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Resuscitation. Author manuscript; available in PMC 2018 June 01.

Published in final edited form as:

Resuscitation. 2017 June ; 115: 11–16. doi:10.1016/j.resuscitation.2017.03.028.

Disparities in Telephone CPR Access and Timing During Out-of-Hospital Cardiac Arrest

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Abstract

Aim—Spanish-only speaking residents in the United States face barriers to receiving potentially life-saving 911 interventions such as Telephone -cardiopulmonary resuscitation (TCPR) instructions. Since 2015, 911 dispatchers have placed an increased emphasis on rapid identification of potential cardiac arrest. The purpose of this study was to describe the utilization and timing of the 911 system during suspected OHCA by Spanish-speaking callers in Metropolitan Phoenix, Arizona.

Methods—The dataset consisted of suspected OHCA from 911 centers from October 10, 2010 through December 31, 2013. Review of audio TCPR process data included whether the need for CPR was recognized by telecommunicators, whether CPR instructions were provided, and the time elements from call receipt to initiation of compressions.

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Author contributions. TN, BJB, and DWS conceived and designed the study. BJB and DWS obtained research funding. KARM, MP, TC, and WT collected and managed the data, including quality control. TN conducted analyzed the data. SMK and AE assisted with drafting of the manuscript, and all authors contributed substantially to its revision. TN takes responsibility for the paper as a whole.

Conflicts of interest Statement: Tomas Nuño, Karen A. Rogge-Miller, Micah Panczyk, Terry Mullins, Wayne Tormala, Antonio Estrada and Samuel M. Keim have no conflict of interests to declare. Drs Bentley J. Bobrow and Daniel W. Spaite reported university support from Medtronic Philanthropy involving community-based translation of resuscitation science. No other disclosures were reported.

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Results—A total of 3,398 calls were made to 911 for suspected OHCA where CPR was indicated. A total of 39 (1.2%) were determined to have a Spanish language barrier. This averages to 18 calls per year with a Spanish language barrier during the study period, compared with 286 OHCAs expected per year among this population. The average time until telecommunicators recognized CPR need was 87.4 seconds for the no language barrier group compared to 160.6 seconds for the Spanish-language barrier group ($p<0.001$).Time to CPR instructions started was significantly different between these groups (144.4 seconds vs 231.3 seconds, respectively) ($p<0.001$), as was time to first compression, (174.4 seconds vs. 290.9 seconds, respectively) ($p<0.001$).

Conclusions—Our study suggests that Hispanic callers under-utilize the 911 system, and when they do call 911, there are significant delays in initiating CPR.

Introduction

Bystander cardiopulmonary resuscitation (BCPR) is a key link in the chain of survival for out-of-hospital cardiac arrest (OHCA).[1] It has been shown to double or triple survival from OHCA.[2-5] While some population groups have dramatically improved survival, there remain large and unacceptable disparities in access to this life-saving care.[6] Race and ethnicity are associated with differences in OHCA and BCPR rates.[7, 8] People who live in neighborhoods that include primarily Hispanic, African American, or lower-income populations are two to three times more likely to have an OHCA.[9]

Studies have shown that Hispanic ethnicity of individuals with OHCA is associated with lower rates of BCPR compared to non-Hispanic white (NHW) individuals and that Hispanic individuals, regardless of the neighborhood where the OHCA occurs, are approximately 30 percent less likely than NHW individuals to receive BCPR.[7, 10, 11] A study of 4,821 OHCAs in Arizona found that BCPR rates and survival to hospital discharge were both significantly lower in Hispanic neighborhoods compared with non-Hispanic neighborhoods.[11] The interaction between race/ethnicity and BCPR is influenced by socioeconomic status (SES), with disparities most apparent when comparing BCPR rates in minority, low-income, and non-English-speaking neighborhoods to high-income, NHW, English-speaking neighborhoods.[12]

BCPR may be the most modifiable system variable to improve survival from OHCA. The ability to call 911 and receive immediate CPR instructions has been shown to increase both BCPR rates and survival.[13-15] Implementation of a guideline-based Telephone - cardiopulmonary resuscitation (TCPR) bundle of care has been shown to be associated with survival to hospital discharge and survival with favorable functional outcome.[16] However, barriers and inconsistencies in accessing 911 TCPR may be an important reason for the disparities in BCPR rates and survival between communities.[17] Since 2015, 911 911 dispatch systems have placed an increased emphasis on rapid identification of potential cardiac arrest, with immediate provision of CPR instructions to the caller (i.e., dispatch-guided CPR).[1, 18] A recent study conducted focus groups and key informant interviews and identified barriers to calling 911 for residents in primarily Hispanic neighborhoods in Denver, CO, such as distrust of law enforcement and language concerns.[19]

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Overall, although English proficiency is increasing among Latinos, one-third of the 55.4 million Hispanics in the United States (US) have limited English proficiency (LEP) and the number of Spanish-speaking residents in the US continues to grow.[20] In the Phoenix, Arizona metropolitan area, this equals approximately 440,000 residents. This demographic group faces barriers to accessing Emergency Medical Services (EMS) and receiving potentially life-saving 911 interventions such as TCPR instructions.[19]

Objectives

The purpose of this study was to describe the utilization of the 911 system during suspected OHCA by Spanish speaking callers compared to callers that had no language barrier and callers that had any other language barrier other than Spanish. We assessed if TCPR instructions were provided with the same frequency and quantified any delays in TCPR calls in Metropolitan Phoenix, Arizona.

Methods

Setting

The State of Arizona has approximately 6.8 million residents and is composed of 15 counties with demographics that vary across urban and rural areas.[21] Arizona's population demographics include 57% non-Hispanic White and 31% Hispanic populations, with the total Hispanic population at 2.1 million people.[21] Arizona has the sixth largest Hispanic population nationwide. Nationwide, over the past decade, there has been a large increase in the Hispanic population , from 35.3 million to 50.5 million, now representing 16% of the total US population.[22]

Data Collection

The Arizona Department of Health Services' Bureau of Emergency Medical Services & Trauma System and the University of Arizona have established the Saving Hearts in Arizona Registry and Education (SHARE) Program. SHARE promotes a comprehensive, standardized system of OHCA care across Arizona through data collection and quality-improvement programs encompassing all "links" in the "chain of survival" – bystander response, 911 TCPR instruction, EMS resuscitation, and in-hospital care. Since 2004, over 20,000 OHCAs have been entered into an Utstein-style database previously described and linked with hospital post-arrest care and outcome data.[3, 23-25]

OHCA has been designated as a public health problem in Arizona and because the objective of SHARE is to improve resuscitation quality and increase survival, the data collected were exempt from the Health Insurance Portability and Accountability Act (HIPPA). Permission to publish deidentified data was obtained from the Arizona Department of Health Services' Human Subjects Review Board and the University of Arizona Institutional Review Board.

Study Design

This was an observational cohort study using the SHARE registry database. The study population included all suspected cases of OHCA during the study period from October 10, 2010 through December 31, 2013. Cases were excluded if: (1) the arrest occurred at a long-

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term care facility; (2) the QI Reviewer documented that CPR was not indicated; (3)the lay rescuer was physically unable to perform CPR; (4) the caller not with patient); (5)CPR was already in progress; (6) the caller hung up,; (7)the audio recording was fragmented; or (8), the patient was obviously dead.

The QI Reviewer assessed whether a language barrier existed in the calls evaluated and documented that language. All telecommunicators spoke English. We then aggregated the language barriers into Spanish language vs. all other languages combined barriers, given that Spanish was the language with the highest frequency of barriers. There were no recordings where the telecommunicator and caller communicated in Spanish.

Investigators developed a 21-element, electronic web-based data collection tool to evaluate the telecommunicator-to-bystander interaction. This has been described in detail elsewhere.[16] Briefly, audio recordings of suspected OHCAs were collected from three regional 911 centers. Moreover, two of those centers serving the Metropolitan Phoenix area, accounted for over 97% of the calls in the dataset.

Incident information is automatically entered into the centers' medical computer-aided dispatch (CAD) systems for telecommunicators to assign units once the location of the event and its nature is determined. Telecommunicators assign designated codes identifying OHCAs to incidents where patients are recognized as not conscious and not breathing normally or not breathing at all.

Calls were analyzed by trained quality improvement evaluators using QuickTime and relevant data elements were entered into a secure, web-based MySQL data collection system and stored in encrypted form on password-protected Windows 2008 servers.

Vital definitions

The indication for performing CPR was defined as the bystander reporting that the victim was not conscious, was not breathing "normally", and CPR had not already begun. Not breathing normally was defined as the caller describing either complete absence of breathing, agonal breathing (gasping), or a rapid or slow respiratory rate. Non-normal breathing was also documented if call evaluators identified audible agonal breaths during the audio recording. Language barrier was defined as CPR was delayed or not given due to the lack of a common language between caller and telecommunicator. TCPR instructions were considered started if the telecommunicator provided any direction that detailed the delivery of either chest compressions and/or rescue breaths. Delay of CPR was defined by the QI reviewer as events such as difficulty getting patient to a hard surface, difficult access to the patient, and difficulty calming the caller. Performance of bystander TCPR was defined as any chest compressions delivered to the victim in response to TCPR instructions (i.e., ventilations without chest compressions were not counted as TCPR performed).

Outcome Measures

The call-evaluation process resulted in strong inter-rater agreement on six key performance metrics:[26] 1) Time interval from call receipt until telecommunicator recognized the need for TCPR; 2) time from call receipt until start of TCPR instructions; 3) time from call receipt

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until bystander performed first chest compression; 4) percent of calls where telecommunicator recognized the need for TCPR; 5) percent of calls where telecommunicator started TCPR instructions; and 6) percent of calls where bystanders started chest compressions.

Data Analysis

Proportions were calculated for categorical data and means and standard deviations for continuous data. For binary variables (coded 0= no; 1= yes), we present percentages and standard deviations. Statistical tests of association for categorical variables were assessed using the chi-square test and one-way analysis of variance (ANOVA) was utilized for continuous variables. Statistical significance was set a priori at $\alpha \leq 0.05$ (2-tailed). All statistical analyses were performed using Stata version 14 (StataCorp, College Station, Texas).

Results

During the study period, a total of 5,555 calls were made to 911 for suspected OHCA (Fig. 1). From these, 1,332 were excluded when the QI Reviewer documented that CPR was not indicated. Furthermore, 825 patients were excluded due to: barriers preventing CPR (physically unable to perform CPR, caller not with patient), CPR already in progress, caller hung up, call fragment recording obstructed review, or patient was obviously dead. This left 3,398 calls where CPR was indicated (study sample).

Analyses of the language barriers documented in the TCPR database are shown below (Table 1). There were a total of 54 calls (1.6%) where a language barrier was documented. Of those, 39 had a Spanish-language barrier and 15 had a different language that was the barrier, which were aggregated into a single group for analyses. The Spanish-language barriers averaged 18 calls per year during the study period.

The association between language barriers and TCPR process measures are shown in Table 2. Those that indicated a Spanish language barrier were significantly younger than those who did not indicate a language barrier or those that had a different language barrier (p=0.02). Overall, there was a strong relationship between language barrier and delay of CPR, with delayed CPR in the least number of cases among those where no language barrier was reported (p<0.001). Between the three groups, there was no significant difference between telecommunicator recognizing the need for CPR, telecommunicator beginning CPR instructions, and CPR chest compressions started. Of note, although telecommunicator recognized the need for CPR in 90%-100% of the entire study group, CPR chest compressions were started in 47%-59% of the entire study sample.

There was a strong significant difference in the timing to events variables between the three study groups. Time until telecommunicator recognized need for CPR was 87 seconds (SD=64) when no language barriers were reported, 161 seconds (SD=98) when there was a Spanish language barrier, and 131 seconds (SD=85) when there was any other language barrier (p<0.001). The mean time until telecommunicator began CPR instructions was 144 seconds (SD=74) when no language barrier was reported compared to 231 seconds

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(SD=103) when a Spanish language barrier was reported and 170 seconds (SD=63) when any other language barrier was reported ($p<0.001$). The mean time from start of call to initiation of first compression was 174 seconds (SD=88) when no language barrier was reported, 291 seconds (SD=144) when a Spanish language barrier was reported, and 174 seconds (SD=83) when any other language barrier was reported ($p<0.001$).

Discussion

BCPR is a critical link in the chain of survival for OHCA. The delivery of CPR instructions to callers by telecommunicators can have a significant impact on both CPR use and survival.[27, 28] However, its effectiveness declines rapidly with each minute after a patient collapses.[29]

OHCA survival rates have been shown to vary by as much as 500% between population groups.[6] Varying rates in BCPR provision is likely part of the large regional differences in OHCA survival.[14, 15, 30] Previous studies have shown that many communities with the highest survival rates have focused on implementing and measuring the TCPR intervention in their systems.[16, 31] Current American Heart Association (AHA) guidelines and the Institute of Medicine (IOM) recommend TCPR to improve CPR rates and OHCA survival, as emphasis has been increased about the rapid identification of potential cardiac arrest by telecommunicators, with immediate provision of CPR instructions to the caller.[1, 32] Properly trained 911 telecommunicators can profoundly improve BCPR rates by identifying cardiac arrest early in calls and directing bystanders to start CPR without delay through clear, standardized instructions.[33] However, there is significant potential to improve the TCPR process in many communities and the goal should be to have compressions started within 2 minutes of call receipt.[34, 35] One way to overcome language barriers proposed in several cities and counties throughout the US is to provide additional financial incentives and training for multilingual telecommunicators.[36, 37]

In our study, we observed three significant findings. First, language barriers pose an important obstacle to receiving life-saving TCPR instructions. The OHCA incidence among Hispanics of 65 per 100,000 per year translates to 286 OHCAs expected per year among the Hispanic LEP population in the Phoenix metropolitan area. We observed an enormous difference in 911 calls (18 observed vs. 286 expected) for CPR among Spanish speaking callers. Second, when Spanish-speaking callers do call 911, we observed a strong association between the language barrier and significant delays to telcommunicators recognizing the need for CPR and starting CPR instructions, with the delay longest among Spanish-speaking callers (231 seconds until telecommunicator began CPR instructions) compared to those where there was no language barrier (144 seconds until telecommunicator began CPR instructions). Third, there was a significant difference in time until 1st chest compression, with the delay longest among Spanish-speaking callers (291 seconds among Spanish-speaking callers and 174 seconds among callers where there was no language barrier). This difference of almost 2 minutes is critical when every minute delay in CPR results in much worse clinical outcomes.

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We believe this is the first utilization of a large registry database to report this finding in actual 911 calls. In general, Hispanics are often viewed as a homogenous group. One distinctive characteristic of Hispanics is their language use. Four out of ten Hispanics are reported to speak English less than very well, thus classified as “linguistically isolated”.[38] As the Hispanic population continues to grow and represent a larger percentage of the US population, Spanish use will continue to be used, especially among recent immigrants. CPR saves lives, but we are not getting this intervention out to all groups, leading to unacceptable disparities in care and outcomes.

Language barriers are widely known to influence patient OHCA outcomes.[8] Language barriers delay initiation of telecommunicator-assisted CPR.[39] They can be a source of frustration and anxiety for callers who are not fluent in English.[19] Six key barriers to calling 911 were identified among focus groups of Hispanics: distrust of law enforcement, immigration status, financial concerns, lack of recognition of cardiac arrest, violence, and language.[19] Among a Cambodian population, a lack of proficiency in English often causes witnesses of an OHCA to call family members or friends rather than calling 911.[40].

Our study has several limitations. The data includes all suspected OHCA. These could include events that were not actually OHCA, including seizure, etc. Another limitation is the challenge in defining language barrier, as there is a subjective component to the definition. Language barrier was coded as may be present when, but not limited to, the telecommunicator not understanding the caller’s language or lack of fluent English or the accent of the caller challenges the telecommunicator’s understanding. Another important limitation is our data is limited to language barrier documented and race/ethnicity designation was not available. However, previous studies have shown that using Spanish language as a proxy for ethnicity is feasible.[11]

Additional research is needed to determine how language barriers interact with socioeconomic variables such as family income, education, and health insurance status as well as patient, clinical, and health system determinants of OHCA survival. This can then help guide the design, implementation, and evaluation of CPR and public health interventions to increase BCR use and improve health outcomes among Spanish-speaking and Hispanic populations.

In conclusion, this study showed that there is a large disparity in the proportion of Spanish-speaking callers for OHCA compared to non-Spanish speaking callers and when they do call 911, there are significant delays in initiating CPR. This suggests implications for the Spanish-speaking Hispanic population. It may explain in part the unacceptably lower rates of BCPR and survival for Hispanic cardiac arrest victims. Further research is needed to address the possible causes and solutions to this finding.

Acknowledgments

We are grateful to the 911 dispatch centers, emergency medical services agencies whose collaborations made this project possible.

Funding and Support. This manuscript was funded, in part, by the Arizona Department of Health Services Bureau of Tobacco and Chronic Disease, the Medtronic Philanthropy Foundation through the HeartRescue Program, and

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the NIH/NHLBI (Award#: 5R25H126140). The content is solely the responsibility of the authors and does not necessarily reflect the official views of the National Institutes of Health.

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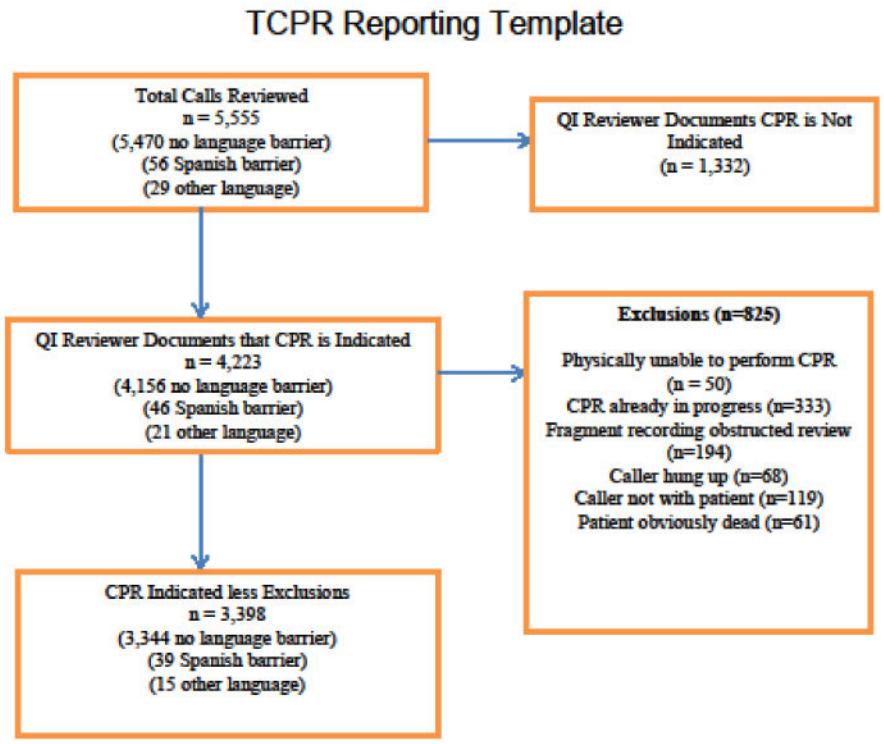

Fig. 1.
TCPR reporting template.

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Table 1

Language barriers of study sample

Variable	Number (%) (n=3,398)
Language Barrier	54 (1.6)
Language was Spanish	39 (1.2)
Language was other	15 (0. 44)
No language barrier	3,344 (98.4)

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Table 2
Association between language barriers and TCPR Process Measures

Variable	No language barrier indicated (n=3,344)	Spanish language barrier indicated (n=39)	All other languages combined barrier indicated (n=15)	*p*-value
Age of victim (mean years)	60.0 (SD=20.5)	52.9 (SD=22.9)	71.4 (SD=13.8)	0.02
Percent of telecommunicators that recognized need for CPR	89.7 (SD=30.4)	89.7 (SD=30.7)	100.0 (SD=0)	0.42
Percent of telecommunicators that began CPR instructions	56.6 (SD=49.6)	74.4 (SD=44.2)	53.3 (SD=51.6)	0.08
Percent of patients that had CPR compressions started	59.0 (SD=49.2)	48.7 (SD=50.6)	46.7 (SD=51.6)	0.27
Percent of patients that experienced delay of CPR	22.0 (SD=41.4)	48.7 (SD=50.6)	60.0 (SD=50.7)	<0.001
Time until telecommunicator recognized need for CPR (mean seconds)	87.4 (SD=63.8)	160.6 (SD=97.6)	130.5 (SD=84.6)	<0.001
Time until telecommunicator began CPR instructions (mean seconds)	144.4 (SD=73.6)	231.3 (SD=103.2)	170.4 (SD=62.7)	<0.001
Time until first compression (mean seconds)	174.4 (SD=88.0)	290.9 (SD=144.4)	174.0 (SD=83.4)	<0.001