

# Grieving Online: A Text Analysis of Narratives of Grief on Reddit

Emily Scheinfeld<sup>1\*</sup>, Chinasa Elue<sup>2</sup>, and Gary B. Wilcox<sup>3</sup>

<sup>1</sup>School of Communication & Media, Kennesaw State University, Kennesaw, GA

<sup>2</sup>Department of Educational Leadership, Kennesaw State University, Kennesaw, GA

<sup>3</sup>Stan Richards School of Advertising & Public Relations, The University of Texas at Austin, Austin, TX

\*Corresponding Author: [escheinf@kennesaw.edu](mailto:escheinf@kennesaw.edu), 470-578-2572, @ProfScheinf

As the world has returned to a sense of normalcy following the height of the COVID-19 pandemic, the compounded grief experiences continue to linger and we realized many have experienced grief to varying degrees, and about a variety of issues. The pandemic also created an environment where people were restricted to cope and seek support in virtual spaces. The realization we could turn online to find support came with the realization that we could sidestep the taboo nature of grief, and allow us to craft a narrative to help us cope with that grief. This study used text analysis of Reddit post using #grieving,

#griefandloss, #grief to better understand just how people used this social media site to grieve. We found that the topics varied from death to relationships to grief experienced during role-playing games. This research opens the door to learn more about why people turn to the internet, what kind of support people find, the benefits of the interactions online, and if internet support of grief is timely or will persist.

*Keywords: text analysis, grief, coping, narrative, sense-making*

---

**A**s the world has returned to a sense of normalcy following the height of the COVID-19 pandemic, the compounded grief experiences continue to linger for many (Scheinfeld et al., 2021b). At this time, we realized many have experienced grief to varying degrees, and about a variety of issues, not just the death of a loved one (Scheinfeld et al., 2021b).

The pandemic also created an environment where people were physically restricted to communally cope with others, and efforts to talk about their grief of these losses with friends and family was restricted to virtual spaces. For one, rather than commiserating over losses, many felt delegitimized in their emotions of loss, or even like others were trying to “one-up” them (Scheinfeld et al., 2021b). For others, hearing messaging to be resilient while navigating an environment of high stress (Elue & Howard, 2023) became a

difficult task (Barney et al., 2023). These processes, taken together with the lingering pandemic's tendency to limit people's ability to engage in their normal coping and grieving processes (Scheinfeld et al., 2021a), and the taboo nature of grief (i.e., people perceive talking about such topics and/or emotions should be restricted), people adopted new ways to grieve with their varying losses, some of which were online.

Although in times of grief, being physically surrounded and receiving verbal and nonverbal social support from others allows people to move through the grieving process and better cope with their emotions (Albrecht & Adelman, 1987; Trees, 2000), the environment the pandemic created restricted our abilities as a society to seek such support (Scheinfeld et al., 2021a). The absence of nonverbal communication in social support needs could very well increase the severity of certain aspects of grief (Scheinfeld et al., 2021a). That is, as this research shows, without the nonverbal communication of touch, people may perceive their grief to be isolated, prolonged, or even lacking closure, rife with additional challenges and stress (e.g., Kempson, 2001). In an attempt to cope with grief, engage in coping practices to move them through the coping process, people may turn to other channels. The pandemic presented outlets like virtual support groups, virtual religious services, online counseling, and helped us realize the benefits of online resources. This not only widened our understanding and perception of what grief "looks like," but also how we "do grief" (Scheinfeld et al., 2021a). Therefore it is not surprising people also turned to online forums to "do grief," in an attempt to cope with the compounded grief experiences the pandemic presented and continues to present.

The goal of this paper is to examine grief in the second two years of the COVID-19 pandemic (2021– 2023). More specifically, this study used text mining (Glowacki et al., 2021; Lazard et al., 2015; Rajesh et al., 2020) in order to more fully understand how people were grieving when their traditional grieving and coping practices were stripped from them during the pandemic (Scheinfeld et al., 2021b), or as they attempted to "reenter" the world after extreme physical social isolation. Going online to grieve may have allowed people to find the comfort of the perception of (or fully) anonymity online for such taboo topics. This study allows us to uncover meaningful themes throughout the process of grieving online, demonstrating questions, concerns, and comments about grief, as well as how people may be using online resources, like social media sites, for grief.

## Communicating Online About Health

Technology and online communication platforms provide patients with an unprecedented means of expressing illness-related concerns, managing emotions, accessing social support, and addressing unmet informational needs (Chou et al., 2011; Chung & Kim, 2008; Eysenbach, 2003; Fox & Duggan, 2013; Love et al., 2013; Ozanne et al., 2018; Rains & Keating, 2011; Rains & Young, 2009; Ross, 2019). These communicative activities have become and remain increasingly common, with many still using blogs to narrate their cancer experiences, and others turning to social networking sites (e.g., Facebook, Instagram, Twitter/X, YouTube; Stage et al., 2020) due to their familiarity. Research has demonstrated that reaching out to support groups or message boards affords users the benefit of availability, reduction of stigma, convenience, and even similarity in certain instances (see Wright, 2016).

Blogs (Chung & Kim, 2008; Keim-Malpass & Steeves, 2012; Rains & Keating, 2015; Ziebland & Wyke, 2012), message boards (e.g., Orgad, 2005), Facebook (Bender et al., 2011; Erfani et al., 2012), Twitter (Sugawara et al., 2012; Tsuya et al., 2014), Instagram, and YouTube (Foley et al., 2015) have all been found to allow people to connect with others and share their life experiences, some of which may be challenging. The platforms provide a space to even chronicle difficult health diagnoses, like cancer, to engage with, seek support from, and find information from others who may reside in other geographical locations, yet share similar experiences. Some of these platforms allow people to write more about their experience, creating a space for catharsis (Pennebaker, 2000), and sense-making (Stieglitz et al., 2018). That is, online communication in social support seeking efforts has the benefit of being able to engage in storytelling or retelling of their narrative. Past research confirms that when individuals are navigating challenges or having difficulty processing their emotions, telling one's story, or narrative, allows people to engage in sense-making processes (Barney & Yoshimura, 2021; Koenig Kellas & Trees, 2006). Moreover, the anonymous feeling of using most social media sites (Clark-Gordon et al., 2019), and actual anonymity of sites like Reddit, may allow people to discuss taboo or difficult topics like death, loss, and grief in ways they may not be able to do in face-to-face interactions. If people are feeling delegitimized by others they confide in during their daily

lives, online settings may also allow for enough similarity and anonymity to receive the support they are seeking.

Others online outlets allow for anonymity (e.g., Reddit) or even small bursts of support seeking (e.g., Twitter/X). It is important to note, however, that in all of these settings, social support can be lost in these virtual contexts (e.g., Robinson et al., 2015), and users are more likely to over-emphasize the individuality and intensity of their situation (Varga & Paulus, 2014). This may influence users to engage in social comparisons that result in that original guilt and delegitimization rather than feelings of support (Scheinfeld et al., 2021b). Additionally, social media outlets provided temporary opportunities for people to share their stories online even though their affective state and wellbeing were under duress (Page, 2012; Stage et al., 2020).

## **Grief**

Conversations surrounding grief are often not received well by others, given that the topic of grief is often seen as taboo (e.g., Christensen et al., 2017). For many, their grief can be felt as an off-limits issue, one that they are unable to talk about with others given the taboo nature of the topic. Or the expectation that they should be moving on more quickly, or to grieve and feel less intensely. For others, they may feel as though their grief is not warranted. That is, their grief is related to a topic that may not be perceived as something we normally grieve, like losing a job, breakups, or something more mundane like not being able to go into work or losing a workout routine, like we saw during the pandemic (Scheinfeld et al., 2021b). Much of this grief can be classified as ambiguous loss, as their grief remains unresolved given the context or type of loss, more generally (Boss, 2010). People may also be experiencing complicated grief, or that which is long and severe (Shear, 2015). But as Scheinfeld and her colleagues (2021b) argued, many of us experience compounded grief, inasmuch as we can grieve multiple things of varying intensity at once. These varying layers of grief make it hard to cope or find support, but moreover, people saw “real” grief felt by others around them (e.g., loss of a loved one, loss of income), and subsequently felt ashamed of their own feelings of grief over the more mundane, but real, losses (Scheinfeld et al., 2021b). People also felt that society delegitimized their grief, making it challenging to communicate grief, engage in coping practices or rituals, or even mourn losses (Doka, 1999; Scheinfeld et al., 2021b). As many people were often left

unresolved with few places to turn as they became quarantined, isolated, or were stranded from family (e.g., at college, in a different city, etc.), and given the taboo nature of grief and how difficult these conversations can be, we may expect people to turn to online outlets to grieve, cope, and find support. Varga and Paulus (2014) argue grief is constructed differently online, as people are more likely to intensify their own experiences and amplify the uniqueness of their grief. However, people are likely to turn to these outlets anyway, as they are more readily available, reduce stigma, are convenient, and allow people to feel heard and even provide the opportunity to collectively grieve for individual or societal issues (see Wright, 2016).

### **Communicative Narrative Sense-Making Theory**

Communicative Narrative Sense-Making Theory (CNSM) may be a thoughtful lens to illuminate how people are able to use storytelling online to make sense of their grief experiences on social media platforms (Koenig Kellas, 2017). This theory embraces the rich narratives people construct when embracing sense making of difficult challenges, and in this study, navigating grief online. Secondly, the content of the stories an individual shares is connected to their interpersonal and familial health (i.e., the structure of the story, the process and other variables connected to family or interpersonal dynamics). This theory also assumes that the connections between engaging in storytelling and one's health can be helpful in understanding the functions of the use of storytelling and narratives. In this context, these functions are helpful for understanding the ways people engage in the use of these functions to make sense of their grief through the process of creating, socializing, and coping.

A central component of CNSM's translational storytelling heuristic is the notion of collaborating to make sense (Kellas et al., 2020). Collaborating is rooted in the need for collaborating to make sense of our lives in communication with others. In this context, it is often difficult for individuals to process difficult life changes along (i.e., grief and loss). Even with the various challenges (i.e., emotional discomfort or shame) people may face when processing their grief experiences on social media, this theory is a helpful tool for examining the extent to which people are able to use storytelling to connect with others when processing their grief. Using social media to share one's grief story can be an invaluable avenue to moving towards healing and making sense of one's loss. Given the

various social platforms that are available for users to engage with others and form communities around shared interests and topics, understanding how these platforms cultivate spaces for users to share the most vulnerable parts of their lives is extremely important. Specifically, when it comes to how users are able to navigate grief, more and more are sharing their experiences on social media platforms in an effort to cope.

### **Text Mining**

Analyzing social media posts provide opportunities for researchers to delve deeper into how people are utilizing these sites in varying contexts. For example, analyzing Twitter/X's posts has allowed researchers to capture public concerns of health crises and how Twitter's interactive qualities impact individuals, as well as information dissemination (Lazard et al., 2015). During the pandemic, social media sites provided a way for people to stay globally connected in light of stay at home orders (Lockwood et al., 2022). By examining the wealth of data on these social networking sites, other researchers have been able to better understand how people engage with one another (Lyu & Luli, 2021; Modrek & Chakalov, 2019), support each other, express opinions and concerns, and even emotions (Sailunaz & Alhajj, 2019) and health outcomes (Al-Dmour et al., 2020). This line of research has helped to shape public health communication efforts by understanding these variables' impacts on behavior enactment (e.g., Oh et al., 2021). Moreover, examining social media posts has allowed us to better understand the role of social media, specifically in relation to public health concerns. Similarly, social networking sites have also been used to gain a better understanding of global human experiences. For example, people have used these sites to find social support online for various health diagnoses (Ashtari & Taylor, 2022), and relationship issues, among other concerns. For researchers who are looking for ways to better support those navigating grief, these shared stories can provide a critical opportunity to search for much-needed solutions to complex problems.

## **METHODS**

### **Data Acquisition**

Textual analytics were used to identify topics and extract meanings contained in unstructured textual data. All messages were collected using Brandwatch (2023) software focusing on the social media channel Twitter (i.e., X). We quickly found that the data were

primarily of marketing/advertising efforts and retweets. As we were aiming to examine how people turn to social networking sites in order to grieve and communicate about that grief, we turned to another social media channel, Reddit. The Brandwatch query was written to include all the following: *grief and coping*, *grief and support*, and *grief and sad*. The query was set to capture data when those pairs of words were used on the same page. The mentions were acquired during the two-year period of February 2021 through February 2023 and included 235,872 global messages. For analysis, these data were separated into two individual files – Feb 1, 2021- Feb 28, 2022 (111,004) and March 1, 2022 to Feb 28, 2023 (124,868) and were analyzed separately using the text-mining software, SAS Text Miner 15.1 (2022).

### **Text Analytics**

SAS Text Miner provides the ability to parse and extract information from text, filter and store the information, and assemble messages into related topics for introspection and insights from the unstructured data (Chakraborty et al., 2013). The initial step in Text Miner was used to extract and create a dictionary of words using a natural language processor (NLP). Next, using the Text Parsing node, each message was divided into individual words. These words were listed in a frequency matrix and words that contributed little to the understanding of the topic such as auxiliary verbs, conjunctions, determiners, interjections, participles, prepositions, and pronouns, were excluded from the analysis.

Following, a Text Filter node was used to exclude words that appeared in less than four messages, as a conservative measure to reduce noise. The parsing process handled by the software involves sorting all of the words into separate terms and assigning a numerical identifier to them. Words that are not essential (“of”, “and”, “but”) are removed. After the software completes this process, the filter feature allows the researcher to review the output and remove unrecognizable characters and/or strings of letters. A single reviewer (the third author) followed a systematic process to maintain objectivity. This same process has been used in multiple studies examining public reactions to health and other issues across social media (Heitkemper et al., 2023).

With the inclusion criteria set, the Text Topic node was used to combine terms into ten and fifteen topic groupings. This clustering divided the document collection into

groups based on the presence of similar themes using expectation maximization (EM) clustering. SAS employs a series of algorithms that select words that are used together frequently to build the topic groups. After visually examining each of the created topics – one for a fifteen-topic solution and one for a ten-topic solution, the ten-topic solution most clearly illustrated the main themes. Lastly, the researchers reviewed the individual messages of the ten-topic solutions to arrive at the final themes. This was accomplished by individually reviewing the actual messages from each cluster or topic to arrive at the description that is now contained in Tables 1 and 2.

## RESULTS

All Reddit messages contained the word *grief*, and either *coping*, *support*, or *sad*. The posts were either original posts or responses/replies to the original poster. Each year addressed the following topics: feelings of love during loss, the loss of a loved one (e.g., mother, child, parent), therapy and support/mental health, stages of grief, the presence of a higher power, the idea of loss and love, heartbreak and the presence of a void, and time passed since the loss. Although within each year, these themes were mutually exclusive, across the two-year span, they overlapped at times. For example, in the first year's sample, mention of time (e.g., day, week, month, year, last) was its own theme. However, the next year, feel and cry were grouped with these mentions of time.

Both years contained one theme addressing the nature of Reddit and the topic of grief. That is, a bot would post a comment in response to a new post (presumably in a subreddit about grief or loss) reminding users about mental health resources, to call 9-1-1 if in distress, and what to do if having suicidal thoughts. This bot also asked users who felt up to it to respond to others' posts to "make this community great." The other theme that was similarly posted by bots to posts, seemingly commented automatically to posts that may be experiencing potential pregnancy loss, making the case to save the subreddit for confirmed losses to ensure said parents have a place to seek resources, support, and grieve properly. These types of automatic replies on posts in some subreddits are not uncommon (Assenmacher et al., 2020; Grimme et al., 2017), and given the topic of grief, it makes sense that the moderators of grief or loss subreddits wanted to keep the community safe, engaged, free of bots, and had the resources necessary.



An additional theme that spanned both years is that surrounding games and gaming culture. Reviewing the messages that fit in the theme of game, character, or player, users were reviewing video games. The idea that these came up as a theme with the keywords of *grief* were interesting, especially as we started to dig deeper into these specific messages. Although some were ads about a Discord server about the game, say Minecraft, others really delved into the world the game they were reviewing or discussing created for them. Woven throughout the reviews and “rules of the game,” users demonstrated that they also felt a level of grief and sadness while playing. That is, users mentioned feeling sadness and experiencing grief when a character died. These games often put the user in role of a character, watching the world through the eyes of the game’s character. Doing so may influence how users experience the game, really bearing the weight of the character they are playing (Brown et al., 2022), or in the case of this study, feeling the grief and sadness when their character dies – potentially after building them up – or other characters die. Being immersed in the world the game creates, and/or relying on other characters may intensify this grief (Cheng & Hsu, 2021), or even the realism of the game allowing for parasocial relationships with other characters (Banks & Bowman, 2021).

Other topics specifically addressed events that may have caused grief more globally. One example revealed itself as its own theme, like the death of Queen Elizabeth II in September of 2022. Other examples of more global grief-stricken events were demonstrated within other themes.

Table 1 *Topics and descriptions – February 1, 2021 – February 28, 2022*

Topic ID	Topic	No. of Posts	Description
1	+feel +loss +love +lose +know	20,522	Moments of storytelling through experiences of loss and grief, and losing someone they loved. Even responses to original posters (OP) guiding them through their grief and loss (e.g., providing support, helping them make sense of the experience, providing advice) also relayed their own stories to some extent.
2	+child +parent +kid +mom +mother	18,989	Stories of relational grief and managing potential relationships, lost relationships, and seeking out support from loved ones.
3	+mental +therapy,health +relationship +work	17,761	Primarily storytelling through issues of mental health crises, trauma, difficult relationship situations, and seeking therapy (e.g., knowing they need to, how to, where to find good therapy).
4	+day +week +month +year,last	14,810	Narratives surrounding illness, others' illness, end of life, loss of a loved one, and the grief and mental health issues surrounding that time. The time indicators of this theme were present throughout these posts as each were narratives/storytelling in chronological order, using these terms of time to move through the story.
5	+character +game +play +player +world	13,930	Posts that describe the game, outlining "laws," discussing playable and non-playable characters, as well as the universe/worlds in these role-playing games.
6	+post +post +comment,subreddit +message	4,216	Bot auto reply to posts within a subreddit to supply resources (e.g., suicide hotline), encourage supportiveness, and ensure subreddit is enriched and safe place for posters.
7	+server,urgent question, minecraftserver, instant support, <a href="https://disord.gg/bcbuzmybsh">https://disord.gg/bcbuzmybsh</a>	2,358	Bot auto reply to a subreddit focused on Minecraft, encouraging posters to go to Discord instead to get support more quickly.
8	+rating,grief +star +stage +higher power	1,146	Potentially a bot auto reply to those experiencing grief and posting about the loss of a loved one. Response post outlines the stages of grief, including sadness, looking to a higher power, and various mental health issues. It also provides resources from webMD and youtube.
9	+heartbreak +idealize +mind +instinct +void	859	Responses to others' posts on heartbreak, as it relates to grief, relationships, etc. Provides information on how the mind and body reacts during heartbreak.
10	+confirmed loss,confirmed +thread +space, this thread	774	Bot auto reply to posts within a subreddit on loss, primarily baby loss (e.g., stillbirth or miscarriage), to ensure space is for a specific group of people, is respectful, and supportive.

Table 2 *Topics and descriptions – March 1, 2022 – February 28, 2023*

Topic ID	Topic	No. of Posts	Description
1	+help +people +feel +therapy +feeling	17,243	Provides ways that people have worked through their own grief, mental health issues, heightened emotions by way of therapy, support groups, medical support, general well-being tactics, and being around other people.
2	+child +mom +parent +dad +husband	16,183	Narratives, both in the form of the OP and commenter, surrounding a time of grief that involved the poster's family. The family could be the source of the grief, and/or where the poster turned to for support during grief.
3	+feel +day +year +month +cry	15,700	Narratives surrounding illness, others' illness, end of life, loss of a loved one, and the grief and mental health issues surrounding that time. The time indicators of this theme were present throughout these posts as each were narratives/storytelling in chronological order, using these terms of time to move through the story
4	+moderator +message, subreddit, +bot +contact	2,591	Bot auto post in order to ensure grief subreddit remains a safe and supportive space, free of trolls, spam, and harassment.
5	+loss +grieve +mom +support +group	2,280	Both OP and responses to OP surrounding grief, end of life, and finding support from others who have experienced similar losses – specifically in therapy and support groups.
6	+heartbreak +idealize +mind +instinct +void	1,564	Narratives discussing heartbreak associated with grief after the dissolution of a relationship or the loss of a loved one. Discusses ways that may help grieve, help the mind, and to realize there is no ideal timeline for grief.
7	+server, minecraft, +player, java +play	1,560	Bot auto reply to a subreddit focused on Minecraft, discussing the gaming community they provide.
8	+rating +stage,grief +star +higher power	1,036	Potentially a bot auto reply to those experiencing grief and posting about the loss of a loved one. Response post outlines the stages of grief, including sadness, looking to a higher power, and various mental health issues. It also provides resources from webMD and Youtube.
9	+confirmed loss,confirmed +thread +space, this thread	643	Bot auto reply to posts within a subreddit on loss, primarily baby loss (e.g., stillbirth or miscarriage), to ensure space is for a specific group of people, is respectful, and supportive.
10	+Truss, britain +queen, queen, british	530	Discussing the loss of Queen Elizabeth II, and its impact on the world, what that means for the British prime minister, the monarchy, and those within the Commonwealth.

## DISCUSSION

This study provided a critical opportunity to examine how people were grappling with their experiences with grief during the 2021-2023 portion of the COVID-19 pandemic. Poor social support and loneliness are a social determinant of poor health outcomes and significantly impact the mental wellbeing of people (Cacciatore et al., 2021), especially when navigating loss. Finding grief support over the course of the pandemic was challenging, but the use of social networking sites has shown to be a supportive place for people seeking support from others. In an effort to explore the ways people engage with social media sites to connect to grief communities and resources, we used text mining (Glowacki et al., 2021; Lazard et al., 2015; Rajesh et al., 2020). Text mining, the process of transforming unstructured text into a structured format to identify meaningful patterns and new insights, allowed us to closely examine how people were attempting to make sense of their grief and potentially locate coping practices through building online communities through these social media platforms. However, this type of coping could translate into rumination, where people cannot stop disclosing their negative thoughts about their stressor, perpetuating stress (Afifi et al., 2015).

### **Reddit Over Twitter (aka X)**

Social media platforms are ripe with opportunities for users to build community around mutual topics and shared interests (Sobré-Denton, 2016). These platforms differ in the modalities they offer for communication. For example, X (formerly known as Twitter) has traditionally been used as a microblogging platform for users to exchange ideas, promote services and products, share critical information, and insights on their daily lives (Java et al., 2007). In this regard, X provided a critical platform for understanding how people were sharing their grief related experiences online. Through text mining software, we examined grief associated hashtags (e.g., #grieving, #griefandloss, #grief), and surprisingly several of the posts generated from X were typically composed of promotional advertising and did not paint a clear picture of users' grief experiences. Further, the character limitations in X also proved to be too short to understand the full scope of how users were grieving or the types of support that would be helpful to them. Further, we are cognizant of the fact that since discussions around grief may be seen as taboo, users may be apprehensive to share openly about their emotional reactions to their grief experiences

due to a lack of anonymity (Selman et al., 2021). This lack of anonymity coupled with several changes to the platform, made X a challenging place to truly capture the grief experiences of its users. To this point, after the platform changed its leadership in 2022, it was predicted that more than 30 million users or 6 out of ten users would leave the platform over the next couple of years due to concerns of increased offensive content and other technical issues (Sweney, 2022; Faverio, 2023). Further, X's expansive changes to its policies has caused concern on how safe the platform is for users when sharing their stories (Counts & Nakano, 2023). As a result, users are forced to determine if they will remain on the platform and if they choose to stay, the extent to which they will engage.

Conversely, Reddit is a useful social media platform to examine how people share their personal stories online anonymously, especially those centered around grief. Reddit provides users with the opportunity to submit content, vote on it, and engage in extensive discussion (Reddit Inc., 2023). The platform touts over 56 million daily users and is composed of smaller communities known as "subreddits" that are typically focused on a certain topic or theme or other crowdsourced investigations, viral internet memes, philanthropy (Morris, 2012; Shelton et al., 2015; Surowiecki, 2013; Vickery, 2014; Watson, 2012). Further, one of the useful features on Reddit is the removal of character limit restrictions, thus creating space for more expansive sharing, potentially even allowing for crafting a narrative and storytelling. For the subreddit communities focused on grief, they contain thousands of users who share to varying degrees how they are grappling with their grief and loss within these communities. Users do not have to fear the discomfort that often comes with engaging in difficult conversations, such as grief, as they are able to share anonymously with each other. They can share freely and engage with other users who provide support and share their personal stories extensively. Users are able to find specific communities of people they resonate with who may share similar grief experiences (i.e., the death of a parent, spouse, pet, etc.) and can connect with users without the fear of judgment. As a result of these characteristics, we ended up analyzing data from Reddit to examine the detailed responses to grief during the COVID-19 pandemic.

### **Applying CNSM Theory to Online Grief Experiences**

Although grief is a natural part of our human experience, society typically shuns conversations around this topic. Reddit allowed people the opportunity to share their

story, craft a narrative, and consequently make sense of their experience and grief. When people have the opportunity to share their story around their experiences with grief and loss, they are able to cope better. For example, Keeley and Koenig Kellas (2005) found that when people have the opportunity to engage in final conversations with and about their loved ones, they are able to find meaning when processing their deaths. Further, the use of narratives and storytelling has been instrumental in helping people process complex emotions associated with navigating traumatic events, such as the death of a loved one (Kellas & Manusov, 2003; Koenig Kellas, 2017). Particularly, CNSM theory has been helpful for understanding how people are able to use storytelling on social media platforms to tell their stories around their grief experiences. People need space to break down the complexities that persist when they are grieving. The anonymity and room to write that Reddit provides as a platform proved to be a useful outlet for people to narrate their grief experiences in way that allowed them to tell the whole story. Further, CNSM theory is especially helpful in processing the sense-making, socialization, and well-being during the turbulent period of bereavement and beyond (Barney & Yoshimura, 2021).

For people who find it hard to articulate their grief experiences in person, online grief communities can be very helpful. Specifically, these communities provide a space for people to express their feelings and process their loss through sharing their stories (Halliwell & Franken, 2016). They may also gain insights on how to navigate their own loss through reading the stories of others in the community, an important component for coping with grief (Bosticco & Thompson, 2005).

As people have been searching for resources to support them in their grieving process, the use of social media sites has been instrumental in providing the emotional support they need (Weaver et al., 2022). The use of story is a critical tool for connecting people in meaningful ways and fostering resilience following the significant disruptions that the grief and loss present (Pangborn, 2019; Barney et al., 2023). This study demonstrates that social media platforms like Reddit, that offer a medium for users to share longer and anonymous narratives, proves to be an important way people are able to share their stories around how they were navigating grief.

## Studying Grief Online

Studying individuals' grieving experiences online particularly through social media platforms has shown us that people are intentionally seeking out spaces where they can connect with others who have experienced similar types of loss. Further, social media has provided individuals with the resources they need in addition to being in communities and spaces they self-select to be a part of. In this same vein, although social media sites are a useful way to research the grieving experiences of others, it is important to note that several problems can arise. For one, online grief groups and other support groups can present problems when individuals over-sensationalize their grief and try to supersede the experiences of others (Abidin, 2022; Kellas et al., 2020). We found that Reddit's anonymity component proved to be helpful in mitigating this from happening often but with any social media platform, bad actors are always present to trouble the waters when discussing serious topics, such as grief. Further, given the intense isolation that occurred over the course of the pandemic due to stay at home orders and fear of the spread of COVID-19, people turned to the internet not only to connect with others but to mourn and express their feelings around the loss of their loved ones in addition to other losses—the loss of normalcy, loss of community, loss of closure from not being able to be present at the funeral to name a few. Our use of the internet evolved during this time given the many challenges that arose. For some, the internet became a place for doomscrolling to take place, where people may have found themselves binging negative news and content on these platforms. What we have come to understand through this paper is that the ways in which have traditionally been used to navigating grief (i.e. talking with a therapist, being with family, attending a funeral), have evolved overtime, and more and more people are turning to online spaces to connect with communities they choose. As this work continues to evolve, we recognize the need to continue to examine how different communities experience grief and how they are accessing grief support online. One line of research to extend this work should explore how users of these online forums interact with them: that is, how individual accounts post, reply, and interact with others. This may also include the frequency of posts and longevity of interaction with the community. By following individual posters, future research could explore how these online communities impact the grieving and coping process. Conducting research in this way would allow us to also

explore if online communities like Reddit assist in coping more often than providing a place to ruminate, elongating the grieving process. An additional line of research, considering the disparate impact of how many students lost a loved one during the course of the pandemic (Flannery, 2021), can examine how college students find support and resources to help them cope and deal with their grief.

## CONCLUSION

Past research has shown us that not only is grief a taboo topic that pushes people to try to cope with their grief independently, but also that some types of grief – or grief about specific issues – may leave people feeling delegitimized in their grief, or even guilty for feeling grief at all. The COVID-19 pandemic not only created limited face-to-face interactions, limiting our ability to find support or cope in person, but also increased the use of online resources more generally to communicate with others. Turning online was a natural shift, especially when it provided the opportunity to have difficult conversations, like grief. However, Varga and Paulus (2014) argue that grief is constructed differently online that may impact the overall experience, including leaving room for rumination of the distress (Afifi et al., 2015). Despite the likelihood for people to intensify their own grief, emphasize the uniqueness and intensity of their situation (Varga & Paulus, 2014), or even increase feelings of guilt or delegitimization (Scheinfeld et al., 2021b), the internet and anonymous social networking sites like Reddit allow people to grieve in a way they are not able to otherwise. Understanding how people are doing so is imperative to providing that space for people and helping those grieving use the space thoughtfully and effectively.

## References

- Abidin, C. (2022). Grief hypejacking: Influencers, #ThoughtsAndPrayers, and the commodification of grief on Instagram. *Information Society, 38*(3), 174–187. <https://doi.org/10.1080/01972243.2022.2071212>
- Afifi, T. D., Davis, S., Merrill, A., Coveleski, S., Denes, A., & Afifi, W. (2015). In the wake of the Great Recession: Economic uncertainty, communication, and biological stress responses in families. *Human Communication Research, 41*, 268–302. <https://doi.org/10.1111/hcre.12048>



- Al-Dmour, H., Salman, A., Abuhashesh, M., & Al-Dmour, R. (2020). Influence of social media platforms on public health protection against the COVID-19 pandemic via the mediating effects of public health awareness and behavioral changes: integrated model. *Journal of medical Internet research*, *22*(8), e19996. <https://doi.org/10.2196/19996>
- Albrecht, T. L., & Adelman, M. B. (1987). *Communicating social support*. Sage Publications, Inc.
- Ashtari, S., & Taylor, A. D. (2022). The Internet Knows More Than My Physician: Qualitative Interview Study of People With Rare Diseases and How They Use Online Support Groups. *Journal of Medical Internet Research*, *24*(8), e39172. <https://doi.org/10.2196/39172>
- Assenmacher, D., Clever, L., Frischlich, L., Grimme, C., Trautmann, H., & Quandt, T. (2020). Demystifying social bots: On the intelligence of automated social media actors. *Social Media + Society*, *6*(3), 1–14. <https://doi.org/10.1177/2056305120939264>
- Banks, J., & Bowman, N. D. (2021). Some assembly required: Player mental models of videogame avatars. *Frontiers in Psychology*, *12*. <https://doi.org/10.3389/fpsyg.2021.701965>
- Barney, K. A., & Yoshimura, C. G. (2021). “Cleaning out the closet”: Communicated narrative sense-making of bereavement. *Journal of Family Communication*, *21*(4), 255–271. <https://doi.org/10.1080/15267431.2021.1943399>
- Barney, K., Scheinfeld, E., Gangi, K., Nelson, E., & Sinardi, C. (2023). Moving forward in compounded grief: Communicated resilience in the face of COVID-19 related losses. *Western Journal of Communication*. <https://doi.org/10.1080/10570314.2023.2179375>
- Bender, J., Jimenez-Marroquin, M. C., & Jadad, A. (2011). Seeking support on Facebook: A content analysis of breast cancer groups. *Journal of Medical Internet Research*, *13*(1), 1-10. <https://doi.org/10.2196/jmir.1560>
- Boss, P. (2010). The trauma and complicated grief of ambiguous loss. *Pastoral Psychol*, *59*, 137–145. <https://doi.org/10.1007/s11089-009-0264-0>
- Bosticco, C., & Thompson, T. (2005). The role of communication and story telling in the family grieving system. *Journal of Family Communication*, *5*, 255–278. [https://doi.org/10.1207/s15327698jfc0504\\_2](https://doi.org/10.1207/s15327698jfc0504_2)
- Brandwatch [computer software]. (2023). <https://www.brandwatch.com/>
- Brown, S., Tu, C., & Tunggal, J. (2022). Character immersion in video games as a form of acting. *Psychology of Popular Media*. <https://doi.org/10.1037/ppm0000435>
- Cacciatore, J., Thieleman, K., Fretts, R., Jackson, L. B. (2021). What is good grief support? Exploring the actors and actions in social support after traumatic grief. *PLOS ONE* *16*(5), e0252324. <https://doi.org/10.1371/journal.pone.0252324>
- Chakraborty, G., Pagolu, M., & Garla, S. (2013). Text mining and analysis. Practical methods, examples, and case studies using SAS. Cary: SAS Institute Inc.
- Cheng, M., & Hsu, M. (2021). Immersion experiences and behavioural patterns in game-based learning. *British Journal of Educational Technology*, *52*(5), 1981–1999. <https://doi.org/10.1111/bjet.13093>
- Chou, W. Y, Liu, B., Post, S., & Hesse, B. (2011). Health-related Internet use among cancer survivors: Data from the Health Information National Trends Survey, 2003-2008. *Journal of Cancer Survivors*, *5*, 263-270. <https://doi.org/10.1007/s11764-011-0179-5>

- Christensen, D. R., Hård af Segerstad, Y., Kasperowski, D., & Sandvik, K. (2017). Bereaved parents' online grief communities: De-tabooing practices or relation-building grief-ghettos? *Journal of Broadcasting & Electronic Media*, *61*(1), 58–72. <https://doi.org/10.1080/08838151.2016.1273929>
- Chung, D. S., & Kim, S. (2008). Blogging activity among cancer patients and their companions: Uses, gratifications and predictors of outcomes. *Journal of the American Society for Information Science and Technology*, *59*(2), 297–306. <https://doi.org/10.1002/asi.20751>
- Clark-Gordon C.V., Bowman N.D., Goodboy, A.K., Wright A. (2019). Anonymity and Online Self-Disclosure: A Meta-Analysis. *Communication Reports*, *32*(2), 98-111. <https://doi.org/10.1080/08934215.2019.1607516>
- Counts, A., & Nakano, E. (2023). Harmful content has surged on Twitter, keeping advertisers away. Time. <https://time.com/6295711/twitters-hate-content-advertisers/>
- Doka, K. J. (1999). Disenfranchised grief. *Bereavement Care*, *18*(3), 37-39, <https://doi.org/10.1080/02682629908657467>
- Elue, C. & Howard, L. (2023). Care for faculty in challenging times: Considerations for exploring hope and healing grieving in color: managing grief from career transitions. Faculty Focus. <https://www.facultyfocus.com/articles/effective-teaching-strategies/care-for-faculty-in-challenging-times-considerations-for-exploring-hope-and-healing/>
- Erfani, S. S., Abedin, B., & Daneshgar, F. (2012). A qualitative evaluation of communication in Ovarian Cancer Facebook communities. In *International Conference on Information Society (i-society) 2013* (pp. 270-272). <https://ieeexplore.ieee.org/document/6636388>
- Eysenbach, G. (2003). The impact of the Internet on cancer outcomes. *CA: A Cancer Journal for Clinicians*, *53*(6), 356-371. <https://doi.org/10.3322/canjclin.53.6.356>
- Faverio, M. (2023). Majority of U.S. Twitter users say they've taken a break from the platform in the past year. Pew Research Center. <https://www.pewresearch.org/short-reads/2023/05/17/majority-of-us-twitter-users-say-theyve-taken-a-break-from-the-platform-in-the-past-year/>
- Flannery, M.E. (2021). <https://www.nea.org/nea-today/all-news-articles/when-students-grieve-how-can-educators-help>
- Foley, N., Mahony, M., Lehane, E., Cil, T., & Corrigan, M. (2015). A qualitative content analysis of breast cancer narratives hosted through the medium of social media. *British Journal of Medicine and Medical Research*, *6*(5), 474–483. <https://doi.org/10.9734/BJMMR/2015/15309>
- Fox, S., & Duggan, M. (2013). *Health Online 2013*. Pew Research Center. <https://www.ordinedeimedici.com/documenti/Docs7-cybercondria-PIP-HealthOnline.pdf>
- Glowacki, E. M., Wilcox, G. B., & Glowacki, J. B. (2021). Identifying #addiction concerts on twitter during the COVID-19 pandemic: A text-mining analysis. *Substance Abuse*, *42*(1), 39-46. <https://doi.org/10.1080/08897077.2020.1822489>
- Grimme, C., Preuss, M., Adam, L., & Trautmann, H. (2017). Social bots: Human-like by means of human control?. *Big data*, *5*(4), 279-293. <https://doi.org/10.1089/big.2017.0044>

- Halliwell, D., & Franken, N. (2016). "He was supposed to be with me for the rest of my life": Meaning-making in bereaved siblings' online stories. *Journal of Family Communication, 16*(4), 337-354, DOI: [10.1080/15267431.2016.1194841](https://doi.org/10.1080/15267431.2016.1194841)
- Heitkemper, E., Wilcox, G., Zuñiga, J., Kim, M., & Cuevas, H. (2023). A text-mining analysis to examine dominant sources of online information and content on continuous glucose monitors. *The Science of Diabetes Self-Management and Care, 49*(2), 101–111. <https://doi.org/10.1177/26350106231158828>
- Java, A., Song, X., Finin, T., & Tseng, B. (2007, August). Why we Twitter: An analysis of a microblogging community. In *International Workshop on Social Network Mining and Analysis* (pp. 118-138). Berlin, Heidelberg: Springer Berlin Heidelberg. <https://doi.org/10.1145/1348549.1348556>
- Keeley, M. P., & Koenig Kellas, J. (2005). Constructing life and death through final conversation narratives. In L. M. Harter, P. M. Japp, & C. S. Beck (Eds.), *Narratives, health, and healing: Communication theory, research, and practice* (pp. 365-390). <https://doi.org/10.4324/9781410613455>
- Keim-Malpass, J., & Steeves, R. H. (2012). Talking with death at a diner: Young women's online narratives of cancer. *Oncology Nursing Forum, 39*(4), 373-406. <https://doi.org/10.1188/12.ONF.373-378>
- Kellas, J. K., Morgan, T., Taladay, C., Minton, M., Forte, J., & Husmann, E. (2020). Narrative connection: Applying CNSM theory's translational storytelling heuristic. *Journal of Family Communication, 20*(4), 360-376. <https://doi.org/10.1080/15267431.2020.1826485>
- Kellas, J. K., & Manusov, V. (2003). What's in a story? The relationship between narrative completeness and adjustment to relationship dissolution. *Journal of Social and Personal Relationships, 20*(3), 285-307.
- Kempson, D. A. (2001). Effects of intentional touch on complicated grief of bereaved mothers. *Journal of Death and Dying, 42*(4), 341–353. <https://doi.org/10.2190/T1U8-JWAU-3RXU-LY1>
- Koenig Kellas, J. (2017). Communicated narrative sense-making theory. In D. O. Braithwaite, E. A. Suter, & K. Floyd (Eds.), *Engaging theories in family communication* (2nd ed. ed., pp. 62–74). Routledge.
- Koenig Kellas, J., & Trees, A. R. (2006). Finding meaning in difficult family experiences: sense-making and interaction processes during joint family storytelling. *Journal of Family Communication, 6*(1), 49–76. [https://doi.org/10.1207/s15327698jfc0601\\_4](https://doi.org/10.1207/s15327698jfc0601_4)
- Lazard, A., Scheinfeld, E., Bernhardt, J., Wilcox, G., & Suran, M. (2015). Themes of public concern: A text mining analysis of the CDC's Ebola live Twitter chat. *American Journal of Infection Control, 43*(10), 1109-1111. <https://doi.org/10.1016/j.ajic.2015.05.025>
- Lockwood, P., Midgley, C., & Thai, S. (2022). Can the social network bridge social distancing? Social media use during the COVID-19 pandemic. *Psychology of Popular Media, 13*(1), 44–54. <https://doi.org/10.1037/ppm0000437>
- Love, B., Thompson, C. M., Crook, B., & Donovan-Kicken, E. (2013). Work and "mass personal" communication as means of navigating nutrition and exercise concerns in an online cancer community. *Journal of Medical Internet Research, 15*(5), e102. <https://doi.org/10.2196/jmir.2594>

- Lyu, J. C., & Luli, G. K. (2021). Understanding the public discussion about the Centers for Disease Control and Prevention during the COVID-19 pandemic using Twitter data: Text mining analysis study. *Journal of Medical Internet Research*, *23*(2), e25108. <https://doi.org/10.2196/25108>
- Modrek, S., & Chakalov, B. (2019). The# MeToo movement in the United States: text analysis of early twitter conversations. *Journal of Medical Internet Research*, *21*(9), e13837. <https://doi.org/10.2196/13837>
- Morris, K. (2012, March 9). How reddit saved the world. The Daily Dot. <http://www.dailydot.com/society/reddit-charity-alexis-ohanian-list/>
- Oh, S. H., Lee, S. Y., & Han, C. (2021). The effects of social media use on preventive behaviors during infectious disease outbreaks: The mediating role of self-relevant emotions and public risk perception. *Health Communication*, *36*(8), 972-981. <https://doi.org/10.1080/10410236.2020.1724639>
- Orgad, S. (2005). *Storytelling online: Talking breast cancer on the internet. (Vol. 29)*. Peter Lang.
- Ozanne, A., Henoch, I., & Strang, S. (2018). Is blogging a new form of communication in palliative health care? A qualitative research study. *International Journal of Palliative Nursing*, *24*(5), 238-245. <https://doi.org/10.12968/ijpn.2018.24.5.238>
- Page, R. (2012). *Stories and social media: Identities and interaction*. Routledge.
- Pangborn, S. M. (2019). Narrative resources amid unspeakable grief: Teens foster connection and resilience in family storytelling. *Journal of Family Communication*, *19*(2), 95-109. <https://doi.org/10.1080/15267431.2019.1577250>
- Pennebaker, J. W. (2000). Telling stories: The health benefits of narrative. *Literature and Medicine*, *19*(1), 3-18. <https://doi.org/10.1353/lm.2000.0011>
- Rains, S. A., & Keating, D. M. (2011). The social dimension of blogging about health: Health blogging, social support, and well-being. *Communication Monographs*, *78*(4), 511-534. <https://doi.org/10.1080/03637751.2011.618142>
- Rains, S. A., & Young, V. (2009). A meta-analysis of research on formal computer-mediated support groups: Examining group characteristics and health outcomes. *Human Communication Research*, *35*(3), 309-336. <https://doi.org/10.1111/j.1468-2958.2009.01353.x>
- Rajesh, K., Wilcox, G. B., Ring, D., & Mackert, M. (2020). Reactions to the opioid epidemic: A text mining analysis of tweets. *Journal of Addictive Diseases*, *39*(2), 183-188. <https://doi.org/10.1080/10550887.2020.1834812>
- Reddit Inc. (2023). Dive into anything. Reddit. <https://www.redditinc.com/>
- Robinson, K. J., Hoplock, L. B., & Cameron, J. J. (2015). When in doubt, reach out: Touch is a covert but effective mode of soliciting and providing social support. *Social Psychological and Personality Science*, *6*(7), 831-839. <https://doi.org/10.1177/1948550615584197>
- Ross, E. (2019). Researching experiences of cancer risk through online blogs: A reflexive account of working toward ethical practice. *Journal of Empirical Research on Human Research Ethics*, *15*(1-2), 46-54. <https://doi.org/10.1177/1556264619867840>
- Sailunaz, K., & Alhaji, R. (2019). Emotion and sentiment analysis from Twitter text. *Journal of Computational Science*, *36*, 101003. <https://doi.org/10.1016/j.jocs.2019.05.009>



- Salas-Zárate, R., Alor-Hernández, G., del Pilar Salas Zárate, M., Paredes-Valverde, M. A., Bustos-López, M., & Sánchez-Cervantes, J. L. (2022). Detecting depression signs on social media: A systemic literature review. *Healthcare, 10*(2), 291. <https://doi.org/10.2290/healthcare10020291>
- SAS Text Miner 15.1 [computer software] (2022). [https://www.sas.com/en\\_us/software/text-miner.html](https://www.sas.com/en_us/software/text-miner.html)
- Scheinfeld, E., Barney, K., Gangi, K., Nelson, E., & Sinardi, C. (2021a). Filling the void: Grieving and healing during a socially isolating global pandemic. *Journal of Social and Personal Relationships, 38*(10), 2817-2837. <https://doi.org/10.1177/026540752111034914>
- Scheinfeld, E., Gangi, K., Nelson, E., & Sinardi, C. (2021b). Please scream inside your heart: Communicating and coping with compounded grief during a pandemic. *Health Communication, 37*(10), 1316-1328. <https://doi.org/10.1080/10410236.2021.1886413>
- Selman, L. E., Chamberlain, C., Sowden, R., Chao, D., Selman, D., Taubert, M., & Braude, P. (2021). Sadness, despair and anger when a patient dies alone from COVID-19: A thematic content analysis of Twitter data from bereaved family members and friends. *Palliative Medicine, 35*(7), 1267-1276. <https://doi.org/10.1177/02692163211017026>
- Shear, M. K. (2015). Complicated grief. *The New England Journal of Medicine, 372*(2), 153–160. <https://doi.org/10.1056/NEJMcp1315618>
- Shelton, M., Lo, K., & Nardi, B. (2015). Online media forums as separate social lives: A qualitative study of disclosure within and beyond Reddit. *IConference 2015 Proceedings*.
- Sobré-Denton, M. (2016). Virtual intercultural bridgework: Social media, virtual cosmopolitanism, and activist community-building. *New Media & Society, 18*(8), 1715–1731. <https://doi.org/10.1177/1461444814567988>
- Stage, C., Hvidtfeldt, K., & Kjastrup, L. (2020). Vital media: The affective and temporal dynamics of young cancer patients' social media practices. *Social Media & Society, 6*(2), 1-13. <https://doi.org/10.1177/2056305120924760>
- Stieglitz, S., Bunker, D., Mirbabaie, M., & Ehnis, C. (2018). Sense-making in social media during extreme events. *Journal of Contingencies & Crisis Management, 26*(1), 4–15. <https://doi.org/10.1111/1468-5973.12193>.
- Sugawara, Y., Narimatsu, H., Hozawa, A., Shao, L., Otani, K., & Fukao, A. (2012). Cancer patients on Twitter: A novel patient community on social media. *BMC Research Notes, 5*, Article 699. <https://doi.org/10.1186/1756-0500-5-699>
- Surowiecki, J. (2013, April 24). The wise way to crowdsource a manhunt. The New Yorker Blogs. <http://www.newyorker.com/online/blogs/comment/2013/04/reddit-tsarnaevmarathon-bombers-wisdom-of-crowds.html>
- Sweney, M. (2022). Twitter 'to lose 32m users in two years after Elon Musk takeover'. <https://www.theguardian.com/technology/2022/dec/13/twitter-lose-users-elon-musk-takeover-hate-speech>
- Trees, A. R. (2000). Nonverbal communication and the support process: Interactional sensitivity in interactions between mothers and young adult children. *Communication Monographs, 67*(3), 239–261. <https://doi.org/10.1080/03637750009376509>

- Tsuya, A., Sugawara, Y., Tanaka, A., & Narimatsu, H. (2014). Do cancer patients tweet? Examining the Twitter use of cancer patients in Japan. *Journal of Medical Internet Research, 16*(5), 1–13. <https://doi.org/10.2196/jmir.3298>
- Varga, M. A., & Paulus, T. M. (2014). Grieving online: Newcomers' constructions of grief in an online support group. *Death Studies, 38*(7), 443-449. <https://doi.org/10.1080/07481187.2013.780112>
- Vickery, J. R. (2014). The curious case of Confession Bear: The reappropriation of online macro-image memes. *Information, Communication & Society, 17*(3), 301–325. <https://doi.org/10.1080/1369118X.2013.871056>
- Watson, T. (2012, August 31). Reddit's fundraising partnerships: A vote up for philanthropy? Forbes. <http://www.forbes.com/sites/tomwatson/2012/08/31/reddits-fundraisingpartnerships-a-vote-up-for-philanthropy/>
- Weaver, R. H., Srinivasan, E. G., Decker, A., & Bolkan, C. (2022). Young adults' experiences with loss and grief during COVID-19. *Death Studies, 46*(1), 53-64. <https://doi.org/10.1080/07481187.2021.1984339>
- Wright, K. B. (2016). Communication in health-related online social support groups/communities: A review of research on predictors of participation, applications of social support theory, and health outcomes. *Review of Communication Research, 4*, 65-87. <https://doi.org/10.12840/issn.2255-4165.2016.04.01.010>
- Ziebland, S., & Wyke, S. (2012). Health and illness in a connected world: How might sharing experiences on the internet affect people's health? *The Milbank Quarterly, 90*(2), 219-249. <https://doi.org/10.1111/j.1468-0009.2012.00662.x>

### Funding and Acknowledgements

The authors declare no funding sources or conflicts of interest.