Crisis in a Foreign Language: Emergency Services and Limited English Populations

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ABSTRACT

Social media are increasingly used by emergency responders as part of the communication infrastructure during crisis. As such, it is important to understand how these new technologies offer opportunities and barriers to information access for population affected during crisis events. In particular, this project explores the extent to which Twitter is used to provide emergency-related information to vulnerable populations both during routine and crisis contexts. We look longitudinally, across four years, at the online information and communication behaviors of official emergency responders in the United States. Our results demonstrate a notable lack of cross-language crisis communication on social media. We discuss the practical implications of these results, and offer directions for future work and improvement of practices.

Keywords

Limited English proficiency populations, policy, social media, social practices

INTRODUCTION

Imagine you live in San Diego county, California; the date is October 24, 2007. You are one of the roughly 500,000 people who are under mandatory evacuation orders during what would become one of the worst wildfire seasons in California history (Reza, 2007). Amidst the chaos, fear and distress of this crisis setting, you need to gather relevant information you can put to use quickly, in order to protect yourself and your home. You might turn to family, friends, neighbors, and officials for help in decision making. You might use new technologies such as mobile phones or social media. Now, imagine trying to do this *without speaking English*.

Navigating crises and making sense of uncertain information ecosystems is difficult for anyone, but for some populations the challenges are enhanced by a lack of understandable information. Americans with limited English proficiency face many information gathering barriers including limited access, interpretability, and cultural relevancy. In the case of the 2007 San Diego fires, these barriers meant that the county's 30% Spanish speaking population was not adequately prepared, had trouble accessing and taking action on crucial emergency information (ACLU San Diego, 2007; Núñez-Alvarez, Martínez, Ramos and Gastelum, 2007). The United States is now home to more than 60 million individuals who speak a language other than English, of which more than 25 million report *limited English proficiency* (LEP.gov, accessed 2016).

Today, disaster communication between emergency management services and affected publics are increasingly taking place on social media platforms such as Facebook, Twitter, and via SMS (Hiltz, Kushma and Plotnick, 2014; Hughes, Denis, Palen and Anderson, 2014). The rapidity, reach, and flexibility of these technologies has boosted their viability for delivering information to vulnerable populations during times of crisis. Social media in particular have been incorporated into crisis communication infrastructures (Hughes and Palen, 2009; Palen, Vieweg, Liu and Hughes, 2007), yet research that explores the opportunities and barriers these new technologies afford to vulnerable populations during disasters is still limited. This study offers an initial investigation of multi-lingual social media practices of US emergency management-related organizations and officials.

BACKGROUND

Examining the role social media plays in crisis management is a growing area of research in disciplines such as human computer interaction and policy studies (Hansen, Bertot and Jaeger, 2011; Hiltz et al., 2014; Hughes et al., 2009). Over the past decade tools like Facebook and Twitter have been enthusiastically adopted by a wide range of government agencies, (US GSA, 2016; Shpayher, 2014). Emergency service providers can search for, disseminate and discuss information during times of crisis (Comunello, Mulargia, Polidoro, Casarotti and Lauciani, 2015; Hughes and Palen, 2012). Much of the research in this area has tended to focus on the social media behaviors of the general public, and somewhat less on how official government entities engage with online platforms (Sutton et al., 2015). In HCI-related fields, studies of social media use during disasters have focused on real-time application such as use in coordinating response efforts and increasing situational awareness (Hiltz et al., 2014; Hughes et al., 2014). Researchers have also investigated how individuals engage with crisis-related content, for example through collective sensemaking processes and rumoring behavior (Zeng, Starbird, and Spiro, 2016). However, despite the contribution of these pioneering studies, many open questions remain. This project focuses on non-English social media practices of crisis management agencies in order to begin exploring the relationship between vulnerable populations and government information provisioning. This exploratory study asks how closely the Twitter communications made by US government entities involved in emergency management work match the language characteristics of their assigned populations. The findings presented in this paper are based on an analysis of four years of Twitter communication by emergency responders, addressing the question of whether or not there was information in languages other than English present in the messages shared by these entities. Further, we assess the extent to which current information and communication practices are aligned with characteristics of constituencies.

Limited English Proficient (LEP): People and Policies

In the United States *Limited English Proficient* are, "individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English" (LEP.gov, accessed 2016). Recent figures report that 8% of the total U.S. population identifies as LEP (Pandya, McHugh and Batalova, 2011; U.S. Census Bureau, 2015; Zong and Batalova, 2015). LEP populations are generally concentrated in the Southwest and Northeast with six states holding approximately two-thirds of the total US LEP population: California, Texas, New York, Florida, Illinois, and New Jersey (Zong and Batalova, 2015).

According to recent reports by the Pew Research Center and the Brookings Institution (Pew, 2013, 2015; Wilson 2014) technology adoption, especially smartphones, is already high and growing in multi and limited English populations in America. Additionally, due to overall cost reductions, improved technology, and increasing entry to the labor force have improved economic outcomes for LEP people (Wilson, 2014).

Spanish ranks as the number one non-English language spoken in the United States, with over 37 million speakers, 44% identifying as LEP. The US Vietnamese population, on the other hand, ranks fourth with just about 1.4 million speakers, 60% of whom identify as LEP (MPI, 2015). This could imply that a focus on providing Spanish language information could be less critical than providing Vietnamese, as the possibility of access within the community to bilingual members is higher in the Spanish speaking community. The Brookings Institute found that 82% of LEP adults live in urban areas, 60% have a high school diploma including 15% have college degrees (Wilson, 2014).

As a result of practices which failed to ensure LEP individuals civil rights President William Clinton, in 2000, issued Executive Order 13166: "Improving Access to Services for Persons with Limited English Proficiency" (U.S. GSA, 2000). The purpose of this order was twofold:

1. to identify LEP individuals under existing civil rights requirements which prohibit discrimination Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d)

2. to require agencies which *receive federal financial assistance*, to develop and implement LEP management plans, ensuring LEP individuals meaningful access to information and services (DOJ, 2002; U.S. GSA, 2000). Management plans vary considerably in structure and efficacy (LEP.gov, accessed 2016).

DATA & METHODS

Twitter is a free, micro-blogging service intended to support a broad range of social interaction such as one-to-one style conversational communication, and one-to-many broadcast type announcements. Currently the Twitter interface is available in over 49 different languages (Twitter Translation Center, accessed 2016), across a variety of mobile and desktop platforms, with over 320 million monthly active users (Twitter, accessed 2016). Twitter has rapidly become a heavily used tool in crisis settings for disseminating information by both official emergency responders and ordinary citizens (Kwak, Lee, Park and Moon, 2010). Depending on context we will use *accounts,* or *agencies* to refer to Twitter account holders, and *statuses* to refer to Twitter messages.

The data we used for this study was compiled and curated by the Hazards, Emergency Response, and Online Informal Communication (HEROIC) Project, an NSF-funded effort between the University of Colorado and University of California-Irvine. HEROIC researchers used a systematic enumeration process to identify Twitter accounts associated with US Federal and state government entities who are part of the alert and warning process for all types of hazards and threats (HEROIC, 2016; Reeder, McCormick and Spiro, 2014). The dataset spans several years and includes profile information, tweet statuses, and meta-data on these accounts. For this study we use data from the five year period, 2010 – 2014 (Table 1).

Collection Window:	Total Number of Unique Twitter Accounts:	Total number of Unique Twitter Statuses:
2010 – 2014	212	544,598

Table 1. Summary of data used for this analysis

Within our data, we observed 212 unique Twitter accounts, each representing a US state or federal agency. Each of these agencies is *concerned* with addressing a federally defined set of needs for the populations who within their *geographic mandate*. For example, the Illinois Department of Public Health is concerned with health related issues such as stopping the spread of contagious disease and encouraging preventative care in the state of Illinois. Using this framework we identified the official geographic reach of each account and classified each account into one of three geographic levels: *national*, *regional*, and *state* (Table 2).

- National accounts are intended for the US as a whole, such as those of the President and Secretary of State;
- Regional accounts serve composite areas composed from a subset of US states and territories. In our data slice this includes ten US Federal and Emergency Management (FEMA) region accounts and two US Coast Guard (USCG) regional accounts, 'Heartland' and 'Pacific NW'.
- State level accounts include state-wide accounts such as governors offices and hyper local accounts such as city police and fire services.

Geographic Level:	Total Number of Unique Twitter Accounts:	Total number of Unique Twitter Statuses:
National	25	95,421
Regional	12	53,258
State	174	395,919

Table 2. Total Number of Accounts by Geographic Level

Linking accounts to geographic areas enabled us to also identify the populations each account is meant to serve. For each account we assigned population numbers for the total population and the total LEP population. All

population numbers used in this study are pulled from the US Census Bureau, American Communities Survey and the Migration Policy Institute.

Finally, we assign one more classification to each account which we called: *concern.* Concern is used here to indicate the area of engagement each agency is involved in with respect to the population. We assessed each agencies area of concern in two ways: by evaluating themes from each agencies guiding mission and by identifying which of the 17 divisions of the US executive branch the agency either falls within or would most likely fall within, in the case of independent agencies. Out of this process we established four thematic areas: *Public Security & Law, Elected Officials & Money, Health & Community,* and *Earth & the Environment.*

This method allowed for a flexible and realistic assignment of accounts to begin exploring content themes. For example, three distinct US Departments are concerned with issues of Public Security & Law; Defense, Justice, and Homeland Security. FEMA is an agency within the Department of Homeland Security. Thus it is reasonable to argue that FEMA's emergency management concerns are influenced by themes of public security and law.

We want to be able to assess the primary language of each messages posted by these emergency Twitter accounts. Currently there is no consensus on which language identification tool yields the best results for use with Twitter data. (Bergsma, McNamee, Bagdouri, Fink and Wilson, 2012; Goldszmidt, Najork and Paparizos, 2013; Lui and Baldwin, 2012, Majlis, 2012). We chose to use the Compact Language Detection (CLD2) kit, running as a package in the R statistical computing language. CLD2 uses a naive Bayes classifier and can work on stand-alone text (Bergsma, et al., 2012; McCandless, 2010). Liu et al. found that CLD2 was the, "single best performing system" in their evaluation of various language identifiers applied to a Twitter corpus (Lui and Baldwin, 2014). We used CLD2 to sort English from non-English statuses rather than focusing on any one non-English language. In comparisons between CLD2 and a human coder coding a sample set of 1,998 statuses CLD2 chose incorrectly only 12 times. Thus we determined it to be a reliable tool for identifying status language (Figure 1).

Status Text	Detected Lan..	Is Reliable	Candidate Langu..	Candidate L..	Candidate Lang..
fixing the unbroken	DUTCH	False	DUTCH	ENGLISH	Unknown
gracias por su interes aqui se encuentra la pagina de empleo para	SPANISH	True	SPANISH	Unknown	Unknown
mndot has closed hwy 25 south of watertown so crews can build up a levee	ENGLISH	True	ENGLISH	Unknown	Unknown
ts rainfall estimates	MALTESE	False	MALTESE	ICELANDIC	Unknown

Figure 1. Illustrative example of CLD2 results. The top line CLD2 miss-detected the language but flagged it's detection as unreliable and the second line is accurate and reliable. Thus we consider the top two lines to be correctly identified. The third line is not accurate until the secondary language candidate and the final example is wildly off. Thus we consider those to be inaccurate.

We acknowledge there are many considerations federal and state agencies must take into account when designing information access plans, and population numbers are but one. For this exploratory study we chose to move from an implied warrant of equity, meaning that what could be considered as adequately meeting the needs of the LEP population would be multi-language tweeting at a rate proportional to the LEP population. We determine what the expected non-English statuses would be if the agency followed this benchmark, i.e. the proportion of non-English statuses matches the proportion of LEP in the area.

$$\textit{Expected Non-English Statuses} = (\textit{Total LEP Population}/\textit{Total Population}) * \textit{Total Statuses}$$

Limitations

We chose to remove data from Puerto Rico because their official language is Spanish and inclusion caused skew problems. This eliminated one state level account, in the Elected Officials & Money theme, and 8,319 statuses from our data slice. We included Washington D.C. in the state level and data from Nevada and Pennsylvania were not present in the original dataset and so are not included in our slice. The trends we observed at all three geographic levels were generally very similar. Since the work of culturally competent design and engagement with vulnerable populations is by necessity intimate work we chose to focus on the state level.

FINDINGS

We approached this analysis with attitudes of curiosity and an understanding that what we might find could be uncomfortable for emergency service providers. We suspected differences existed between the English and non-English practices of the agencies in our dataset but the actual results turned out to be even more surprising than we anticipated. The findings showed not only more substantial gaps then we expected between English and non-English statuses (Table 3), but also that these gaps remained fairly consistent across a variety of measures including time.

Total number of Unique Twitter Statuses:	544,598
Observed Number of English Statuses:	537,707
Observed Number of non-English Statuses:	6,891

Table 3. Language summary, all data 2010 - 2014

Expected vs. Observed

To explore the significance of this gap and we started with the assumption that tweeting at a rate proportionate to the LEP population could arguably be considered adequate for meeting that populations needs. This is not a necessary assumption for similar English language practices because, as the dominant language, information in English is readily available in culturally relevant and easily accessible ways. Marginalized populations often do not have those access privileges thus a warrant of equity is a justified assumption.

US State	LEP % of total state population	Total Statuses	Expected non-English Statuses	Observed non-English Statuses
California	19.7%	11,379	2,246	103
Texas	14.4%	8,321	1,201	208
New York	13.5%	9,908	1,334	85
New Jersey	12.6%	4,183	525	35
Hawaii	12.0%	9,593	1,155	46
Florida	11.9%	2,801	332	26
Arizona	9.8%	12,392	1,213	60
Illinois	9.6%	301	29	37
New Mexico	9.6%	4,584	440	49
Rhode Island	9.0%	8,423	755	38
Massachusetts	8.9%	18,418	1,633	81
Connecticut	8.4%	8,561	718	101
Washington	8.0%	5,453	435	81
Colorado	6.8%	12,601	859	141
Maryland	6.4%	9,609	612	162
Oregon	6.3%	3,178	201	26
Georgia	5.8%	13,942	804	139
Alaska	5.7%	4,243	240	37
Virginia	5.6%	3,710	210	63
Utah	5.3%	5,966	319	20
North Carolina	4.8%	8,057	390	112
Delaware	4.8%	17,382	826	204
Nebraska	4.7%	3,321	155	25
Kansas	4.6%	16,624	768	440
Minnesota	4.3%	10,770	461	93
District of Columbia	4.1%	41,296	1,714	795
Oklahoma	3.9%	2,945	114	11
Idaho	3.9%	2,601	101	18

Wisconsin	3.3%	6,595	217	56
Arkansas	3.3%	2,185	72	13
Michigan	3.2%	11,820	377	37
Indiana	3.2%	5,488	177	18
South Carolina	3.0%	2,543	77	113
Tennessee	2.9%	3,612	103	41
Iowa	2.9%	5,929	175	66
Louisiana	2.8%	4,809	136	270
Alabama	2.4%	11,182	274	101
New Hampshire	2.4%	987	24	2
Ohio	2.3%	7,294	170	192
Missouri	2.3%	5,637	131	12
Kentucky	2.1%	26,644	562	113
South Dakota	2.1%	1,797	38	9
Wyoming	1.9%	2,973	57	23
Mississippi	1.7%	2,951	50	30
Maine	1.7%	17,578	299	179
Vermont	1.6%	5,917	93	26
North Dakota	1.4%	5,769	80	184
Montana	0.9%	606	5	20
West Virginia	0.8%	3,041	25	118

Table 4. Expected and observed non-English statuses by US state, sorted by LEP population percentage of total state population. Population data: Migration Policy Institute tabulations from the US Census Bureau's pooled 2009-2011 American Community Survey and 2007-2011 ACS Table B16001 "Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over."

Table 4 shows both expected and actual tweeting behavior by language for each state. The state of California has an LEP population of 19.7%, almost 7 million people. Based on that population number we would have expected to see 2,246 non-English statuses over the 2010-2014 collection period if the agencies were tweeting at a rate proportionate to the population. However, we found only 103 non-English statuses for the entire time period. The data also suggests that a significant LEP population may not be a strong indicator increased non-English tweeting practices. Again, California has the highest percent LEP, far above the national average, but does not even rank in the top five for observed non-English statuses. Washington D.C. ranks number one in observed non-English statuses, still only 46% of what we might expect given their 4.1% LEP population.

As noted earlier regional and national level findings show similar results but FEMA's Region II account is worth noting. This region includes Puerto Rico and though this account was responsible for almost 31% of the non-English statuses for all 12 regional accounts that still only amounts to 291 total observed non-English statuses out of 4,426. This opens a door for future questions considering the adequacy of support provided to US territories and possessions whose official languages are not English.

Even if we reject equity as a reasonable base for expected service provision the clear numeric chasm between observed practice and the millions of LEP people makes a solid case for continued investigation.

Time

In order to discover possible temporal patterns we graphed the quantity of tweets produced over various time measures. Ultimately we observed (Figure 2) that graphing by month for each of our categories provided the best visualization of year-to-year variations in tweeting behaviors, despite some time windows where data was lost or not collected. The tweeting pattern over time for non-English statuses remains consistent. We saw that neither spikes in English statuses nor focusing in on crisis events known to have taken place in high LEP population areas, such as the example we introduced this research with, seemed to impact the non-English patterns. Non-English statuses remained markedly flat through the years despite increasing use of and support for social media by government agencies; and the growing LEP population.

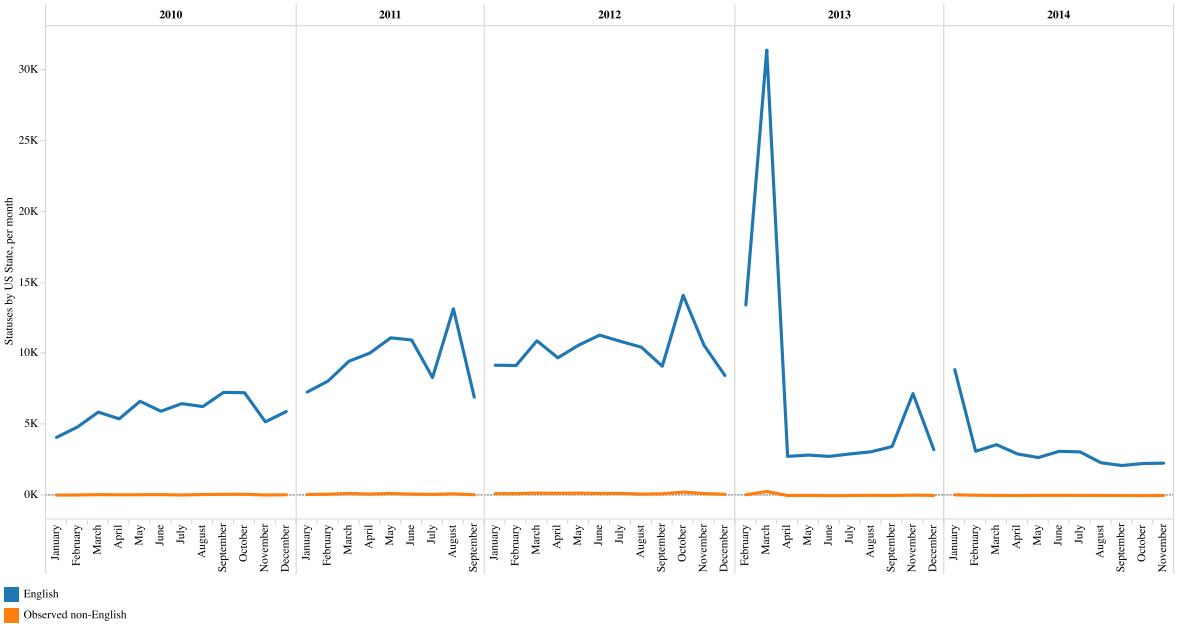

Figure 2. Count of observed English and non-English statuses over the five year period. Note the relative lack of change of non-English compared to English.

Concern

Addressing the information needs of any person is not generally met by simply increasing the volume, an issue we attend to further in our discussion section. Content may be as important as quantity and our thematic coding strategy lays foundations for further content analysis. The initial results show that agencies guided by concerns in the areas of *Public Security & Law* amount for almost 50% of all accounts and 75% of the observed non-English statuses (Table 5). Exploring these findings further may have implications for enacting positive social change in many areas. Some examples include: reducing information gatekeeping (Shiu-Thornton, et al., 2007), increasing cultural sensitivity (Sakpal, 2012), and design effective outreach (Burke, Bethel and Brit, 2012).

Concern:	Total Number of Unique Twitter Accounts by Concern:	Total number of Unique Twitter Statuses:	Expected Number of non-English Statuses:	Observed Number of non-English Statuses:
Public Security & Law	105	264,540	17132	5173
Elected Officials & Money	65	216,572	5300	1253
Health & Community	31	42,848	8457	324
Earth & the Environment	10	20,638	1801	141

Table 5. Summary by concern, including expected and observed non-English statuses. Calculations based on total US population, 289077900, and LEP population, 25227900.

To further visualize the relationship between emergency responder characteristics and use of Twitter for multi-language communication we built a simple regression model (Figure 3). We consider a binary distinction on multi-language tweeting; in other words accounts with at least one tweet in a language other than English are considered as multi-language tweeters, and accounts with only English language tweets are considered English language tweeters. Our response variable of interest is therefore a binary categorical variable. We use a logistic regression model, regressing multi-language status on various organizational covariates such as general activity measure, area of concern and other characteristics as discussed in the findings below. Our primary goal is to test the association between the tendency to tweet in a language other than English and the size/proportion of constituents that report LEP. To explore differences across time we fit a separate model for each year in the dataset.

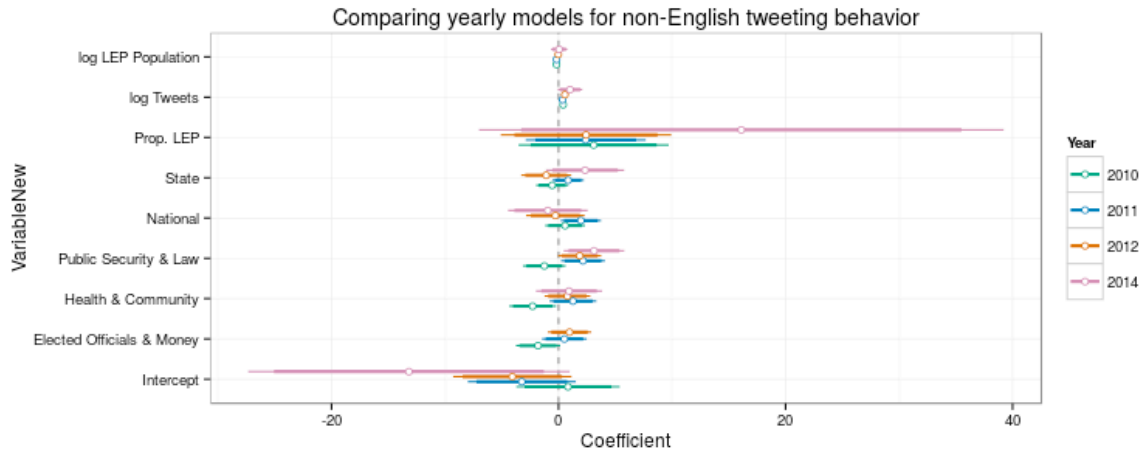

Figure 3. Comparing yearly models for non-English tweeting behavior.

DISCUSSION

There are many prevailing myths regarding LEP people in the Unitized States, such as poverty, low literacy and limited social engagement. It may be due to these myths that the gaps we observed in our data exist. Independent researchers and non-profit organizations continue to document information access problems for LEP individuals during different types of emergency events such as environmental disasters and health crisis, (Andrulis, Siddiqui and Gantner, 2007; Benitez and Rodriguez, 2008; Nguyen and Salvesen, 2014; Shiu-Thornton, et al., 2007). Through the observation of this gap in information practices we believe we can see opportunities for making things better in our communities. Implications for redesigning policies and tools need to begin with realigning ethical commitments to a more culturally competent stance.

Culturally competent practices

There are a handful of agencies who have begun multi-lingual social media practices. Twitter accounts such as, @GobiernoUSA, @USAenEspanol, @FEMAespanol, and @FDAenEspanol are a few examples. However, because these accounts tend to not to duplicate the information from the dominant culture accounts, often suffer from broken or irrelevant links, and sometimes use imperfect machine translation they can be isolating rather than integrating. The power dynamic between federal agencies and LEP populations could be addressed by adopting a culturally competent ethical stance. This requires a recognition of how government agencies become 'cultural brokers' and gatekeepers for certain communities (Shiu-Thornton, et al., 2007). Cultural competency goes beyond simple notions of cultural sensitivity (Paasche-Orlow, 2004). In practice a culturally competent stance recognizes plurality and includes many cultures while actively attempting to minimize harm. This ethical stance encourages using the needs of all stakeholders to shape data gathering and transformation (Bertot, Luna-Reyes, Mellouli, Jaeger, Bertot Carlo and Shilton, 2012; Mathew and Kelly, 2008; Paasche-Orlow, 2004).

Policy

Some of the lack of social media engagement by emergency management agencies on behalf of LEP constituencies may be due in part to the outdated assessment method used to write LEP management plans. The DOJ requires that agencies conduct a, "four factor-analysis" (DOJ, 2002) in order to determine how best to meet

the needs of their local LEP constituency. The four factors include assessments of population data, the frequency of physical contact between the agency and LEP persons, the importance of the agency or program to LEP individuals, and the costs of providing LEP services. These assessment guidelines are highly reliant on in-person contact for determining the breadth and scope of services LEP individuals need. Most agencies have used the results from the four factor analysis to develop materials such as brochures and websites, provide legal access, and cultural competency worker training (LEP.gov, accessed 2016)

While these materials and trainings meet many needs, the analysis method does not suggest adequate guidelines for how to develop relevant social media tools and does not provide agencies with enough flexibility to develop locally relevant population assessment mechanisms of digital use (Hansen, et al., 2011; US Congress, 2011).

Design

Innovators are providing numerous platforms and tools which emergency management agencies could leverage for the benefit of their LEP constituencies. FEMA stated that LEP people use their mobile phones as an "assistive technology" for basic communication, translation tools and other applications (FEMA, 2013). Social media such as Twitter is an ideal way to connect rapidly and clearly via mobile technology. Of course agencies have concerns about the availability of reliable, affordable translation. Organizations such as the Multilingual Digital Group, a US government initiative working to improve digital non-English content, and innovative research collaborations such as TransPHorm, a public health translation project, are building ways to help emergency management agencies reach their LEP constituencies.

CONCLUSION

The relationship between non-English speakers and non-English information in America is a troubled one, marred by instances of discrimination, inconsistent practices, and social inequality. This five year snapshot of the multi-lingual, Twitter practices, of over 200 US federal and independent emergency management agencies provides an important contribution to the work of crisis management in the United States by bringing to light important questions about service providers vulnerable populations.

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