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Clinical paper

Simulation training to improve 9-1-1 dispatcher identification of cardiac arrest: A randomized controlled trial

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ABSTRACT

Background: The objective of this study was to test the effectiveness of simulation training, using actors to make mock calls, on improving Emergency Medical Dispatchers' (EMDs) ability to recognize the need for, and reduce the time to, telephone-assisted CPR (T-CPR) in simulated and real cardiac arrest 9-1-1 calls.

Methods: We conducted a parallel prospective randomized controlled trial with n = 157 EMDs from thirteen 9-1-1 call centers. Study participants were randomized within each center to intervention (i.e., completing 4 simulation training sessions over 12-months) or control (status quo). After the intervention period, performance on 9 call processing skills and 2 time-intervals were measured in 2 simulation assessment calls for both arms. Six of the 13 call centers provided recordings of real cardiac arrest calls taken by study participants during the study period.

Results: Of the N = 128 EMDs who completed the simulation assessment, intervention participants (n = 66) performed significantly better on 6 of 9 call processing skills and started T-CPR 23 s faster (73 vs 91 s respectively, $p < 0.001$) compared to participants in the control arm (n = 62). In real cardiac arrest calls, EMDs who completed 3 or 4 training sessions were more likely to recognize the need for T-CPR for more challenging cardiac arrest calls than EMDs who completed fewer than 3, including controls who completed no training (68% vs 53%, $p = 0.018$).

Conclusions: Simulation training improves call processing skills and reduces time to T-CPR in simulated call scenarios, and may improve the recognition of the need for T-CPR in more challenging real-life cardiac arrest calls.

Clinical trial registration: http://www.clinicaltrials.gov Trial # NCT01972087.

Introduction

Each year in the United States, over 350,000 people experience out-of-hospital cardiac arrest (OHCA); fewer than one in ten survives [1,2]. Timely arrest identification and initiation of CPR is critical; the chances of survival decrease by 7–10% every minute CPR is delayed [3]. Survival is higher among people with bystander CPR [4], but unfortunately, it occurs in less than half of OHCA in most communities [5]. To increase bystander CPR 9-1-1 Emergency Medical Dispatchers (EMDs) aid callers in identifying cardiac arrest and instruct them to perform CPR over the telephone (T-CPR). T-CPR is associated with an increase in bystander CPR rates [6] and an increase in OHCA survival [7–9]. Conversely, survival is lower when EMDs do not recognize the need for T-CPR [10,11].

OHCA identification by EMDs using Criteria-Based Dispatch (CBD) guidelines relies on standardized questions that ask if the patient is conscious and if the patient is breathing normally [12]. If the patient is reported to be not conscious and not breathing normally, CBD guidelines direct EMDs to provide T-CPR instructions.

There are challenges to T-CPR. Callers do not always provide clear or consistent answers to EMDs' consciousness and breathing

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questions [13], and recognition of cardiac arrest is further complicated when agonal respirations are present [14–16].

In addition, OHCA comprises a small proportion of 9-1-1 calls, challenging EMDs' ability to become proficient in recognition of the need for T-CPR. One study observed that a low number of OHCA calls per call receiver was associated with lower probability of survival [17]. One way to increase exposure to rare events is by using simulation training.

Simulation training allows trainees to practice skills in a realistic but safe environment, where mistakes do not have serious consequences. Simulation training has been used extensively in training of medical providers, including training on effective communication with patients [18–20]. Successful simulation training includes six characteristics: (a) the simulation is a valid representation of clinical practice, (b) immediate feedback, (c) repetitive practice, (d) increasing levels of difficulty and clinical variation, (e) a controlled environment, and (f) clearly defined outcome measures [21].

The objective of this study was to test the effectiveness of a simulation training, using actors to present scripted mock medical emergency calls followed by immediate performance feedback, on the ability of 9-1-1 EMDs to recognize the need for, and reduce the time to delivery of T-CPR instructions in both simulation assessment and real cardiac arrest (CA) calls.

Methods

We conducted a parallel prospective randomized controlled trial to determine if simulation training improved OHCA identification and time to T-CPR for EMDs using a CBD guideline-based dispatch system. The study was reviewed and approved by the Human Subjects Division of the University of Washington, study #44640.

Enrollment, Randomization, and Study Intervention

The study enrolled EMDs from thirteen 9-1-1 call centers in the states of Washington, Oregon, Alaska and Arizona. Call centers were eligible if the center's EMDs used the standardized identification approach employed by CBD guidelines for assessment of patient's consciousness and breathing status [12].

EMDs were recruited via flyers, e-mails, and word of mouth between September 2013 and April 2016. Study enrollment was voluntary and all participants were consented. Details on sample size and power have been previously published [22].

Procedures

To account for variations in participant years of experience, training, and certification levels, participants were randomized within each call center to intervention or control arm in a 1-1 ratio, blocking on participant years of experience. During study participation, all regular training, certifications, and Quality Improvement (QI) continued as usual for all centers; the intervention was in addition to any ongoing call center activities.

The study intervention consisted of simulation training using four 30-min training sessions over a 12-month time period. Each session included three mock 9-1-1 calls followed by immediate feedback from a trained research staff member. Three individuals (one man and two women) who work as standardized patients for the University of Washington were trained on 12 different caller scripts based on real 9-1-1 recordings. The actors dialed in during the training sessions, which took place at a training console in the participating call centers[1] and, using scripted language, reported a variety of chief complaints. Each script was designed to reinforce the following skills: (1) avoid distraction by the caller's attempted diagnosis of the medical emergency (label); (2) assess the patient's level of consciousness, (3) assess the patient's breathing status by asking if breathing is *normal*, and (4) start T-CPR instructions right away if patient is not conscious and not breathing *normally*. The literature on T-CPR suggests that these factors are associated with lack of recognition and greater delays in T-CPR [13,23,24].

Feedback on and assessment of call processing skills focused on communication up to the start of T-CPR instructions. The complexity of case simulation increased over the course of the study by increasing the number of training points covered in each script; calls were categorized as simple, medium, complex. Eight of the 12 scripts were cardiac arrest scenarios; sudden, cardiac-caused (primary) arrest, in adult patients where CPR was indicated. The other four scripts were fall and diabetic reaction where the patient was determined to be conscious and breathing normally or unconscious and breathing normally. The scenario scenes were hazard free to reduce variability in delays due to scene circumstance. For study design, see Fig. 1.

During the training sessions a research staff member used a standardized form to note which call processing skills were done correctly and to record the exact language used by the EMD during the simulation. After the three mock calls were completed, the research staff member immediately called the participant back to provide feedback on select training points. Feedback included both corrective review and positive reinforcement (up to four feedback observations per mock 9-1-1 call). A detailed description of script and simulation development has been previously published [22].

Outcome assessment

Participants in both groups took part in an assessment: three simulated calls 12 months after randomization. The first call was not scored, and served as a practice call for control participants not familiar with the simulation call format; in this call, the patient is conscious, and breathing normally. The second and third mock calls were scored test calls, and required participants to recognize the need for T-CPR. In both scored test calls the actors labeled the medical emergency with an attempted diagnosis (i.e., "My mother's having a reaction. She won't take her insulin and now she won't snap out of it;" "My neighbor just fell to the ground"), provided an unclear response to the question "Is she conscious?" and either enacted agonal respirations (by making snorting/gasping sounds) or provided common verbal descriptions of agonal respirations (e.g., snoring) in response to the question "Is she breathing normally?" The two scored test calls each included all 9 of the training points (defined in Table 1). The three actors were balanced by intervention and control participants' assessment calls to reduce actor variability on main outcomes.

Assessment calls were recorded and abstracted by two trained research staff members who were blind to the participant's randomization status. Eleven data points were captured as detailed in Table 1: Nine training point scores and two time intervals; the time from start of call to "transition to CPR" (defined as the time at which the participant verbally indicated that pre-arrival CPR instructions were needed), and the time from start of call to first T-CPR pre-arrival instruction. Discrepancies in coding occurred on 32 items out of a possible 884 items (3.6%). Discrepant codes were further reviewed by two other team members and the consensus code was used.

[1] In one call center, participants took the training calls from a computer at home. For all sessions participants used a web-link to access a mock CAD screen for typing information received during the mock call. Participants verbally confirmed that there were no distractions in their environment during each session and the mock CAD screen entries were audited to confirm participants completed all required tasks.