

# Community Segmentation and Inclusive Social Media Listening

**Lucia Castro Herrera**

University of Agder  
lucia.c.herrera@uia.no

**Terje Gjørøster**

University of Agder  
terje.gjosater@uia.no

## ABSTRACT

Social media analytics provide a generalized picture of situational awareness from the conversations happening among communities present in social media channels that are that are, or risk being affected by crises. The generalized nature of results from these analytics leaves underrepresented communities in the background. When considering social media analytics, concerns, sentiment, and needs are perceived as homogenous. However, offline, the community is diverse, often segmented by age group, occupation, or language, to name a few. Through our analysis of interviews from professionals using social media as a source of information in public service organizations, we argue that practitioners might not be perceiving this segmentation from the social media conversation. In addition, practitioners who are aware of this limitation, agree that there is room for improvement and resort to alternative mechanisms to understand, reach, and provide services to these communities in need. Thus, we analyze current perceptions and activities around segmentation and provide suggestions that could inform the design of social media analytics tools that support inclusive public services for all, including persons with disabilities and from other disadvantaged groups.

## Keywords

Inclusive Social Media Listening, Universal Design, Community Segmentation, Improvisation Strategies, Social Media Alignment

## INTRODUCTION

Social media is a powerful resource for crisis management (Reuter, Hughes, and Kaufhold, 2018). More than a communication tool to amplify messages and reach the population online, social media holds ongoing conversations that could provide a picture of what might be going on in areas affected by crises (Zade et al., 2018), maintain a two-way conversation with the affected communities (Hughes and Palen, 2012; Pogrebnyakov and Maldonado, 2018), respond to requests for help (Ehnis and Bunker, 2020; Petersen, Fallou, Reilly, and Serafinelli, 2017), and early warning of events (Avvenuti, Cresci, La Polla, Meletti, and Tesconi, 2017; Pekar, Binner, Najafi, Hale, and Schmidt, 2020; Sun and Scanlon, 2019). Social media data can provide insightful information about an area of interest if it is extracted, classified, and analyzed well. One of the advantages of social media insights is the ability to be accessed remotely which could reduce the need for resources present in the location of the crisis, which makes social media a particularly attractive source of information in the management of crises.

Social media channels house the constant production of narratives and opinions about the perception of the world as experienced both online and offline (Cohen, 2020; Jurgenson, 2012). In general, high production of content indicates high connectivity, high density of population, and wealth (Burns, 2015; Wang and Ye, 2018). Therefore, low-resource areas are often ignored, and social inequalities are exacerbated (Burns, 2015; Semaan and Mark, 2011; Soden and Palen, 2018). Similarly, research mostly focuses on case studies from geographical areas with resources for research and development such as North America, Australia, and Europe (Reuter et al., 2018). Furthermore, in crisis situations often those “who scream the loudest”, or in this case, those who post more frequently on social media, are not usually the ones that need help the most (Karanasios, Cooper, Balcell, and Hayes, 2019). In addition, language becomes a barrier because conversations on social media occur in the primary language (or languages) spoken by the majority of a given population, the language in the social media channels (usually English) and other languages and linguistic variations in the social media content in the form of slang, modified grammar, emoji, and mixing languages that reflect diverse levels of knowledge and style in an official

language for reasons of immigration or socio-economic position (Caragea, Squicciarini, Stehle, Neppalli, and Tapia, 2014; Phengsuwan et al., 2021). These different uses of language in social media constitute both a challenge for those who work in obtaining insights from social media and a disability of those communities needed to be heard.

In crisis response, the needs of vulnerable populations are different from the needs of the general population (International Federation of Red Cross and Red Crescent Societies, 2020), and should be addressed differently (Karanasios et al., 2019; Luna and Pennock, 2018). The Sustainable Development Goals (SDGs), the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction 2015–2030, indicate that vulnerable populations should be included in disaster risk management strategies and actions in order to foster resilient communities (UNDRR, 2015). According to the IFRC’s World Disasters Report, despite the increased disaster risk and financial support towards managing and recovering from disasters, reaching the most at-risk populations continues to be a challenge, mainly for people affected by conflict, migrants and displaced people, and urban poor and marginalized communities “whose capacity to manage shocks is already strained” and have different challenges to access services and assistance (International Federation of Red Cross and Red Crescent Societies, 2020). This inflow of financial resources and the disparities in access to services is especially evident throughout the response and management of the current pandemic situation.

We notice that social media analytics tools that are used to support social media listening might not completely respond to the information requirements and need of focus in community segmentation of public service organizations in times of crises (Hiltz et al., 2020). Social media analytics tools tend to present generalized insights of reach, sentiment, topics of conversation, and volume. Moreover, organizational, and environmental barriers including knowledge and experience of those executing work with social media also influence the quality of the insights gathered from social media channels (Reuter, Kaufhold, Spahr, Spielhofer, and Hahne, 2020; Stieglitz, Mirbabaie, Fromm, and Melzer, 2018).

Our study illustrates the challenge to integrate different audiences into the analysis of social media conversations through an exploratory analysis of interviews from professionals in the public service organizations and software developers. Our findings indicate that the use of social media analytics has limitations that prevent public service organizations from reaching various sectors of a community. Therefore, alternative strategies converging other sources of information are implemented with the aim to target other segments of the population including those more vulnerable. These strategies suggest the convergence of offline (physical) and online forums (Hughes and Tapia, 2015; Karanasios et al., 2019). Some strategies include offline presence through community liaisons or “information brokers” (Hughes and Palen, 2012) while others focus on knowing the intrinsic characteristics of the segment of the population in question and craft a social media strategy specifically directed towards that segment. Furthermore, our findings suggest that organizations that dedicate time in preparing for a crisis by strategizing, testing, and exercising approaches to extract insights from social media could be more aligned to the overall crisis management strategy (Herrera, Majchrzak, and Thapa, 2021b). By doing so the process of handling data from social media becomes more analog/manual than the ideal automated system that reaches conclusions with minimal human intervention (Hiltz et al., 2020).

Thus, with our analysis we attempt to answer the following research questions:

*How are crisis management strategies in public service organizations responding to the need to focus on segmented sectors of the population? And how are social media analytics tools including perspectives from different segments of the community, including people with disabilities and other vulnerable populations while supporting crisis management?*

The rest of the paper is structured as follows: section 2 provides an overview of social media listening and addresses the importance of segmentation from a vulnerability perspective. Section 3 describes the methodology of the study. Sections 4 and 5 present and analyze our findings while section 6 concludes.

## BACKGROUND

### Mechanics of Social Media Listening

The characteristics of big data, namely, veracity, velocity, variety and volatility (Castillo, 2016) make the aggregation and analysis of social media data a challenge in terms of speed and accuracy. Numerous methods of artificial intelligence and more specifically machine learning have been used to solve these challenges in processing data (Imran, Castillo, Diaz, and Vieweg, 2015) and extract relevant and actionable information (Kaufhold, Bayer, and Reuter, 2020; Zade et al., 2018). When attempting to address these issues, research considers communities as homogeneous, thus designing solutions for aggregation and generalization (Reuter and Spielhofer, 2017). Therefore, technology tools that support the extraction and analysis of publicly available

information provide a generalized and aggregated picture of a situation (Blanford et al., 2014), including overall sentiment and topics of conversation (Lu et al., 2015; Power and Kibell, 2017) and actionable nuggets of information (Zade et al., 2018). Methods and tools continue to be developed and implemented for specific use cases and tailored to unique users as opposed to unique communities (Imran, Castillo, Lucas, Meier, and Vieweg, 2014; Pezanowski, MacEachren, Savelyev, and Robinson, 2018; Power, Robinson, Wise, and Cameron, 2013) and while most solutions and research is based on English language datasets, there is increased interest for multilanguage solutions (Bügel and Zielinski, 2013; Doan, Vo, and Collier, 2011; Mozetič, Grčar, and Smailović, 2016; Tarasconi, Farina, Mazzei, and Bosca, 2017; Zielinski, 2013).

The process of looking for and analyzing big data from social media is often described as intelligence, surveillance, listening, or monitoring that in essence refers to the extraction, classification, analysis, and use of social media analytics. In this article, like practice, we use the terms interchangeably. While social media as an information source is deemed more useful during the first 48 hours of an incident (Tapia and Moore, 2014), crises are not static but dynamic, changing through time (Conrado, Neville, Woodworth, and O’Riordan, 2016) and present in the crisis management life cycle namely: preparedness, response, recovery, mitigation, and prevention (Blanford et al., 2014; Chakraborty and Banerjee, 2013; Gu et al., 2014). For example, context, magnitude, and scope of the crisis constitutes the first information requirements after an incident occurs, followed by needs of affected population and availability of goods and services (Dynes, 1994). Then involvement of other stakeholders in the response is included to facilitate coordination of efforts (Mojtahedi and Oo, 2017). Thus, to respond to the need for information, trusted and familiar sources of information are deemed sufficient to fulfill crisis management objectives and “get the job done” (Tapia and Moore, 2014). Hence, social media in practice is not the sole source that informs actions in crisis management (Herrera, Majchrzak, and Thapa, 2021a).

### Considering Community Segmentation form a Vulnerability Perspective

Communities in need are defined as vulnerable populations, characterized by limited resources and increased risk for morbidity (Flaskerud and Winslow, 1998). These populations have specific characteristics such as gender, age, ethnicity, proximity to services, health status or disability (Mannan, MacLachlan, McVeigh, and Consortium, 2012) that make them prone to exclusion from social and financial services, unable to self-sustain and, thus requiring assistance, particularly during crises. Determining what is a vulnerable community and to what degree is a group vulnerable has traditionally focused on socioeconomic status and demographic characteristics (Flanagan, Gregory, Hallisey, Heitgerd, and Lewis, 2011) that tend towards generalizations. More recently, an intersectional perspective to further explore differences in vulnerabilities based on lived experiences and identities of the above-mentioned segments (Kuran et al., 2020; Paupini and Gjørseter, 2021). International organizations such as the World Bank, the Red Cross and the United Nations have highlighted the importance of prioritizing risk and crisis management strategies for the most vulnerable as a path to foster resilience and build back better and stronger communities after a crisis.

In social media, communities exhibit different patterns of usage that can be classified as convergence and functional behaviors (Petersen et al., 2018; Subba and Bui, 2017), degree of activity (Bruns and Stieglitz, 2012), emotional proximity to an event (Huang et al., 2015; Meesters, van Beek, and Van de Walle, 2016) and type of eyewitness (Zahra, Imran, and Ostermann, 2020). Moreover, segmentation in social media goes beyond personal interests or trends (Mirbabaie, Ehnis, Stieglitz, and Bunker, 2014), socioeconomic factors together with geographical features such as rural or urban location are key when selecting social media channels and their content (Dargin, Fan, and Mostafavi, 2021). Lower socioeconomic and minority backgrounds lean towards collective intelligence from peers rather than authorities or news outlets (Dargin et al., 2021). However, as research advances on identifying and describing users and behaviors in social media, there is a latent need to account for diversity and prioritize vulnerable populations when relying on humans-as-sensors to inform crisis management (Samuels and Taylor, 2020).

### METHODOLOGY

We conducted 13 semi-structured interviews with professionals who either work with social media in organizations offering public services such as the police, emergency management agencies, and local governments or are designers or developers of software tools that provide monitoring services using information publicly available including social media analytics. We did not focus on one geographic location, because, while crisis management is extremely context dependent, the tools used to extract information from social media are quite general and the needs for information to counterbalance uncertainty is a general attribute of crisis management strategies globally. Thus, countries represented in our sample are Norway, Italy, Spain, Netherlands, United States, Nepal, Australia, and United Kingdom. To protect our informants’ identities, details of their place of work and location will be kept confidential and an identifier in the format of R# (short for respondent number) was

assigned. Table 1 brings an overview of our participants. Note that some participants fall into one or more categories, for example, some emergency management organizations can also be characterized as communications departments.

**Table 1. Participant distribution according to attributes.**

Software developers and designers	3
Emergency management (including police)	5
Communication departments	6
Service oriented social media listening	2
City or municipal level organizations	6
Managerial roles	7
Analyst roles	3
<b>Total participants</b>	<b>13</b>

Note: some participants fall into one or more categories of classification.

Each interview had a duration of between 60 to 90 minutes. Our questions included processes of extraction and analysis using social media as a source of information and the reasoning or objective behind social media use. We also asked the history of implementation of social media analytics and if they were not using social media, participants were asked about alternative information sources. In these conversations, the topic of reaching different sectors of the population, as well as their different needs and degrees of vulnerability emerged from the participants' reflections. Research has suggested the topic of vulnerable populations and social media analytics as a research avenue (Herrera, 2021; Reuter et al., 2018; Zahra et al., 2020), analyzing the ways practitioners manage to hear the concerns of different segments of the population was a logical next step.

The interviews were recorded and transcribed. The transcripts, about 14 to 20 pages long, were uploaded to the NVivo software for analysis. We followed an inductive approach to coding by reiterative rounds. Initially, every transcript was first read to get a sense of possible topics for coding. Then, each transcript was reviewed one-by-one and coded as topics emerged. After that, similar codes were grouped into more general categories. The findings on audience segmentation and processes to obtain insights from social media were a clear pattern throughout the interviews. Therefore, the research team focused on these topics to extract and construct a narrative of our findings that will be presented in the following sections.

## FINDINGS

*“Audience segmentation is something that we're trying to get a little bit better at” (R1)*

Our findings reveal that crisis management strategies in social media are including often overlooked sectors of the population present on social media such as the young or multilingual communities. However, among our participants, there is a generalized awareness about the road ahead for improvement and the potential for social media to contribute to strengthening the work to reach and understand diverse sectors of the population. This section presents our findings about strategies and processes used by public service organizations located in different parts of the world. The findings are aggregated by themes and examples found in our data. Moreover, our findings hint at different levels of specialization that motivate our discussion in the next section.

## Background Work

Taking a service design perspective, any user who is monitoring publicly available sources, such as public service organizations, is interested in a consolidated analysis of the “extremely overwhelming raw data” (R4). Understanding takes time and resources which availability should not be conditioned only to the occurrence of crises. According to R4, the amount of time spent beforehand contributes to improving results of social media analytics tools. Moreover, R4 highlights the importance of strategizing, testing, and training when using social media analytics to prepare for potential crises. Thus, the time dedicated to preparedness and readiness tasks contribute to the awareness on how social media insights contribute to the fulfillment of information requirements that in turn contribute to crisis management operations (R4). Therefore, familiarity with the role of information in the organization, strategies to extract and analyze social media data using the tools at hand, and the immediacy in which these insights are required are essential for users of social media analytics. Without this background work, results from social media analytics, even the basic ones embedded in social media channels, such as Twitter

analytics or Facebook and Instagram Insights, provide a generalized overview on how social media users interact with a specific social media profile, topic, or hashtag. This provides a biased understanding of a situation focused exclusively on the followers of a specific profile or topic on a specific social media channel. Therefore, partial understanding is achieved, excluding sectors of the community that are not interested or are unaware of the presence of public service organizations in social media.

Moreover, even when processes of social media listening are partially automated, understanding requires human work which makes the difference in different social media activities across organizations “There's no magic tool. Most of [our work] is human analysis, [...] I think that's where [our processes] are unique because [our organization] has invested in the resources [...] it also makes it difficult to duplicate because it requires actual manpower” (R8). Up to this point, understanding is related to the adoption and operationalization of activities of social media listening.

When social media analytics are seen as a service that contributes to crisis management in an organization, background work is proactively carried out to identify the role of social media insights in internal work processes and the context around demographics participating in the social media conversation. However, when social media work is an isolated component which analytics only consider information published in the organization's own social media accounts, background work (if any) might be conducted reactively. “Social media is seen as a way of having a little bit more control over your audience and reach of who you are, at least knowing who you are reaching and where you're not reaching” (R7). Signals of isolation include: formulating strategies based solely on findings from basic analytics from the social media channels where public service organizations have a presence; and lack of awareness of the impact from the insights reported to decision makers. For example, a public service organization with a team for social media, did not consider their resources to be sufficient to maintain many social media profiles, so most of their insights are derived from questions sent through messenger and comments from posts, and reports are only done once a month with no distinction between crisis management and non-crisis (R2).

An opposite view is seen when a fully integrated business analytics team combine their knowledge and experience with social media analytics within the organization, scientific research, and known best practices to respond to specific requests for information. During the COVID-19 Vaccine rollout in 2021, a topic of concern for public services was vaccine hesitance. R1's team initially relied on previously documented experiences, academic research, and historical public health data about vaccine hesitancy locally and internationally. Moreover, based on previous team interactions with relevant stakeholders, they make an assessment about how those experiences could inform the rollout of vaccines as a crisis mitigation measure. Then, this analysis is integrated to find out how social media data can contribute to informing the problem at hand. “For example, we tend to create a brainstorming neural board, mapping out stakeholder need, current user research, analogous research, best practice research, bringing all of that research together. Then we distill insights from that research and come up with some questions to guide the project [...] to define the purpose of the project itself” (R1). This example however was targeted to a general sentiment of vaccine hesitancy as opposed to a specific sector of the population.

### **From Broad to Segmented**

From our interviews, we found that social media insights are mostly used to get a quick overview of the situation at hand. In terms of reporting and resource management, social media listening is carried with the awareness that “We have to play a balancing act and acknowledge that we can't cover everything. And we're not going to get into super granular detail about everything” (R8). However, the need for segmentation is latent. Our findings reveal that the first step in working with segmentation is to understand that priorities differ from different segments of the community and then to align social media listening to those priorities or needs. Nevertheless, within the organizations we interviewed it is unclear if social media is trusted enough to provide insights on vulnerable populations or if there is an awareness about the possibility for such insights originating from social media. We found that traditional community outreach is one of the most common strategies used to reach vulnerable populations. The strategy is usually carried out face-to-face in public forums such as faith based organizations or community centers, the community outreach is usually performed through designated representatives from the public service organization that work to identify and establish a relationship with determined community groups such as immigrants, youth groups, businesses, students, or faith groups.

This outreach is mostly performed offline and maintained as a mutually beneficial relationship where the community's concerns are heard, and information is exchanged. Thus, public service organizations increase their visibility and potential compliance on matters of safety, security, and public health such as COVID 19 lockdown mandates or public gathering restrictions after reopening attempts. For example, when reaching school students, a colleague of R7 works as a community liaison or “information broker” acting as the bridge between the youth and the public service organization, not only to amplify health and safety messages related to end of academic year celebrations during a pandemic, but also informally observe the social media conversation where the students

are present (in this case SnapChat or Instagram). In this example, the informal presence of “information brokers” in social media channels used by young people serves as an amplifier between social media channels, in this case, official information on Facebook is informally and seemingly unofficially transferred to SnapChat. In addition, the information broker monitors the conversation on SnapChat and reports the concerns and reactions of the youth to the organization. R7 pointed out that a similar approach is used with immigrant communities. These online-offline relationships indirectly enhance the use of social media for vulnerable populations in crisis management.

### **Between Systematic Listening and Improvising**

Most informants use social media because it is a mechanism “to be present where the people are” (R9 and R13) and this is a common practice when social media is used as a tool to establish presence. For example, during the core of the lockdowns in the pandemic, some of the informants reported opening social media profiles (official and personal accounts) in emerging channels such as TikTok to increase reach to their communities. This was done from a communications and content production perspective. However, other informants take the meaning of presence in social media from a different perspective where monitoring social media is compared to the police patrolling the streets, where the starting point for addressing the community is listening, as opposed to information sharing.

This listening presence strategy affords organizations the possibility to obtain similar insights as those provided by social media analytics or information brokers. When asked about the origins of this strategy R13 explained the requirement to be present online was the main driver to establish their team: “[We] saw the value of being present where the youth are because at that time, we were trying to be present at schools, at clubs but we weren't present on the Internet, and the Internet was emerging, and it was becoming a bigger part of [the youth's] daily life. [...] we must be where the people are and right now the people are on the Internet” (R13). R13's team is present not only to monitor but also to answer questions that citizens or residents ask through social media channels and social media messaging apps such as Facebook Messenger and WhatsApp.

Among our interviewees, uncertainty, the need for information during a crisis, and the possibility of cascading events are the main motivation to improvise with social media to establish presence. While the previous example had a systematic approach for the adoption of a social media monitoring team, we found that other approaches involve improvising by taking advantage of network contacts or tools at hand or skipping the chain of command amid crisis response operations.

On the immediate aftermath of a major disaster, an ad-hoc social media team is trained and set up on the spot, when a high-ranking leader sees the value of presence in social media and skips the chain of command to ask for authorization. This is a process that otherwise would have been lengthy and bureaucratic (R9). By taking this risk, quick situational awareness was achieved, and the community started to trust and interact with the organization. A mutually beneficial relationship was facilitated through social media. In this case, monitoring of social media was manual and focused only on the profiles of the organization and, to some degree, followed trending topics on Twitter. The manual nature of the use of social media facilitated the identification of needs that the ad-hoc team proactively reported and directed to the indicated channels. For example, when the team found a need for psychological support, the need was both reported through formal (an incident report system) and informal channels (direct contact with health organizations through other means of communication such as radio or phone) to make health professionals aware of the need and the urgency (R9). In addition, while official psychological help was being set up, alternative solutions were considered, such as musical programs targeted for people in distress (R9). On a more targeted level, conversations on social media showed that when relief resources were given to survivors, they did not have food for infants and small children and lacked supplies for women-specific needs (R9). Then these needs were communicated both on informal and formal channels to address them. Then it became evident that relief resources were designed with adult males in mind. This improvisation example was successful because of the access this ad-hoc group had to resources and contacts in other operational areas, the robust communications system in place before social media, and the quick relationship of trust forged between the public service organization and the community in need. However, this initiative did not count with the support and resources from decisionmakers for its continuity after the crisis. Today, this social media program is reduced to official content posting.

Communities in social media are not static, they are active in diverse social media channels and gravitate towards more segmented or intimate group settings that suit their interests and allow some privacy such as social media messaging apps. This poses a challenge to understanding the community and calls for a revision of the strategies in place to handle publicly available information. For example, before the pandemic, R3 was able to spot and monitor protests through social media, usually protests were easily spotted through events announcements in public interest groups profiles or by monitoring trending topics in major social media channels. However, during the pandemic, violent protests emerged as cascading events and, in her location, the general protocol to inform

the occurrence of a protest changed, demanding additional work on the protest organizers. When R3 tried to follow her usual routine, she realized that protest organizers and potential supporters no longer wanted to be associated with orchestrating a protest. This change called for improvised strategies: So “[protest organizers] have now moved away. So, no one is posting on Facebook or Facebook events that they’re attending, [the information] is all gone to Parlor... Telegram... and there are some others as well. And the problem is that we have a lot of legislation around data protection. I can’t go and join these groups and pretend to be someone I’m not, because I can’t get the data that way [...] we need to see what’s on Parlor. But because we don’t have a legal requirement to do that, we’re just basically being nosy” (R3). For R3’s community of protesters, it wasn’t enough to move to other channels, they also modified strategies in traditional social media channels like Facebook and Twitter. For example, “we’re relying on things being on Twitter but now, people are starting to share the protests and then delete the original source within an hour because no one wants to be the organizer. [...] I mean, it’s quite clever how they’re doing it [...]and then there’s WhatsApp groups, and Telegram where people are getting this information, but I don’t know how to find it. I don’t know how to join them.” (R3).

Thus, informal listening emerges as an interim solution to the increasing uncertainty. In R3’s case, personal contacts using their private profiles identify information that could be of interest for the public service organization and informally report it. “[My contacts] will send me stuff that I then send to the police for Intel scanning and fact checking. So, anything that gets flagged to us, we usually flag it to the police as well” (R3). Improvisation approaches have been studied in the past with different configurations by answering requests for help without verification as help lines are overwhelmed (Chatfield, Scholl, and Brajawidagda, 2014; Ehnis and Bunker, 2020), to encourage a two-way conversation and trust during a disaster (Subba and Bui, 2017), or for the incorporation of external organizations, including volunteers into internal processes (Fathi, Thom, Koch, Ertl, and Fiedrich, 2019; Petersen et al., 2018).

### Formalizing and Institutionalizing

Apart from improvisation to reduce uncertainty, we found that social media activities are institutionalized as part of a crisis management strategy. For example, increasing capacity through additional resources such as hiring. In reaching young audiences, the gaming community is essential, thus, “we have just hired someone that is quite good at gaming so he will be having a bigger task in that community trying to reach the younger gamers and being more available on forums such as Discord and Twitch” (R13). On the language side, the need for segmented listening was evident and exacerbated after a disaster impacted various Spanish-speaking communities in a mostly English-speaking country, “we obviously realized that we needed people who could do social media listening in Spanish. [...] we recruited specifically for someone who could understand the overall online Spanish speaking community, how conversations are different online for Spanish speakers versus English speakers, for example, do they use Facebook more than Twitter? Do they comment more on news stories, rather than have conversations on group pages? having that understanding was really important to us” (R8). The need for connection with this segment of the population was driven by the difficulty to get awareness and provide a service to the affected community through social media because of a language barrier. Furthermore, the task of understanding segments of the population is mostly done during non-crisis periods in organizations, where teams are tasked with projects specifically targeted to a sector. “That requires a lot more desktop research. And so, we try to do that. [...] right now, we have a department interested in Aboriginal people in our location. So, we are understanding online community sentiment towards that campaign” (R1).

Contrary to the previous examples, translations of content and multimedia were mentioned by some of our participants as a popular one-way communication strategy to address multilingual communities. However, for this strategy to succeed, the receiver of the information needs to have the intention to find this information that sometimes is not searchable due to a difficult website navigation or lack of knowledge of the local language. In this sense, website usage analytics becomes a source of insights that provide profiles, statistics, and heatmaps useful for insights on current topics of interest about the type of content that people will look for in public service organization’s profiles and websites. “Well, the city has its webpages and we put out news stories on that. And those get seen by some people who happen to be on our web pages. Visitors to our pages can’t really subscribe to the news stories, except if they did some RSS feed, which nobody knows about” (R7). Therefore, the best hope for reach is that content from those websites grabs the attention of traditional media, but this is also a one-way communication strategy.

However, the work towards identifying and monitoring segments of the community is not limited to improvisation, additional resources, or website traffic monitoring. In our interviews, manual approaches were often quoted as a necessity to trust social media and reach better insights and information. Some public service organizations reported abstaining from using advanced monitoring tools because they are perceived as lacking human characteristics such as closeness, attention, and compassion. Manual strategies are implemented to reach segments of the population that analytics applications cannot perform automatically. For example, R8 gives more

importance to Boolean search capabilities rather than “impressive visualizations”, because in addressing dynamic information requirements, “the technology we use needs to be able to get more into the nitty gritty” (R8). This information is then contextualized and analyzed to provide meaning to the organization.

We found that the integration of segmentation in social media listening is easier in public service organizations with defined and strong crisis management information reporting and escalating routines. For example, in the referenced case for the Spanish-speaking communities, trust in social media, processes, routines and infrastructure were in place. With the addition of resources, a strategy for this segment was created and executed. In the case of the referenced ad-hoc team, their strong reporting and routing system facilitated the integration of social media activities in the response operations. Conversely, organizations with isolated social media strategies face difficulties in demonstrating the value of social media. For example, one of our participants in charge of answering to citizen requests in web and social media, showed excitement with the implementation of an organization-wide information management system (R6). With this, system requests from citizens, regardless of the source (i.e., social media, e-mail, or phone), would be routed directly to the specific department in charge of providing an answer. In addition, a repository of answers would be centrally available for analysts to search and provide responses to commonly asked questions. This improvement would likely reduce analysts’ workload and improve the service provided to the citizens (R6).

### Room for Improvement

Most of our respondents agreed that it is not possible to cover everything, or reach every segment of communities in need, but there is room for improvement in that aspect. “I think that even with our current team we could do a better job of listening for other audiences” (R8). conversely, our respondents indicate that complaints are part of the job, and it is unlikely that everyone will be satisfied with the information and services provided. One area for improvement is the formulation of strategies with segmentation in mind that consider people with disabilities and vulnerable populations “because they’re having completely different experiences than others” (R8). The use of digital volunteers was mentioned as a possibility, however, none of our respondents had used such resources before, the closest was the use of temporary staff. Research on this domain discusses the importance of both integration of digital volunteers and a universal design approach for digital tools used to crowdsourcing information to avoid the experience of situational disabilities (Radianti and Gjørseter, 2019). Another area for improvement is incorporating insights from diverse data formats other than text (i.e., multimedia). However, while the technology is available, the commercial value for software designers and developers is still not enough to cover the effort to include this feature for customers.

### DISCUSSION

We started with the motivation to explore how social media analytics support strategies to include vulnerable populations in crisis management. We conducted a series of interviews to explore the mechanics of social media listening in public service organizations. In the interviews and when analyzing the data, community segmentation and vulnerable populations emerged as a prominent theme of discussion and reflection. Inspired by international recommendations to focus on vulnerable populations, in our study, we packaged our findings in identifiable strategies that social media monitoring performs when caring for segmentation. Namely, *background work*, *awareness of segments of the community*, *formalization of routines*, and *improvement*. Thus, we explain how a combination of online, offline and collaboration strategies contribute to reaching communities beyond those already following public service organization profiles on social media. The analysis of semi-structured interviews with professionals working with social media in public service organizations and software designers, indicates that while there is ample room for improvement, these organizations have advanced in implementing strategies of inclusion in both online and physical settings. Some of the most sophisticated online strategies include dedicated social media resources for monitoring and two-way conversations for specific communities, and web analytics that provide insights of what topics of interest resonate with the public. On the physical aspect, we observed that online and offline strategies converge with the help of an *information broker* that based on trust relationships acts as a bridge between formal communications and specific needs (Hughes and Palen, 2012). The convergence of online and offline strategies, whether systematically planned or improvised suggests that there is a continuous commitment from public service organizations to reach and serve a diverse range of the population. Furthermore, our findings suggest two overarching points of discussion presented in the following paragraphs.

First, the implementation of social media analytics and convergence of offline and online strategies respond to the needs of public service organizations of *understanding*, being *present* and *available* for diverse segments of the community, including persons with disabilities, minorities, and other vulnerable groups. Addressing these organizational needs translates into better services for a wide range of people which in turn, encourages communities to trust public services organizations. Improvisation emerges when current routines and technologies



are not enough to fulfill the service objectives. or sudden changes in the environment (Stieglitz et al., 2018), such as the introduction of new legislation or the dynamic changes in user-preferences for social media channels, call for alternatives to “get the job done” (Tapia and Moore, 2014).

Thus, even with improvisation, the robustness of internal reporting and crisis management routines, together with the support tools used such as social media analytics can make the difference in the speed in which new or spontaneous strategies are aligned to the overall crisis management of the organization and in turn improve the services provided to the community (Ehnis and Bunker, 2020). From our findings we infer that there are different levels of alignment of social media use in public service organizations. On one side, robust social media teams and clear support from decision makers such as R1, R2, R13, are more integrated into the organization and work on strategies that target community segments. Then, on the other side, public service organizations that place social media isolated from core crisis management functions tend to be unaware about segmentation in social media and other outreach initiatives carried on at the organization. and expect communities to follow their online presence R2, R6, R12. In between, are organizations where segmentation is not practiced through social media but there is an effort to coordinate efforts with other parts of the organization to reach communities other than the usual followers. These are the organizations where improvisation is mostly exercised.

## CONCLUSION AND FUTURE RESEARCH

Motivated by the importance of including vulnerable populations to foster resilient communities and noticing the differences between the offline diversity and the generalized picture presented by social media analytics, we conducted interviews with public service organizations from different parts of the world that use social media as a source of information. Our data showed different levels of awareness of diverse communities through strategies that responded to the organizational needs to understand, be present and establish a two-way conversation to include as many members of the community as possible. From a segmentation perspective, social media analytics when analyzed manually with a focus on context, can address specific sectors of the community. However, this endeavor calls for additional resources and robust crisis management routines. To address the needs of the population, public service organizations resort to improvisation and offline strategies to improve the services provided to the different communities.

As our study indicates, there is *room for improvement* in *reaching*, *understanding*, and *responding* to the needs of segmented communities both in practice and research. This study has limitations in that we did not cover the full spectrum of types of public service organizations and geographical locations. Future avenues of research include enhancing and validating our findings by increasing our sample size, through additional interviews or other methodologies such as workshops and surveys. Moreover, future studies could also address the spectrum of alignment of social media listening strategies taking a segmentation approach. Lastly, future research could focus on requirements for the design of support tools for segmentation with a universal design approach that helps the assessment of the needs against the vulnerability of different segments of the population in need.

## REFERENCES

- Avvenuti, M., Cresci, S., La Polla, M. N., Meletti, C., and Tesconi, M. (2017). Nowcasting of Earthquake Consequences Using Big Social Data. *Ieee Internet Computing*, 21(6), 37-45.
- Blanford, J. I., Bernhardt, J., Savelyev, A., Wong-Parodi, G., Carleton, A. M., Titley, D. W., and MacEachren, A. M. (2014). Tweeting and tornadoes. *ISCRAM*.
- Bruns, A., and Stieglitz, S. (2012). Quantitative Approaches to Comparing Communication Patterns on Twitter. *Journal of Technology in Human Services*, 30(3-4), 160-185.
- Bügel, U., and Zielinski, A. (2013). Multilingual analysis of twitter news in support of mass emergency events. *International Journal of Information Systems for Crisis Response and Management (IJISCRAM)*, 5(1), 77-85.
- Burns, R. (2015). Rethinking big data in digital humanitarianism: practices, epistemologies, and social relations. *GeoJournal*, 80(4), 477-490.
- Caragea, C., Squicciarini, A. C., Stehle, S., Neppalli, K., and Tapia, A. H. (2014). *Mapping moods: Geo-mapped sentiment analysis during hurricane sandy*. Paper presented at the ISCRAM.
- Castillo, C. (2016). *Big crisis data: social media in disasters and time-critical situations*: Cambridge University Press.
- Chakraborty, B., and Banerjee, S. (2013). *Modeling the evolution of post disaster social awareness from social web sites*. Paper presented at the IEEE International Conference on Cybernetics.
- Chatfield, A. T., Scholl, H. J., and Brajawidagda, U. (2014, 6-9 Jan. 2014). *#Sandy Tweets: Citizens' Co-Production of Time-Critical Information during an Unfolding Catastrophe*. Paper presented at the 47th HICSS.
- Cohen, H. (2020). Social Media Definition: The Guide You Need To Get Results.
- Conrado, S. P., Neville, K., Woodworth, S., and O'Riordan, S. (2016). Managing social media uncertainty to support the decision making process during emergencies. *Journal of Decision Systems*, 25(sup1), 171-181.
- Dargin, J. S., Fan, C., and Mostafavi, A. (2021). Vulnerable populations and social media use in disasters: Uncovering the digital divide in three major U.S. hurricanes. *International Journal of Disaster Risk Reduction*, 54.
- Doan, S., Vo, B.-K. H., and Collier, N. (2011). *An analysis of Twitter messages in the 2011 Tohoku Earthquake*. Paper presented at the International conference on electronic healthcare.
- Dynes, R. R. (1994). Situational altruism: Toward an explanation of pathologies in disaster assistance.
- Ehnis, C., and Bunker, D. (2020). Repertoires of collaboration: incorporation of social media help requests into the common operating picture. *Behaviour & Information Technology*, 39(3), 343-359.
- Fathi, R., Thom, D., Koch, S., Ertl, T., and Fiedrich, F. (2019). VOST: A case study in voluntary digital participation for collaborative emergency management. *Information Processing & Management*.
- Flanagan, B. E., Gregory, E. W., Hallisey, E. J., Heitgerd, J. L., and Lewis, B. (2011). A social vulnerability index for disaster management. *Journal of Homeland Security and Emergency Management*, 8(1).
- Flaskerud, J. H., and Winslow, B. J. (1998). Conceptualizing vulnerable populations health-related research. *Nursing research*, 47(2), 69-78.
- Gu, H., Chen, B., Zhu, H., Jiang, T., Wang, X., Chen, L., . . . Jiang, J. (2014). Importance of Internet surveillance in public health emergency control and prevention: evidence from a digital epidemiologic study during avian influenza A H7N9 outbreaks. *Journal of Medical Internet Research*, 16(1).
- Herrera, L. C. (2021). Configuring Social Media Listening Practices in Crisis Management *ISCRAM*
- Herrera, L. C., Majchrzak, T. A., and Thapa, D. (2021a). Ecosystem of Social Media Listening Practices for Crisis Management. *IFIP Conference e-Business, e-Services, and e-Society*
- Herrera, L. C., Majchrzak, T. A., and Thapa, D. (2021b). Principles for the Arrangement of Social Media Listening Practices in Crisis Management. *INTAP*.
- Hiltz, S. R., Hughes, A. L., Imran, M., Plotnick, L., Power, R., and Turoff, M. (2020). Exploring the usefulness and feasibility of software requirements for social media use in emergency management. *International Journal of Disaster Risk Reduction*, 42, 1-14.
- Huang, Y. L., Starbird, K., Orand, M., Stanek, S. A., Pedersen, H. T., and Acm. (2015). *Connected Through Crisis: Emotional Proximity and the Spread of Misinformation Online*. Paper presented at the Proceedings of the 2015 Acm International Conference on Computer-Supported Cooperative Work and Social Computing.
- Hughes, A. L., and Palen, L. (2012). The Evolving Role of the Public Information Officer: An Examination of Social Media in Emergency Management. *JHSEM*, 9(1).
- Hughes, A. L., and Tapia, A. H. (2015). Social Media in Crisis: When Professional Responders Meet Digital Volunteers. *JHSEM*, 12(3), 679-706.
- Imran, M., Castillo, C., Diaz, F., and Vieweg, S. (2015). Processing social media messages in mass emergency: A survey. *ACM CSUR*, 47(4), 1-38.

- Imran, M., Castillo, C., Lucas, J., Meier, P., and Vieweg, S. (2014). *AIDR: artificial intelligence for disaster response*. Paper presented at the International Conference on World Wide Web, Seoul, Korea.
- International Federation of Red Cross and Red Crescent Societies. (2020). *World Disasters Report 2020*. Retrieved from ifrc.org
- Jurgenson, N. (2012). When atoms meet bits: Social media, the mobile web and augmented revolution. *Future Internet*, 4(1), 83-91.
- Karanasios, S., Cooper, V., Balcells, M. P., and Hayes, P. (2019). Inter-organizational collaboration, information flows, and the use of social media during disasters: a focus on vulnerable communities.
- Kaufhold, M. A., Bayer, M., and Reuter, C. (2020). Rapid relevance classification of social media posts in disasters and emergencies: A system and evaluation featuring active, incremental and online learning. *Information Processing and Management*, 57(1).
- Kuran, C. H. A., Morsut, C., Kruke, B. I., Krüger, M., Segnestam, L., Orru, K., . . . Torpan, S. (2020). Vulnerability and vulnerable groups from an intersectionality perspective. *International Journal of Disaster Risk Reduction*, 50.
- Lu, Y., Hu, X., Wang, F., Kumar, S., Liu, H., and Maciejewski, R. (2015). Visualizing social media sentiment in disaster scenarios. *International Conference on World Wide Web*, 1211-1215.
- Luna, S., and Pennock, M. J. (2018). Social media applications and emergency management: A literature review and research agenda. *International Journal of Disaster Risk Reduction*, 28, 565-577.
- Mannan, H., MacLachlan, M., McVeigh, J., and Consortium, E. (2012). Core concepts of human rights and inclusion of vulnerable groups in the United Nations Convention on the rights of persons with disabilities. *Alter*, 6(3), 159-177.
- Meesters, K., van Beek, L., and Van de Walle, B. (2016). *# Help. The Reality of Social Media Use in Crisis Response: Lessons from a Realistic Crisis Exercise*. Paper presented at the 49th HICSS.
- Mirbabaie, M., Ehnis, C., Stieglitz, S., and Bunker, D. (2014). *Communication roles in public events*. Paper presented at the Working Conf. on Information Systems and Organizations.
- Mojtahedi, M., and Oo, B. L. (2017). Critical attributes for proactive engagement of stakeholders in disaster risk management. *International Journal of Disaster Risk Reduction*, 21, 35-43.
- Mozetič, I., Grčar, M., and Smailović, J. (2016). Multilingual Twitter sentiment classification: The role of human annotators. *Plos One*, 11(5).
- Paupini, C., and Gjørseter, T. (2021). Disaster Risk Reduction for All? *ITDRR*, 183-192.
- Pekar, V., Binner, J., Najafi, H., Hale, C., and Schmidt, V. (2020). Early detection of heterogeneous disaster events using social media. *Journal of the Association for Information Science and Technology*, 71(1), 43-54.
- Petersen, L., Fallou, L., Havârneanu, G., Reilly, P., Serafinelli, E., and Bossu, R. (2018). November 2015 Paris terrorist attacks and social media use: preliminary findings from authorities, critical infrastructure operators and journalists. *ISCRAM* 629-638.
- Petersen, L., Fallou, L., Reilly, P., and Serafinelli, E. (2017). *Public expectations of social media use by critical infrastructure operators in crisis communication*. Paper presented at the ISCRAM.
- Pezanowski, S., MacEachren, A. M., Savelyev, A., and Robinson, A. C. (2018). SensePlace3: a geovisual framework to analyze place-time-attribute information in social media. *Cartography and Geographic Information Science*, 45(5), 420-437. doi:10.1080/15230406.2017.1370391
- Phengsuwan, J., Shah, T., Thekkummal, N. B., Wen, Z., Sun, R., Pullarkatt, D., . . . Ranjan, R. (2021). Use of Social Media Data in Disaster Management: A Survey. *Future Internet*, 13(2), 46.
- Pogrebnyakov, N., and Maldonado, E. (2018). Didn't roger that: Social media message complexity and situational awareness of emergency responders. *IJIM*, 40, 166-174.
- Power, R., and Kibell, J. (2017). The social media intelligence analyst for emergency management. *HICSS*.
- Power, R., Robinson, B., Wise, C., and Cameron, M. (2013). *Information Integration for Emergency Management: recent CSIRO case studies*.
- Radianti, J., and Gjørseter, T. (2019). *Digital Volunteers in Disaster Response: Accessibility Challenges*. Paper presented at the HCII, Cham.
- Reuter, C., Hughes, A. L., and Kaufhold, M.-A. (2018). Social media in crisis management: An evaluation and analysis of crisis informatics research. *International Journal of Human-Computer Interaction*, 34(4), 280-294.
- Reuter, C., Kaufhold, M.-A., Spahr, F., Spielhofer, T., and Hahne, A. S. (2020). Emergency service staff and social media – A comparative empirical study of the attitude by emergency services staff in Europe in 2014 and 2017. *International Journal of Disaster Risk Reduction*, 46.
- Reuter, C., and Spielhofer, T. (2017). Towards social resilience: A quantitative and qualitative survey on citizens' perception of social media in emergencies in Europe. *Technological Forecasting and Social Change*, 121, 168-180.

- Samuels, R., and Taylor, J. E. (2020). Deepening the divide: crises disproportionately silence vulnerable populations on social media. *Journal of Management in Engineering*, 36(6), 04020083.
- Semaan, B., and Mark, G. (2011). Technology-mediated social arrangements to resolve breakdowns in infrastructure during ongoing disruption. *ACM Transactions on Computer-Human Interaction* 18(4), 1-21.
- Soden, R., and Palen, L. (2018). Informing Crisis: Expanding Critical Perspectives in Crisis Informatics. *ACM Human Computer Interaction Conference*, 2(CSCW).
- Stieglitz, S., Mirbabaie, M., Fromm, J., and Melzer, S. (2018). The Adoption of social media analytics for crisis management—Challenges and Opportunities. *ECIS*, 4.
- Subba, R., and Bui, T. (2017). *Online convergence behavior, social media communications and crisis response: An empirical study of the 2015 nepal earthquake police twitter project*. Paper presented at the HICSS.
- Sun, A. Y., and Scanlon, B. R. (2019). How can Big Data and machine learning benefit environment and water management: a survey of methods, applications, and future directions. *Environmental Research Letters*, 14(7).
- Tapia, A. H., and Moore, K. (2014). Good Enough is Good Enough: Overcoming Disaster Response Organizations' Slow Social Media Data Adoption. *Comput Supported Coop Work*, 23(4), 483-512.
- Tarasconi, F., Farina, M., Mazzei, A., and Bosca, A. (2017). The Role of Unstructured Data in Real-Time Disaster-related Social Media Monitoring. *IEEE International Conference on Big Data*, 3769-3778.
- UNDRR. (2015). Sendai Framework for Disaster Risk Reduction 2015–2030. *3rd UN World Conference on DRR*, 14-18.
- Wang, Z., and Ye, X. (2018). Social media analytics for natural disaster management. *International Journal of Geographical Information Science*, 32(1), 49-72.
- Zade, H., Shah, K., Rangarajan, V., Kshirsagar, P., Imran, M., and Starbird, K. (2018). *From Situational Awareness to Actionability: Towards Improving the Utility of Social Media Data for Crisis Response*. Paper presented at the ACM on Human-Computer Interaction Conference.
- Zahra, K., Imran, M., and Ostermann, F. O. (2020). Automatic identification of eyewitness messages on twitter during disasters. *Information Processing and Management*, 57(1). doi:10.1016/j.ipm.2019.102107
- Zielinski, A. (2013). Detecting Natural Disaster Events on Twitter across Languages. In G. A. Tsihrintzis, M. Virvou, T. Watanabe, L. C. Jain, and R. J. Howlett (Eds.), *Intelligent Interactive Multimedia Systems and Services* (Vol. 254, pp. 291-301). Amsterdam: Ios Press.