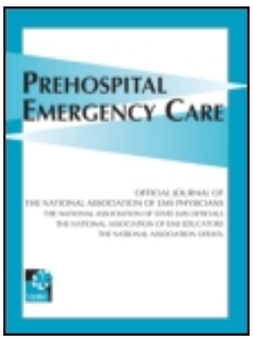

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Focus on Emergency Dispatch

The Effect of Language Barriers on Dispatching EMS Response

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Abstract

Objective. The objective of this study was to investigate the effect of language barriers during medical 9-1-1 calls, on the time to dispatch and level of medical aid (Basic or Advanced Life Support). **Methods.** All 9-1-1 medical calls to two large call centers during one week for each of the months of August, October, December 2010 and February 2011, were reviewed for a notation of language barrier (LB). Non-language barrier calls were identified from the same time period such that there were an equal proportion of LB and non-LB calls by dispatch code and dispatcher. A total of 272 language barrier calls were identified. The computer-assisted dispatch (CAD) reports for the LB and non-LB calls were abstracted by research staff using a standard form, including: Start time of call, time to dispatch of BLS, time to dispatch of ALS, dispatch code, interpretation service use, on-scene upgrade to ALS, and on-scene downgrade to BLS. 9-1-1 recordings were abstracted for LB calls only to obtain information about use of interpreter services. Difference between LB and English speakers in time to assignment of BLS and ALS was examined using linear mixed effects models with log time as the outcome; language barrier, call center and dispatch code as fixed effects and dispatcher as a random effect. **Results.** The effect of language barrier on time to BLS assignment was, on average, 33% longer ($p < 0.001$) and time to ALS assignment 43% longer ($P = 0.008$). A majority of the effect was due to the effect of interpreter use, which increased time to BLS by 82% and 125% for ALS, when compared to non-language barrier calls. Data from the 9-1-1 recordings showed an average of 49 seconds between connecting to the service operator and connecting to the language interpreter. Language barrier calls were more likely to be up- and downgraded, only statistically significantly so for on-scene downgrades. **Conclusion.** Language barriers increase time to dispatch and the accuracy of the level of aid dispatched during medical emergency calls. Decreasing the time to connecting to an actual interpreter when using an interpretation service could minimize existing delays. **Key words:** dispatch; literacy; underserved populations; EMS; English proficiency

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Background

A number of studies investigating stroke, cardiac arrest, and breathing problems indicate that the timeliness and accuracy of information gathered by 9-1-1 telecommunicators is critical in order to dispatch appropriate responses, to provide prearrival instructions (such as bystander CPR), and to provide the first responders with information about what they should expect to encounter on arrival.[1–3] This important information exchange between caller and 9-1-1 telecommunicator is complicated when the caller has limited English proficiency (LEP). In a survey of medical telecommunicators, 62% reported that they felt communication difficulties affect how quickly they are able to provide assistance more than once a week.[4] Very little is known about the effect of language barriers on medical dispatch.

As of 2007, over 55 million people in the United States speak a language other than English at home, representing an increase of 140% between 1980 and 2007.[5] Of this 55 million, over 13.5 million speak English "less than very well," as defined by the US Census Bureau. The American Community Survey reports

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that 24% of King County, Washington, residents, where this study is set, speak a language other than English at home and nearly half of them speak English "less than very well."[6] Populations with limited English proficiency have been found to have less access to care, as shown by a study in which uninsured LEP adults were 9.3% less likely than their English-speaking counterparts to have a usual source of care ($p = 0.046$).[7] They are less likely to receive recommended care,[8] and have longer hospital stays (pediatric LEP patients stayed 60% longer in the hospital, on average, than patients with English-proficient primary caregivers).[9] Health communications with these populations is impeded by language and cultural differences as well as by low health literacy.[10] Although relatively little is known about LEP populations in the prehospital setting, a recent study found that LEP populations are less likely to receive bystander CPR (64.3% [36/56] vs. 77.5% [702/906]; $p = 0.02$) and that the time to initiation of CPR with 9-1-1 telecommunicator assistance was longer (median 84 seconds vs. 50 seconds; $p < 0.001$).[11] Additionally, another study found that language barriers contribute to prehospital delay, with 2052 delays attributed to language barriers in the 18-month study period, for a rate of 3.3 delays per 1000 encounters.[12] Although over-the-phone interpretation services are available for use by 9-1-1 telecommunicators, a recent survey found that many barriers exist for accessing those services.[4] As linguistic diversity and the proportion of limited English speakers in the country grows,[5] the ability of prehospital care systems to respond effectively to these populations increases in importance.

The objective of the current study was to investigate the effect of language barriers during medical emergency 9-1-1 calls, including the effect of over-the-phone interpretation, on the time to dispatch of medical aid and the level of aid dispatched (basic or advanced life support) and to determine if this effect varied by dispatch code (chief complaint).

METHODS

Setting

This study includes calls received by two large call centers in King County, Washington, which together respond to approximately 97% of all 9-1-1 calls in the county, excluding the city of Seattle. Annually, these call centers handle approximately 616,000 calls of which 16% ($n = 96{,}000$) are for medical emergencies. For each 9-1-1 call received by the center, telecommunicators generate a computer-aided dispatch (CAD) report. The CAD report includes patient contact information, dispatch code (chief complaint), and type of assistance dispatched—basic life support (BLS) and advanced life support (ALS). The protocol used in this jurisdiction is "Criteria Based Dispatch, version 2010." The protocol specifies that BLS be dispatched immediately upon verification of address for all medical calls and that ALS be dispatched in life-threatening situations. It also specifies that telecommunicators should note pertinent information for the responders in an open text field, which includes information about a caller's language barrier and if an over-the-phone interpretation service was used.

Design

All medical calls to 9-1-1 during one week for each of the months of August, October, and December 2010 and February 2011, chosen to ensure seasonal variation, were reviewed for a notation of language barrier as defined by use of any of the following terms in the text field: "language barrier," "lang barr," "ESL," or "language line." Telecommunicators are trained to note a language barrier whenever they experience difficulty communicating with a caller due to the caller's lack of English fluency. The sample therefore includes callers who speak some English as well as callers who speak no English at all. Given that the focus of this study was the communication between 9-1-1 telecommunicators and callers that may or may not cause delay in dispatch, it was deemed appropriate to utilize the telecommunicator notation for identification of language-barrier calls. Non-language-barrier calls were also identified from the same time period and included in the sample such that there were an equal proportion of LEP and non-LEP calls by dispatch code and telecommunicator. A total of 9097 calls were reviewed of which 303 (3.3%) had language barrier noted in the text field. Thirty-one of these calls were excluded, leaving 272 language-barrier calls. Reasons for exclusion were call transferred to the nonemergency nurse line ($n = 8$), rare dispatch code (i.e., animal bite) or telecommunicator that could not be balanced in the sample ($n = 14$), no on-scene time reported ($n = 7$), and corrupted file ($n = 2$). A total of 272 calls that did not have a notation of language barrier were identified from the same time period that matched the language-barrier calls on telecommunicator and on primary complaint (operationalized as the assignment of the same dispatch code). The CAD reports were abstracted by research staff using a standard form and data were entered into a database. Variables abstracted included start time of call, time to dispatch of BLS, time to dispatch of ALS, dispatch code, interpretation service use, on-scene upgrade to ALS, on-scene downgrade to BLS, patient gender, and patient age. An accurate time to dispatch of BLS or ALS could not be determined for the first 165 calls recorded for one of the call centers due to variations in the way the call center recorded the start of the call in the CAD report; subsequent to discovery of this problem the start of calls for this center was

taken from the timestamp of the call recording; these timestamps were not available for the initial 165 calls, and these 165 calls and an additional 12 calls from the same dispatch center where the call timestamp was not available were not included in the analysis of time to dispatch, leaving 367 calls included in the analyses of time to dispatch (185 language-barrier calls, 182 non-language barrier calls).

In order to better understand the effect of interpretation service use on time delays, the audio recordings of all language barrier calls to 9-1-1 were downloaded, listened to, and abstracted. We confirmed that none of these calls had obvious technical problems (i.e., static or low volume) that would have caused communication challenges in addition to the perceived language barrier. Variables abstracted included in this analysis are interpretation service time variables (i.e., time to connect to the interpretation service operator, time to connect to the actual interpreter). Audio abstraction was completed by two research assistants. In order to establish intercoder reliability, a random sample of 31 recordings was identified and abstracted by both assistants. Time intervals were defined to be in agreement if the difference between coders was less than or equal to 3 seconds; kappa values were calculated on these agreements for the time intervals reported in this analysis were both equal to 1 (corresponding to 100% agreement).

Analysis

The difference between LEP and English speakers in time to assignment of basic life support and advanced life support was examined using linear mixed effects models with log time as the outcome; language barrier, call center, and dispatch code as fixed effects; and telecommunicator as a random effect. Differences in the effect of language barrier on time to first unit assignment (BLS) with respect to dispatch code (chief complaint) was examined using a linear mixed effects model with log time as the outcome; language barrier, call center, dispatch code, and interaction between language barrier and dispatch code as fixed effects; and telecommunicator as a random effect, for dispatch codes with at least 16 time observations. A logistic regression mixed effect model was used to examine the effects of language barrier on on-scene upgrades and on-scene downgrades. Language barrier and call center were included as fixed effects and telecommunicator as a random effect.

Results

Table 1 shows that the effect of language barrier on time to the first unit assigned (basic life support) was, on average, 33% longer ($p < 0.001$). Although this is a large percentage difference, because time to first unit assignment is generally low, the actual effect of language barrier in absolute terms is fairly small (median of 18 seconds, 1st quartile 13 seconds, 3rd quartile 28 seconds). A majority of the effect of language barrier was due to the effect of interpreter use. The use of the interpretation service increased time to BLS by 82% (median of 52 seconds, 1st quartile 37 seconds, 3rd quartile 79 seconds) when compared to non-language-barrier calls, while language-barrier calls that did not use the interpretation service were 17% longer to BLS dispatch than non-language-barrier calls (median increase of 10 seconds, 1st quartile 7 seconds, 3rd quartile 15 seconds).

Among those calls assigned advanced life support by the telecommunicator, language-barrier calls took 43% longer, on average, to assignment of ALS ($p = 0.008$). Similar to BLS, the majority of the effect is due to use of the interpretation service, which increased time to ALS (compared to non-language-barrier calls) by 125%. Language-barrier calls without the use of interpretation service were 35% longer than non-language-barrier calls. Unlike for BLS assignment, the absolute effect of interpretation service use of time to ALS assignment for longer calls is substantial; at the 3rd quartile of time to ALS assignment, the time increases from 138 seconds for non-language-barrier calls to 311 seconds for calls that use the interpretation

TABLE 1. Effect of language barrier and interpreter use on time to assignment of BLS and ALS

					Absolute effect[a]	
	n	Effect	95% CI	*p* value	1st quartile	Median	3rd quartile
Time to assignment of basic life support (BLS)							
Effect of language barrier	367	1.33	1.19–1.50	<0.001	13	18	28
Effect of use of interpreter services	367	1.94	1.62	<0.001	37	52	79
Effect of language barrier minus use of interpreter services	367	1.17	1.04–1.33	0.011	7	10	15
Time to assignment of advanced life support (ALS)[b]							
Effect of language barrier	86	1.43	1.11–1.84	0.008	29	40	59
Effect of use of interpreter services	86	2.25	1.20–4.24	0.007	85	118	173
Effect of language barrier minus use of interpreter services	86	1.35	1.04–1.75	0.028	24	33	48

[a] The absolute effect represents the number of additional seconds required on time to assignment of BLS and ALS. The median time for non-language-barrier calls is 55 seconds to BLS assignment and 94 seconds to ALS assignment.
[b] Among the 86 calls assigned ALS by the call receiver.

TABLE 2. Time to connect to interpretation service and to actual interpreter

Connected to OPI $N = 79$ (29%)	Mean (sec)	Median (sec)	Standard deviation (95% CI)
Time to connect to interpretation service	110	92	80.11 (18–390)
Time to connect to interpreter	158	144	93.4 (36–435)
Difference between connecting and talking to interpreter	49	45	38.9 (12–319)

Data for this table were abstracted from 9-1-1 recordings.

TABLE 3. Effect of language barrier by dispatch code (for dispatch codes with at least 16 observations)

Dispatch code	Chief complaint	*n*	Effect	95% CI	*p* value
1	Abdominal/back pain	50	1.343	0.988–1.826	0.061
4	Bleeding nontrauma	16	1.091	0.634–1.876	0.754
5	Breathing difficulty	16	1.605	0.933–2.762	0.088
7	Chest pain/heart	31	1.782	1.207–2.633	0.004
16	Seizures	18	0.767	0.46–1.279	0.31
17	Sick unknown/other	48	1.279	0.935–1.749	0.125
19	Unconscious/syncope	20	0.976	0.601–1.586	0.921
21	Assault/trauma	16	1.129	0.656– 1.941	0.663
24	Falls/accidents/pain	74	1.288	1.001–1.657	0.05

service—a difference of 173 seconds (median increase of 118 seconds, 1st quartile 85 seconds).

Table 2 shows that when connecting to the interpretation service, there is an average of 49 seconds between connecting to the service operator and connecting to the actual language interpreter. Table 3 shows that the effect of language barrier was observed to differ by dispatch code ($p = 0.046$). The effect of language barrier on time to BLS assignment for the chest pain/heart and falls/accidents/pain dispatch codes was observed to be statistically significant. Due to the smaller number of calls with ALS assignment, the differences in the effect of language barrier between dispatch codes was not examined. As shown in Table 4, language-barrier calls were more likely to be upgraded and more likely to be downgraded on-scene, although the effect was only statistically significant for on-scene downgrades.

TABLE 4. Effect of language barrier on on-scene upgrades, downgrades, or any change

	N	Odds ratio[a]	95% CI	*p* value
On-scene upgrade	415	2.11	0.94–4.71	0.069
On-scene downgrade	129	3.66	1.24–10.81	0.019
On-scene change (upgrade or downgrade)	544	2.36	1.29–4.33	0.006

[a]Odds ratio for on-scene upgrades were calculated using the 415 calls not assigned ALS by the call receiver, odds ratio for on-scene downgrades were calculated using the 129 calls that were assigned ALS by the call receiver, and odds ratios for on-scene change were calculated using all calls.

DISCUSSION

The results found that the majority of time delay associated with language-barrier calls can be attributed to the use of interpretation services. Despite the communication challenges inherent in calls with limited English speakers, 9-1-1 telecommunicators were able to confirm the address and send BLS with only a slight delay (median 10 seconds) when the interpretation service was not used. Even when connecting to the interpretation service, the absolute effect was under one minute at the median for BLS dispatch. The King County protocol of rapid dispatch, in which BLS is sent to all medical emergencies immediately upon confirmation of the address, may explain the small differences in time to BLS when comparing English-speaking callers to callers with a language barrier. In 45% of the 79 language barrier calls that ultimately did connect to the interpretation service, the first unit was dispatched prior to connection to the interpretation service, indicating the telecommunicators were able to gather address information prior to connection to the interpreter. This means that only 10% of all calls labeled language barrier by telecommunicators required interpretation to gather basic address information. This lack of substantial delay to BLS dispatch with no interpreter points to a possible opportunity for community education regarding the importance of knowing your address in English. This may decrease the percentage of people who need interpretation for that basic address information exchange, further minimizing delays to BLS dispatch. The delay to ALS dispatch was larger than for BLS with a median of a 33-second delay for language-barrier calls that did not use interpretation services. However, again the substantial effect (125%) in dispatching ALS was for those calls using OPI services, with the median delay at nearly 2 minutes. Although this is a substantial effect, it may not have significant clinical implications for many medical emergencies, with the possible exception of cardiac arrest and stroke.

Clearly, when using an interpretation service, the telecommunicator must trade off the potential for clarity and accuracy in the communication with the additional time it takes to access and allow for interpretation. In our sample, 29% (79/272 total LB calls) of the calls marked as language-barrier callers were connected to the interpretation service. In that sample of 79 calls, the average time from connection to the service and connection to the actual interpreter was 49 seconds. While part of that time is attributable to identifying the correct language needed, a large portion of it is spent in an exchange of call center and operator identification numbers. This may be an area of the system that could benefit from automation through technology. Streamlining this process may minimize

the median absolute interpretation effect of a 52-second delay to BLS dispatch seen in Table 1, bringing calls using the interpretation service more in line with the shorter delay seen for all language-barrier calls.

The results show that there was some variation in the delay caused by language barrier in time to BLS dispatch between dispatch codes, with the delay being largest for chest pain/heart complaints and smallest for seizures. This is an interesting finding that should be explored further in future research to determine if there are specific communication challenges or system protocols that could minimize the delay.

Once on the scene of an emergency, BLS providers may upgrade a call by requesting that advanced life support be dispatched or they may downgrade a call by notifying dispatch that advanced life support is not needed. Although the effect of language barrier on on-scene downgrades was larger than the effect of language barrier on on-scene upgrades as shown in Table 4, there were many fewer ALS calls in the sample that could be downgraded than there were BLS calls that could be upgraded. In a separate analysis of on-scene change (upgrades or downgrades), with language barrier, dispatch code, and call center included as fixed effects and telecommunicator as a random effect and on-scene change as outcome, language barrier was observed to be associated with an increased likelihood of on-scene change. The effect of language barriers on the need for on-scene change leading to ALS upgrades and downgrades found in this study is indicative of the communication challenges faced by the telecommunicators as they try to determine the appropriate level of response. That only the on-scene downgrades are statistically significant in this sample shows that telecommunicators in King County were taking the more conservative action of over sending ALS to language-barrier calls.

The small absolute time effect to BLS and the inclination to overdispatch ALS, indicate that the system in King County seems to serve callers with language barriers well. For the majority of calls, the small BLS delays found would likely not have an effect on clinical outcomes. However, the larger effect to ALS dispatch is of some concern, especially when considering chief complaints, such as chest pain, where time is more closely tied to clinical outcomes. The communication challenges that this research demonstrated may have more serious implications for those systems that do not have a rapid dispatch protocol. In systems requiring more information from callers prior to dispatching any help, language-barrier calls may have much more significant delays and subsequent clinical consequences.

Limitations

One limitation in this study is that measuring the concept of language barrier is difficult and was operationalized to include any call in which the telecommunicator noted a language barrier. It is possible that some operators never or rarely make that notation, leaving some language-barrier callers out of our sample. Alternatively, it is possible that some telecommunicators note even a slight accent as language barrier, thus overrepresenting language-barrier calls in the sample. If this had occurred, however, it would have the effect of reducing differences between language-barrier and non-language-barrier calls, which would be a conservative error that would not weaken the findings. Additionally, given our interest in delays caused by the communication challenges the telecommunicators themselves experience when handling these calls, we felt that the telecommunicator's notation of language barrier would indicate their belief that they were dealing with a communication challenge.

A second limitation was that this study was conducted in one county, in one state. The results cannot be generalized to jurisdictions that do not operate with a similar system of rapid dispatch protocols. However, this focused look did give us the ability to assess language-barrier effects in this system, which may now stand as a point of comparison for future work.

Conclusion

Language barriers are found to have an effect on time to dispatch and the accuracy of the level of aid dispatched during medical emergency 9-1-1 calls. However, the absolute effects were generally small and the conservative dispatch of ALS indicated that language-barrier callers to 9-1-1 in King County are generally being well served by the system. Efforts to decrease the time to connecting to an actual interpreter when using an interpretation service and efforts to conduct community education on the importance of knowing your address in English could minimize existing delays.

For 9-1-1 systems without rapid dispatch of BLS, the delay associated with collecting more detailed information from callers before sending any response may cause much greater delays than those seen in this sample. Further research should be conducted in a wider variety of jurisdictions to determine if system structure is a factor in delay in dispatch to callers with a language barrier.

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