Resuscitation 86 (2015) 1–5

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Simulation and education

A novel approach to life support training using "action-linked phrases"

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ARTICLE INFO

Article history:
Received 26 May 2014
Received in revised form 20 August 2014
Accepted 10 October 2014

Keywords:
Action-linked phrases
ACLS
BLS
Response time
Education
CPR training

ABSTRACT

Background: Observations of cardiopulmonary arrests (CPAs) reveal concerning patterns when clinicians identify a problem, (e.g. loss of pulse) but do not immediately initiate appropriate therapy (e.g. compressions) resulting in delays in life saving therapy.
Methods: We hypothesized that when individuals utilized specific, short, easy-to-state action phrases stating an observation followed by an associated intervention, there would be a higher likelihood that appropriate action would immediately occur. Phase I: A retrospective analysis of residents in simulated CPAs measured what proportion verbalized "There's no pulse", statements and/or actions that followed and whether "Action-Linked Phrases" were associated with faster initiation of compressions. Phase II: Two prospective, quasi-experimental studies evaluated if teaching three Action-Linked Phrases for Basic Life Support (BLS) courses or six Action-Linked Phrases for Advanced Cardiovascular Life Support (ACLS) courses was associated with increased use of these phrases.
Results: Phase I: 62% (42/68) of residents verbalized "there's no pulse" during initial assessment of a pulseless patient, and only 16/42 (38%) followed that by stating "start compressions". Residents verbalizing this Action-Linked Phrase started compressions sooner than others: (30 s [IQR:19–42] vs. 150 [IQR:51-242], $p < 0.001$). Phase II: In BLS courses, the three Action-Linked Phrases were used more frequently in the intervention group: (226/270 [84%] vs. 14/195 [7%]; $p < 0.001$). In ACLS courses, the six Action-Linked Phrases were uttered more often in the intervention group: (43% [157/368] vs. 23% [46/201], $p < 0.001$).
Conclusions: Action-Linked Phrases innately used by residents in simulated CPAs were associated with faster initiation of compressions. Action-Linked Phrases were verbalized more frequently if taught as part of a regular BLS or ACLS course. This simple, easy to teach, and easy to implement technique holds promise for impacting cardiac arrest teams' performance of key actions.

1. Introduction

Basic Life Support (BLS) is the foundation of saving lives following cardiac arrest.[1–3] When a patient is pulseless, chest compressions must begin immediately to provide blood flow to the brain, heart, and other vital organs. Performance of cardiopulmonary resuscitation (CPR) during cardiac arrest is highly variable,

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http://dx.doi.org/10.1016/j.resuscitation.2014.10.007
0300-9572/

Table 1
Actual examples of real clinical situations where basic life support maneuvers (CPR and early defibrillation) were delayed despite adequate personnel. In cardiac arrest, the patient's opportunity for recovery decreases with each minute of delay. 14.

Administration of epinephrine, sodium bicarbonate, and calcium without chest compressions to circulate the drugs
Placing a nasal cannula on a patient with agonal breaths
A resident stating "That's VF, let's get the defibrillator," without making sure that chest compressions are performed in the interval
In-hospital rescuers delaying chest compressions while they place a backboard, get on a step stool, and put defibrillator pads on the patient
An operating room team notices a sudden decrease of end tidal CO2. The team listens for breath sounds, suctions the ETT, feels for a pulse, and administers epinephrine before notifying the surgeon and pulling down the drapes to start chest compressions
A nurse finds an unresponsive patient in a waiting area, calls for a stretcher, moves the patient to another room and then initiates basic life support maneuvers
Team stops chest compressions to obtain IV access or to intubate a pulseless patient

denoting inadequate compliance with American Heart Association (AHA) guidelines.[4,5] Survival is clearly improved with earlier onset of CPR;[1] similarly, the sooner a patient who has a lethal cardiac rhythm such as pulseless ventricular tachycardia (PVT) or ventricular fibrillation (VF) is defibrillated, the higher the likelihood of survival.[6] Recent data reveal that chest compression fraction (the proportion of time a patient who is pulseless receives chest compressions) is highly associated with likelihood of survival to discharge in patients with out-of-hospital cardiac arrest[7–9].

Two institutions that are highly invested in resuscitation training, Johns Hopkins University and the Penn State Hershey Medical Center, explored new educational strategies intended to prompt rescuers to begin chest compressions and defibrillate as soon as possible and to remind rescuers to limit interruptions to CPR. We observed that when in-hospital providers recognize a loss of pulse, many focus on advanced life support (ALS) resulting in delayed initiation of BLS. We describe this as a "loss of first responder instincts[10]". During both simulations and actual cardiac arrests we observed instances of health care providers stating "There's no pulse, please call the Code team. . ..", resulting in initiation of ALS measures such as getting the Code Cart, preparing epinephrine, and initiating advanced airway placement, but not starting compressions. (Table 1) In these cases, it seemed there was a missed opportunity to verbalize the life threatening observation, for example "There's no pulse" or "That's ventricular fibrillation," as a memory trigger to prompt immediate, time sensitive associated lifesaving actions, such as "Start compressions." We refer to our approach of verbally stating an observation followed by a specific linked action in a scripted two-part sentence as "Action-Linked Phrases."

The objectives of this project were to: (1) review existing data to measure whether the intuitive use of Action-Linked Phrases was associated with shorter times to initiation of chest compressions in simulated cardiac arrest scenarios and (2) measure whether a brief educational intervention can increase the likelihood that participants of AHA, BLS or Advanced Cardiovascular Life Support (ACLS) courses will utilize specific Action-Linked Phrases.

2. Methods

We describe three simulation-based studies that explore the use of Action-Linked Phrases in cardiac arrest scenarios. Phase 1 was a retrospective review of data from an observational study. Phase 2 included two prospective quasi-experimental studies using convenience samples to assess the impact of an evolving educational intervention. For categorical variables, we calculated proportions and reported a chi square statistic. For continuous variables, we reported medians and interquartile ranges (IQR) and a Wilcoxon Rank Sum test was utilized to compare groups. A p value of <0.05 was considered significant.

2.1. Phase 1 – initial observational study

The initial study was undertaken to systematically determine if there was an association between spontaneous use of Action-Linked Phrases and performance during simulated cardiac arrest events.

2.1.1. Methods

With institutional review board (IRB) approval, we performed a retrospective review of video recordings from an observational study of pediatric residents participating in an annual simulation-based assessment of their resuscitation skills. There was no intervention. The detailed methods and results of the original study are reported elsewhere.[11]

Residents were asked by a simulation confederate (actor) playing the role of a nurse to evaluate an adolescent patient (manikin) who was transferred from the Emergency Department to the ward and was now having premature ventricular contractions. The high-fidelity manikin simulator (Laerdal SimMan, Stavanger, Norway) was programmed to develop pulseless ventricular tachycardia (PVT) 1 min after the residents entered the simulated hospital room. We measured the proportion of residents that assessed the pulse, started chest compressions, time elapsed between onset of PVT to starting compressions, words uttered in recognition of pulselessness, and phrases and/or actions that followed. Based on our clinical observations, we hypothesized that residents who said out loud, "there's no pulse" directly followed by the phrase "start compressions" would be more likely to perform compressions, and that chest compressions would be initiated more quickly than those that did not utter these phrases together.

2.1.2. Results

Seventy of 80 residents in the Johns Hopkins pediatric residency program participated. Two video recordings were not utilized due to poor quality, thus data from 68/80 (85%) of the residents were available for review. Once the manikin simulator developed PVT, 42/68 (62%) stated aloud "there's no pulse" during their initial assessment, 9/68 (13%) assessed the pulse but did not make any verbal comment. (Fig. 1) The remaining 17/68 (25%) did not assess the pulse initially, rather focusing their attention on the rhythm. Of the 42 residents who stated, "there's no pulse", only 16/42 (38%) followed that phrase directly by stating "start compressions." Other verbalized phrases were documented, and were noted to fall into the following categories: "defibrillate" 19/42 (45%), "intubate" 2/42 (5%), "check blood pressure" 2/42 (5%), "place IV" 1/42 (2%), "call the code team" 1/42 (2%) and "administer epinephrine" 1/42 (2%). (Fig. 2)

A higher proportion of residents who stated, "there's no pulse, start compressions" ultimately started chest compressions vs. those that did not (16/16 [100%] vs. 30/52 [58%], $p = 0.002$). Of those that ultimately started chest compressions, residents verbalizing this phrase had a faster median time (interquartile range (IQR)) to starting chest compressions than all others (30 s [IQR: 19–42] vs. 150 [51–242], $p < 0.001$). (Fig. 2)

These findings confirmed that those who verbalized the Action-Linked Phrase connecting identification of loss of pulse to initiation of compressions were more likely to start chest compressions and to begin sooner than those that did not. The overarching question of our current research program is whether *teaching* people to use