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Delivering 9-1-1 CPR Instructions to Limited English Proficient Callers: A Simulation Experiment

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Abstract Having 911 telecommunicators deliver CPR instructions increases cardiac arrest survival, but limited English proficiency (LEP) decreases the likelihood callers will perform CPR and increases time to first compression. The objective of our study was to assess which 9-1-1 CPR delivery modes could decrease time to first compression and improve CPR quality for LEP callers. 139 LEP Spanish and Chinese speakers were randomized into three arms: receiving CPR instructions from a 9-1-1 telecommunicator (1) with telephone interpretation, (2) using alternative, simple ways to rephrase, or (3) who strictly adhered to protocol language. Time interval from call onset to first compression, and CPR quality were the main outcomes. The CPR quality was poor across study arms. Connecting to interpreter services added almost 2 min to the time. CPR training in LEP communities, and regular CPR training for phone interpreters may be necessary to improve LEP bystander CPR quality.

Keywords CPR · Limited English proficiency · 9-1-1 · Health communication · Immigrants

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Introduction

Cardiac arrest is a major and persistent public health challenge; every year there are an estimated 420,000 out-of-hospital sudden cardiac arrests in the United States [1]. Early initiation of lay bystander CPR improves survival and neurological function outcomes following cardiac arrest [2–5]. 9-1-1 telecommunicators relay CPR instructions over the phone, which has been shown to significantly increase survival [6]. Effective communication between the 9-1-1 telecommunicator and on-scene bystander is essential in recognizing a cardiac arrest and delivering understandable CPR instructions [7, 8].

Limited English proficiency (LEP) is widely prevalent in the United States. Approximately 20 % of the United States population speaks a language other than English at home, almost 60 million people [9]. Half of non-native English speakers report speaking English less than "very well" [9]. New approaches are needed to help 9-1-1 tele-communicators communicate critical pre-arrival instructions to the growing population of LEP callers. A prospective cohort study of out-of-hospital cardiac arrests found that LEP in 9-1-1 callers is associated with less use of bystander CPR, delays in CPR, and lower survival to hospital discharge [10]. Provision of 9-1-1 CPR instructions are standard practice in many emergency call centers but protocols differ and protocol language may not be uniform. In a survey of call centers in Washington State (unpublished data), 54 % (n = 12) of call centers where telecommunicators provide CPR instructions over the phone (n = 22) reported they do not allow telecommunicators to vary the words in the CPR instructions. Of the centers that allow such variation, there is no evidence regarding the efficacy of this policy. While most call centers encourage their telecommunicators to connect to

the interpreter services line when language barriers get in the way of efficient call processing, our prior research suggests this adds a time delay to the provision of bystander CPR instructions [11]. We do not know if engaging interpreter services improves bystander CPR quality for LEP callers. The aim of our study was to create evidence-based communication guidelines for 9-1-1-relayed CPR instructions, with a focus on LEP callers.

Conceptual Framework

There are many challenges to communication between 9-1-1 telecommunicators and LEP callers including the concept of "face threats", threats to a positive public self-image, due to the format of standard 9-1-1 dispatch protocols. A study on 9-1-1 telecommunicator-caller interaction suggests that the rigidity in 9-1-1 communication protocols can negatively affect caller satisfaction and behavior because it leads to "face threats" [12]. The paper suggests that 9-1-1 telecommunicators strictly adhering to 9-1-1 scripts and repeating questions over and over, as opposed to rephrasing, can be taken as a "face threat" by LEP callers, adding time and conflict into the interaction [12]. In addition, a study on Chinese speaking practices, including "face-directed communication strategies", noted that "to North Americans, the word 'yes' suggests agreement and affirmation, while, to Chinese, a "yes" may convey multiple layers of meanings such as 'I'm listening' and 'that's possible'" [13]. In this study, we will explore ways to improve communication in 9-1-1 calls with LEP callers, including potentially removing some "face threats" and ambiguity in yes/no questioning from the 9-1-1 interaction, by allowing rephrasing instead of repetition and through the use of telephone interpreters.

Methods

The simulation was a randomized controlled trial using a 9-1-1 call simulation to assess which 9-1-1 CPR delivery modes could decrease time to first compression and improve quality of CPR performance for LEP callers. Two main protocol modifications were examined: (1) enforcing expedient use of phone interpreters for communication with LEP callers and (2) giving telecommunicators alternative, simple ways to rephrase and elaborate on the 9-1-1 script in the case of misunderstandings during call interactions. The third arm of the study, strict adherence to protocol language without the option to connect to interpretation, or to rephrase or elaborate, served as the comparison group.

Setting

The study took place in King County, Washington in partnership with Public Health Seattle and King County, Emergency Medical Services Division. All study procedures were reviewed and approved by Human Subjects at the University of Washington. Recruitment and administration occurred from July 2010 to August 2011.

Participants

The study population consisted of King County residents over the age of forty who were LEP Mandarin, Cantonese, or Spanish speakers. In order to qualify as LEP, participants needed to report they did not speak English well. Study participants were recruited through, and the experiments were conducted at, community based organizations whose primary mission is to serve Chinese and Latino LEP communities. Participants received a $25 gift card for their time.

Procedures

Bilingual research assistants consented and gave instructions to participants in Mandarin, Cantonese, or Spanish. Participants were given a standardized scenario of a collapsed family member (represented by a Laerdal CPR manikin). They were told in their native language that the person was not awake and not breathing, and they must help by calling a mock 9-1-1 number and following the instructions given. The call was answered by a former 9-1-1 telecommunicator who conducted the simulated 9-1-1 calls from another building. Before the start of each simulation the telecommunicator opened a randomized envelope to determine which of the three 9-1-1 CPR delivery modes she would use. Randomization was stratified on age and gender as both may affect CPR quality, for example, ability to push to adequate depth. For participants randomized to the interpreter arm, the second question the telecommunicator would ask was "What language do you speak? I am going to get an interpreter". The telecommunicator then followed standard 9-1-1 procedures and connected to the same interpreter service used by 9-1-1. The interpreters were told it was a simulation rather than a real 9-1-1 call. After the simulation, participants were given a brief demonstration of appropriate CPR by study staff and had an opportunity to practice compressions.

Data Collection

A Laerdal CPR manikin recorded CPR quality measurements (rate, depth, complete release, and hands-off time). Study staff observed and recorded time to first visible chest

compression. Inter-rater reliability for agreement on time to first compression within 1 % of mean time was 100 %. The telecommunicator recorded the calls for the purpose of assessing the integrity of study protocols. The telecommunicator also completed a short survey after every call, noting which words appeared challenging for the caller, as well as her perception of whether she would have connected to interpreter services independent of study arm assignment. After the simulation, participants completed a written survey in their native languages, which asked for feedback about the interaction with the 9-1-1 telecommunicator and interpreter.

Measures

The primary outcomes of the study were the time interval from call receipt to the first chest compression and CPR quality (rate, depth, complete release, and hands-off time) during the first 3 min of CPR performance. Based on American Heart Association (AHA) recommendations, sufficient compression depth was considered greater than or equal to 38 mm and sufficient compression rate was 90–100 compressions per minute.

Analysis

Analyses were based on 3 min of participant CPR. Time to first compression, total hands-off time, number of hands-off periods, mean depth, compression rate, percent complete release, percent of compressions greater than or equal to 38 mm, percent correct hand position, and percent sufficient rate were analyzed using analysis of variance (ANOVA) with randomization group as the factor. All statistical analyses were performed in R version 2.13.

Results

The sample consisted of 139 participants, 43 % Spanish-speaking and LEP and 57 % Chinese-speaking and LEP. The sample was largely female (61 %) and older than fifty (63 %). There was some evidence that the groups were not balanced with respect to ethnicity (Hispanic/non-Hispanic, $p = 0.055$ for test of equal proportion Hispanic within each group), so ethnicity was included as a covariate in the ANOVA models for all outcomes where ethnicity was observed to have a statistically significant effect. Of the 139 participants, 42 were randomized into the strict protocol adherence group, 43 into the elaboration group, and 54 into the interpreter group. Time was not recorded for three participants who declined to perform CPR after the simulation began, and were thus excluded from the time analysis. The manikin failed to record data for nine

participants, who were thus excluded from analyses of quality measures, but included in the time analyses (three from the strict protocol adherence group, two from the elaboration group, and four from the interpreter group). Of the 130 participants with manikin data, 19 participants did not press hard enough on the manikin, or near enough to the chest for the manikin to register compressions and were dropped from rate analyses because no values were recorded by the manikin. Another participant had sufficient compressions to calculate a mean compression rate, but not to calculate the percent of compressions with sufficient rate or percent complete release. Correct hand position could not be calculated by the manikin for 13 participants.

Time and Quality

LEP participants who had been randomized to the interpreter arm began chest compressions nearly 2 min later than those in the other arms, but were also more likely to have complete release between compressions (93.6 vs. 80.3 % for strict protocol adherence). There were no other significant differences between the interpreter arm and the strict protocol adherence arm. There were no significant differences between the strict protocol adherence arm and the elaboration arm. Time and quality results can be seen in Table 1.

Secondary Analyses

In practice, 9-1-1 telecommunicators decide whether to connect to an interpreter based on their perspective of the clarity of communication. To examine the simulation through this perspective, a separate analysis was conducted among participants whose use of an interpreter was consistent with their need for an interpreter, as determined by the 9-1-1 telecommunicator. Of the original 139 participants, 51 were excluded as not being compatible with randomization group (interpreter versus no interpreter) and seven were excluded as no information was recorded on whether or not the 9-1-1 telecommunicator would have requested an interpreter. In this "forced reality" analysis, intervention arm was shown to have no effect on depth, complete release, or hand position. However, the mean time to first compression was over 2.5 min longer and the compression rate was substantially slower in the interpretation arm. Results can be seen in Table 2.

Study participants randomized into the interpreter arm completed a survey regarding their communication experience during the simulation call. Results from this survey can be seen in Table 3. Subjects assigned to an interpreter reported understanding the instructions better with an interpreter (94.3 %).

Table 1 Quality and time

	Strict protocol adherence[a] (n = 42)	Elaboration (n = 43)	Interpreter (n = 54)
Time to first compression (s)[b]			
p value		0.847	<0.001
Mean (CI)	176 (154.3, 197.6)	168.4 (144, 192.8)	288.3 (265.7, 310.9)
n (136)	41	41	54
Depth (mm)[b]			
p value		0.76	0.06
Mean (CI)	18.8 (14.3, 23.3)	23.3 (18.9, 27.7)	26.9 (22.2, 31.6)
n (129)	39	40	50
% depth ≥ 38 mm[b]			
p value		0.63	0.54
Mean (CI)	17.9 (6.7, 28.8)	22 (10.9, 33.1)	27.4 (16.0, 38.7)
n (116)	32	36	48
Rate (compressions/min)			
p value		0.83	0.08
Mean (CI)	92.9 (85.1, 100.7)	91.8 (85.2, 98.5)	83.4 (76.1, 90.8)
n (110)	28	37	46
% 90–110 compressions/min			
p value		0.75	0.97
Mean (CI)	33.0 (−20.0, 86.1)	28.3 (−19.5, 76.0)	22.8 (−20.0, 72.0)
n (109)	28	36	46
Complete release (%)			
p value		0.58	0.04
Mean (CI)	80.3 (67.6, 92.8)	84.1 (73.8, 94.4)	93.6 (87.7, 99.6)
n (129)	39	40	50
Correct hand position (%)[b]			
p value		0.67	0.35
Mean (CI)	59.4 (45.4, 73.5)	63.3 (50.5, 76.1)	51.3 (40.4, 62.2)
n (117)	33	36	48

[a] Reference group

[b] Adjusted for ethnicity

Table 2 Quality and time, forced reality

Outcome	Strict protocol adherence[a]	Elaboration	Interpreter
Time to first compression (s)[b]			
p value		0.47	<0.01
Mean (SD)	143.9 (88.2, 199.5)	122.4 (64, 180.7)	310.2 (145.5, 475)
n (80[c])	22	22	36
Rate (compressions/min)			
p value		0.36	<0.01
Mean (CI)	99 (53.8, 144.2)	92 (46.5, 137.5)	78.5 (29.9, 127.1)
n (65[d])	15	21	29

[a] Reference group

[b] Adjusted for ethnicity

[c] No time recorded for one participant

[d] No compressions recorded for 16 out of the 81 participants

Table 3 Emergency communication using a telephone interpreter (n = 54)

Communication outcome	True n (%)	Not true or unsure n (%)
When the 9-1-1 operator was talking to someone else, I knew it was the interpreter	48 (88.9)	6 (11.1)
The interpreter spoke my language well	50 (92.6)	4 (7.4)
I understood the 9-1-1 operator's instructions better when they were interpreted	50 (94.3)	3 (5.7)

Discussion

The study was a randomized controlled trial of 9-1-1 CPR delivery modes for LEP callers. The study did not find a significant difference in any of the outcome measures between the strict protocol adherence arm and the elaboration arm suggesting that less rigidity (and possibly less face threat) did not necessarily improve time or quality of CPR. This study did find that use of an interpreter led to significantly longer time (2 min) to delivery of first

compression. Participants reported understanding instructions better with an interpreter, but this did not translate to improved depth or compression rate. Similarly, in the "forced reality" analysis where the participant arm reflected the interpreter choice the 9-1-1 telecommunicator would have made on the job, a longer time to first compression persisted and the compression rate significantly worsened. Use of elaborated instructions showed a slight improvement in time and some of the CPR quality measures over standard instructions but these differences were not statistically significant.

9-1-1 telecommunicators report that it can be difficult to communicate with LEP callers [14]. It is often the 9-1-1 call center policy that when language barriers are present and affecting clear communication, interpreters are to be used. However, research shows that telecommunicators often do not connect to this resource even when they make a language barrier notation [14, 15]. Reasons 9-1-1 telecommunicators cite for not using interpreter services include long connection times, caller hang-ups during these connections, and not trusting interpretation quality [14, 15].

This study confirms it takes additional time to connect to an interpreter, which explains the longer time to first compression. This study was a simulation and as such was not a true reflection of an actual 911 call but other research confirms that using interpreter services during 9-1-1 calls adds a time-delay to the interaction [11]. A two-minute delay can seriously affect survival rate and important clinical outcomes. In one study we examined 30 Spanish language 9-1-1 calls where an interpreter was used and found that almost one-minute of delay is due to connecting to an interpreter and exchange of billing information between the 9-1-1 telecommunicator and the interpreter [7]. As such, it might be possible to address this issue through technological solutions and alternative billing strategies. This would be preferable over discouraging use of interpreter services as LEP participants reported understanding the instructions better with an interpreter. Of the participants who were randomized to the interpreter delivery mode, 39 % did not know that interpreters could be accessed during 9-1-1 calls. There is an opportunity to potentially decrease LEP barriers to calling with more education on the availability of 9-1-1 interpreters.

We also recommend that medical interpreters receive training in compression-only CPR and how to coach CPR. The lower rate of compressions in the interpreter arm may suggest that interpreters do not understand the importance of interpreting the words "one, two, three…" at the appropriate compression rate. We recommend interpreters have access to metronomes during cardiac arrest calls to assist them in communicating the appropriate compression rate. There are metronome computer-based applications that can be easily installed and accessed.

In addition, CPR education for LEP communities needs to be expanded. Studies have shown that CPR training does not reach minority populations in large numbers [16, 17]. Most people trained in CPR are young, of higher socioeconomic status, higher education levels, and speak English as a first language [18, 19]. Thus, it is important to identify effective training approaches that will ensure wider knowledge of CPR skills.

In response to this and other research indicating the challenges experienced by LEP communities in interfacing with 9-1-1, a new initiative was funded through the EMS Division of the Seattle-King County Public Health. The "Vulnerable Population Strategic Initiative" will specifically focus on the development of programs that will improve the interface between vulnerable populations and the prehospital care delivery system, including dispatch, EMS providers, and after-care.

New Contribution to the Literature

There is a growing literature on the challenges LEP communities face in accessing emergency medical services [7, 10, 11, 14, 15, 20]. EMS care delivery can mean the difference between life and death for patients and research on communication challenges can further our knowledge of how to better serve these communities during times of crisis. This study provides insight into the way 9-1-1 communication protocols affect call outcomes. The results may assist EMS departments in developing more effective 9-1-1 protocols for communicating with LEP callers, in addition to illustrating the challenges inherent in the system and community that can potentially be addressed through training.

Limitations

This study was limited by virtue of being a manikin simulation study; citizen bystanders in real cardiac arrest situations may behave differently. The benefit of a manikin study is the ability to accurately measure rate and depth of compressions. Unfortunately, the manikin occasionally turned-off during the simulations, resulting in some missing data. The study had limited power to detect differences in CPR performance and only evaluated the first 3 min of single rescuer compression-only CPR. A larger sample size or more extended measurement could produce different results. In addition, the 9-1-1 telecommunicator in this study introduced the call to the interpreter by stating that the forthcoming interaction was a test, not a true emergency. This may have affected the urgency of the situation, which could have added time to the interaction. Although,

as stated above, other studies support that there is a time delay with connecting to an interpreter.

Conclusion

Overall, LEP participants had poor rate and depth as compared to CPR standards. Future research should look into training the LEP communities, 9-1-1 telecommunicators, and interpreters. It will take a whole system approach to improve bystander CPR measures among LEP communities involving 9-1-1, interpreter services, and LEP communities. Future research is needed to continue to reduce cardiac arrest survival disparities in these vulnerable populations.

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