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#BeTheMatch: Assessing How Testimonials on Reddit Promote the Importance of Donating Bone Marrow

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This study explores how sharing testimonials on the social media network Reddit may encourage individuals to donate bone marrow. The theory of planned behavior guided a quantitative content analysis of 1,015 Reddit comments about donation. Research questions asked how individuals post about donation and how Redditors engage with this content. Overall, comments addressed more positive than negative outcome, efficacy, and normative beliefs. Comments that discussed beliefs related to registering to donate and the process of donating received significantly higher engagement than other comments. Additionally, comments that included positive outcome beliefs related to registering, positive efficacy beliefs related to registering and donating, and positive normative beliefs related to donating received higher engagement than other comments. Results suggest testimonials may be most effective if they focus on behavior facilitators and if they present donation as a positive norm deviant behavior. Finally, the Reddit forums functioned as places for individuals to seek out and share information. Comments included calls to action and hyperlinks for health resources. This research reveals how organic conversations on Reddit may promote health information seeking and advocacy behavior adoption. Implications for the theory of planned behavior and the use of Reddit as a platform for health promotion are discussed.

Each year, approximately 18,000 individuals in the United States are diagnosed with a life-threatening blood disease, such as leukemia or lymphoma that requires a bone marrow transplant (Department of Health and Human Services, 2019). The National Marrow Donor Program (NMDP) estimates that 70% of in-need patients are medically unable to receive a donation from a family member and must rely on unknown others for donations (National Marrow Donor Program, 2020). To become a bone marrow donor, an individual volunteers their biomarker data through a mail swab kit and signs up for Be the Match, the world's largest donor registry, which is operated by the NMDP. If matched, the individual may be asked to take part in a non-surgical procedure to donate peripheral blood stem cells, or a surgical procedure to donate bone marrow, based on the patient's needs (National Marrow Donor Program, 2020). Donation can be an invasive process and therefore it is considered a "self-sacrificing behavior" in which the severity and susceptibility of personal costs and others' gains are juxtaposed (Schwartz, 1970, p. 283).

According to their website, the NMDP facilitates an average of 6,200 transplants per year and has 20 million potential donors in their system. However, one out of three individuals in need of donation do not fully match with individuals in the registry (National Marrow Donor Program, 2020). The likelihood of a patient and donor matching is based on unique

inherited biomarkers, human leukocyte antigen, which makes ethnic background important for match success. Furthermore, age is a factor that contributes to success, with older individuals having decreased probability of finding a match (Gupta et al., 2010). With younger individuals, there is a possibility of matching with a child family member and, in these cases, ethical dilemmas about medical consent and the physical and psychosocial outcomes of pediatric donation need to be considered (Weisz & Robbenolt, 1996). If matched, the potential donor on the registry can decline donating. Declined requests (i.e., empty pledges) happen in an average of 47% of all donation cases (Carollo, 2010). Overall, a critical need for donors exists and awareness and education efforts can help to communicate this issue to the general public (Norvilitis & Riley, 2001). Kaster, Rogers, Jeon, and Rosen (2014) conducted focus groups to explore factors that may increase bone marrow registrant recruitment. Their participants suggested that donors should share testimonials on their social media to increase awareness and emotionally engage their peers. While this may be a viable strategy for promoting the need for bone marrow donors, no research to date has analyzed how individuals engage with these stories on social media and how this engagement may inform beliefs about donation. The current study aimed to fill this need by analyzing responses to shared testimonials on the social media network Reddit. Doing so addresses a critical research gap and can help health professionals understand potential uses of social media for increasing bone marrow registrant recruitment.

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Health Promotion on Reddit

An estimated 70% of adults in the United States spend time on social media (Perrin & Anderson, 2019), making these unique platforms for sharing testimonials aimed at increasing awareness of the need for donors. Reddit is a social media network that encourages individuals to share news, information, and personal insights. Self-described as “the front page of the Internet,” Reddit has over 430 million monthly visitors and is ranked the sixth most popular website in the United States and the 18th most popular website globally (Alexa Internet Inc, 2020). Reddit is a community network in which individuals post content to over one million crowd-sourced discussion forums called subreddits (Reddit, 2020).

Reddit facilitates discussion through the use of conversation threading, in which an individual submits a post to a content-specific subreddit and users can comment directly to the post or reply to other commenters. Replying to a comment creates a new conversation thread under the original post (see Figure 1 for an example of this tree-like structure). Users score content by voting on it. Content with the highest score (i.e., upvotes minus downvotes) moves to the top of a discussion thread to be seen first by future viewers. Scores are important engagement metrics because they provide evidence for the content that resonates with audiences and signals the discussions that will be viewed by the most people. Discussion-based social media such as Reddit presents information in the form of a mass conversation, in which a reader sees an aggregate of public thoughts on a given topic (Tasente, 2019). These platforms facilitate the viral spread of health testimonials and thus can provide readers with unique insight on public opinion of health behaviors (Park, Conway, & Chen, 2018). Reddit specifically is an anonymous social media, which may encourage individuals to share authentic health testimonials if they know their identity is protected (De Choudhury & De, 2014).

Reddit is an important source of information, yet there is an overall lack of research on how individuals engage with content on this platform, especially in regard to health information seeking and sharing. Most of the research that has been conducted focuses on communities for health behavior change such as the weight loss subreddit *r/loseit* (Pappa et al., 2017) and alcohol and smoking cessation subreddits *r/stopdrinking* and *r/stopsmoking* (Harikumar et al., 2016). The current study is specifically interested in how individuals engage with shared health testimonials on Reddit, which is an understudied topic.

Testimonials

A testimonial is a form of narrative that is based off on an individual’s personal experiences, eye-witness accounts, or personal opinions (Bilandzic & Busselle, 2013). Narrative persuasion research shows that testimonials can promote health behavior change through many mechanisms, including increased emotional involvement, message retention, and recall (e.g., Braverman, 2008; Johnson, Quintero Johnson, Yilmaz, & Najarian, 2017). Narratives that increase emotional

involvement may be useful for encouraging donation. An experiment conducted by Lindsey (2005) found that emotional appeals were more effective at promoting bone marrow donation than logic-based appeals. Similarly, Studts, Ruberg, McGuffin, and Roetzer (2010) found that emotional appeals were better than rational appeals at motivating individuals to join the bone marrow registry. In regard to retention and recall, Tversky and Kahneman (1974) research on the availability heuristic suggests that individuals frequently rely on mental shortcuts informed by their own and others’ stories when making decisions. If individuals do not have personal experience with bone marrow donation then they may rely on testimonials from mass media or social media that they have encountered on the topic.

Individuals may be driven to share their health stories on social media to gain support, reduce stigma, enhance coping, share their progress, and help to visualize a medical process or disease for unknowing others (Ziebland & Wyke, 2012). Furthermore, patient’s testimonials often describe the process, experience, and outcomes associated with a medical procedure (Shaffer, Focella, Hathaway, Scherer, & Zikmund-Fisher, 2018). There are many benefits to sharing a health testimonial including the possibility that testimonials may be seen as more authentic and better at conveying emotions than didactic forms of health promotion (De Wit, Das, & Vet, 2008; Johnson et al., 2017). Testimonials are frequently featured in official health promotion materials. As such, the NMDP and similar services highlight donor’s and patient’s stories on their website (www.bethematch.org/blog). However, there is a lack of research on how individuals engage with these testimonials, and how this engagement may reveal individuals’ underlying beliefs. A useful theory for analyzing and interpreting individuals’ health-related beliefs in the theory of planned behavior (TPB) (Ajzen, 1991).

Theory of Planned Behavior

The TPB posits that the best predictor of an individual’s decision to adopt or change a health behavior is the intent to carry out that behavior, and that multiple constructs affect intent including attitudes, subjective norms, and perceived behavior control. A first step in creating a targeted intervention using this model is to elicit the salient beliefs that underlie these constructs: outcome beliefs (a predictor of attitudes), normative beliefs (a predictor of subjective norms), and efficacy beliefs (a predictor of perceived behavioral control) (Ajzen, 1991). In the context of bone marrow donation, TPB beliefs are as follows:

Outcome Beliefs

Outcome beliefs include evaluations that individuals have of the positive and negative results that may occur from participating in a behavior (Ajzen, 1991). The most common positive outcome belief associated with donation is the possibility to save an individual’s life. Other positive outcome beliefs include feeling selfless and generous, and having the opportunity to express an individual’s altruistic identity (Simmons,

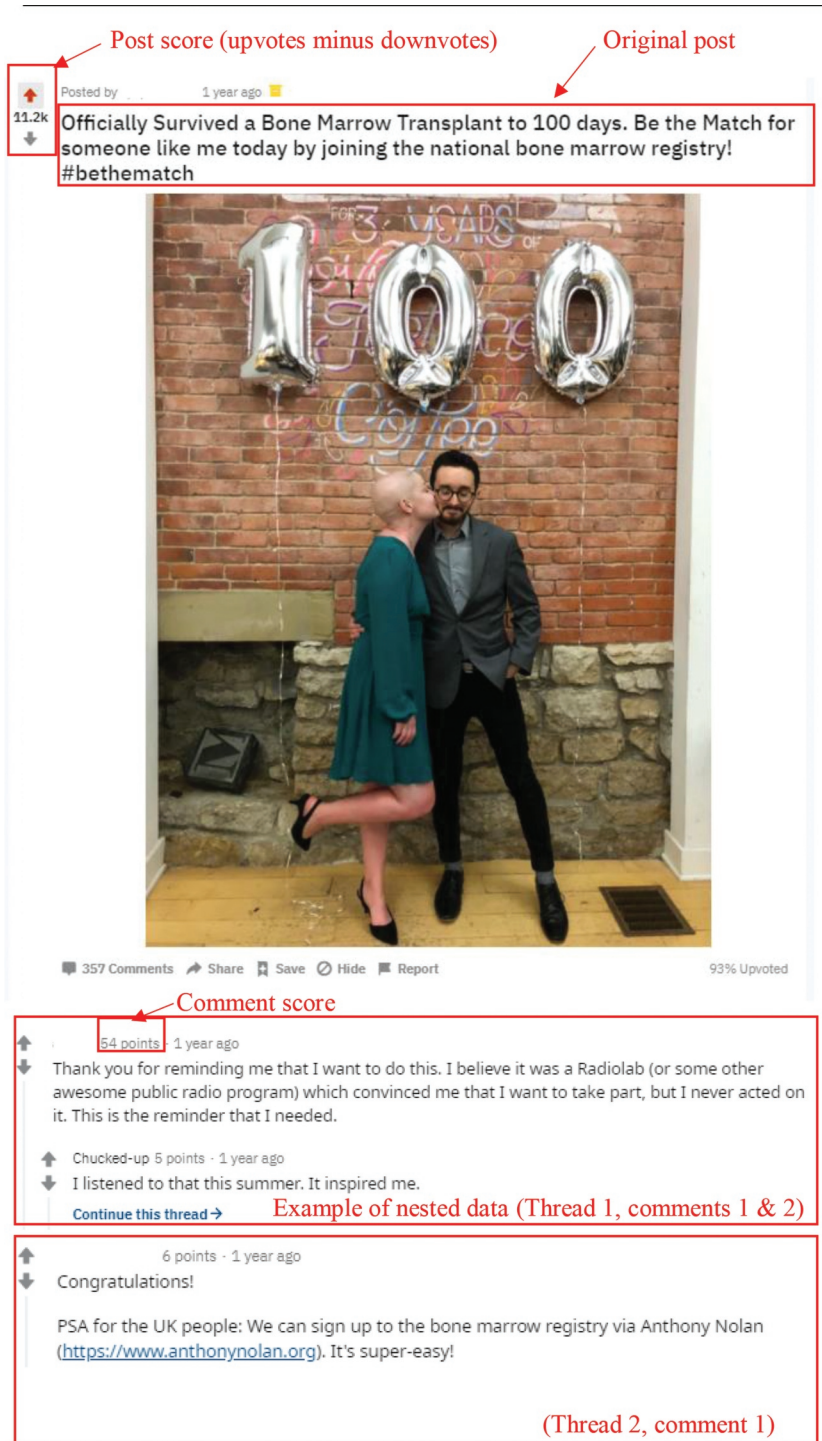


Figure 1.: Example Reddit Post with Nested Threads and Comments.

Schimmel, & Butterworth, 1993). In contrast, a negative outcome belief is the possibility that the recipient may die, which

could trigger feelings of grief or guilt (Butterworth, Simmons, & Schimmel, 1992). Other negative outcome beliefs stem

from the possibility of suffering from pain or surgical complications (Stroncek et al., 1993) and feeling the procedure is bodily invasive (Hyde, McLaren, & White, 2014).

Normative Beliefs

Normative beliefs refer to individuals' perceptions of what their peers, friends, and family members think (i.e., injunctive norms) or do (i.e., descriptive norms) (Ajzen, 1991). Donating bone marrow is a low frequency, non-normative behavior, as only 2% of individuals in the United States and 1% of individuals worldwide are on official registries (Bergstrom, Garratt, & Sheehan-Connor, 2009). Thus, norms may not be the best predictor of bone marrow donation, but deviant regulation theory (Blanton, Stuart, & Van den Eijnden, 2001) provides practitioners with some insight on how norms may still be useful for promoting this behavior. This theory suggests that individuals react positively to norm deviant behaviors that are associated with socially desirable images. In the case of bone marrow donation, this may include comments that presented donors as charitable and altruistic. Furthermore, higher engagement may be a signal of an injunctive norm. If positive beliefs receive high engagement, others may view these comments as endorsed by their peers.

Efficacy Beliefs

Efficacy beliefs refer to perceptions of things that make donating bone marrow easy or difficult. Several character traits are considered facilitators of intentions to donate. For instance, empathetic concern is considered an altruistic motivator for increasing helping and donation behaviors (Batson et al., 2010). Several factors hinder donation as well. Research on how individuals viewed donating bone marrow found inconvenience, lack of donation opportunities, fear, and perceived costs as barriers to donating (Laver et al., 2001). Results from a belief elicitation survey suggested that efficacy beliefs accounted for the greatest amount of variance in predicting individuals' intentions to join a bone marrow registry (Hyde et al., 2014). However, the sample for that study consisted of a small heterogeneous group of university students. More research is needed to understand these antecedents of donation, especially in the context of how individuals discuss them in natural, unprompted situations. Batson, C. D. (2010)

Overall, a theory-driven content analysis will increase understanding of the outcome, normative, and efficacy beliefs that inform individuals' decisions to donate bone marrow as well as decisions to join the registry and may provide insight for how testimonials on Reddit could promote other self-sacrificing and advocacy behaviors. Thus, our research questions for this study are as follows:

RQ1: How, and by whom, is bone marrow donation discussed on Reddit, and how do users engage with this content?

RQ2: How are TPB constructs in the form of behavioral, normative, and efficacy beliefs represented in bone marrow donation comments on Reddit, and how do users engage with this content?

Method

The proposed research questions were answered through a quantitative content analysis guided by the TPB. Content analysis is a useful methodology to identify patterns of media messages that individuals are likely to be exposed to in order to draw implications for audience effects (Jordan, Kunkel, Manganello, & Fishbein, 2010).

Sample

We analyzed posts about bone marrow donation from the subreddit r/pics, which focuses on individuals sharing their own personal stories and pictures. As of September 2020, the community of r/pics has 25.7 million subscribers. All posts on r/pics that featured the words "bone marrow" were scraped using the Reddit ExtractR package from the Comprehensive R Archive Network (Rivera, 2019). There were 25 r/pics posts, with a total of 3,488 comments available for extraction.¹ The dates of posts ranged from July 2011 to October 2018.

Reddit organizes comments in a tree-like structure with three levels of nested data: posts, threads, and comments. It is important to know whom a comment is directed to when coding. A random sample of all comments would lose this mass conversation structure; thus, for each of the 25 posts, we chose to code the most popular three threads and their associated comments. This resulted in a final sample of $N = 1,015$ comments about bone marrow donation.² The sample included 665 unique commenters with most Redditors providing one to two comments in the sample ($M = 1.53$, $Mdn = 1$, $SD = 1.75$). As such, 77.4% of Redditors contributed one comment, 12.3% contributed two comments, 4.4% contributed three comments, 3.0% contributed four comments, and 2.9% of Redditors contributed five or more comments to the discussion.

Content Coding

The codebook included the following categories: (1) individuals' relationship to bone marrow donation (2) discussion of beliefs related to the process of registering to donate, the process of donation, both (registering and donating), or neither, (3) the presence of calls to actions, (4) information seeking, (5) information sharing, and the (6) source and (7) type of hyperlinks shared. Our codebook definitions were developed using non-sample comments and an open-coding technique. If a comment included a reference to the process of registering to donate or the process of donation, we then coded it further for constructs based on Ajzen's (1991) TPB (see Table 1).

¹The number of comments on posts ranged from 7–1,170. ExtractR only retrieved the top 500 comments for each post due to API limitations.

²The researchers coded 1374 posts, of which 73.8% (1,015) related to bone marrow donation. The additional 26.2% related to other topics and coding categories did not apply (e.g., conversations about blood donation or side-tracked conversations). The initial sample of 1374 was used for intercoder reliability.

Table 1. Content Coding Categories, Definitions, and Example Quotes

Category	Definition	Example
Bone marrow donation	Comment discusses or mentions the process of bone marrow donation	"The actual process involves harvesting bone marrow cells. In this case, using a process called leukapheresis."
Outcomes - positive	Positive outcomes that can result from donation	"Best thing I've ever done. My recipient (now 14) just had another birthday this past weekend, that wouldn't have been possible without the technology, doctors, and nurses. My part was just showing up."
Outcomes - negative	Negative outcomes that can result from donation	"The soreness from that procedure lasted about two or three days, and was severe enough the first couple of days that I stayed home in bed because walking felt like you had been hit by a truck..."
Norms - positive	Peers/others approve of donation	"What [he] is doing is extremely brave, and it actually inspired me and my roommate to join Be The Match's registry. If you ever get to see this, the entire track and field community is so proud of you and what you're doing man."
Norms - negative	Peers/others disapprove of donation	"I signed up, but never went to the physical exam. I told a friend, and he told me about how painful recovery was, and that I can't make everyone else's problems my own."
Efficacy - positive	Things that make donating easy	"I did not pay for my flights, hotels, car service to pick me up and take me to the airport, or much of anything else."
Efficacy - negative	Things that make donating difficult	"I was kept under longer than they anticipated due to my marrow not being easy to aspirate."
Bone marrow registry ¹	Comment discusses or mentions the process of joining the bone marrow registry	"If you signed-up as a bone marrow donor before, you do not need to sign-up again. You just need to keep your information updated with the donor center you registered with originally so they can contact you should you be a match for a patient.."
Outcomes - positive	Positive outcomes that can result from registering	"I signed up and they called me 30 days later to donate. I thought they were calling me just to thank me for signing up. I was pleasantly surprised when I got to donate!"
Outcomes - negative	Negative outcomes that can result from registering	"I did, but I read that 47% of people who do get called end up declining. I mentioned this in a previous comment below, but if you back out after the recipient has been prepped to receive the marrow, they'll likely die because of that prep."
Norms - positive	Peers/others approve of registering	"A couple of friends and I setup a group under the Anthony Nolan umbrella at our university a couple of years ago and over 3 years we signed about 4 people up."
Norms - negative	Peers/others disapprove of registering	"I'm interested in signing up, but it seems everybody I know is against it."
Efficacy - positive	Things that make registering easy	"The process is super-easy. Go to the website, fill out the form, then they will mail you a kit. You swab the inside of your cheek like the instructions say, mail it back and you're done."
Efficacy - negative	Things that make registering difficult	"I tried to register on marrow.org and they required a fee of \$100."
Intent to join the registry	Commenter explicitly mentions intent to join the registry	"Thanks to some comments on this thread and OP, I'm about to go sign up."
Self-reported registry behavior	Commenter self-reports registering to donate bone marrow because of Reddit	"I signed up because of this post. Hopefully some day I will be able to save a life and it will all be because of this post."
Call to action	Commenter includes a call to action in their post	"Please please please sign up it's so easy and could help save a life or give someone more time."
Information seeking	Commenter asks a question about donating or registering	"What was the process like?"
Information sharing	Commenter answers a question about donating or registering	"It is surgery. I was in the hospital for half the day and put under for the process. I had to go into the OR.."
Relationship to bone marrow donation	Post or comment identifies an individual's relationship to bone marrow donation	

(Continued)

Table 1. (Continued)

Category	Definition	Example
Recipient	Individual states that they are in need of a bone marrow transplant or they have received a bone marrow transplant in their lifetime	“Recent recipient here, 43 years old and planning to live a lot longer. Thank God for people as generous as you. I’m about a month post-transplant and doing pretty well.”
Donor	Individual states that they are in the process of donating bone marrow or they have donated bone marrow in their lifetime	“I donated stem cells through https://bethematch.org back in 2007. Easily one of the greatest things I’ve ever been a part of -It’s bringing tears to my eyes just thinking of it now..”
Family of recipient	Family member of an individual in-need of a bone marrow transplant or an individual who has received a bone marrow transplant in their lifetime	“My brother-in-law had to have bone marrow transplants, and while he ultimately passed, I know how much hope it can give.”
Family of donor	Family member of an individual in the process of donating bone marrow or whom has donated bone marrow in their lifetime	“Proud of my daughter. 10 days before her wedding. Became a bone marrow match. Doing a Peripheral Blood Stem Cell donation for a leukemia patient.”
Individual on the registry	Individuals already signed up to donate but are waiting for a match	“I’m Hispanic & waiting on a marrow donor & was told I’m more likely to find a match from someone of my same ethnic background than blood type.”
Individual interested in the registry	Individual states a desire to join the bone marrow donation registry	“How does one go about doing that? I’d be interested in signing up, too.”
Health professional	Individual who identifies as a health professional (doctor, nurse, community health worker, etc)	“Hi! Stem Cell Transplant Coordinator here, the goal of both collections is very similar. Mainly we are looking for a type of stem cell that grows into red blood cells, white blood cells, and platelets..”

¹We combined the process questions into one variable and coded possible outcomes as discussing the “registry only”, “donation only”, “both”, or “neither.” This allowed us to run Kruskal Wallis H-tests that require mutually exclusive categories. The neither category included all comments that were part of the conversation that we did not code as specifically discussing the process of registering/donating, such as an individual expressing gratitude for information.

Inter-coder Reliability

After a period of training, two researchers coded 10% of posts ($n = 137$) for inter-coder reliability. After pre-testing and subsequent protocol changes, inter-coder reliability testing showed Cohen’s Kappa was on average .75. Individual coefficients were all reliable, with the lowest at .70 (complete list is available upon request).

Analytical Strategy

To answer the research questions, descriptive statistics were analyzed for post and comment characteristics and TPB constructs. Then, Mann-Whitney U and Kruskal Wallis H tests were used to determine if there were differences in median engagement scores (upvotes minus downvotes) between comments with a variety of dichotomous and nominal independent variables. These non-parametric tests were used to consider differences because social media engagement data are not normally distributed, so the median is a better measure of central tendency than the mean (Guidry et al., 2018). When differences in relationships were observed for nominal variables, post hoc pairwise comparisons were performed using Dunn’s (1964) procedure with a Bonferroni correction for multiple comparisons.

Results

The first research question asked how and by whom bone marrow donation is discussed on Reddit and how individuals engage with this content. The 25 original posts came from recipients (12%, $n = 3$), donors (52%, $n = 13$), registrants (12%, $n = 3$), individuals interested in joining the registry (4%, $n = 1$) and others (e.g., friends, family, and health professionals) (20%, $n = 5$). These posts spurred organic conversations about bone marrow donation, which included comments from recipients (7.0%, $n = 71$), donors (17.3%, $n = 176$), registrants (16.4%, $n = 166$), individuals interested in joining the registry (9.8%, $n = 99$) and others (e.g., friends, family, and health professionals) (7%, $n = 71$). Individuals did not discuss their relationship with bone marrow donation in nearly half of the comments (42.6%, $n = 432$).

Of the total sample of comments, 54.1% addressed the process of donation only, 19.6% registering to donate only, 4.7% both the process of donation and registering, and 21.6% neither category. How individuals discussed donation varied, with 8.4% of all comments featuring a call to action in which individuals encouraged others to donate. Furthermore, 15% of comments included information seeking and 46.7% included information sharing. Shared information was mostly anecdotal. As such, only 6.7% of comments included a hyperlink, and the majority of

Table 2. Reddit Comment Characteristics

Variable/sub-variable (<i>N</i> = 1015 unless otherwise noted)	Frequency
Discussion of beliefs related to donation or registering	
Donation only	54.1% (<i>n</i> = 549)
Registry only	19.6% (<i>n</i> = 199)
Both donation and registry	4.7% (<i>n</i> = 48)
Neither donation nor registry	21.6% (<i>n</i> = 219)
Commenter's relationship to bone marrow donation	
Recipient	7.0% (<i>n</i> = 71)
Donor	17.3% (<i>n</i> = 176)
Family of recipient	4.1% (<i>n</i> = 42)
Family of donor	1.3% (<i>n</i> = 13)
Individual on registry	16.4% (<i>n</i> = 166)
Individual interested in registry	9.8% (<i>n</i> = 99)
Health professional	1.6% (<i>n</i> = 16)
Other/cannot tell	42.6% (<i>n</i> = 432)
Call to action	8.4% (<i>n</i> = 85)
Seeking information	15.0% (<i>n</i> = 152)
Sharing information	46.7% (<i>n</i> = 474)
Hyperlink source (<i>n</i> = 69)	
Individual	13.0% (<i>n</i> = 9)
Commercial	1.4% (<i>n</i> = 1)
News	8.7% (<i>n</i> = 6)
Official medical	68.1% (<i>n</i> = 47)
Nonprofit	4.3% (<i>n</i> = 3)
Other	4.3% (<i>n</i> = 3)
Hyperlink type (<i>n</i> = 69)	
Blog	1.4% (<i>n</i> = 4)
Social media	7.2% (<i>n</i> = 5)
Commercial	4.3% (<i>n</i> = 3)
Official bone marrow donation	68.1% (<i>n</i> = 47)
Other	18.8% (<i>n</i> = 13)

these pointed to official bone marrow donation websites where people can sign up to be part of the registry (see Table 2).

To analyze engagement, we tested for differences in median comment scores for each of our content categories. First, we analyzed the commenter's relationship with bone marrow. Results from a Kruskal Wallis H test revealed at least one median comment score varied across relationship type ($\chi^2(5) = 24.12, p < .001$). Post hoc analyses revealed that scores were statistically significantly higher for commenters who were donors (*Mdn* = 4.00) and for individuals whom you could not tell their relationship to bone marrow donation (*Mdn* = 4.00), both compared to individuals interested in the registry (*Mdn* = 2.00). No other differences between relationship types were observed.

Then, we explored differences in median engagement scores between posts that differed in content type (donation, registry, both, or neither). Results from a Kruskal Wallis H test revealed at least one median difference between groups ($\chi^2(3) = 12.72, p = .005$). Pairwise comparisons revealed that scores were statistically significantly higher for comments that mentioned both donation as well as the registry (*Mdn* = 6.00) compared to

those that only mentioned the registry (*Mdn* = 3.00). No other comparisons were significant.

Third, we analyzed median engagement scores for comments with and without a call to action. Results from a Mann-Whitney U test showed no difference between groups ($U = 38109.50, Z = -.55, p = .58$).

In regard to information seeking and sharing, results from a Mann-Whitney U test showed that comments displaying no information seeking (*Mdn* = 4.00) had higher scores than commenters that asked for information (*Mdn* = 3.00) ($U = 58144.50, Z = -2.12, p = .03$). Results from a Mann-Whitney U test revealed no differences between groups for comments that shared information versus comments that did not ($U = 125279.50, Z = -.63, p = .52$).

The second research question focused on the presence of TPB constructs in the comments, as well as engagement with these comments. Among comments related to bone marrow donation (*n* = 597), 21.1% mentioned a positive outcome,

Table 3. Reddit Comment Characteristics: Theory of Planned Behavior Constructs

Variable/sub-variable	Frequency
Bone marrow donation (<i>n</i> = 597)	
Outcome beliefs	
Positive	21.1% (<i>n</i> = 126)
Negative	12.6% (<i>n</i> = 75)
Both	8.4% (<i>n</i> = 50)
Neither	58.0% (<i>n</i> = 346)
Normative beliefs	
Positive	16.9% (<i>n</i> = 101)
Negative	.2% (<i>n</i> = 1)
Both	.2% (<i>n</i> = 1)
Neither	82.7% (<i>n</i> = 494)
Efficacy beliefs	
Positive	26.1% (<i>n</i> = 156)
Negative	23.8% (<i>n</i> = 142)
Both	10.9% (<i>n</i> = 65)
Neither	39.2% (<i>n</i> = 234)
Bone marrow registry (<i>n</i> = 247)	
Outcome beliefs	
Positive	11.7% (<i>n</i> = 29)
Negative	3.6% (<i>n</i> = 9)
Both	.8% (<i>n</i> = 2)
Neither	83.8% (<i>n</i> = 207)
Normative beliefs	
Positive	9.3% (<i>n</i> = 23)
Negative	.4% (<i>n</i> = 1)
Both	0% (<i>n</i> = 0)
Neither	90.3% (<i>n</i> = 247)
Efficacy beliefs	
Positive	42.5% (<i>n</i> = 105)
Negative	20.6% (<i>n</i> = 51)
Both	5.3% (<i>n</i> = 13)
Neither	31.6% (<i>n</i> = 78)
Intent to join the registry	2.6% (<i>n</i> = 26)
Self-reported behavior of registering	1.8% (<i>n</i> = 18)

12.6% a negative outcome, 8.4% both positive and negative, and 58.0% did not mention an outcome related to donating. Considering normative beliefs, 16.9% mentioned positive norms, 0.2% mentioned negative norms, and 82.7% did not mention norms at all. Furthermore, 26.1% referred to positive efficacy (behavior facilitators), 23.8% to negative efficacy (inhibitors), 10.3% both, and 39.2% did not mention efficacy beliefs (see Table 3).

Among comments related to joining the bone marrow registry ($n = 247$), 11.7% mentioned a positive outcome, 3.6% a negative outcome, 0.8% both, and 83.8% did not mention an outcome at all. Considering normative beliefs, 9.3% mentioned positive norms, 0.4% negative, and 90.3% did not mention norms. In addition, 42.5% referred to positive efficacy, 20.6% as negative efficacy, 5.3% both, and 31.6% did not mention efficacy. Furthermore, 2.6% of comments mentioned intent to join the bone marrow registry and 1.8% mentioned registration as a self-reported behavior.

Finally, we ran a series of tests to explore engagement with comments that discussed beliefs related to donation and registering to donate. Kruskal Wallis tests showed there were no significant differences in scores between donation-related outcome beliefs ($\chi^2(3) = 5.85, p = .12$). Mann-Whitney U-tests showed that for donation normative beliefs, comments with positive norms ($Mdn = 6.00$) elicited higher scores than comments that did not mention norms ($Mdn = 3.00$) ($U = 21440, Z = -2.46, p = .02$). Additionally, Kruskal Wallis tests showed there were significant differences in median engagement scores between bone marrow donation-related efficacy variables ($\chi^2(3) = 10.35, p = .01$). Scores were statistically significantly higher for commenters who described donation as easy ($Mdn = 4.50$) compared to commenters who mentioned donation as being hard ($Mdn = 3.00$), as well as for commenters who did not mention efficacy related to donation ($Mdn = 4.50$) compared to commenters who mentioned donation as being hard ($Mdn = 3.00$).

Related to joining the bone marrow registry, Mann-Whitney U tests showed that comments with positive outcome beliefs ($Mdn = 9.00$) elicited higher engagement scores than comments that did not mention outcome beliefs ($Mdn = 3.00$) ($U = 2229.50, Z = -2.25, p = .02$). There were no differences in scores between comments that mentioned different types of norms related to registering ($U = 2036.00, Z = -1.66, p = .09$). Finally, Kruskal Wallis tests showed there were significant differences in engagement scores between registry-related efficacy variables ($\chi^2(3) = 13.08, p = .004$). Engagement scores were statistically significantly higher for commenters who described registering as easy ($Mdn = 4.00$) as well as for commenters who did not mention efficacy related to registering ($Mdn = 3.50$), both compared to commenters who mentioned registering as being hard ($Mdn = 2.00$).

Discussion

This paper presents the findings from a quantitative content analysis of bone marrow donation content on Reddit. Most of the initial posts that spurred discussion about donation featured

testimonials from donors and donors with recipients. Results from the current study showed that users commented on these posts and engaged in conversation about donation.

However, there was a lack of posts that solely featured bone marrow recipients and thus there may be an opportunity to increasingly recruit these individuals to share testimonials and inspire others from the perspective of those in need. There were only 25 posts total that discussed bone marrow donation on this subreddit, yet these posts received a significant amount of social amplification. To draw more attention to this important issue, transplant organizations may consider educating recipients, donors, and associated family members with ways that they can share their experiences on discussion-based social media and promote positive donation-related outcomes, norms, and self-efficacy.

In regard to the comments, the data suggest that more comments addressed outcome beliefs related to donating bone marrow than beliefs related to joining the registry. Additionally, comments that simultaneously addressed donating and joining the registry received higher engagement than comments that solely discussed joining the registry. Consequently, promoting the registry may raise awareness; however, if not also promoting donation, exposure to this information may result in an empty pledge, in which an individual backs out when called upon (Carollo, 2010).

Nearly half of all comments included some form of information sharing. Research on the availability heuristic (Tversky & Kahneman, 1974) suggests that individuals without extensive knowledge of donation may use information derived from media to inform their perceptions of the procedure. It was encouraging to see that individuals answered questions and shared their health experiences on Reddit. Additionally, some of these comments included hyperlinks to official bone marrow donor registries. These responses may inform individuals' perceptions of donation. However, it is important to note that few of the commenters were health professionals and so future studies should analyze the types of misinformation about bone marrow donation on discussion-based social media so it can be corrected. Previous research by Silberman, Santiago, and Ham (2018) found that perceived credibility of health information on Reddit did not predict whether or not individuals enacted health advice that they received on the platform. More research is needed to explore how health professionals can enhance their credibility and convey correct health information on anonymous platforms. Misinformation such as commenters incorrectly discussing the cost of registering may hinder individuals from donating (Laver et al., 2001), and the consequences of this misinformation could be detrimental for patients waiting for matches.

Comments from donors received higher engagement than comments from other groups (e.g., registrants, recipients, individuals interested in the registry). Additionally, there was no difference in engagement between comments that addressed the positive and negative outcomes associated with donation. These findings suggest that regardless of the outcome, individuals engaged with content from donors. These findings suggest that individuals wanted to engage with these stories and praise

donors' behaviors, which supports Studts et al.'s (2010) research on the effectiveness of emotional appeals.

In line with previous research (e.g., Blanton et al., 2001), normative perceptions of donations were rarely discussed. However, comments with positive normative beliefs about donation received greater engagement than comments that did not mention normative beliefs. Considering the fact that donation is a low-frequency behavior, deviance regulation theory (Blanton et al., 2001) may provide insight for interpreting these results. This theory suggests that individuals react positively to norm deviant behaviors that are associated with socially desirable images. In the case of bone marrow donation, this may include comments that presented donors as altruistic. Thus, health professionals using the TPB to promote donation may consider testing norm deviant message strategies for promotion.

Efficacy beliefs were discussed more frequently than outcome and normative beliefs for both joining the registry and donating. Efficacy beliefs in the current study consisted of comments that addressed the facilitators and inhibitors of both joining the registry as well as donation. Research by Shaffer et al. (2018) proposed that experience-based health messages are often underutilized. There is a need for these messages because they have the potential to promote health behavior information seeking, increase a person's confidence (Gustafsson, Gustafsson, & Snellman, 2013), and provide powerful, real-world examples of what a health procedure entails (Shaffer et al., 2018). Findings from Hyde et al.'s (2014) research suggested that efficacy beliefs accounted for the greatest amount of variance in predicting intentions to donate bone marrow. Findings from the current study support the importance of efficacy beliefs in promoting donation. Specifically, people engaged more with comments that featured facilitators of donation compared to those that discussed inhibitors. Thus, focusing messages on the aspects of registering and donating that make these processes easy may increase message engagement and promote self-sacrificing and advocacy behaviors.

Limitations and Future Directions

The current study offered a quantitative content analysis of Reddit posts and comments on the r/pics forum. This research is not without limitations. First, the sample used for this study was limited to one subreddit. Several other subreddits feature discussions of bone marrow donation, including news about new treatments (r/science), conversations with medical professionals (r/IAMA), and historical facts about unique transplants (r/todayilearned). We were interested in specifically analyzing testimonials in this study. The subreddit r/pics requires that posters own the rights to the content and individuals use this forum for personal storytelling. Future research may consider comparing information between subreddits to understand the multiple ways bone marrow donation is discussed on this platform outside of testimonials. Next, this research does not provide a qualitative analysis of the beliefs individuals discussed in the comments about bone marrow. Additional analyses should be conducted to explore themes related to outcome, normative, and efficacy beliefs. While the spread of health misinformation

is a risk on all social media platforms, including on Reddit (Jang, McKeever, McKeever, & Kim, 2019), this study did not explicitly code posts or comments for misinformation. Future studies should add this to their coding scheme and to their analyses. Finally, considering the prominence of efficacy beliefs, future research may consider analyzing similar data through the theoretical lens of Bandura's (1989) Social Cognitive Theory to provide a more nuanced understanding of how individuals learn about donation through mass conversations on social media.

Implications for Practice

One take away from these findings is that health professionals should encourage individuals to share correct information about joining the registry and donating simultaneously to address a possible value-action gap that could occur by only promoting the registry. This may in turn reduce the prevalence of empty pledges. In addition, official bone marrow donation organizations should be aware that conversations are taking place on Reddit and they should consider assigning specialists to monitor these conversations to provide consistent and correct information.

Findings also suggest that if public health campaigns use testimonials as a way to promote donation, they should include an interactive component that enhances and encourages information seeking. It may be of interest to health professionals that individuals underlying beliefs were often revealed through a process of information seeking and sharing. A benefit of using social media to promote bone marrow donation is the possibility to enhance organic conversations that include testimonials and social support (Ziebland & Wyke, 2012). This research supports that behavior change theories and information processing theories should be considered as complementary and Reddit may provide opportunities to integrate these approaches.

Conclusion

Overall, Reddit is a popular, international social network that remains under-researched as a platform to discuss health-related issues. Each of the 25 posts analyzed for this paper had the potential to reach millions of r/pics subscribers. The engagement with this content was high and shows promise for promoting both advocacy and self-sacrificing behaviors. The current study takes a step forward by exploring how bone marrow donation is discussed on Reddit and how users engaged with this content. If bone marrow donors and recipients are made aware of how Reddit can encourage these behaviors, they may be more inclined to share their own success stories, and play a role in future public health campaigns to increase bone marrow donations.

As a society, we are still lacking sufficient levels of bone marrow donors (National Marrow Donor Program, 2020). In conclusion, Reddit may be a unique platform for bone marrow donors to share testimonials, raise awareness, encourage information seeking, and promote behavior change, and public health practitioners should consider including Reddit in their toolkit.

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References

- Aguirre-Zero, O., Westerhold, C., Goldsworthy, R., & Maupome, G. (2016). Identification of barriers and beliefs influencing engagement by adult and teen Mexican-Americans in oral health behaviors. *Community Dental Health*, 33(1), 44–47.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. doi:10.1016/0749-5978(91)90020-T
- Alexa Internet Inc. (2020, January). Reddit.com competitive analysis, marketing mix and traffic. Retrieved from: <https://www.alexa.com/siteinfo/reddit.com>
- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, 44(9), 1175.
- Bartholomew, L. K., Kay Bartholomew, L., & Mullen, P. D. (2011). Five roles for using theory and evidence in the design and testing of behavior change interventions. *Journal of Public Health Dentistry*, 71, S20–S33.
- Batson, C. D. (2010). Empathy-induced altruistic motivation. In M. Mikulincer & P. R. Shaver (Eds.), *Prosocial motives, emotions, and behavior: The better angels of our nature* (pp. 15–34). Washington, DC: American Psychological Association. <https://doi-org.proxy.library.vcu.edu/10.1037/12061-001>
- Bergstrom, T. C., Garratt, R. J., & Sheehan-Connor, D. (2009). One chance in a million: Altruism and the bone marrow registry. *The American Economic Review*, 99(4), 1309–1334.
- Bilandzic, H., & Busselle, R. (2013). Narrative persuasion. In J. P. Dillard & L. Shen (Eds.), *The Sage Handbook of Persuasion: Developments in Theory and Practice* (2nd ed., pp. 200–219). Thousand Oaks, CA: Sage.
- Blanton, H., Stuart, A. E., & Van den Eijnden, R. J. (2001). An introduction to deviance-regulation theory: The effect of behavioral norms on message framing. *Personality and Social Psychology Bulletin*, 27(7), 848–858. doi:10.1177/0146167201277007
- Braverman, J. (2008). Testimonials versus informational persuasive messages: The moderating effect of delivery mode and personal involvement. *Communication Research*, 35(5), 666–694. doi:10.1177/0093650208321785
- Butterworth, V. A., Simmons, R. G., & Schimmel, M. (1992). When altruism fails: Reactions of unrelated bone marrow donors when the recipient dies. *Omega*, 26(3), 161–173. doi:10.2190/U20C-PQ5H-YBN7-9G62
- Carollo, K. (2010, May). *New York woman dies of leukemia after bone marrow donors back out*. Retrieved from <http://abcnews.go.com/Health/woman-dies-leukemia-bone-marrow-donors-back/story?id=12120620#.ULEncYdQVHc>.
- De Choudhury, M., & De, S. (2014, May). Mental health discourse on Reddit: Self-disclosure, social support, and anonymity. In *Eighth international AAAI Conference on Weblogs and Social Media, Québec City, Québec, Canada*.
- De Wit, J. B., Das, E., & Vet, R. (2008). What works best: Objective statistics or a personal testimonial? An assessment of the persuasive effects of different types of message evidence on risk perception. *Health Psychology*, 27(1), 110.
- Department of Health and Human Services (2019). The need for more donors. Retrieved from: https://bloodcell.transplant.hrsa.gov/donor/need_for_donors/index.html
- Dunn, O. J. (1964). Multiple comparisons using rank sums. *Technometrics*, 6(3), 241–252.
- Guidry, J. P., Austin, L. L., Carlyle, K. E., Freberg, K., Cacciatore, M., Meganck, S., ... Messner, M. (2018). Welcome or not: Comparing# refugee posts on Instagram and Pinterest. *American Behavioral Scientist*, 62(4), 512–531.
- Gupta, V., Eapen, M., Brazauskas, R., Carreras, J., Aljurf, M., Gale, R. P., ... Sabloff, M. (2010). Impact of age on outcomes after bone marrow transplantation for acquired aplastic anemia using HLA-matched sibling donors. *Haematologica*, 95(12), 2119–2125. doi:10.1002/(SICI)1099-0798(199623)14:4<375::AID-BSL247>3.0.CO;2-8
- Gustafsson, C., Gustafsson, L. K., & Snellman, I. (2013). Trust leading to hope—the signification of meaningful encounters in Swedish healthcare. The narratives of patients, relatives and healthcare staff. *International Practice Development Journal*, 3(1), 1–13.
- Harikumar, H., Nguyen, T., Gupta, S., Rana, S., Kaimal, R., & Venkatesh, S. (2016). Understanding behavioral differences between short and long-term drinking abstainers from social media. In Li J., Li X., Wang S., Li J., Sheng Q. (eds) *Advanced Data Mining and Applications*. ADMA 2016. Lecture Notes in Computer Science, vol 10086. Springer, Cham. https://doi.org/10.1007/978-3-319-49586-6_36
- Henninger, N. M. (2019). ‘I gave someone a good death’: Anonymity in a community of Reddit’s medical professionals. *Convergence*, Advance online publication. doi:10.1177/1354856519847329.
- Hyde, M. K., McLaren, P. J., & White, K. M. (2014). Identifying belief targets to increase bone marrow registry participation among students who have never donated blood. *Psychology, Health & Medicine*, 19(1), 115–125. doi:10.1080/13548506.2013.775467
- In M. Mikulincer & P. R. Shaver (Eds.) (2019). Prosocial motives, emotions, and behavior: The better angels of our nature (pp. 15–34). Washington, DC: American Psychological Association. <https://doi-org.proxy.library.vcu.edu/10.1037/12061-001>
- Jang, S. M., McKeever, B. W., McKeever, R., & Kim, J. K. (2019). From social media to mainstream news: The information flow of the vaccine-autism controversy in the US, Canada, and the UK. *Health Communication*, 34(1), 110–117. doi:10.1080/10410236.2017.1384433
- Johnson, J. M. Q., Quintero Johnson, J. M., Yilmaz, G., & Najarian, K. (2017). Optimizing the presentation of mental health information in social media: The effects of health testimonials and platform on source perceptions, message processing, and health outcomes. *Health Communication*, 32(9), 1121–1132. doi:10.1080/10410236.2016.1214218
- Jordan, A., Kunkel, D., Manganello, J., & Fishbein, M. (2010). *Media messages and public health: A decisions approach to content analysis*. Abingdon, UK: Routledge.
- Kaster, E. C., Rogers, C. R., Jeon, K. C., & Rosen, B. (2014). Getting to the heart of being the match: A qualitative analysis of bone marrow donor recruitment and retention among college students. *Health Educator*, 46(1), 14.
- Laver, J. H., Hulsey, T. C., Jones, J. P., Gautreaux, M., Barredo, J. C., & Abboud, M. R. (2001). Assessment of barriers to bone marrow donation by unrelated African-American potential donors. *Biology of Blood and Marrow Transplantation*, 7(1), 45–48. doi:10.1053/bbmt.2001.v7.pm11215698
- Lee-Won, R. J., Abo, M. M., Na, K., & White, T. N. (2016). More than numbers: Effects of social media virality metrics on intention to help unknown others in the context of bone marrow donation. *Cyberpsychology, Behavior and Social Networking*, 19(6), 404–411. doi:10.1089/cyber.2016.0080
- Lindsey, L. L. M. (2005). Anticipated guilt as behavioral motivation: An examination of appeals to help unknown others through bone marrow donation. *Human Communication Research*, 31(4), 453–481. doi:10.1093/hcr/31.4.453
- National Marrow Donor Program (2020, January). Transplant basics. Retrieved from: <https://bethematch.org/transplant-basics>.
- Norvilitis, J. M., & Riley, T. M. (2001). Exploring the motivations of bone marrow typing donors. *Journal of Psychosocial Oncology*, 19(1), 49–62. doi:10.1300/J077v19n01_04
- Pappa, G. L., Cunha, T. O., Bicalho, P. V., Ribeiro, A., Couto Silva, A. P., Meira, W., Jr, & Beleigoli, A. M. R. (2017). Factors associated with weight change in online weight management communities: A case study in the Loselt Reddit Community. *Journal of Medical Internet Research*, 19(1), e17. doi:10.2196/jmir.5816

- Park, A., Conway, M., & Chen, A. T. (2018). Examining thematic similarity, difference, and membership in three online mental health communities from Reddit: A text mining and visualization approach. *Computers in Human Behavior, 78*, 98–112. doi:10.1016/j.chb.2017.09.001
- Perrin, A., & Anderson, M. (2019). Social media use in 2019. Pew Research Center. Retrieved from: <https://www.pewresearch.org/fact-tank/2019/04/10/share-of-u-s-adults-using-social-media-including-facebook-is-mostly-unchanged-since-2018/>
- Pilkington, P. D., & Rominov, H. (2017). Fathers' worries during pregnancy: A qualitative content analysis of reddit. *The Journal of Perinatal Education, 26*(4), 208–218. doi:10.1891/1058-1243.26.4.208
- Record, R. A., Silberman, W. R., Santiago, J. E., & Ham, T. (2018). I sought it, I Reddit: Examining health information engagement behaviors among Reddit users. *Journal of Health Communication, 23*(5), 470–476. doi:10.1080/10810730.2018.1465493
- Reddit. (2020, January). Reddit by the numbers. Retrieved from: redditinc.com.
- Rivera, I. (2019). Package 'RedditExtractoR'. Retrieved from: <https://cran.r-project.org/web/packages/RedditExtractoR/RedditExtractoR.pdf>
- Sanders-Jackson, A., Brown, C. G., & Prochaska, J. J. (2015). Applying linguistic methods to understanding smoking-related conversations on Twitter: Table 1. *Tobacco Control, 24*(2), 136–138. doi:10.1136/tobaccocontrol-2013-051243
- Schwartz, S. H. (1970). Elicitation of moral obligation and self-sacrificing behavior: An experimental study of volunteering to be a bone marrow donor. *Journal of Personality and Social Psychology, 15*(4), 283–293. doi:10.1037/h0029614
- Scott, W. A. (1955). Reliability of content analysis: The case of nominal scale coding. *Public Opinion Quarterly, 19*(3), 321–325. doi:10.1086/266577
- Shaffer, V. A., Focella, E. S., Hathaway, A., Scherer, L. D., & Zikmund-Fisher, B. J. (2018). On the usefulness of narratives: An interdisciplinary review and theoretical model. *Annals of Behavioral Medicine, 52*(5), 429–442.
- Shaffer, V. A., Owens, J., & Zikmund-Fisher, B. J. (2013). The effect of patient narratives on information search in a web-based breast cancer decision aid: An eye-tracking study. *Journal of Medical Internet Research, 15*(12), e273. doi:10.2196/jmir.2784
- Simmons, R. G., Schimmel, M., & Butterworth, V. A. (1993). The self-image of unrelated bone marrow donors. *Journal of Health and Social Behavior, 34*(4), 285–301. doi:10.2307/2137368
- Starbird, K., Dailey, D., Mohamed, O., Lee, G., & Spiro, E. S. (2018, April). Engage early, correct more: How journalists participate in false rumors online during crisis events. In *Proceedings of the 2018 CHI conference on human factors in computing systems*, Montreal, Québec, Canada (pp. 1–12).
- Stroncek, D. F., Holland, P. V., Bartch, G., Bixby, T., Simmons, R. G., Antin, J. H., & Hansen, J. A. (1993). Experiences of the first 493 unrelated marrow donors in the National Marrow Donor Program. *Blood, 81*(7), 1940–1946. doi:10.1182/blood.V81.7.1940.1940
- Studts, J. L., Ruberg, J. L., McGuffin, S. A., & Roetzer, L. M. (2010). Decisions to register for the National Marrow Donor Program: Rational vs emotional appeals. *Bone Marrow Transplantation, 45*(3), 422–428. doi:10.1038/bmt.2009.174
- Tasente, T. (2019). Social Media Communication in the European Administration. Case study: European Commission. *Acta Universitatis Danubius. Communicatio, 13*(2), 118–129.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*(4157), 1124–1131. doi:10.1126/science.185.4157.1124
- Weisz, V., & Robbenolt, J. K. (1996). Risks and benefits of pediatric bone marrow donation: A critical need for research. *Behavioral Sciences & the Law, 14*(4), 375–391.
- Ziebland, S. U. E., & 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. doi:10.1111/j.1468-0009.2012.00662.x