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Bystander CPR in out-of-hospital cardiac arrest: The role of limited English proficiency☆

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ABSTRACT

Background: The proportion of non-native English speakers is increasing in the United States. We sought to determine if limited English proficiency in callers to 9-1-1 for out-of-hospital cardiac arrest is associated with provision of bystander cardiopulmonary resuscitation (CPR) and delays in telephone-assisted CPR.
Materials and methods: We completed a secondary analysis of cohort data collected as part of a randomized trial of emergency dispatcher bystander CPR instructions. Included patients suffered confirmed cardiac arrest treated by emergency medical services. Callers were identified as limited English proficient through review of the dispatcher report.
Results: Of 971 eligible cardiac arrest cases, 5.9% ($n = 57$) of 9-1-1 callers were limited English proficient. Comparing arrest events of limited English proficient 9-1-1 callers with English-fluent callers, a lower proportion of limited English proficient arrest cases received bystander CPR (64.3% [36/56] vs. 77.5% [702/906]; $p = 0.02$) or survived to hospital discharge (8.8% [5/57] vs. 16.5% [151/914]; $p = 0.12$). Dispatchers took longer to recognize cardiac arrest with limited English proficient callers compared with English-fluent callers (median 84 vs. 50 s; $p < 0.001$). Among callers attempting bystander CPR, the interval from call receipt to initiation of CPR was longer for limited English proficient compared with English-fluent callers (median 237 vs. 163 s; $p < 0.001$).
Conclusion: In this observational study of dispatcher-identified cardiac arrest, limited English proficiency in 9-1-1 callers was associated with less frequent provision of bystander CPR and delays in arrest recognition and implementation of telephone CPR, underscoring the health challenges and potential disparities of pre-hospital care related to limited English proficiency.

1. Introduction

Out-of-hospital cardiac arrest is a major public health concern with an estimated 300,000 cases annually in the United States.[1,2] Successful resuscitation from out-of-hospital cardiac arrest requires a coordinated series of actions including early identification, early cardiopulmonary resuscitation (CPR), early defibrillation, timely advanced care, and post-resuscitation treatment.[2] Early CPR by lay bystanders prior to arrival of emergency medical services (EMS) can increase the chances of survival and long-term favorable neurological function following cardiac arrest.[3–5] Thus, efforts directed at increasing bystander CPR provide an important means to improve survival following cardiac arrest. Dispatcher-assisted CPR, in which dispatchers provide CPR instructions over the phone to on-scene bystanders, is one method to substantially increase the proportion of arrest patients who receive early CPR and in turn increase the likelihood of survival.[6]

Importantly, dispatcher recognition of cardiac arrest and delivery of CPR instruction requires effective communication between the caller and the dispatcher.[7] In this regard, approximately 20% of the US population speak a language other than English at home, a proportion that translates to more than 50 million people and constitutes a 63% increase over the past 15 years.[8] Half of non-native English speakers are limited English proficient, defined as speaking English less than "very well." Limited English proficient populations have less access to health care,[9] report worse overall health,[10] and are less likely to receive recommended care,[11] but the role of limited English proficiency in cardiac arrest resuscitation has not

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Dispatcher Identification of Cardiac Arrest

Determined from "no" responses to the following questions:

1. Is the person conscious?
2. Is the person breathing normally?

Dispatcher Bystander CPR Instructions

Chest compression alone

1. Get the phone NEXT to the person, if you can.
2. Listen carefully. I'll tell you what to do.
   - Get them FLAT on their back on the floor.
   - BARE the chest.
   - KNEEL by their side.
   - Put the HEEL of your HAND on the CENTER of their CHEST, right BETWEEN the NIPPLES.
   - Put your OTHER HAND ON TOP of THAT hand.
   - PUSH DOWN FIRMLY, ONLY on the HEELS of your hands, 2 inches.
   - Do it 50 times, just like you're PUMPING the chest. Count OUTLOUD 1-2-3… (correct rate if needed)
   - MAKE SURE THE HEEL of your hand is in the center of the chest right between the nipples.
   - KEEP DOING IT. KEEP PUMPING THE CHEST UNTIL HELP CAN TAKE OVER.
   - I'll stay on the line.

Chest compression plus ventilation

1. Get the phone NEXT to the person, if you can.
2. Listen carefully. I'll tell you what to do.
   - Get them FLAT on their back on the floor.
   - BARE the chest.
   - KNEEL by their side.
   - PINCH their nose
   - With your OTHER hand, LIFT the CHIN so the head BENDS BACK.
   - COMPLETELY COVER their mouth with your mouth.
   - GIVE 2 BREATHS OF AIR
   - THEN COME BACK TO THE PHONE.
3. Listen carefully, I will tell you what to do next.
   - Put the HEEL of your HAND on the CENTER of their CHEST, right BETWEEN the NIPPLES.
   - Put your OTHER HAND ON TOP of THAT hand.
   - PUSH DOWN FIRMLY, ONLY on the HEELS of your hands, 2 inches.
   - Do it 15 times, just like you're PUMPING the chest. Count OUTLOUD 1-2-3… *(correct rate if needed)
   - MAKE SURE THE HEEL of your hand is in the center of the chest right between the nipples.
   - Pump 15 times
   - Then PINCH the nose, LIFT the CHIN so the head BENDS BACK.
   - 2 MORE breaths and then PUMP the CHEST 15 times.
   - KEEP DOING IT. PUMP THE CHEST 15 TIMES. Then 2 BREATHS.
   - KEEP DOING IT UNTIL HELP CAN TAKE OVER.
   - I'll stay on the line.

Fig. 1. Dispatcher identification of cardiac arrest and bystander CPR instructions.

been systematically evaluated. Given the increasing prevalence of limited English proficiency and the importance of effective communication in the pre-hospital care of cardiac arrest, we undertook a study to evaluate the role of limited English proficiency in the provision of bystander CPR. We hypothesized that cardiac arrest cases involving 9-1-1 callers with limited English proficiency compared to English fluent callers would be less likely to provide bystander CPR prior to arrival of EMS. Additionally, we anticipated cardiac arrest cases involving 9-1-1 callers with limited English proficiency compared to English fluent callers would experience delays in both arrest recognition and the initiation of dispatcher-assisted CPR.

2. Methods

2.1. Design and setting

The current investigation is an ancillary prospective cohort study of the Dispatcher Assisted Resuscitation Trial (DART) (clinicaltrials.gov NCT00219687) in King County, Washington. The DART study is a randomized, controlled trial of telephone CPR instructions by emergency dispatchers that compares instructions of chest compression alone to instructions consisting of chest compressions and ventilation.[12] Persons access pre-hospital emergency care by calling 9-1-1 emergency dispatcher. In the setting of a suspected cardiac arrest, the dispatcher will offer CPR instructions when bystander CPR is not already ongoing. The EMS response is a 2-tier system. The first tier is comprised of emergency medical technicians–firefighters trained in basic life support including use of the automated external defibrillator. The second tier is comprised of paramedics trained in advanced life support and manual defibrillation. In suspected cardiac arrest, both tiers are dispatched simultaneously with the first tier arriving on average in 6 min and the second tier arriving on average in 10 min. The study was approved by the Institutional Review Board at the University of Washington.

2.2. Study population and CPR algorithm

The study cohort was drawn from all cardiac arrest events enrolled in the DART trial in King County, Washington, from June 1, 2004 to October 1, 2008. Patients were enrolled in the trial if the

9-1-1 dispatcher presumed a diagnosis of cardiac arrest based on a standard identification approach and the cardiac arrest victim was 18 years or older. Identification of suspected cardiac arrest requires that the caller answer "no" to a series of questions. The dispatcher first asks if the patient is conscious. If the answer is "no", the dispatcher asks if the patient is breathing normally. If the answer is "no", then the dispatcher asks if CPR is ongoing. If CPR is not ongoing, the dispatcher offers CPR instructions (Fig. 1). We limited our analysis to patients with confirmed out-of-hospital cardiac arrest treated by first and second tier EMS providers to ensure failure to initiate bystander CPR was inappropriate and not related to failure of the 9-1-1 dispatcher to identify non-arrest cases. We excluded cases that occurred in skilled nursing facilities given presumed differences in patients and callers to 9-1-1 in these settings that could not be adequately adjusted for in our analysis.

2.3. Data collection and definitions

As part of the DART study, each eligible case of cardiac arrest was reviewed and abstracted using a uniform abstraction form. Information was ascertained from review of the written dispatcher reports, the dispatch audio recording, the EMS reports, hospital records, and death certificates. Data included the Utstein data elements describing patient demographics, arrest circumstances, pre-hospital care, and hospital outcome. Callers were identified as limited English proficient through review of EMS dispatcher comments (e.g. "language barrier," "broken English,") in the text fields of the dispatcher report.[13]

Outcomes were determined blinded to assessment of limited English proficiency status. The primary outcome was provision of bystander CPR as witnessed by EMS first responders on arrival. Secondary outcomes included the time interval from receipt of 9-1-1 call to dispatcher recognition of cardiac arrest, the time interval of call receipt to initiation of dispatcher-assisted CPR in the subset who received this level of care, and survival to hospital discharge. Time intervals were determined from review of the taped recordings. The time of arrest recognition was based on the time when "no" answers were obtained or presumed by dispatchers for questions of whether the patient was conscious and breathing. The time of dispatcher-assisted CPR initiation was based on when the first resuscitation breath or chest compression was delivered among patients receiving this care.

2.4. Statistical analysis

Baseline patient, arrest circumstance, and pre-hospital care characteristics are reported with descriptive summary statistics. We used the Chi-squared test to compare the proportion of patients receiving bystander CPR and survival to hospital discharge between limited English proficient and English fluent callers. Because of the non-normal distribution of time intervals, we used the rank test to compare the median time intervals for dispatcher recognition of cardiac arrest and bystander initiation of dispatcher-assisted CPR according to English proficiency status. In approximately 15% of calls, time elements required to generate interval information used for the secondary outcomes were incomplete. Primary analyses were restricted to the cases with complete data. We conducted sensitivity analyses whereby we used the most relevant time point for missing or inconsistent cases. For example, when the time of dispatcher arrest recognition was missing, we substituted the time of initial dispatcher CPR instructions. We did not conduct multivariable analyses because of insufficient sample size. All statistical analyses were conducted with Stata/IC version 10.0 (StataCorp LP, College Station, TX).

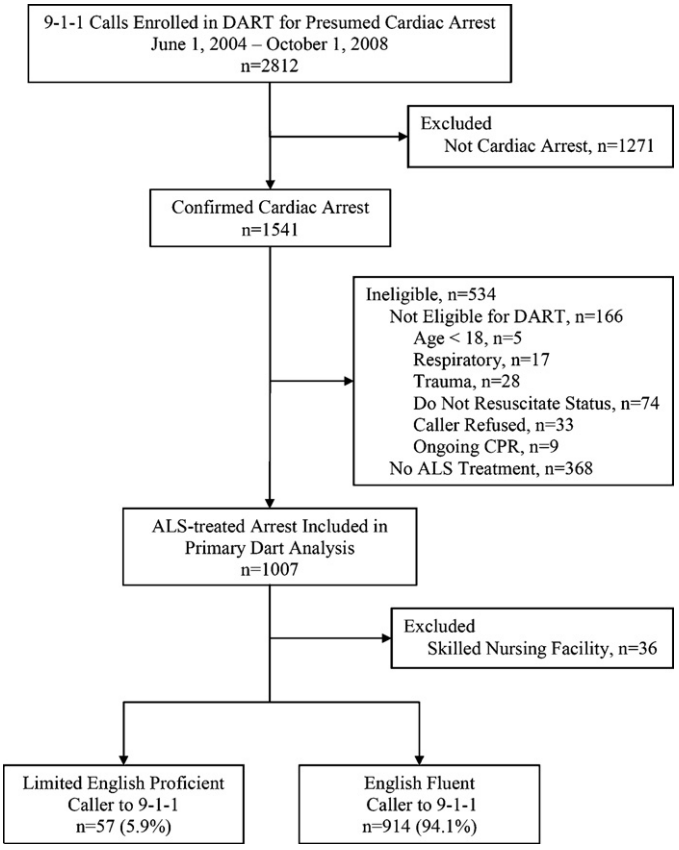

Fig. 2. Study cohort – DART, Dispatcher Assisted Resuscitation Trial; ALS, advanced life support.

3. Results

A total of 2812 presumed cardiac arrest cases were enrolled in the DART during the study period with 1007 confirmed as true out-of-hospital cardiac arrests and receiving advanced life support treatments from EMS (Fig. 2). We excluded 36 cases that occurred in skilled nursing facilities. Of the eligible 971 cases of cardiac arrest, 5.9% ($n = 57$) of 9-1-1 callers were identified as limited English proficient. Patient, arrest circumstance, and pre-hospital care characteristics were similar according to English fluency status (Table 1).

Table 1
Patient, arrest circumstance, and pre-hospital care characteristics.

Characteristic	Limited English proficient ($n = 57$)	English fluent ($n = 914$)
Age, mean (SD)	61.6 (16.4)	61.7 (16.1)
Men, *n* (%)	33 (57.9)	607 (66.4)
Location, *n* (%)		
Home	54 (96.4)	837 (91.6)
Work	0 (0.0)	13 (1.4)
Public	2 (3.6)	64 (7.0)
Witnessed arrest, *n* (%)*	28 (49.1)	456 (50.0)
BLS interval, min median (IQR)†	6 (4, 7)	5 (4, 7)
ALS interval, min median (IQR)†	11 (7, 13)	9 (7,11)
VT/VF initial rhythm	19 (33.3)	331 (36.2)
Compression only CPR instructions, *n* (%)	32 (56.1)	472 (51.6)

VT, ventricular tachycardia; VF, ventricular fibrillation.
No missing data on remaining variables.
* Maximum level of missing data <1%
† Maximum level of missing data <11%

Table 2
Receipt of bystander CPR and survival by English proficiency of caller to 9-1-1.

Outcome, no. (%)	Limited English proficient (n = 57)	English fluent (n = 914)	Odds-ratio (95% CI)	p-Value
Interval from 9-1-1 call to dispatcher arrest recognition, s				
Median (IQR)[*]	84 (49, 178)	50 (30, 82)	N/A	<0.001
Interval to CPR with telephone instructions, s				
Median (IQR)[†]	237 (164, 333)	163 (119, 217)	N/A	<0.001
Bystander CPR without dispatcher instructions[‡]	3 (5.4)	109 (12.0)	0.41 (0.08–1.31)	0.13
Any bystander CPR[‡]	36 (64.3)	702 (77.5)	0.52 (0.29–0.97)	0.02
Survival to admission[§]	18 (32.1)	352 (39.2)	0.73 (0.39–1.35)	0.29
Survival to discharge[a]	5 (8.8)	151 (16.5)	0.49 (0.15–1.24)	0.12

[a] No missing data.
[*] Missing 13.9% overall (n = 135), 19.3% (n = 11) among limited English proficient cases and 13.6% (n = 124) among English fluent cases.
[†] Missing 16.1% overall (n = 156), 17.5% (n = 10) among limited English proficient cases and 16.0% (n = 146) among English fluent cases.
[‡] Missing 0.9% overall (n = 9), 1.8% (n = 1) among limited English proficient cases and 0.9% (n = 8) among English fluent cases.
[§] Missing 1.9% overall (n = 18), 1.8% (n = 1) among limited English proficient cases and 1.9% (n = 17) among English fluent cases.

The primary outcome – provision of bystander CPR – was missing in 1.8% (n = 1), in limited English proficiency callers and 0.9% (n = 8) in English fluent callers (p for comparison = 0.5). Outcomes by English proficiency are summarized in Table 2. Comparing arrest events of limited English proficient 9-1-1 callers with English-fluent callers, a lower proportion of limited English proficient cardiac arrest cases received bystander CPR or survived to hospital discharge. Dispatchers took longer to recognize a need for CPR for limited English proficient 9-1-1 callers compared with English-fluent callers. Among callers attempting bystander CPR with telephone instructions, the interval from call receipt to initiation of CPR was longer for limited English proficient compared with English-fluent callers. The relationships and statistical significance were unchanged in sensitivity analyses evaluating these time intervals.

4. Discussion

In this prospective cohort of out-of-hospital cardiac arrest, cases with callers identified as limited English proficient were associated with lower provision of bystander CPR compared with English fluent callers. Furthermore, limited English proficient callers were associated with delays in dispatcher recognition of the arrest and need for CPR and a longer duration to implement dispatcher-assisted CPR in the subset who received this care.

We observed that dispatchers classified approximately 6% (57/1007) of suspected cardiac arrest callers as limited English proficient. Importantly the study cohort was drawn from 9-1-1 calls of presumed cardiac arrest based on a standard identification algorithm applied by the dispatcher for cases of suspected cardiac arrest. Limited English proficiency may also obscure the identification of the arrest circumstance prior to the arrival of EMS, an additional challenge associated with limited English proficiency that the current study cannot address. As a consequence, the results of this study may underestimate the prevalence and influence of limited English proficiency among callers to 9-1-1 for cardiac arrest. The investigation was drawn from a particular region of the United States with a specific ethnic profile. Other communities may have a different prevalence or profile of limited English proficiency so that the observed prevalence may not be generalizable. Indeed, the study community has a greater proportion of English fluent persons than the United States population.[8] Taken together, these considerations suggest that the current study may be a conservative estimate of the magnitude of the national challenge of dispatcher CPR instructions for limited English proficiency callers.

In the current study, limited English proficiency was a barrier to early identification and early CPR – key aspects in the "chain of survival" that are important for successful resuscitation of out-of-hospital cardiac arrest.[14] A number of techniques have been described to improve communication with limited English proficient individuals, including reducing use of jargon, using simple sentence structure, and using a translator.[15,16] The additional and important dimension that must be considered in cardiac arrest is the time urgency of the condition, which necessitates expedient as well as effective communication.

Attempts to simplify the English version of the message may improve communication with limited English proficiency callers, but the current approach to CPR instructions has been refined to maximize case capture for English fluent callers, so that impact on CPR provision among English fluent calls must be considered in any change to instructions. A process that modifies the non-English translation (as opposed to the English version) may achieve a more interpretable and culturally relevant message that may be more effective. This process however would seemingly require language-specific assessment; for example, whether changes in the Spanish version (translation) produced improvement among Spanish-speaking callers. This latter process depends on the ready availability of a translator. Dispatchers may be reluctant to use interpreters because of real or perceived delays.[13] Obstacles to effective use of translators, either in-house or via an external language line, need to be identified and addressed in an effort to limit the potential adverse consequences of the limited English proficiency interaction.

A complimentary approach to improve the dispatcher interface with limited English proficiency callers is to increase CPR training in limited English communities. Greater dissemination of CPR training in languages other than English may be useful in increasing the proportion of patients that receive bystander CPR in limited English proficient populations. Little is known about the availability of this type of training in most US communities. Multilingual training resources have been developed by certified training organizations, but little is known about the extent of use.

The current study has several limitations. As discussed, the study cohort was drawn from 9-1-1 calls of presumed cardiac arrest in a particular community; these circumstances have implications for the generalizability of the findings. The investigation was observational in nature with limited English proficiency determined from review of 9-1-1 dispatcher comments. There is potential for variation between dispatchers as to what constitutes a language barrier; however the resulting analytic misclassification would likely bias our findings toward the null. In addition, review of call recordings by study investigators is unlikely to provide a more reliable determination of limited English proficiency as no criteria have been defined for this purpose. Finally, dispatcher designation of a language barrier is clinically perhaps the most relevant definition of limited English proficiency given that strategies to improve recognition of cardiac arrest in limited English proficient communities

and telephone instruction in bystander CPR would likely be targeted at the dispatcher level. Our study lacked data on bilingual language capabilities of dispatchers and preferred first language of limited English proficient callers. Understanding these factors may serve useful in devising local solutions to providing dispatcher CPR instructions to limited English proficient populations. However, this information would not generalize to other communities as the distribution of first languages for limited English proficient communities may vary regionally. The study lacked sufficient sample size to conduct hierarchical multivariable analyses in order to adjust for the influence of dispatcher and covariates that might have confounded the relationship between limited English proficiency and the provision of bystander CPR. However, the distribution of patient, arrest circumstance, EMS response characteristics, and CPR instruction type were comparable between limited English proficient and English fluent cases. Additionally, a slightly higher proportion of limited English proficient callers received the simpler chest-compression only instructions which would tend to bias our results toward the null. We also had limited power to detect differences in survival related to English proficiency. The study had only 22% power with a two-sided alpha of 0.05 to detect a statistically significant survival difference in the current study. Yet the observed survival difference of 8% (9% vs. 17%) would be a substantial and important clinical difference. Information used to evaluate the secondary outcomes of time intervals to arrest recognition and start of CPR were incomplete in 15% of calls. We conducted sensitivity analyses that indicate the findings are likely robust even with this limitation.

5. Conclusion

In this prospective cohort investigation of dispatcher-identified cardiac arrest, limited English proficiency in callers to 9-1-1 was associated with less frequent provision of bystander CPR as well as delays in arrest recognition and implementation of telephone CPR instruction, underscoring the health challenges and potential health disparities for communities with limited English proficiency. Innovative approaches involving communication or training may help address this challenge. These efforts should draw from generalizable and generic improvements in technical and training processes as well as community-specific characteristics that are guided by local cultural influences or resources.

Conflict of interest statement

The authors have no commercial affiliation or consultancy that could be construed as a conflict of interest with respect to the submitted data. No disclosures were reported.

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