelines for sub-skills such as respiratory rates are well established, but not often observed in practice without recording devices. Most professionals with a duty to act can easily learn and perform skills component in giving ventilation such as the amount of volume to deliver and the interval between breaths within a regular class time. Trainers should put more attention, emphasis, and practice on respiratory rates during class period. Using training manikins that can highlight areas of improvements have significant implications for implementation and design of training protocol, resuscitation research, and quality assurance for professionals and should not be overlooked.

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