Accommodating Grief on Twitter: An Analysis of Expressions of Grief Among Gang Involved Youth on Twitter Using Qualitative Analysis and Natural Language Processing

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ABSTRACT: There is a dearth of research investigating youths' experience of grief and mourning after the death of close friends or family. Even less research has explored the question of how youth use social media sites to engage in the grieving process. This study employs qualitative analysis and natural language processing to examine tweets that follow 2 deaths. First, we conducted a close textual read on a sample of tweets by Gakirah Barnes, a gang-involved teenaged girl in Chicago, and members of her Twitter network, over a 19-day period in 2014 during which 2 significant deaths occurred: that of Raason "Lil B" Shaw and Gakirah's own death. We leverage the grief literature to understand the way Gakirah and her peers express thoughts, feelings, and behaviors at the time of these deaths. We also present and explain the rich and complex style of online communication among gang-involved youth, one that has been overlooked in prior research. Next, we overview the natural language processing output for expressions of loss and grief in our data set based on qualitative findings and present an error analysis on its output for grief. We conclude with a call for interdisciplinary research that analyzes online and offline behaviors to help understand physical and emotional violence and other problematic behaviors prevalent among marginalized communities.

KEYWORDS: Social media, grief, gangs, natural language processing

Introduction

The process of grieving is a misunderstood phenomenon and is further complicated when layered with complexities found at the intersections of adolescence and urban life in a networked public. Grieving in the United States may happen in public and private spaces. Although many aspects of grieving are in fact private, there is often a desire to share the news of death with others, which has typically occurred through death announcements in newspaper obituaries, churches, and Web sites. Researchers suggest that social media has reconfigured grieving due to social media platform features that allow for persistence, replicability, scalability, and searchability.[1,2] In this study, we investigate expressions of grief—defined as the reaction to loss—on Twitter, among Gakirah Barnes and her peers, who include a group of young people who provide signals of gang knowledge, or affiliations on Twitter through mentions of gang names, symbols, images, and videos. In this study, we do not anonymize Gakirah Barnes because her story and Twitter handle was first published in several national media outlets.[3]

Gakirah Barnes, a 17-year-old female member of the Chicago gang St. Lawrence Boys, created the online Twitter account @TyquanAssassin at 13 years old in memory of her friend Tyquan Tyler who was killed by a rival gang, O-Block, in 2013. Gakirah was an active Twitter user posting more than 27 000 tweets from December 2011 until her own death on April 11, 2014, using the account to express the events of her daily life, which ranged from friendships and other relationships to gang violence and the deaths of her peers.

Although many accounts of gang behavior in Chicago have focused on gang-related violence and homicide, few have highlighted the psychological and social responses of youths to the sudden, violent, and recurring losses of close friends and family in their community. Social media is an important outlet for responding to these losses; however, we could find no publications related specifically to the role of social media for coping with grief among gang-involved youth who are born digital. Reactions to loss can include expressions of anger and in some cases a death can elicit deliberately provocative responses. Platforms such as Twitter can increase the likelihood of electronic aggression and corresponding retaliatory behaviors that lead to serious injury or homicide in the community.

This study uses qualitative analysis and an error analysis of our natural language processing (NLP) system[4] to examine tweets that followed 2 deaths. First, we conduct a close textual reading of a sample of tweets over a 19-day period during which 2 significant deaths occurred: Raason "Lil B" Shaw (March 29, 2014) and Gakirah's own death (April 11, 2014). We leverage the grief literature to understand the ways in which Gakirah and users in her Twitter network express thoughts, feelings, and behaviors at the times of these deaths. We also present and explain the rich and complex style of

online communication among gang-involved youth, one that has been overlooked in prior research.

Next, we show the results of a natural language computational system we developed previously to identify expression of loss and grief in our data set based on qualitative findings[4]; our focus here is on how well we identify loss, presenting an error analysis of the output related to loss (eg, what types of tweets were correctly identified as loss and why).

We conclude with a call for interdisciplinary research that uses online and offline behaviors to help understand physical and emotional violence and other problematic behaviors prevalent among marginalized communities.

Theoretical Background

Gang-involved youth in 21st-century America are born into an advanced technological age in which they are comfortable using the Internet, cell phones, and social networking sites (SNSs) to express themselves.[5] Understanding when, how, and why young people use digital communication may provide an important way to deepen our understanding of the experience of these youth.

Research from Pyrooz et al[6] highlights online behaviors common among gang members. In a study of 585 current and former gang members in 5 US cities who have been involved in the criminal justice system, Pyrooz et al found that gang-involved youth and young adults spend similar amounts of time online and engage in many of the same behaviors as non–gang-involved individuals, including sharing music and connecting with friends.

As geographic and digital space converge, youth craft their identity and express their feelings in front of multiple and invisible audiences.[7] However, gang-involved individuals differ regarding participation in online crime and deviance. For example, 45% of the sample from the Pyrooz study engaged in drug sales or the sale of stolen items online. In addition, although gang-involved youth primarily use cell phones and social media for entertainment and/or communicating with friends, similar to non–gang-involved individuals, it is increasingly becoming a space for youth to discuss violence and crime occurring in their community. Over the past few years, Internet users have turned to social media sites such as Twitter to communicate their lived experiences. For gang members and youth living in urban settings, this experience often includes significant trauma and violent and aggressive communication.

In addition, the practice of making insults and threats, a phenomenon known as "Internet banging"[8] is a new and growing activity where youth turn to social media sites to trade insults or make violent threats, which can escalate to violent altercations and result in physical assault or even homicide.[9–11] Although there is not yet empirical evidence, many scholars believe that the real-time nature of social media has amplified youth threats and increased the likelihood of physical violence. The speed of Twitter communication makes it difficult for violence interrupters—adults who are trained to go into neighborhoods and intervene—to respond. In fact, our informal conversations with violence workers reveal that the first thing they do during a time of tension is take away a gang member's smartphone.

Grieving On and Offline

Bereavement is among the most stressful of life experiences. In particular, loss of a young person by violent means is highly stressful.[12] A recent report documented increased rates of onset of a range of mood and anxiety disorders following sudden unexpected death.[13] Bereavement is also associated with the onset and worsening of physical illness. Grief is the natural response to bereavement and is a multifaceted and time-varying complex individual process with biological, psychological, and social components[14,15] Arguably grief is the form love takes when someone we love dies.

Each episode of grief is unique to the bereaved person and the specific loss. However, there are commonalities: the hallmark of grief is yearning, longing, and sorrow accompanied by thoughts and memories of the deceased person. In general, *acute grief* is an intense response that includes a mix of other emotions, mostly negative but sometimes also positive, a sense of disbelief, frequent insistent thoughts of the deceased person, and relatively little interest in anything else. Over time, adaptation to the loss occurs and grief is integrated.[14,15] *Adaptation* is also a uniquely individual process but generally includes acceptance of the finality and consequences of the loss, revision of the internal relationship to the deceased (continuing bonds), and reenvisioning life in a way that has purpose and meaning in a world infused with the absence of the deceased loved one.[16] Grief is not resolved but its intensity and dominance in a bereaved person's life recede over time. Grief can also be prolonged and complicated by maladaptive thinking, inadequately regulated emotions, or dysfunctional behaviors that impede the natural process of adaptation.[17,18]

How we experience grief is influenced by our social context. Race and community embeddedness influence the process of grieving and adaptation to loss as well as how it is interpreted by others. In a robust ethnographic account of violence, trauma and grief in a predominately black Chicago neighborhood, Laurence Ralph[19] focuses on the importance of uncovering and uplifting local, indigenous responses to grief. From Ralph's perspective, devaluation of black lives that were killed prematurely creates a form of grief that should be understood in context to contain both a "temporary sadness that can be overcome (mourning) and a perpetual condition that cannot (madness)" (p. 32).

As youth grapple with acute grief and adaptation to loss, they often narrate their experience on social media. For instance, Roberts and Vidal[20] describe "virtual cemeteries" as a space online for the bereaved to create a public memorial. Brubaker and colleagues investigated grief on social media sites such as Facebook and MySpace.[21,22] In one study, researchers manually coded 2213 comments for emotional distress and used LIWC (Linguistic Inquiry and Word Count), a linguistic

analysis program,[23] to detect sentiment across the data set.[21] Massimi et al have explored the role of technology at the end of life more broadly and consider the changing nature of artifacts (eg, physical photos to digital photos), identities (eg, the loss of ownership of a social media profile page), and temporality (eg, what it means to create a digital monument).[23,24]

Adaptation to loss includes the reenvisioning of a future without the deceased that still has a sense of purpose and meaning. However, in a social context of devalued black lives, there can be no acceptance of senseless untimely death and purpose and meaning can be found in the continued public expression of intense grief that reminds the community of the power of love and the horror of devaluation. As the bereaved accepts the finality and consequences of the loss and reconfigures existing internal psychological representations to incorporate this reality, the loss is integrated. Their bond with the deceased continues to inform their lives moving forward.[25(p17)] However, adaptation requires a social community that shares the outrage and pain of a premature death and protests it. Social networking sites provide a platform where youth are able to document, historicize, share, and reflect on their experiences with the deceased in a way that supports adaptation to the loss. However, distracting maladaptive scenarios can also be played out on SNSs and these may complicate grief and impede adaptation.[26] Currently, little is known of the grieving process of urban gang-affiliated youth or of the possibility that SNSs can be a cause of grief complications; these are 2 significant gaps that we investigate.

Method

The richness and complexity of tweets from gang-involved youth requires a case study approach that considers the context and environment of urban youth to explicate their use of Twitter. We created a social media corpus composed of publicly available Twitter communication from Gakirah Barnes. We use a mixed methods approach, first qualitatively analyzing tweets from Gakirah and users in her Twitter network to understand how they communicate in times of distress following a homicide. We then use NLP to automatically identify expressions of loss and grief in our data set. Finally, we conduct an error analysis to determine how effective we have been.

Setting: Gakirah's history of loss

Gakirah Barnes lived in a community where lives are devalued. She experienced tremendous violence starting at a young age and had recurring experiences of death and loss.[27] Just weeks before her first birthday, her father was shot and killed. As a teenager, Gakirah affiliated with a group of boys and young men in the Woodlawn neighborhood of Chicago called the St. Lawrence Boys (STL), or Fly Boy Gang, a Gangster Disciples faction. Gakirah frequently used Twitter to express loss after a death of a friend. Chicago-based media reported the death of

Carlton "Tutu" Archer who affiliated with the same gang as Gakirah. Gakirah posted on a photo on Twitter with the text "RIP Carlton" that showed her with her hands pressed together in prayer.

The death that seemed to have the most impact on Gakirah was the murder of 13-year-old Tyquan Tyler. Gakirah grieved for Tyquan, with whom she reportedly had a close relationship, and adopted the Twitter handle "@TyquanAssassin" in reference to him. During this time, she also graduated from the eighth grade at a local charter school in Chicago. Before Gakirah's brutal and untimely death on April 11, 2014, Gakirah also used Twitter to grieve the death of friend and gang member Raason "Lil B" Shaw who was allegedly killed by a rival gang on March 29, 2014.

Data collection

We retrieved 2000 tweets, retweets, and mentions of @TyquanAssassin published between Saturday, March 29, and Thursday, April 17, 2014, using Radian6, a social media tracking service. This time frame represents that 2 significant deaths are connected to Gakirah Barnes: The former is the date Raason "Lil B" Shaw was allegedly killed by the Chicago police and the latter is 1 week after Gakirah's death. We also identified retweets of Gakirah's posts on the day she was shot, as mourners visited and interacted with her Twitter profile to express their grief. Our research assistants eliminated tweets, retweets, and mentions that did not specifically mention, describe, or make reference to these deaths. Our final data set for the qualitative analysis includes 408 tweets.

Qualitative analysis

We applied a deep, textual analysis to tweets from Gakirah Barnes and users in her Twitter network between March 29 and April 17, 2014. A deep read is a type of textual analysis in which annotators use outside knowledge such as context to interpret textual data and to identify and describe subtle details of the tweet such as moments of escalation.[3] We hired 3 research assistants with graduate-level training in social work and with experience in the language and emojis used by gang-involved youth on Twitter. The research assistants read and coded each tweet and assisted in the analysis of the data.

Coding process. The coding team first analyzed a random sample of 50 of Gakirah's tweets using open coding to develop a codebook with a total of 26 codes. Codes ranged from examples of threats, tweets related to death, and general discussion of family, friends, and relationships. Central to this process was an effort to acquire additional context regarding Gakirah and users in her Twitter network.[28] To do so, we reviewed the biographical sections of the Twitter profiles of Gakirah and other users who interacted with her account between March 29 and April 17, 2014. We sought contextual clues (eg, T-shirts with

Table 1. Sample codes.

CODE	DESCRIPTION
Loss	This is coded as an event. A tweet about death could be coded as loss; death is a subset of loss events
Grief	Grief is defined as the response to a meaningful loss, and the code is used for tweets that are judged to be the writer's response to loss. Grief is especially intense when it follows the death of someone who matters to the person. For example, reactions to a death such as disbelief, "Tell me this shit ain't true"
Threat	Tweets expressing, either directly or indirectly, the possibility or intent to commit a violent act toward an individual, group, or gang. This includes prospective and retrospective threats. Example of a retrospective threat includes "I Knew Dat nigga was a Bitch should of killed his ass wen we went on dat lick"

RIP notations, gang signs, locations of activities) in background images, photos, videos, and "about me" descriptions that suggested connections to gangs. The research team then used the codebook to code all 718 identified tweets, mentions, replies, and retweets.

In the first round of coding, we identified a pattern in communication in which an expression of loss or grief preceded an aggressive or threatening tweet. We then engaged in a second round of coding where we looked specifically within tweets identified as being expressions of loss or death and those identified as grief. Tweets related to death typically include phrases or acronyms such as "RIP" or "Free" or mention someone that was killed followed by identification of the writer's emotional state via emojis such as praying hands or a crying face. We had peer debriefing meetings in which the research team discussed the codes, identified examples of communications that contradicted our initial categories and themes, and worked to reconcile differences. Table 1 provides several examples of codes that emerged from our data.

These codes are most relevant to Gakirah's tweets about the death of her friend Lil B and those related to how Gakirah's friends reacted to her death. For example, a post may include the acronym RIP (ie, rest in peace) and sometimes included references to incarceration (eg, #free). For example,

Free my gang rip my gang man 🔓🙏🏽

Many of the tweets we collected use unconventional acronyms, shorthand, slang, and emojis in their expression. Consider an example tweet posted in response to Gakirah's death:

SHIT #KRAZY Man ! #BIP AY #HITTA & AY MF #STL #EBT LEGEND K.I & HBD #BOSSTRELL @TyquanAssassin @Stl_trell #GaNgGaNG pic.twitter.com/ifvVTZKVZP

This tweet is translated up to the @ replies as, "Things are crazy, man! Ball in paradise all you killers and all you motherfucking St. Lawrence and Eberhart legends, K.I. and, honored by death, Boss Trell." "Ball in paradise" is slang for "rest in peace." St. Lawrence and Eberhart refer to gang neighborhoods. "K.I" was one of Gakirah's nicknames, and Rodney "Boss Trell" Stewart is a deceased gang member.

We note that researchers have debated whether or not to anonymize Twitter handles in academic research. We use real handles and names here because Gakirah and her online presence have been covered extensively in mainstream news sources; however, we lightly anonymize other details including the handles of her followers.

Results

Of the 408 tweets that coders examined, 112 were sent from Gakirah's @TyquanAssassin account between the death of Lil B and her own death; 42 (38%) of these were coded as grief. The remaining 296 tweets were replies to or mentions of @TyquanAssassin during the data collection period; of these, 232 (78%) were coded as loss, either Gakirah's or their own. We present illustrative examples of tweets that fall into 2 categories: acute grief and adaptation to loss.

Acute grief

Following the death of Lil B, Gakirah's posts often expressed anger:

Why da police have 2 kill my Broski 😔😔

Later, after Gakirah's death, many followers in her network refused to acknowledge that they had lost her. They mentioned her in tweets or retweeted the news of her death, adding their own disbelief and denial to their tweets. For example,

Naw Not Gakirah Mann Tell Me This Shit Ain't True "@ {anonymized}: Shit Crazy Rip my Hitta Stl Finest @ TyquanAssassin"

Here, in a post that expresses disbelief and denial, Gakirah is described as one of the St. Lawrence Boys gang's finest assassins. Posts between users in Gakirah's Twitter network indicate that her death deeply affected those she knew in geographic and digital space. Gakirah's peers exhibited disbelief, proximity-seeking, and yearning, often wishing to address her directly as if she were still living and would be able to respond:

- Rip Lil bro tyquan I gotta different mind stage now. Is you really gone @TyquanAssassin LIGHTBRIGHT in steady calling yo phone 😓

@TyquanAssassin Why TF You Leave Us 😡 Why Man I Swear This Ain't Really Happening I'm Finna T'UP 😈😤 Shit O V A
I Wanna Cry So Loud In This Pillow Hoping You'll Hear Me & Come Wipe My Tears @TyquanAssassin They So Cold On My Face 💔

- I try to sleep to keep you off my mind @TyquanAssassin but you in my dreams too baby girl 😩😪🙈

This type of response is consistent with prior research on memorial Web sites where conversations with the deceased and yearning for proximity were also prominent.[19] The context of the deaths, known as the "death surround,"[29] may have left Gakirah before her death—and her network after her death—ill-equipped to adapt. Death through gang violence is usually sudden and unexpected, eliciting very intense and painful emotions and difficulty accepting the reality.

Anger and retaliation

Preoccupation with thoughts and memories of a person who died is typical during acute grief. Gakirah tweeted about her memories of Lil B:

Remember wen we played 2 da left n we stayed out of trouble cuz we stayed 2 our self yea dem was da times my brother rip Lil b

Quoting lyrics from a song by rap artist Lil Wayne called "I Miss My Dawgs," in this tweet Gakirah reflects on earlier times before she had become embedded in gang life. "Playing to the left" means "avoiding a dangerous or harmful situation," suggesting that she longed for the time when they were safe. Gakirah referred to past losses on her Twitter account in similar ways as she grieved for Lil B. For example, on April 2, 2014, she tweeted,

Rip Shondale Tooka tutu Lil B n Boss Trell 🙏🏽

With the acronym "RIP," Gakirah was recalling the violent deaths of 3 other members of her gang over several years. Shondale "Tooka" Gregory was shot in January 2011, Carlton "Tutu" Archer in November 2011, and Rodney "Boss Trell" Stewart in November 2012. In a brutal and ironic twist, Gakirah became one of the mourned, and her network similarly remembered and longed for her. One Twitter user exclaimed. "I'm so sad man, who Ima talk to now. Who gone Ft and Text me Just to Curse Me Out. Who gone make me Smile @TyquanAssassin Did all that"💯

Adaptation

Adaptation to a companion's death requires accepting the finality and consequences of the death, reenvisioning a future that still has a sense of purpose and meaning and maintaining a sense of connection to the deceased. The way this unfolds is influenced by the social context of bereavement. In Gakirah's world, the often used red symbol of "100" with 2 lines under it means "keep it 100" or stay true to yourself, meaning have integrity in what you do and say. This admonition may be a way of reminding others that life can still have purpose and meaning. We found also that Gakirah and users in her Twitter network often shared memories of the person who died.

When Gakirah adopted the Twitter handle @TyquanAssassin in response to the death of her friend Tyquan Tyler, she provided a way to keep her friend's memory alive. Tyquan Tyler's name appeared as part of every tweet that was a reply or mention of Gakirah's account made by other users, and it appeared every time another user retweeted one of Gakirah's tweets.

During our analysis, we noticed another Twitter handle, @GKirahAssassin, which frequently mentioned @Tyquan Assassin and retweeted @TyquanAssassin's tweets. Our collection of tweets from Radian6 came with URLs pointing to the tweets on the Twitter Web site. We saw that the URLs for another user's tweets before Gakirah's death were redirected to the @GKirahAssassin account. Through this, we deduced that this user had changed their Twitter handle to @GKirahAssassin after Gakirah's death, continuing this way of keeping a friend's memory alive through Twitter handles.

Accepting the reality of death

The response to death can be affected by sharing functions embedded in many social media platforms. Social media posts are often shared within and outside of one's social media network. Gakirah's voice seemed to resonate with her followers. She was often retweeted while she grieved Lil B's passing. For example, on April 11, 2014, at 2:16 PM, only a few hours before her own death, Gakirah tweeted,

I Do wat I Do Cuz I Kno God Got a day 4 me.

This was retweeted 9 times in the first 15 minutes after she posted it. In addition, after Gakirah's death, her followers returned to her profile and retweeted this tweet and others she had posted before her death. They occasionally added comments at the end of the retweet to express their feelings about her death in the form of disappointment, anguish, and anger, such as "damn RIP" or "smh damn girl" (smh = "shaking my head").

When Gakirah's followers retweeted her posthumously, they reflected on the possibility that she had anticipated her own death (although no evidence suggests she actually expected to be shot that day). For example,

Funny how you tweeted this 2 days ago. RiP doe smfh. Its really gettin hot out dere :/ RT @TyquanAssassin In da end we DIE 🙏🏽💯

"It's really getting hot out there," refers to the increasing levels of gang violence in the area. Post-hoc, Gakirah's original tweet, "In da end we DIE," which is likely related to the growing numbers of deaths around her, takes on an ominous tone that seems to predict her own death. Other users added similar comments to this tweet when retweeting it, such as "A week after tweeting it, she died! RIP Gakirah (K.I.)," "So fxck'n true," and "Damn K.I #SleepTight Kidd." We conjecture that this public conversation presents a unique form of social support for Gakirah and her Twitter network, likely to be a helpful way to use social connection as a way to foster adaptation after a death.

NLP analysis

We developed a computational system that classified tweets from our corpus into "aggression," "grief statements or emotions," or "other" (see Blevins et al[4] for full details). Our supervised machine learning approach uses a cascading classifier consisting of 2 support vector machines (SVMs), the first of which discriminates "other" tweets from either "aggression" or "loss" and the second distinguishes between "aggression" and "loss." The system uses training data labeled by the qualitative analysis coding team; the data set includes 616 tweets that were used to train the classifier and 102 tweets used to tune the parameters of the classifier. We tested the classifier to see how well it performed on a held-out test set of 102 tweets. The features which were included in the system include words, bigrams (2 words that consistently appear together), emojis, part of speech tags, and indications of the strength and quality of the emotion associated with the words in the tweet drawn from the Dictionary of Affect in Language (DAL).[30] Given the non-standard language used in the tweets, traditional NLP tools and resources (eg, part-of-speech taggers and lexicons) that are widely used in the field (eg, Stanford core NLP[31]) could not be used. Instead, we developed our own part-of-speech tagger using SVMs on tweets that we labeled with part of speech, as well as a phrase book that maps words in our corpus to standard American English words that convey the same meaning (see Blevins et al[4] for details). The phrase book was developed by glossing a subset of our data and using Manning[32] to align words in the tweets with the glosses. The phrase book was essential for enabling use of the DAL which includes only words from standard American English. The DAL has 3 entries for each word that indicate (1) how pleasant or unpleasant it is, (2) the intensity of the emotion, and (3) how concrete the word is (ie, Can we imagine an object in the world on hearing the word?). After training the classifier, we tested it and found that it could identify loss-related statements or emotions with an F measure of 64%. F measure is the mean of precision (ie, Of all the tweets that the system labeled as loss, how many were labeled correctly?) and recall (ie, Of all the tweets labeled as loss in the test set, how many did the system find?). We found that the system is much better at recall (93%) than precision (48%).

Table 2. Single word features, weights, and their occurrences in the overall data set.

FEATURE	WEIGHT	OCCURRENCES
RIP	1.39	129
Free	1.07	16
Damn	1.02	35
🙏	0.93	84
R.I.P.	0.93	18

Table 3. Tweet text: Young niggas still getting shot babies still dying 🙏.

SIGNIFICANT FEATURES	WEIGHT	OCCURRENCES
🙏	0.927694	1
Dying	0.234504	1
Young	0.081417	1

As community outreach workers will filter the output manually to decide which tweets to act on, high recall helps to ensure that they see all possible relevant tweets.

System analysis

Our analysis of the system indicates which features are most important. "RIP" is the feature that has the most impact by far. This is not surprising, as its presence is a strong indicator of the death of a friend or family member. The second strongest feature was the word "free," a term often used to respond to the loss of a friend or family member who is currently in jail or prison followed by the features "damn," the emoji of praying hands 🙏), r.i.p., "rest" and "happen." The full set of features is shown in Table 2.

An examination of tweets that were classified as "grief statements or emotions" and the features that were most important to the classification can also shed light on how the classifier works (see Table 3). The first 2 tweets were classified correctly, whereas the third was incorrectly classified. In the first example, the emoji is the most important feature, followed by the words "dying" and "young." It is clear that the use of these features is similar to the words that a person might find important in determining that the tweet is about death.

In Table 4, the word "RIP" is the most important feature followed by the emoji and the word "Tutu." Here, the praying emoji is used to respond to the death of a friend or family member and "Tutu" is the name of the individual who was killed.

Table 5 highlights an example where the classifier predicted that a tweet was about loss when it was not. The features that the classifier used are "STL," an acronym used to describe the St. Lawrence Boys gang, the emoji, and the word "a." Clearly,

Table 4. Tweet text: Rip dem Boyz BT Tooka Tutu 🙏.

SIGNIFICANT FEATURES	WEIGHT	OCCURRENCES
Rip	1.389889	1
🙏	0.927694	1
Tutu	0.0	1

Table 5. Tweet text: STL o Shellz EBT o Get Put on a T 😈.

SIGNIFICANT FEATURES	WEIGHT	OCCURRENCES
Stl	0.588251	1
😈	0.567623	1
A	0.233422	1

relying on "a" as a predictor is incorrect. Given the nonstandard language of the tweets, we found early on that stop words such as "a" could help us determine nouns that might otherwise have gone undetected. They also have false alarms, however, as in this tweet. References to gangs (eg, STL) can be useful for determining aggression when the gang mentioned is a rival and thus gang references also were not removed.

Discussion

Although a superficial glance at the communications of gang-involved youth on social media paints a picture of violence, aggression, and abuse, our study shows that youth also use social media to narrate their response to the death of gang members about whom they cared. Our findings may be used by clinicians and outreach workers to support the grieving process for youth living in communities with high rates of violence. Our findings also have implications for designers of social media sites to better serve this community of users.

The array of expressions of grief, mourning, and memorializing are evidence of the movement from community violence exposure offline into a process of grieving online. In the Twitter feed we analyzed, youth exposed to the deaths of their friends turned to social media to express clear feelings of yearning sadness and emotional pain rather than signing off and seeking isolation.

So why might gang-involved youth in Chicago express grief on Twitter? Ralph[19] argues that grief within the context of shared trauma and violence is a collective experience. We advance this argument by offering Twitter as a new context where expressions of grief have a social meaning. Our NLP findings further indicate that youth use signals and text on Twitter (eg, RIP and praying hands emoji) to amplify their grief emotions and include others in their process of grieving. Similar to the mother in Ralph's exposition, the madness of acute grief is amplified in this social context as a loud declaration of love and protest against devalued young lives. However,

the accessability, visibility, and omnipresent natures of social media may sometimes be an impediment to the grief process. For instance, Patton et al[3] found that rival Twitter users sometimes direct insults and threats toward the bereaved or make light of recent homicides. This hostile interchange may impair or prolong adaptation to the loss and/or provoke rage that leads to increased violence in the community.

This study demonstrates the potential that Twitter and other social media platforms have channels that enable us to support people online who are more difficult to reach by traditional means offline.[31] Such access might be used to promote more effective grief support and/or to reduce community self-harm or violence that occurs in response to loss. In particular, youth who live in violent neighborhoods may lack access to people and resources to support them in managing their response to death and loss. Social media posts that foster adaptation as opposed to retaliation in response to the death of a comrade could have a critical role in violence reduction strategies. Our larger goal is to develop ways to use Twitter as a clinical tool for both assessment and intervention. As illustrated in this report, the study of Twitter feeds allows us to learn more about marginalized populations. This information can assist individuals and organizations with the development of prevention and intervention initiatives to mediate gang violence and provide support to victims.

Our findings also have important implications for the development of new technologies to support community organizations focused on diffusing violent conflicts and helping young people cope with their trauma exposure. Social media researchers and designers could pair qualitative and computational approaches to better support urban youth using trauma- and loss-informed interventions that aim to address emotional well-being and physical safety. Software could detect keywords or phrases that indicate an individual has been exposed to a traumatic or a loss-related event, and then community organizations could intervene (either online or offline) to enhance adaptive responses and prevent conflict escalation. Our study provides insights into how social media can provide young people with opportunities to support each other after a painful loss.

One major barrier to the development of social media assessment and intervention technologies is the unique communication style used by urban youth. Computational tools such as AnalyzeWords and LIWC should develop dictionaries and libraries to capture the unique features of the communication styles of urban youth—perhaps even hiring and training marginalized youth as crowdworkers to help with this decoding. Our study paired a dictionary-based computational analysis with an in-depth detailed interpretation that elucidated patterns of grief as expressed using gang-relevant terminology that would be unlikely to be recognized in big data sets. We started by using qualitative analysis to understand the unique style of communication used by Gakirah and her network. This essential step enabled us to conduct quantitative analyses that

would have been very difficult, if not impossible, if we had not first coded tweets qualitatively. When we compare the results produced by qualitative and NLP methods, we see that NLP systems need a more "human-like" understanding and intelligence if they are to aid in effective intervention. Future research using NLP might examine grief on other social media platforms with stronger conversational features which may produce robust conclusions about the role of social media in the grieving process of gang-involved youth.

Limitations

The data presented in this study examine a single African American female Twitter user and a small sample of her Twitter network. Gakirah posted more than 27 000 tweets from the time that she joined Twitter in December 2011 until her death. She also had thousands of Twitter followers. A more robust examination into Gakirah's Twitter network may elucidate broader connections between Twitter behavior and urban youth violence. We did not examine the Twitter communication of other youth living in similar conditions nor did we examine Twitter communication of youth who live in low-risk neighborhoods outside of Chicago. Moreover, we only use data from a limited time period, which does not allow us to examine expressions of loss and grief longitudinally. Although our current approach allows us to acutely examine Gakirah's experiences with death, it is unclear where these communications fit in an overall continuum of Gakirah's experiences with loss and how she communicates those experiences with her peers on Twitter.

With these limitations in mind, our purposive sample and approach provide an opportunity to look closely at how trauma is communicated on Twitter to generate future directions for research. Our results are, by definition, preliminary and cannot be generalized to other African American youth or other Twitter users. However, the coding presented in this article can be used as a foundation for future research studies.

Implications and Future Research

This study has implications for both theory and practice and contributes to research in 3 ways. First, to the best of our knowledge, this study is the first to investigate how gang-involved youth express and cope with grief on Twitter. This is an important theoretical contribution because of the intense use of social media by youth, particularly African American youth.[33] Although Twitter appears to provide a space for youth to cope with grief in their community, uncontrollable factors such as interpretation, audience, and the permanency of Twitter posts have the potential to complicate the natural grieving process. Future research might explore the relationship between expression of grief on Twitter and complicated grief.[34]

Second, this study highlights a unique style of communicating and expressing grief on Twitter that includes a mixture of gang-specific vernacular, text messaging abbreviations, and the use of emojis that may be difficult to interpret using a big data approach. Individuals observing this specific style of Twitter communication may have vastly different interpretations of the communications that may have negative consequences for the Twitter user who wrote the post. Future research should examine types of communication styles and how they evolve, especially in the context of traumatic events such as urban-based violence and death.

Finally, our study suggests that retweeting posts can facilitate processes related to adaptation to loss among youth living in violent urban neighborhoods who may not have good access to grief support. Future research might explore the extent to which retweeting, particularly of the messages of recently deceased Twitter users, affects the grieving process for youth.

This study highlights the opportunity for the designers of social media platforms such as Twitter to pair qualitative and computational approaches to better support youth in urban neighborhoods in their grieving and emotional processing. Youth who live in violent urban neighborhoods are often socially isolated and lack access to resources that can support them during times of crisis, a problem that likely contributes to ongoing cycles of violence. Software could detect expressions of loss among youth and try to intervene either offline or online to prevent escalation of violence while supporting processes that foster adaptation to loss, social skill building, and survival.

Conclusions

In this study, we investigate how gang-involved youth communicate expressions of grief on Twitter. The results of our study show that Twitter provides gang-involved youth with multiple ways in which to express and communicate about their response to loss. Computational studies of social media have overlooked the nuanced behaviors among social groups, especially marginalized populations such as youth living in violent urban neighborhoods. We highlight the need for future research and designers of social media platforms to acknowledge and attend to the active and diverse demographics of social media users and to identify ways that these platforms can be used to support social work practice.

Author Contributions

DP conceptualized the research study, conducted qualitative analysis, contributed to writing the the introduction, literature review, qualitaitve methods and discussion section, edited the manuscript. JM collected the social media data, contributed to writing the introduction, NLP and discussion sections, edited the manuscript. SS provided feedback and edited the manuscript. KS contributed to writing the literature review, provided

consultation on grief, edited the manuscript. KM conducted the NLP analysis and wrote the initial draft of the NLP section.

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