

Implications of Social Media on Disaster Response: Commentary on the Flint Twitterverse

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The Flint Water Crisis is a profound humanitarian disaster for the citizens of Flint, Michigan. It is also an event that has captured the attention of individuals throughout the United States and indeed the world through extensive media coverage. It is unthinkable to many that a developed country can have a city whose water supply is poisoning its citizens and that the government failed to respond in an appropriate, timely manner to the water contamination. Given the increasing use of internet-based communication, this technological crisis created a high volume of human communication in the digital news and social media. It is apparent that humans are using social media as a new form of adaptation for dealing with extreme events and its challenges such as the Flint water crisis (Bernabé-Moreno et al.2014, Hossmann 2011, Saleem et al. 2014). In order to explore the possibilities and pitfalls of online communication during critical events, this chapter will discuss the collective ability of social media users to communicate, reach out to others for collective action, and organize in response to the negative consequences of the Flint disaster through the lens of Twitter. Rather than focusing on the technical aspects of data collection and analysis, our goal is to reach a wide variety of audiences with a key message, social media has the capacity to transform the way public and private sectors and civil society manage critical events in general and technological disasters in particular. The chapter starts by describing the event as observed in Twitter followed by some inferences from the data, building on former theoretical and empirical work about social media and disasters.

Flint's Twitterverse

Twitter is a widely used microblogging platform that allows users to post 140-character messages or tweets and interact with others through following, friendship, likes and re-tweets. Across all social media platforms, Twitter is used most often for reading and discussing the news, therefore, it is proven to be a highly “event driven” media platform that can be used to learn about individual and collective attitudes and behavior (Murthy 2010). Each day, there are about a half billion tweets generated worldwide from over 310 million users (DMR 2016). Twitter was developed in the United States and has a heavy social media footprint throughout the country. For these reasons, this platform is considered a very useful resource for investigating human response to high profile events in the United States, such as the Flint Water Crisis. The Flint Water Crisis clearly became a high profile event when the state of Michigan declared it to constitute “a state of emergency” in early January, 2016. With this announcement, media attention including social media activity began to increase focusing on the lead contamination in the Flint water system. Over the next several weeks, many significant events occurred that helped structure a timeline for the Flint Twitterverse:

- The state of Michigan declared a state of emergency for Flint and on the same day EPA announced a federal investigation (January 5, 2016).
- Michael Moore, film-maker and activist, who is also a resident of Flint expanded his webpage to include a petition to arrest Michigan Governor Snyder for his role in the Flint

Crisis¹. On his webpage, Moore called for bloggers to address the Flint situation since he felt it was not being adequately covered in traditional media (January 6, 2016).

- President Obama issues a statement declaring Flint to be a federal emergency area and makes available 5 million dollars in federal funds (January 16, 2016).
- Presidential candidates waded in on this crisis (e.g., Bernie Sanders on January 16 and Hillary Clinton on January 17 of 2016).
- Michigan governor, Rick Snyder delivers the state of the state address to the legislature that included both a call for \$28 million in funding for Flint, and an apology, “I am sorry, and I will fix it.” (January 19, 2016).
- Time Magazine publishes an influential article overviewing the Flint Crisis, entitled “The Toxic Tap” (February 1, 2016).

During January and February, Twitter activity addressing the Flint Crisis began to rapidly increase. In these two months, using the full fire-hose of archived tweets provided by GNIP², the research team obtained about 2.5 million tweets discussing the Flint water crisis. These tweets were generated by approximately 80,000 different Twitter accounts. This estimate of Twitter activity on Flint was obtained by filtering the fire-hose of tweets using the following keywords and hashtags: *Flint water, Flint lead poisoning, Flint water poisoning, Flint volunteer, Flint volunteering, Flint aid, Flint help, Flint water, Flint lead poisoning, Flint water poisoning, Flint volunteer, Flint volunteering, Flint aid, Flint help, #Flint, #FlintWater, #FlintWaterCrisis, #FlintHelp, #HelpFlint, #FlintLivesMatter, #FlintOp, and #NewPipesForFlint*. Tweets using these keywords and hashtags were collected globally from January 3, 2016 to February 28, 2016. If additional keywords and hashtags were applied, it is likely that more tweets would be identified suggesting that this two-month Twitterverse would be even larger than 2.5 million tweets.

Figure 1 provides a depiction of the daily Twitter traffic for January and February of 2016. There are a number of patterns that are worth noting. First, there was a comparably low level of Twitter activity at the beginning of 2016. However, an examination of the content of these tweets indicates that users at this stage were focusing on the severity of the water poisoning, the health risks, especially for children, and the accountability of government officials. Second, even though the announcement of a state of emergency and an investigation being launched by the EPA occurred on January 5th, the rapid expansion of the Flint Crisis Twitterverse did not take off until about a week later on January 13th. Given the content and users that produced the tweets, this increase is attributed to the focus on the topic among presidential candidates from the Democratic party. During the next week, there was an extremely rapid growth of Twitter activity reaching its peak on January 21st, a few days after President Obama’s declaration of Flint as a federal emergency, Governor Snyder’s state of the state address apologizing for the crisis, and comments from presidential candidates Sanders and Clinton. There was another smaller but significant spike in the frequency of Twitter messages at the beginning of February that coincided with the Toxic Tap article in Time Magazine. During the rest of February, there were modest spikes but a clear decline and leveling of the size of the Flint Twitterverse.

[Figure 1 here]

Understanding Twitter During Extreme Events

Twitter data provides an important lens to understand the nature of social media discussions during an extreme event. It also allows for analysis of the form and strength of networks that develop around important issues and organic or self-organizing behavior as a response or adaptation to a crisis. There is gathering evidence that social media can encourage and enable organic and self-organizing responses to extreme situations such as natural disasters, technological disasters, or terrorist events (Centers for Disease Control and Prevention 2014, Hossmann et al. 2011, Magsino 2009). In the realm of collective action facing these types of critical events, social media has the potential to enhance rapid response and resilience (Colander and Kupers 2014). By reviewing social media activity during a number of recent extreme events, it is possible to identify important patterns of behavior and communication. The study of the Flint Water Crisis in Twitter evidenced this.

It is common to find cases of social media usage to promote community-based responses during natural disasters such as Hurricane Sandy, Japanese Tsunami, or Pakistan Earthquake where social media became an important aspect of disaster response and community resilience (Keim and Noji 2011; Kongthon et al. 2012; Landwehr and Carley 2014). For example, during Hurricane Sandy, Twitter was extensively used to request and offer assistance and organize groups to aid others impacted by the disaster (Edwards, Mohanty & Fitzpatrick 2015). This organic or self-organizing behavior utilizing social media may very well represent a new form of resilience during extreme events. In similar fashion, “big data” enterprises such as Uber are emerging as important self-organizing forces during emergency situations. Uber was utilized during the Paris terrorist incident to evacuate individuals from the site of the attack (Hawkins 2015). An even more adaptive example is the recent Indian based Uber-like service Ola that responded to the flooding in India by rapidly including boats as an Ola service to evacuate people during the flooding (The Times of India, 2015).

However, responses from social media users may differ in cases of technological disasters, such as the Flint Water Crisis. For Baum et al. (1983, 334-5) technological catastrophes are human made events, “they are accidents, failures, or mishaps involving the technology and manipulation of the natural environment that we have created to support our standard of living”. During these situations, victims are experiencing further uncertainties of personal and social consequences of the disaster. Many are seeking compensation or searching for who is accountable for the catastrophe and there are blame conflicts between citizens, public organizations or businesses, government entities and politicians. In addition, as social capital in communities affected by technological disasters tends to be fragile, the internal recovery initiatives are minimal and instead outsiders might lead these efforts (RCAC 2004). Social media is potentially facilitating outsider recovery efforts by reducing coordination and communication costs and eliminating problems of physical distance. It can also enhance victims’ reactions as they seek help and/or investigate and publicize the anomalies that led to the disaster. In the case of Flint there were abundant responses from outsiders whom promoted campaigns to collect funds for relief and send water to Flint. Inside the community of Flint, there is a widespread campaign to hold bureaucrats and politicians accountable for their actions and claims for social justice.

Observing the Twitterverse

In order to summarize the approximately 2.5 million tweets that were collected during the 2-month study, several social analytics were used to detect patterns of communication and networks within the Flint Twitterverse. These included examinations of trend data, time specific word clouds, Klout (social media influence scores; Schaefer 2012; Rao et al. 2015), networks of Twitter users (network analysis) and networks of concepts (word collation analysis). The results of these analyses were used to shape and inform the commentary in this chapter. Based on this initial investigation, three major themes of organic or self-organizing tweets were occurring in the Twitterverse. These were 1) organizing humanitarian responses, 2) government accountability and citizen's participation, and 3) social justice.

Organizing Humanitarian Responses

Several sub-categories of tweets can be discerned within the humanitarian theme: 1) self-organizing for help, 2) raising funds for Flint primarily through crowdsourcing, 3) recognizing organizations or groups for their efforts to help the people of Flint, and 4) challenging others to assist the citizens of Flint. This theme (Table 1) reveals how individuals used social media to organize disaster and relief efforts for victims of the Flint Water Crisis. Many of these efforts were organized by individuals, groups, local companies, celebrities, and larger corporations. Some tweets consisted of providing information via hyperlinks about how to help the people of Flint. Also, many tweets included websites with direct links to online crowdsourcing programs, such as GoFundMe or to Beyonce's *#BeyGood* campaign. Other tweets suggested making disaster relief efforts a challenge. For example, one hashtag, *#GroceryStoreForFlint* challenges other companies, including Kroger and Walmart by name to have a "race" in their assistance for Flint victims. One aspect of these tweets that is particularly interesting is the fact that 'who is' organizing outreach efforts is often mentioned. This could possibly be in attempt to motivate others to get more involved in assisting the people of Flint. These tweets tend to provide credit to volunteerism by recognizing the individual and/or collective efforts of organized behavior. Further, from the information in these tweets, we can detect that there are many individuals and companies of diverse backgrounds and locations who are interested in organizing large outreach efforts for Flint, such as VanDrie (a local furniture company). There were numerous other examples of tweets that recognize organizations and groups to assist in the Flint efforts, such as: Michigan State University organizing to help Flint, Michigan prisoners pledging a third of their income to Flint victims, and Muslim groups collecting bottled water.

[Table 1 here]

Government Accountability and Citizen's Participation

Research on disasters often make a distinction between natural disasters and technological disasters. As mentioned earlier, this distinction can have profound implications on the nature of human response, reaction, and interpretations of events. At the very center of this distinction is the commonly held view that natural disasters such as hurricanes, tornadoes, and earthquakes are acts of nature, and consequently humans or human organizations do not cause or produce the core disaster. But technological disasters, such as oil spills, train wrecks, nuclear power plant

failures, and toxic waste spills are typically seen as caused by human failures or neglect. The Flint Water Crisis can be classified as a disaster of the second type, and the Flint Twitterverse is replete with examples of messages calling for accountability and pointing to individuals and organizations that are responsible for the lead exposure to the citizens of Flint.

The Flint crisis also had another dimension that influenced the high level of accountability discussion. Flint is home to the highly influential, activist and film producer, Michael Moore. He was recognized by Time Magazine in 2005 as one of the world's one-hundred most influential people (Penn 2005). Michael Moore's entry into the Flint crisis has primarily been one of promoting his view of accountability and responsibility for governmental failure. He has focused his attention on Governor Rick Snyder and his administration. On his website, he promotes the hashtag, *#ArrestGovernorSnyder* and has an ongoing petition for Governor Snyder to resign and be arrested by the Federal Bureau of Investigation (FBI). By mid May, Moore's website reports that over 600,000 individuals have signed the Snyder petition. There is little doubt that Moore's media activism including that on Twitter have helped shape the discussions of the Flint Water Crisis.

One of the likely outcomes of technological disasters is engagement in blaming narratives. As can be seen in Table 2, this is also true for the Flint Water Crisis. Within this theme, we find several narratives of blaming, including: 1) holding Governor Snyder accountable, such as by responding to the petition that Michael Moore put together using *#ArrestGovernorSnyder*, 2) blaming arguments that shift back and forth between republicans and democrats and 3) a general discussion of blame generated at politicians and the government's role in the Flint Water Crisis. The majority of tweets tended to focus on blaming Governor Snyder or signing the Michael Moore petition for his resignation and incarceration.

[Table 2 here]

Social Justice

Flint is one of the nation's poorest large cities in America and has been experiencing a long-term trend of economic decline - the average median household income in Flint is \$24,679 compared to the American average of \$53,482 and the percentage of persons in poverty is 41.6% versus the national average of 14.6%. The city has consistently lost population over the last several decades as automobile industry jobs have left the area. Accompanying this period of economic distress, the city's racial composition has also changed from a majority white community to a majority African American community. The reality that the poisoning of the drinking water occurred in a predominantly African American community raises questions about race and racism as factors in the creation of the problem and the response to it. Dialogue about race and racism emerged as one of the important themes in the Flint Twitterverse.

The Flint Twitterverse includes numerous accusations and interpretations of the crisis having its roots in race and racism (Table 3). The dialogue also includes numerous examples of counter arguments maintaining that race was not a factor or that "the race card" was being used. Michael Moore's accusation of "racial genocide" and Hillary Clinton's tweet, "would it have happened if

they were rich and white instead of poor and black?” are examples of high profile interpretations of the crisis as a form of racism. Interestingly, adjectives describing racism included not only genocide but also references to environmental racism and structural racism. Counter arguments were occasionally in direct reaction to accusations of racism. For example, Governor Snyder stated that race had no role in the response to the Flint water crisis. The subcategories identified under this theme, include the following: 1) providing information to build the argument that the crisis response was due to racism, classism, or the intersection of the two, 2) arguing that some groups would always make issues about race, and 3) arguing that race had no role in the Flint Water Crisis.

[Table 3 here]

Conclusion

It is evident that the Flint Twitterverse created novel forms of human adaptation, organization, and response to the Flint Water Crisis in ways that could not have occurred prior to the advent of social media. In fact, Twitter was being used to create virtual communities that were capable of expanding conversation about the crisis and producing actions that were having impact on the humanitarian response, public accountability, and collective interpretations of the crisis. Significantly, Twitter users were promoting a particular mode of social organization that was both self-organized and independent from traditional hierarchical schemes of authority. Also, the very nature of Internet based interaction was producing outcomes that were either eliminating or reducing the limiting effects of physical distance to promoting collective actions. In the Flint data, there were abundant responses from outsiders who promoted campaigns to collect funds for relief and send water to Flint. Both inside and outside the community of Flint, there was a widespread and intense campaign to hold bureaucrats and politicians accountable for their actions as well as to promote calls for social justice.

Flint is also an example of how social media platforms, such as Twitter can be used to engage citizens in public affairs debates. In some respects, the Flint data depicts Twitter as a forum for both the participation of the disenfranchised and less powerful in an important public issue as well as that for the more powerful and elite members of society. In general, there are optimistic views suggesting that Internet promotes access to information and allows open participation in online debates. However, there are other perspectives suggesting that online interactions are likely to follow the same patterns of the political world and issues, such as information bias, lack of access, and power structures in which elites define content and in general Internet literacy. The Flint Twitterverse is highly complex and there is ample evidence to support either of these seemingly opposing perspectives. There are numerous examples of elites and the powerful utilizing Twitter to promote their views on humanitarian approaches to the crisis, accountability and responsibility, and social justice. At the same time, the data is replete with examples of “everyday citizens” tweeting their views on the same topics. Both perspectives have valid points and are not mutually exclusive. The Flint Twitterverse provided an opportunity to examine the role of social media in the midst of a technological disaster and provides insight into the relationship between democracy and the Internet. In this regard, the Twitter activity around the Flint Water Crisis created the conditions that enabled deliberation and enhanced democratic

debate. This is the result of increased access and easiness of the spread of information, reduction of the complexities of face-to-face interaction, and the provision of an open forum to express the opinions in public debates (Paparachissi 2002). Dalberg (2007) suggests that in a deliberative model of Internet democracy rhetoric and practice that there is potential to create and expand an inclusive public sphere by fostering rational public opinion which enhances accountability. This may have special implications for technological disasters because it enables citizens to address not only the negative effects of the disaster but also the distrust and dissatisfaction with the government. In the Flint crisis, Twitter allowed citizens to create online communities, spread information, and engage with others to report the salient aspects of the crisis and to promote accountability.

Appendix

Figure 1. Daily Data Volume

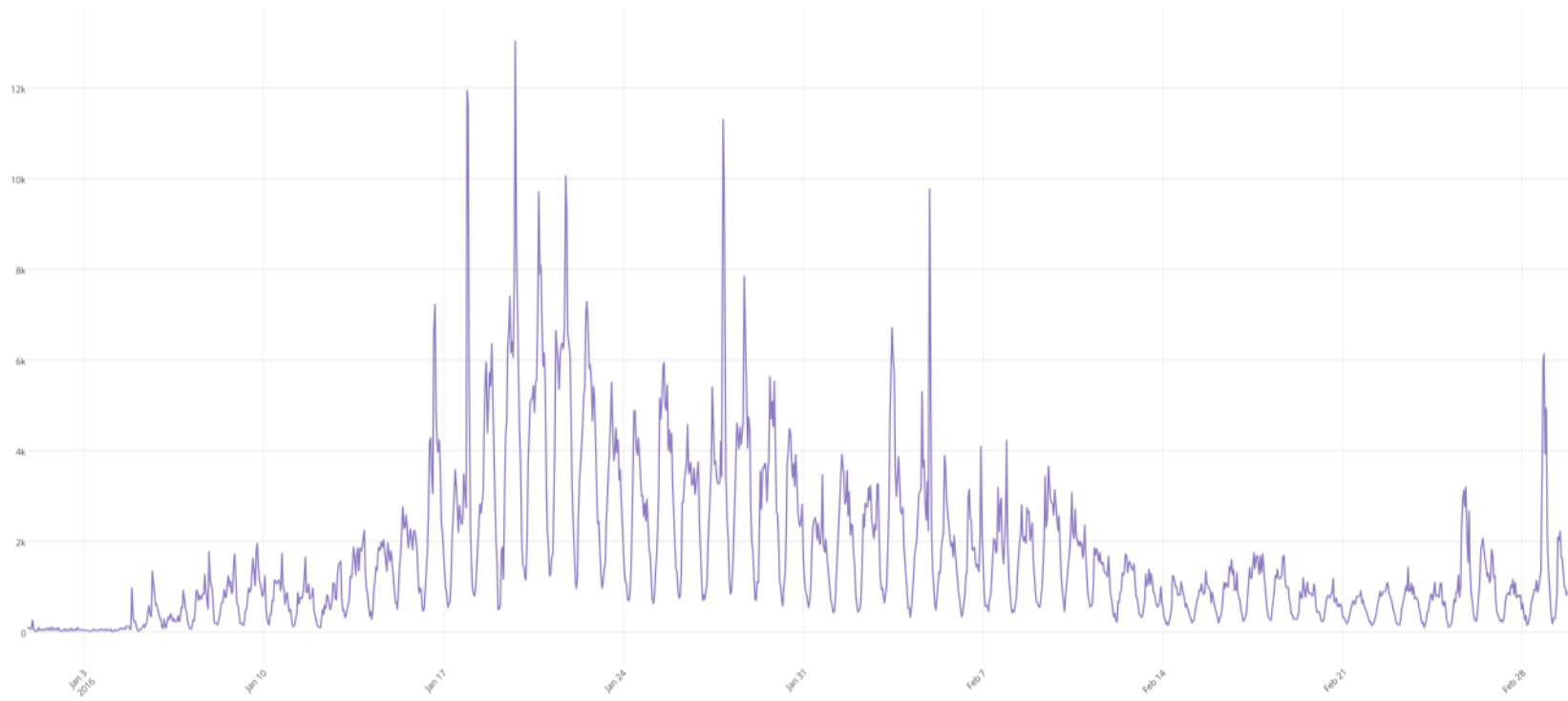


Table 1. Humanitarian Tweets: Examples from the Flint Water Crisis Twitterverse.

For those who are looking for ways to help #Flint, here's some info for you. Please share. #FlintWaterCrisis <https://t.co/JCTBnXbD4o>

HELP: All VanDrie locations are collecting bottled drinking water through Friday to deliver to #Flint! More info: <https://t.co/XaH4jEGbee>

RT: Beyoncé Announces #BeyGood Campaign to Aid Children Affected by Flint Water Crisis <https://t.co/FZwG1hJnNq><https://t.co/46QITGCEdc>

RT #GroceryStoreForFlint Let's make it a race! First one wins! @meijer @Walmart @kroger @SaveALot Help them! #FlintTownHall #Flin...

RT @ComplexMusic: Salute @MeekMill for contributing to the Flint Water Crisis relief in a big way: <https://t.co/qCWIRK0v3v> <https://t.co/DLi...>

<https://t.co/jaU0x80DPq> Beyonce Joins Diddy, Mark Wahlberg and Big Sean to Aid Relief Efforts for Flint Water Cri... <https://t.co/L8w625un0P>

RT Muslim Charity @LIFEforRELIEF dist. 100K+ water bottles, volunteers walking neighborhoods in major relief effort. #FlintWaterCrisi...

RT Wanna help out the victims of the #FlintWaterCrisis? Donate <https://t.co/ltN2GhCatW>

RT @essencemag: Big Sean launches #HealFlintKids fundraiser to help during #FlintWaterCrisis: <https://t.co/CtqusLYTtc> <https://t.co/Dz0sNYoU...>

@NSBE Launches #GoFundMe Campaign to Help Flint. Donate now: <https://t.co/QQlbGezcJT> Setting up a Gofundme for #FlintWaterCrisis need everyone help!!

RT MSULiveOn: Spartans! Head to student services tomorrow to discover ways to help Flint through the water crisis #SpartansWill...

#Michigan prisoners pledge to donate a third of their monthly incomes to help #Flint<https://t.co/sxXEG7Qrfd>

Table 2. Accountability Tweets: Examples from the Flint Water Crisis Twitterverse

So important to set precedent in holding Gov. Snyder accountable 4 #Flint. Other city/state officials can learn.

Rep Lawrence: Emergency Manager Act dissolves home rule; therefore, local govt (Flint) should not be held responsible. #FlintWaterCrisis

Hold the gov accountable for poisoning Flint. Sign the petition: [@moveon](https://t.co/FyneHya82e) #FlintWaterCrisis #ArrestGovSnyder

RT @Usher: I signed a petition to help hold Gov. Snyder accountable for poisoning Flint children. Will you? <https://t.co/HJNm4CPsKx>

Governor Knew About Flint Water Poisoning for Nearly a Year, Tried to Shift Blame <https://t.co/ZMDOLnUpvb>

RT @Eclectablog: Why is the man most to blame for the #FlintWaterCrisis still the Emergency Manager of Detroit schools? <https://t.co/CGw8md...>

RT @starfirst: Republicans Laughably Try to Blame Democrats For Flint Water Poisoning <https://t.co/DO5qfPBqOB> via @politicususa

Dems caused POLLUTED H2O in Flint why blame GOV as sole source problem.. Look to the Mayor who started the issue <https://t.co/uaKg4X4anZ>

Michigan governor: solve Flint water crisis instead of laying blame <https://t.co/2siy1IAngV>

Republicans pointing finger at EPA instead of #Flint Governor, really says how can we blame PBO. #FlintWaterCrisis

Instead of bitching about blame, fix the #FlintWaterCrisis already. It's going on 2 years now. Worry about fault later.

Emergency manager told flint to stop buying detroit water? to tie into Flint River? Nope. blame flint politicians <https://t.co/aDEyodgjQY>

SNYDER IS NOT TO BLAME. The lead in the water is the fault of the local government, NOT THE GOVERNOR #DemDebate #FlintWaterCrisis

RT: While he poisoned children, GovSnyder gave clean water to GM plant #Flintwater corroded their parts. Unbelievably evil and...

RT: Somewhere a kid is in jail over a dime bag of weed. But no one is behind bars for poisoning an entire city of children. #Fl...

RT: Sanders: "I did ask for the resignation of Gov. Snyder. His irresponsibility was so outrageous." #FlintWaterCrisis #DemDebate

Table 3. Social Justice Tweets: Examples from the Flint Water Crisis Twitterverse

RT @markmobility: #FlintWaterCrisis - 99,000 residents - 57% Black - 40% Poor - 9,000 kids with lead poisoning Flint HOSPITAL Water: <https://t.co/9d9UHn26Av>

RT @larryelder: Democrats And The Race Card: Don't Leave Home Without It #FlintWaterCrisis #DemDebate <https://t.co/AQdrSpfMV4>

Race baiting. The switch in water supply was cost saving measure. Wouldn't happen in a rich black community either. <https://t.co/9d9UHn26Av>

RT @AP: Flint, Mich., asks what role race, wealth and class have played in public health crisis caused by lead in water: <https://t.co/YQyNs...>

Michigan Governor Says Race Had No Role in Flint Water Response <https://t.co/bBtETfyOPP>

RT: The potential long term damage caused by the lead poisoning of children in Flint, Michigan should Outrage ALL OF US Regardless of race!

RT @billmckibben: MI Gov who says 'race played no role' in #flintwatercrisis is simply lying. No possible chance this would have happened i...

RT @RestingPlatypus: Race Is in the Air We Breathe and the Water We Drink: The Moral Failure in 9.Flint @HuffPostBlog <https://t.co/kGSwidE5cg...>

RT @DorothyERoberts: #Race is not an innate biological category, but #racism has deadly biological effects. #FlintWaterCrisis #FatalInventi...

RT @MSNBC: EXCLUSIVE: @HillaryClinton writes about race, justice & the #FlintWaterCrisis in MSNBC op-ed <https://t.co/ln0TunPzA7> <https://t.co/ln0TunPzA7>

RT @CharlesMBlow: Clinton bringing up the #FlintWaterCrisis. This is an outrageous story. Google it... #PoisonWater #Race #DemDebate

Flint's structural racism: This is why providing poisoned water to the city's citizens seemed like a reasonable idea <https://t.co/BFNPLnCSyX>

'Racism' Behind Flint Water Crisis – But Majority-Black City Council Started It All <https://t.co/5b4yCQR6ws>

Environmental racism Flint, Michigan: Did race and poverty factor into water crisis? @CNN <https://t.co/DLGVocZyEL>

Michael Moore determines that the Flint water crisis is racist genocide <https://t.co/UoBZFkmxBJ>

The Racist Roots Of Flint's Water Crisis <https://t.co/LWSA1ClqWC> #BlackLivesMatter #OscarsSoWhite #Racism #Assault #Crime

The #FlintWaterCrisis is the most egregious case of environmental racism/classism in my lifetime. On par w/ #Tuskegee and #JimCrow or worse. RT @HuffPostPol:

Footnotes

1 <http://michaelmoore.com/ArrestGovSnyder/>

2 Paid service provided by Twitter that pushes data to end users in near real-time, and guarantees delivery of 100% of the tweets that match the search criteria.

3 <https://gnip.com/sources/twitter/>

References

- Baum, Andrew, Raymond Fleming, and Laura M. Davidson. "Natural Disaster and Technological Catastrophe." *Environment and Behavior* 15, no.3 (1983): 333–54.
- Bernabé-Moreno, J., A. Tejada-Lorente, C. Porcel, and E. Herrera-Viedma. "Leveraging Localized Social Media Insights for Early Warning Systems." *Procedia Computer Science* 31 (2014):: 1051–60.
- Centers for Disease Control and Prevention. *Crisis and Emergency Risk Communication 2014 ed.* U.S. Department of Health and Human Services: 2014.. Retrieved from https://emergency.cdc.gov/cerc/resources/pdf/cerc_2014edition.pdf
- Colander, David, and Roland Kupers. *Complexity and the Art of Public Policy: Solving Society's Problems from the Bottom Up*. Princeton, N.J.: Princeton University Press, 2014.
- Dahlberg, Lincoln. "The Internet, Deliberative Democracy, and Power: Radicalizing the Public Sphere." *International Journal of Media & Cultural Politics* 3, no 1 (2007): 47–64.
- DMR. By the Numbers: 170+ Amazing Twitter Statistics. 2016. <http://expandedramblings.com/index.php/march-2013-by-the-numbers-a-few-amazing-twitter-stats/> (accessed May 21, 2016)
- Edwards, John F., Somya Mohanty, & Patrick Fitzpatrick. *Assessment of Social Media Usage During Severe Weather Events and the Development of a Twitter-based Model for Improved Communication of Storm-related Information*. Starkville, MS (2015):: Coastal Storm Awareness Program, NOAA.
- Hawkins, Andrew J. "Tracing the Spread of Uber Rumors during the Paris Terrorist Attacks." *The Verge, November 16* (2015): <http://www.theverge.com/2015/11/16/9745782/uber-paris-terrorism-rumors-twitter-facebook> (accessed April 22, 2016).
- Hossmann, Theus, Paolo Carta, Dominik Schatzmann, Franck Legendre, Per Gunningberg, and Christian Rohner. "Twitter in Disaster Mode: Security Architecture." *Architecture. SWID '11 Proceedings of the Special Workshop on Internet and Disasters*, Article No. 7 (2011).
- Keim, Mark E., and Eric Noji. "Emergent Use of Social Media: A New Age of Opportunity for Disaster Resilience." *American Journal of Disaster Medicine* 6, no 1 (2011): 47–54.
- Kongthon, Alisa, Choochart Haruechaiyasak, and Jaruwat Pailai. "The Role of Twitter during a Natural Disaster: Case Study of 2011 Thai Flood." *Proceedings of PICMET '12: Technology Management for Emerging Technologies*. (2012): 2227–32.
- Landwehr, Peter M., and Kathleen M. Carley. Social Media in Disaster Relief. In *Data Mining and Knowledge Discovery for Big Data*. Studies in Big Data 1. Edited by Wesley W. Chu. Berlin, Heidelberg: Springer (2014).

- Magsino, Sammantha L. (Ed.). *Applications of Social Network Analysis for Building Community Disaster Resilience. Workshop Summary*. Washington, D.C.: The National Academy Press. (2009) Retrieved from <https://www.nap.edu/download/12706>
- Murthy, Dhiraj. Towards a Sociological Understanding of Social Media: Theorizing Twitter. *Sociology* 46 no 6 (2012):1059–73.
- Papacharissi, Zizi. The Virtual Sphere: The Internet as a Public Sphere. *New Media & Society* 4 no 1 (2002): 9–27.
- Penn, Sean. “Michael Moore.” *Time Magazine* 165 no 16 (2005): http://content.time.com/time/specials/packages/article/0,28804,1972656_1972696_1973072,00.html (accessed May 22, 2016).
- Prince William Sound Regional Citizens’ Advisory Council, RCAC. *Coping with Technological Disasters: A User Friendly Guidebook*. Anchorage, AK (2004): Prince William Sound Regional Citizens’ Advisory Council: http://www.pwsrca.org/wp-content/uploads/filebase/programs/oil_spill_prevention_planning/coping_with_technologica1_disasters.pdf (accessed April 10, 2016).
- Rao, Adithya, Nemanja Spasojevic, Zhisheng Li, and Trevor DSouza. “Klout Score: Measuring Influence Across Multiple Social Networks.” *IEEE International Big Data Conference - Workshop on Mining Big Data in Social Networks* (2005): <http://arxiv.org/pdf/1510.08487v1.pdf> (accessed April 20, 2016).
- Saleem, Haji Mohammad, Yishi Xu and Derek Ruths. “Novel Situational Information in Mass Emergencies: What Does Twitter Provide?” *Procedia Engineering* 78 (2014): 155–164
- Sanburn, Josh, Sean Gregory, and Alexandra Sifferlin. “The Toxic Tap.” *Time Magazine* 187 no 3 (2016): <http://time.com/magazine/us/4188304/february-1st-2016-vol-187-no-3-u-s/> (accessed April 2, 2016).
- Schaefer, Mark. *Return on Influence: The Revolutionary Power of Klout, Social Scoring, and Influence Marketing*. New York, NY (2012): McGraw-Hill.
- The Times of India. “Ola Launches Boat Service in Flood-Affected Chennai.” *The Times of India*, (2015): <http://timesofindia.indiatimes.com/tech/tech-news/Ola-launches-boat-service-in-flood-affected-Chennai/articleshow/49816195.cms> (accessed May 22, 2016).
- United States Census Bureau. “Flint City, Michigan.” *QuickFacts, United States*. (2014): <http://www.census.gov/quickfacts/table/PST045215/00,2629000> (accessed May 21, 2016).