Research Article

The Wording of Telephone Guided CPR Affect on Senior Citizens Performance: A Simulation Study

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Abstract

Objectives: To assess how senior citizens followed Telephone CPR (T-CPR) instructions in a simulated cardiac arrest scenario. Methods: Twenty-two voluntary senior citizens were studied in a simulated cardiac arrest scenario following the instructions given to them by an Emergency Medical Dispatcher. The phone calls and the CPR performance were recorded and analyzed. Results: The rescuers reported that they had performed better than the analysis of video and phone call recordings showed. When asked after the scenario the rescuers felt that they had coped with the situation well 72% and quite well 28% of the cases. Every participant evaluated the given telephone CPR instructions as very easy to understand. 35% of the participants thought that performing CPR was physically quite easy. The unexpected result was the EMDs' bad protocol compliance. Protocol was not strictly followed by the dispatchers. They gave more straight forward instructions without the full knowledge of the situation, than they should have. From the 12 analyzed instructions that the dispatchers should have given to the rescuer, only three instructions (give two deep rescue breaths, correct positioning of the rescuers arms and to compress 15 times) were totally as in the protocol. Conclusions: The quality of CPR given by the senior citizens was inadequate in this study. The EMDs had bad protocol compliance. Standardized and feasible T-CPR instructions by the dispatcher are not seen in this study, even if the rescuers stated that the instructions were clear and easy to understand.

Background

The main patient group suffering a cardiac arrest is the senior citizens. The lay person who witnesses the arrest and calls for help is often about the same age as the victim. Sweden with its 10 million inhabitants has 16 Emergency Medical Communication Centers (EMCC). They all use the same Medical Index Protocol since 1998 [1-3]. The EMCC has two essential roles in the chain of survival of the cardiac arrest patients: to dispatch EMS response and to give telephone guided cardiopulmonary resuscitation (T-CPR) [4-9] to the bystander on scene.

In this study the dispatcher's gave instructions for both mouth-to-mouth ventilation and for chest compressions. Usually the telephone CPR instructions for adults include only compressions, but still children and persons in hypoxia need ventilation performed [10,11]. Also in rural areas, where EMS response times are usually significantly longer than in urban environment, case by case decisions have to be made by dispatcher of also to give or not to give instructions for mouth-to-mouth ventilation as well.

Senior citizens with their limited physical capacity have difficulties in performing satisfactory T-CPR [12] but little is known how the telephone instructions are understood by senior citizens and into what extent the protocol is followed. The purpose of this study was to assess senior citizens CPR performance when guided by telephone instructions and how the senior citizens understood and followed the telephone CPR instructions given to them.

What this study adds, is knowledge, that senior citizens might not follow telephone CPR instructions as effectively as might generally be assumed by the emergency dispatchers, or perform the CPR as effectively as thought. In general, they are more weak and slower in their physical performance, than layman in working age. This knowledge is of importance, because senior citizens are likely to witness a partners or friends cardiac arrest and call for help.

Material and Methods

Pilot study

Fifteen voluntary senior citizens, who did not participate in this study, were tested in a pilot study. Pilot test was done to assess the senior citizens overall ability to give chest compressions for a resuscitation manikin. A Laerdal Resuscitation manikin with the compression rate meter was used in this test. All participants provided informed consent before their participation.

In the pilot study chest compressions only-test shows also a poor quality of the CPR: Average compressions/ minute: 70.4 (range 44-118). Average compression depth 41 mm (range 23-56 mm) and the amount of deep enough compressions were only 28.5% in average (range 0-88%). The correct recoiling of the chest was performed best: 91.7% correct recoiling after the compression (range 0-100%). The pilot study showed that senior citizens were able to perform CPR on a resuscitation manikin, but that the observed quality of chest compressions was worse than expected.

Participants

Senior citizens: The participants where all members of the same senior citizens center in Sweden. The center was contacted with a letter explaining the study, and the interested senior citizens could contact the head nurse of the center to inform their interest to participate. Twenty two voluntary senior citizens (average age 70 years, range 65-82 years) not attending the pilot study and with no prior knowledge of CPR participated. They were all physically in good condition and they had normal cognitive functions to their age.

Dispatchers: All personnel (N=40) from two EMCC's were asked to participate. Fourteen had the opportunity and voluntarily participated. They had working experience as a dispatcher from less than one year up to twenty years. The dispatchers had a prior experience to answer a real cardiac arrest emergency call from zero to four cases (four dispatchers) up to more than one hundred calls (ten dispatchers). The total amount of cardiac arrest calls per participating EMCC is not known.

All EMD's in Sweden are required to pass an 11-day training program in medicine, interview techniques, communication, regulations, theoretical and practical exercises. Furthermore, they are required to pass an individually based education, which consists of a 40-hour, interactive web-based program in medicine and 6-month training at an EMD centre. Annually their knowledge is tested and they have to pass complimentary courses.

Scenario

A simulated cardiac arrest scenario in a home environment was built up at the research center. The participating senior citizens were advised to enter the room, assess the situation as it would be a real person lying on the floor and then react according to that. They were acting alone and they had a cellular phone, which was used to call the EMCC. They had to dial a special number to start the call. The cellular phone was a simple model and the participant had to hold it against their ear in order to hear the instructions given by the dispatcher.

The dispatchers knew that it was a simulated situation, not a real call, although they performed their work in an authentic environment and were informed to handle the call as they use to do. The phone calls were recorded and analyzed afterwards by two of the authors.

The senior citizens entered the scene with a Resuscitation Ann-manikin (Laerdal Medical, Norway) laying on her back on the floor. They called the EMCC and then were to follow the 12 instructions given by the dispatcher. The Medical Index [3] protocol starts with the questions: "What has happened?" Where is the patient?" and "From what number are you calling?", followed by: "Is the patient awake?" and "Is she/he breathing normally?". The senior citizens actions were video recorded and analyzed. Observed and analyzed actions and times both by senior citizens CPR and dispatcher's phone instructions are presented in tables 1-4 and in table 5.

Assessment

Four different time periods were measured from the video tapes: time from the beginning of the emergency call (definition: when the dispatcher picks up the phone) to when the dispatcher hears the senior citizen report the patients unconsciousness, time from the beginning of the emergency call to when the dispatcher hears the senior citizen report the lack of breathing, time from the beginning to the first mouth-to-mouth ventilation and time from the beginning to the first chest compressions.

From the video recordings the overall quality of the rescuers actions were rated (yes/no) from opening the airways, acceptable mouth-to-mouth ventilations, acceptable quality of chest compressions and adequate use of the mobile phone during the scenario. The acceptability of the performance was rated by two experienced CPR instructors in consensus. The chest compressions exact depth couldn't be measured from the video recordings, so visual assessment and the correct amount of chest compressions per minute were used as surrogates for quality of the resuscitation. After the scenario senior citizens answered four written questions with a Likert scale from one to five (1=totally agree, 5=totally disagree).

From the dispatchers audio recordings analyzing the use of the protocol for giving T-CPR instructions, 12 steps in the protocol were assessed. The performance was rated as a yes if the protocol was followed and as no if it was not. Two experienced dispatchers rated the recordings in consensus. Descriptive statistics were used to present the results.

Statistical analysis was performed using SPSS for Macintosh version 14.0 statistical software (SPSS Inc., Chicago, IL).

Results

The surprising result was the EMDs bad protocol compliance. Protocol was not strictly followed by the dispatchers. They gave more straight forward instructions without the full knowledge of the situation, than what they should have. From the 12 analyzed instructions in the dispatchers protocol that the dispatcher should have given to the rescuer, only three instructions (give two deep rescue breaths, correct positioning of the arms and compress 15 times) were totally as in the protocol (Table 1). The right sequence of the chest compressions was given by the dispatcher in only 50% of the cases. Results of the telephone instructions given by the dispatcher are presented in table 5.

The mean times for the dispatcher to hear the senior citizen report unconsciousness, lack of breathing, and the times from the beginning of the emergency call to the first mouth-to-mouth ventilation and to the first chest compressions are presented in Table 2.

Table 1: The dispatcher's assessed actions from the handling of the emergency call (n=22). Scale 1-5 (1= unacceptable, 3= accepted, 5= experienced dispatcher).

		min	max	mean
1	Need for immediate help is recognized by the dispatcher	4	5	4.9
2	Prioritizes the problem	3	5	4.6
3	The dispatcher has a plan with the emergency call and follows the "Answering the call" guideline	3	4	3.9
4	The dispatchers role and leadership during the emergency call	4	5	4.5
5	Communication	4	5	4.3
6	Situation awareness, plans ahead	4	5	4.5
7	Level of medical knowledge of the T-CPR instructions	3	5	3.8

Table 2: Measured times from the recordings (n=22) from the beginning of the call.

	min (sec.)	max (sec.)	mean (sec.) (median)
Time from the beginning of the call to recognizing unconsciousness	10	90	35 (26)
Time from the beginning of the call to recognizing abnormal breathing	13	127	32 (26)
Time from the beginning to the first mouth-to-mouth ventilation	72	250	151 (145)
Time from the beginning to the first chest compressions	100	325	185 (172)

Table 3: Resuscitators technical performance from video recording observations.

	Yes (n)	No (n)	Could not be evaluated (n)
Opening the airway as instructed	18% (4)	68% (15)	14% (3)
Acceptable mouth-to-mouth ventilations	27% (6)	59% (13)	14% (3)
Acceptable chest compressions	77% (17)	9% (2)	14% (3)
Adequate use of the mobile phone	64% (14)	18% (4)	18% (4)

Table 4: Questions answered by the senior citizens (n=22) after the scenario. Scale 1-5 (1= totally agree, 5= totally disagree).

Scale Questions	1 (n)	2 (n)	3 (n)	4 (n)	5 (n)	Average (scale 1-5)
Did you feel that you could cope with the CPR situation?	72% (16)	28% (6)	0	0	0	1.27
Were the T-CPR instructions easy to understand?	100% (22)	0	0	0	0	1.0
Do you think your CPR performance was technically correct?	32% (7)	63% (14)	0	5% (1)	0	1.77
Was the CPR physically difficult? (Did you have enough strength?)	35% (7)	30% (6)	0	0	35% (7)	2.45

Table 5: 12 steps of the telephone CPR instructions for the dispatcher to give to the rescuer. In how many cases out of 22 the dispatcher did or did not give this specific instruction, as recommended in the Swedish Index for T-CPR.

	Yes (n)	No (n)
Take a deep breath and put your lips firmly around patients lips	55% (12)	45% (10)
Give two deep rescue breaths	100% (22)	0%
Take a breath between the mouth-to-mouth ventilations. Do it now.	18% (4)	82% (18)
Come back to the phone and report if the chest rises during the rescue breath	68% (15)	32% (7)
Kneel on the side of the patient, if possible	41% (9)	59% (13)
Open the clothes from the chest	50% (11)	50% (11)
Put your hands on the patient's chest, between the nipples.	100% (22)	0%
Push firmly the chest downwards with straight arms and let the chest rise back	91% (20)	9% (2)
Push 15 times in the rhythm:	100% (22)	0% (0)
One-two-three-four... and so on	50% (11)	50% (11)
Count the compressions aloud! Then come back to the phone.	59% (13)	41% (9)
Good! Now you shall continue with 2 mouth-to-mouth ventilations and 15 chest compressions until the ambulance arrives.	86% (19)	14% (3)

The main finding of this study was that rescuers reported that they had performed better than video and phone call recordings showed when analyzed.

The rescuer used the mobile phone adequately during the CPR in 64% (n=14), opened the airway successfully in only 18% (n=4) of the cases, gave acceptable mouth-to mouth ventilations in 27% (n=6) of the cases and acceptable chest compressions in 77% (n=17) of the cases (Table 3).

When asked after the scenario the rescuers felt that they had coped with the situation well (72%, n=18) or quite well (28%, n=6). Every participant evaluated the given telephone CPR instructions as very easy to understand (100%, n=22). Participants own assessment of the technical quality of the CPR performed was rated as very good in 32% (n=7), quite good in 63% (n=14) and quite poor in 5% (n=1). Performing CPR was considered physically very demanding in 35% (n=7), or quite demanding in 30% (n=6) of the cases. 35% (n=7) of the participants thought that performing CPR was physically quite easy (Table 4).

Discussion

The overall CPR performance of the senior citizens was quite poor. They could give information about unconscious patient with no breathing on the average within 35 seconds from the beginning of the emergency call, but then to follow telephone instructions to start mouth-to-mouth ventilation and chest compressions took 151 seconds and 185 seconds respectively. These are very long no-flow times from the beginning of the emergency call but in line with earlier studies [13-15]. Yet every participating senior citizen rated the T-CPR instructions as very easy to understand, and felt that they had coped with the situation very well or fairly well. So a critical revision of T-CPR instructions for the EMD´s should be done and tested to see if there are steps that could be instructed in some other way in order to maximize the time used for chest compressions, and to begin them as early as possible.

Opening the airway and adequate mouth-to-mouth ventilation were performed poorly, but the quality of chest compressions was acceptable in over ¾ of the cases. In their study Richman et al. [16] found out that only 29% of the participating senior citizens delivered high quality chest compressions. Performing CPR was considered physically very demanding or quite demanding for most of the senior citizens in this study, and yet all participants were considered normal or fit for their age and were willing to perform CPR. Should we consider and develop alternative ways to give chest compressions? At least for those rescuers who don't have normal adult's physical strength and capability? Also in an interview study by Vaillancourt et al. [17] physical limitations was found to be the number one limiting factor to perform CPR amongst elderly people.

Our limited data also suggests that the 2015 European Resuscitation Councils T-CPR guidelines [10], which suggest chest compressions-only instructions for the laypersons in the case of sudden cardiac arrest when no hypoxia is suspected, are easier to perform than the older guidelines for senior citizens with no prior experience on CPR. But instructions for mouth-to-mouth ventilation cannot be totally ignored even in the future. For example cardiac arrest due to near-drowning, or other cases where the lack of oxygen is the cause, the patients might still benefit from those instructions.

Even senior citizens take care of children, and many accidents with foreign objects in the airways takes place in senior homes.

The dispatchers did not follow their T-CPR protocol strictly. Even if we only look at the compression part of the instructions, only four of seven analyzed steps were followed and these were followed in only about 50% of the cases. A deeper analysis is needed, is the problem due to difficulties in using the T-CPR aid for the EMDs? We do not know if the rescuers would perform better if the protocol was strictly followed. A more thorough analysis is needed to assess how the EMD's are thinking and how they are tested for their ability to recognize and successfully handle a cardiac arrest emergency call. Should, for instance, a certain amount of simulation training be obligatory during the annually training, as a recent study [18] would indicate? And should the new instructions, when updated, always be tested in a simulation settings before they are applied to guidelines and other instructions? When revising T-CPR protocols and instructions, it might be worth testing the possible changes in simulations with senior citizens among the test groups.

Limitations of the Study

The number of participants was very low, only 22 participants, so reliable statistical analyzes is difficult to get. We couldn't compare afterwards which EMD had given instructions to a certain rescuer, thus we were not able to compare if a certain miss, or communication error in telephone instructions had an effect on technical performance of the CPR. This is due to the fact that individual dispatcher information was not noted reliably with each of the simulations. Our result of 77% of acceptable chest compressions is probably too high and is based only on the video recordings, not on actual compression data from the mannequin.

Cellular phone used by the rescuers was a simple, basic model. On the market there is a large variety of smartphones with different kind of CPR applications available, but is debatable could such programmes make it any easier, or especially quicker, for elderly rescuers to perform CPR, when even basic instructions spoken to them took a long time to be carried out. And yet all rescuers were considered to be cognitively normal to their age.

Conclusion

There was bad protocol compliance from the EMDs. Standardized and easy to use T-CPR instructions by the dispatcher are not seen in this study, even if the rescuers stated that the instructions were clear and easy to understand. The instructions need to be revised in a scholarly way as many times as it takes to get the performance needed to save a life. Might we need a more simplified telephone instructions for instance for senior citizens and for children?

References

1. Karlsten R, Elowsson P. Who calls for ambulance: implications for decision support. A descriptive study from a Swedish diapatch centre. Eur J Emerg Med. 2004; 11: 125-129.

2. Hjälte L, Suserud B-O, Herlitz J, Karlberg L. Initial emergency medical dispatching and prehospital needs assessment: a prospective study of the Swedish ambulance service. Eur J Emerg Med. 2007; 14: 134-141.

3. Swedish Index to Emergency Medical Assistance. Laerdal ÅS, editor. SOS Alarm AB. A/S Stavanger. In: The Laerdal Foundation for Acute Medicine. 2001.

4. Roppolo L, Pepe P, Cimon N, Gay M, Patterson B, Yancey A, et al. Modified cardiopulmonary resuscitation (CPR) instruction protocols for emergency medical dispatchers: rationale and recommendations. Resuscitation. 2005; 65: 203-210.

5. Kuisma M, Boyd J, Väyrynen T, Repo J, Nousiala-Wiik M, Holmström P. Emergency call processing and survival from out-of-hospital ventricular fibrillation. Resuscitation. 2005; 67: 89-93.

6. Ma M, Lu T-C, Ng J, Lin C, Chiang W-C, Ko P, et al. Evaluation of emergency medical dispatch in out-of-hospital cardiac arrest in Taipei. Resuscitation. 2007; 73: 236-245.

7. Roppolo L, Westfall A, Pepe P, Nobel L, Cowan J, Kay J, et al. Dispatcher assessments for agonal breathing improves detection of cardiac arrest. Resuscitation. 2009; 80: 769-772.

8. Bohm K, Stålhandske B, Rosenqvist M, Ulfvarson J, Hollenberg J, Svensson L. Tuition of emergency medical dispatchers in the recognition of agonal respiration increases the use of telephone assisted CPR. Resuscitation. 2009; 80: 1025-1028.

9. Svensson L, Bohm K, Castrén M, Pettersson H, Engerstrom L, Herlitz J, et al. Compression-Only CPR or Standard CPR in Out-of-Hospital cardiac Arrest. NEJM. 2010; 363: 434-442.

10. Perkins G, Handley A, Koster R, Castrén M, Smyth M, Olasveengen T, et al. European Resuscitation Council Guidelines for Resuscitation 2015. Section 2: Adult basic life support and automated external defibrillation. Resuscitation. 2015; 95: 81-99.

11. Machonochie I, Bingham R, Eich C, López-Herze J, Rodríguez-Nunez A, Rajka T, et al. European Resuscitation Council Guidelines for Resuscitation 2015. Section 6: Paediatric life support. Resuscitation. 2015; 95: 223-248.

12. Dorph E, Wik L, Steen PA. Dispatcher-assisted cardiopulmonary resuscitation. An evaluation of efficacy amongst elderly. Resuscitation. 2003; 56: 265-273.

13. Kellermann AL, Hackman BB, Somes G. Dispatcher-assisted cardiopulmonary resuscitation. Validation of efficacy. Circulation. 1989; 80: 1231-1239.

14. Eisenberg MS, Hallstrom AP, Carter WB, Cummins RO, Bergner L, Pierce J. Emergency CPR instruction via telephone. Am J Public Health. 1985; 75: 47-50.

15. Culley LL, Clark JJ, Eisenberg MS, Larsen MP. Dispatcher-assisted telephone CPR: common delays and time standards for delivery. Ann Emerg Med. 1991; 20: 362-366.

16. Richman P, Bobrow R, Clark L, Noelck N, Sanders A. Ability of citizens in a senior living community to perform lifesaving cardiac skills and appropriately utilize AEDs. J Emer Med. 2007; 33: 395-399.

17. Vaillancourt C, Charette M, Kasaboski A, Brehaut J, Osmond M, Wells G, et al. Barriers and facilitators to CPR knowledge transfer in an older population most likely to witness cardiac arrest: a theory-informed interview approach. Emerg Med J. 2014; 31: 700-705.

18. Meischke H, Painter IS, Stangenes SR, Weaver MR, Fahrenbruch CE, Rea T, et al. Simulation training to improve 9-1-1 dispatcher identification of cardiac arrest: A randomized controlled trial. Resuscitation. 2017; 119: 21-26.