Full Length Research Paper

Pharmaceutical companies' Twitter communications: Engagement and message frames

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This study conducted a content analysis of tweets from the top five pharmaceutical companies to examine the levels of engagement between these companies and their audiences. The research also investigated the relationships between different types of tweets, including topics and message frames, and user interactions. The results revealed that pharmaceutical companies were more inclined to engage with tweets related to their own business practices rather than other subjects. The analysis further showed that pharmaceutical companies predominantly utilized episodically framed tweets for disseminating information about their own company, while thematic frames were employed for almost all other topics. Surprisingly, thematically framed tweets garnered more retweets compared to episodically framed tweets. The study's findings highlight that pharmaceutical companies predominantly communicate about their own businesses with their audiences, instead of utilizing Twitter's conversational features to discuss various health-related topics.

Key words: Twitter communications, pharmaceuticals, engagement, message framing.

INTRODUCTION

Social media has been extensively utilized in health communications to facilitate interactions and share tailored health information (Moorhead et al., 2013). Among various social media platforms, Twitter, now known as X, has evolved into a vital tool for organizations, particularly in the healthcare industry, to engage with the public, including patients or healthcare providers (Pershad et al., 2018). In line with this trend, pharmaceutical companies have increasingly turned to Twitter to stay competitive and disseminate news and healthcare-related information to key stakeholders such as patients, physicians, and investors (Enyinda et al., 2018; O'Brien, 2023). Recent research also indicates that pharmaceutical companies' Twitter accounts play a crucial role in reaching a broader audience with health messages, especially as individuals with lower health literacy are more likely to seek and trust health information from pharmaceutical companies and social media platforms rather than from physicians (Chen et al., 2018).

However, higher levels of activity by pharmaceutical companies on Twitter did not necessarily result in greater consumer interactions (Jackson et al., 2015). Despite Twitter's effectiveness in immediate information sharing and consumer engagement, research on pharmaceutical

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companies' social media practices has noted predominantly one-way communication from pharmaceutical companies to their primary targets, such as physicians and healthcare consumers, rather than fostering two-way communication (Enyinda et al., 2018; Jackson et al., 2015).

To gain a better understanding of how pharmaceutical companies utilize Twitter to disseminate health information and engage with the public, this study examines the level of engagement by pharmaceutical companies and their audiences, as well as the relationships between types of tweets and interactions. By conducting a content analysis of the top five pharmaceutical companies' Twitter accounts, this study explores the topics and frames of tweets used by pharmaceutical companies to determine whether the level of engagement varies depending on the topic and use of frames in their tweets. This study contributes to a broader understanding of social media practices within the pharmaceutical industry by providing insights into the types of pharmaceutical companies' tweets that generate a greater audience response and how pharmaceutical companies should engage with their Twitter audiences.

LITERATURE REVIEW

The use of Twitter by pharmaceutical companies

Pharmaceutical companies have used social media to provide health information to the public, patients, and health professionals (Moorhead et al., 2013). The three most important objectives of using social media among pharmaceutical companies are customer engagement, communication, and trust (Enyinda et al., 2018). Among the various social media platforms, Twitter has been the most popular social media platform used in healthcare communications (Pershad et al., 2018). For instance, Jackson et al. (2015) found that about 90% of pharmaceutical firms used Twitter, followed by YouTube (70%), and Facebook (50%). In healthcare, any Twitter user can post and share a message of 280 characters or fewer to provide medical information to a broader audience. The relative advantage of Twitter is that it is the fastest online platform because it enables users to communicate with a short tweet quickly (Pfeffer et al., 2014). A previous study also found that the main goal of Twitter use by pharmaceutical companies is to disseminate real-time information as quickly and as broadly as possible (Jackson et al., 2015). Hence, it helps pharmaceutical companies to meet the demands of consumers and patients who use social media to research healthcare providers and disease information as well as to seek support. Thus, social media allow pharmaceutical companies to stay competitive, increase sales, and cultivate brand awareness by communicating information about their firms, brands, or services with health consumers more cost-effectively than through traditional media (Enyinda et al., 2018).

To use social media effectively, strategies for enhancing engagement with its audience members via two-way messaging and dialogic conversations should be developed (Neiger et al., 2013a). Social media engagement refers to "the presence of meaningful dialogue between an organization and its stakeholders, and the ability of the organization to predict those stakeholders' behavior by measuring their signs of engagement on a social media site" (Jiang and Luo, 2017, p. 409). Twitter research in health communications shows that the level of engagement on Twitter can be measured with certain Twitter features at two different levels: 1) organizations' engagement with hashtags (#), reply (@), and mention (@), and 2) audiences' engagement with the number of retweets, replies to tweets, and likes.

Firstly, a hashtag is a word or phrase (with no spaces) preceded by the pound (#) sign, which is clickable and helpful for people searching for tweets on a specific topic. A hashtag within a tweet is used as a one-way communication tool by linking people to more relevant information that they search for using keywords or topics (Neiger et al., 2013a). The hashtag is effective during a pandemic situation such that tweets with more hashtags about the pandemic facilitate the rapid dissemination of emergency information with faster retweets (Son et al., 2019).

Secondly, the reply function is a direct response to another user's specific tweet; it begins with the @symbol along with the username of the Twitter user to whom one is replying (that is, @username). Another conversational component is the mention function, which includes other users but places @username in the middle of tweets. Both reply and mention functions indicate the medium level of engagement by organizations because they demonstrate that organizations are aware of the specific user and start dialogic conversations with them (Neiger et al., 2013b). On the other hand, a reply that a tweet received from audiences is a direct response to a post, which indicates audience engagement.

Thirdly, the retweet function allows users to repost someone else's tweets on their Twitter pages and share those reposted tweets with all their followers (Lee and Sundar, 2013). The number of retweets (shares) made by audiences indicates a two-way communication demonstrating that others receive the message from organizations and accept that it is important to share (Neiger et al., 2013b).

Lastly, a "like" is symbolized by the heart icon, representing another engagement activity by audiences. Alongside the number of retweets, the number of likes also shapes consumer engagement (Eslami et al., 2021). To examine which types of content in pharmaceutical companies' tweets are associated with higher or lower audience engagement, it is necessary to first assess the level of engagement of pharmaceutical companies with the public on Twitter, as posed in the following research question:

RQ1: How do global pharmaceutical companies engage with the public on Twitter?

Topics of pharmaceutical tweets

Selecting a topic for a message provides audiences with "a central organizing idea or story line that provides meaning to an unfolding strip of events" (Gamson and Modigliani, 1987, p. 143). The agenda-setting approach, rooted in memory-based models of information processing, explains that emphasizing certain issues makes them more salient, enabling people to attribute importance to those issues (Price and Tewksbury, 1997). Given that the selection of a specific topic influences the public's perception of issue importance, the primary topics of pharmaceutical tweets can shape the public's perception of what the issues posted on pharmaceutical companies' Twitter feeds entail and what they think about them. Research on the topics appearing on pharmaceutical companies' Twitter feeds and how these topics elicit audience reactions towards posts has been limited. One study explored the interactions between pharmaceutical companies and consumers on various social media platforms, revealing that the top three topics of social media posts created by pharmaceutical companies were related to disease awareness, business updates, and community outreach projects related to diseases (Jackson et al., 2015). However, it is still necessary to explore the association between the topics of tweets and audience engagement. Therefore, this study aims to examine the topics selected by pharmaceutical companies for their tweets, as well as the level of engagement as proposed in the following research questions:

RQ2a: What are the main topics of pharmaceutical companies' tweets?
RQ2b: Is there a difference in the level of engagement across the topics of pharmaceutical tweets?

Episodic and thematic framing of pharmaceutical tweets

Framing focuses on how topics or issues should be presented to influence people's attitudes and evaluations of an issue (Entman, 1993). Iyengar (1991) demonstrated that media framing can affect the attribution of responsibility for issues through episodic and thematic frames. Episodic frames place more focus on individual cases and specific events, which are related to personal experience and individual responsibilities for problems. On the other hand, thematic frames focus more on broader contexts such as the environment and public policies, which are related to societal factors and broader social responsibilities for problems. For example, the use of personal narrative is a form of episodic framing that provides a more personal connection to the individual,

whereas using statistics or background information on a topic is an example of using thematic frames to provide broader trends. Thus, the attribution of societal responsibility elicited by thematic frames gets people to support government programs or policy changes, whereas the attribution of individual responsibility derived from episodic frames leads people to consider their individual actions for their own situation.

Several public health studies have applied episodic-thematic frames to different health topics, such as obesity (Gearhart et al., 2012), pandemic flu (Lee, 2014), Alzheimer's disease (Kang et al., 2010), mental illness (Long et al., 2022) and smoking (Kenterelidou, 2012), and have shown that health news stories tend to use more episodic frames than thematic frames (Gearhart and Trumbly-Lamsam, 2017). On the other hand, for topics related to public health threats such as pandemic flu or obesity, thematic frames could be more effective than episodic ones in providing information on how to prevent health problems by focusing more on societal responsibility, as individual health problems are sometimes beyond individual control and require support from societal and environmental factors, such as the food industry or government regulations, to yield desirable health behaviors (Kenterelidou, 2012). Public health officials also recommended that journalists use more thematic frames by emphasizing social causes and treatments broadly rather than relying solely on episodic frames so that people value society's role in health issues (Higgins et al., 2006). It would be interesting to examine the use of episodic-thematic framings in pharmaceutical tweets to determine whether they are created in broader social contexts or in case-specific contexts, as well as their associations with the topics of the tweets and the level of engagement. Therefore, the following research questions are asked:

RQ3a: How has the message framing (episodic vs. thematic) of global pharmaceutical companies' tweets been utilized?
RQ3b: Are there differences in the use of episodic-thematic framings in pharmaceuticals' tweets across different topics of tweets?
RQ3c: Is there a difference in the level of engagement between episodic and thematic frames in pharmaceutical tweets?

METHOD

Data collection

To examine how pharmaceutical companies have communicated and engaged with the public on Twitter, this study conducted a content analysis of tweets from the top five pharmaceutical companies' Twitter accounts, including both original tweets and retweets. The top five pharmaceutical companies ranked by total revenues were, in order, Pfizer, Merck and Co., Johnson and Johnson, Roche Holding, and Sanofi (Dezzani, 2017). One week from each month during the first five months of 2017, from January 1 to June 1, was randomly chosen to construct a composite month of

tweets in order to identify a representative sample of pharmaceutical tweets at the time of the research being conducted, and also due to the higher volume of Twitter use by pharmaceutical companies compared to other social media platforms (Jackson et al., 2015). The sampling selection process resulted in a total of 460 tweets posted on the top five pharmaceutical companies' Twitter accounts.

Coding categories

Five main coding categories heavily used in Twitter communications were selected: (1) the key topic of each tweet; (2) the message framing; (3) the date of each tweet, which was coded to identify the unit of analysis—each tweet including both retweets and original tweets; (4) the originality of a posted tweet, which was coded as one of the three types of tweets: original, retweets, and a reply tweet; and finally, (5) the interactive components of Twitter, which were coded by looking at both companies' engagement activities, such as the number of hashtags, the use of mention and reply functions on each tweet, and users' engagement activities with the corporations, such as the number of replies, retweets, and likes that each tweet received.

The key topic of each tweet was determined in terms of primary issues of the tweets and coded as falling into one of six topics, which were initially developed based on previous content analysis studies on health topics (Jackson et al., 2015; Lee et al., 2019; Neiger et al., 2013a; Park et al., 2016) and were also refined using the sample tweets of the data to add to or remove from the initial coding categories. The six topics are as follows: (1) company information, which included topics related to their own products, services provided, news, reports, employees, and events; (2) disease treatment/prevention, including general facts or personal cases related to a specific disease or medical problem, as well as disease prevention focused on reducing the severity or incidence of specific diseases but with no mention of the company's involvement with a disease; (3) corporate social responsibility (CSR) or social marketing campaigns, which included specific CSR initiatives or campaigns along with hashtags of the campaign title promoting active participation in a campaign and focusing on a generally healthy population; (4) medical/scientific research, which included clinical, medical, and scientific research progress and outcomes, aimed at sharing information; (5) policy changes, including governmental health policy changes as information updates; and (6) other.

Message framing for each tweet was coded as either episodic or thematic frames by using Iyengar's (1991) definition of episodic and thematic frames. For example, tweets depicting particular persons or specific events were coded as episodic (that is, Kirsten Axelsen, our Global Policy VP, addresses the value of medicines today at #amamtg), whereas tweets using statistics, broader facts or trends over time without any personalized relevance were coded as thematic (that is, Chronic #HepC is a global burden that can be challenging to manage).

A single researcher coded all the tweets. To determine intercoder reliability, a randomly selected 10% of the sample ($n = 47$) was independently coded by a second coder who was trained in content analysis coding. The intercoder reliability was calculated using Scott's pi because there were only two coders (Allen, 2017). Each variable was above .88, with the overall intercoder reliability of 97%, confirming an acceptable level of agreement between the coders (Neuendorf, 2017).

RESULTS

Of all 460 tweets, 140 tweets (30.4%) were collected from Pfizer, which has 490k followers, 116 tweets (25.2%) from Roche Holding with 246k followers, 104 tweets (22.6%) from Sanofi with 152k followers, 74 tweets (16.1%) from Merck and Co. with 224k followers, and 26 tweets (5.7%) from Johnson and Johnson with 250k followers. In terms of the originality of the tweets, about 87% ($n = 401$) of the tweets were original posts and approximately 13% ($n = 59$) were retweets. Only one reply tweet (0.2%) was posted. Frequency analyses, chi-square tests, and Kruskal–Wallis tests were performed to answer research questions.

RQ1 examined the level of interaction of global pharmaceutical companies on Twitter by looking at different indicators of interaction and engagement on Twitter: the number of hashtags and the use of mention and reply to functions that each pharmaceutical tweet used as companies' engagement activities, and the number of replies, retweets, and likes that each tweet received from audiences as users' engagement activities with the corporations. Since there was only one reply tweet, a reply tweet was not included in the analysis. The results of frequency analysis showed that nearly three-quarters of tweets ($n = 341$, 74.1%) used either one ($n = 168$, 36.5%) or two ($n = 172$, 37.4%) hashtags. None of the tweets used more than six hashtags. Approximately 11.5% ($n = 53$) of tweets did not include a hashtag, and about 12.4% ($n = 57$) used three hashtags. A few tweets used four ($n = 8$, 1.7%) or five ($n = 2$, 0.4%) hashtags. Moreover, the mention feature was not actively used in the pharmaceutical companies' tweets. About a third of the tweets ($n = 142$, 30.9%) used the mention feature, while almost 70% of tweets ($n = 317$, 69.1%) never included the mention feature. Most pharmaceutical companies' tweets did not receive any replies—the median number of replies was zero. Regarding the retweet and like functions, which indicate how frequently a tweet was retweeted and liked by others, the results showed a median of seven retweets and 11 likes (Table 1).

RQ2a focused on the main topics of pharmaceutical companies' tweets and the level of interactions on pharmaceutical companies' Twitter by topic. The most frequently appearing topic was disease treatment or prevention ($n = 167$, 36.3%), followed by company information ($n = 126$, 27.4%), CSR and social marketing campaigns ($n = 104$, 22.6%), others ($n = 43$, 9.3%), and medical research ($n = 20$, 4.3%).

Regarding the level of interactions on pharmaceutical companies' Twitter by topic (RQ2b), chi-square tests were used to examine a significant difference in the use of hashtags and mentions across topics. The results showed a significant difference only in the use of the mention function across topics, χ^2 (4, $N = 460$) = 29.665, $p < .001$, but not in the use of the hashtag feature by the topic, χ^2 (4, $N = 460$) = 7.774, $p > .05$. Out of 142 (31%) tweets that used mentions, the mention function was most frequently used for a topic about their own pharmaceutical companies ($n = 57$, 40.1%), followed by disease prevention/treatment ($n = 35$, 24.6%), CSR/Campaigns ($n = 24$, 16.9%), others ($n = 21$, 14.8%), and medical research

Table 1. Descriptive statistics of interactive components of pharmaceutical tweets.

Interactive components	Pharmaceutical companies' tweets (N = 460)		
	Range	Mdn	Mean (SD)
Hashtag	0-5	2	1.58 (.94)
Mention	0-4	0	.37 (.63)
Replies	0-398	0	2.07 (19.87)
Retweets	0-2400	7	23.05 (131.97)
Likes	0-8700	11	47.26 (418.85)

Table 2. Message frames by the topic of tweets.

Frame	Topic of Tweets					
	Company	Disease	CSR/Campaign	Research	Other	Total
Thematic	30 (23.8%)	130 (77.8%)	66 (63.5%)	19 (95.0%)	11 (25.6%)	257 (55.9%)
Episodic	96 (76.2%)	36 (22.2%)	39 (36.5%)	1 (5.0%)	32 (74.4%)	203 (44.1%)
Total	126 (100.0%)	167 (100.0%)	104 (100.0%)	20 (100.0%)	43 (100.0%)	460 (100.0%)

$\chi2$ (4, N = 460) = 115.960, p < 0.001.

progress and outcomes (n = 5, 3.5%).

In addition, Kruskal–Wallis tests were conducted with the number of replies, retweets, and likes as dependent variables and the topic as an independent variable to examine differences in reply, retweet, and like frequencies according to the topic of tweets. No significant difference was found in the number of replies, $\chi2$ (4, N = 460) = 6.995, p > .05, and retweets across the topic of tweets, $\chi2$ (4, N = 460) = 6.242, p > .05. However, there was a statistically significant difference in the number of likes between different topics of tweets, $\chi2$ (4, N = 460) = 10.427, p < 0.05. The multiple pairwise comparisons showed that there was a significant difference in the number of likes for only one pair of topics—disease treatment/prevention and pharmaceutical companies' own information, with a mean rank of 205.29 likes for tweets about disease treatment/prevention compared to a mean rank of 253.18 for tweets about pharmaceutical companies' own information. Tweets directly related to their own pharmaceutical company received more likes compared to tweets about disease information. None of the other pairwise comparisons showed any significant difference between topics.

RQ3a examined the use of episodic and thematic frames in pharmaceutical companies' tweets. The frequency analysis results showed that thematic frames (n = 256, 55.7%) were used more frequently than episodic frames (n = 204, 44.3%). RQ3b asked about the use of the episodic-thematic framing of pharmaceuticals' tweets across topics. A chi-square test showed a statistically significant difference in the use of the episodic–thematic framing on pharmaceuticals' Twitter feeds by the topic of tweets, $\chi2$ (4, N = 460) = 115.960, p < 0.001. Nearly 76% (n = 96) of

tweets about company information used episodic frames rather than thematic frames (n = 30, 23.8%). For all other topics, thematic frames were used more frequently than episodic frames (Table 2).

Regarding the level of interactions on pharmaceutical companies' Twitter by frames (RQ3c), chi-square tests were used to examine a significant difference in the use of hashtags and mentions between episodic-thematic frames. The results showed a significant difference only in the use of the mention function across topics, $\chi2$ (1, N = 460) = 26.519, p <.001., but not in the use of the hashtag feature by the topic, $\chi2$ (1, N = 460) = 1.128, p > .05. Out of 142 (31%) tweets that used mentions, the mention function was used more frequently for episodically framed tweets (n = 88, 62.0%) than for thematically framed tweets (n = 54, 38.0%).

In addition, Kruskal-Wallis tests were conducted to examine differences in reply, retweet, and like frequencies according to the frame of tweets. No significant difference was found in the number of replies, $\chi2$ (1, N = 460) = .022, p > .05, and likes between the frames of tweets, $\chi2$ (1, N = 460) = .145, p > .05. However, there was a statistically significant difference in the number of retweets between different frames of tweets, $\chi2$ (1, N = 460) = 11.472, p < 0.001. Thematically framed tweets (mean rank = 249.12) were retweeted more than episodically framed tweets (mean rank = 206.93).

DISCUSSION AND CONCLUSION

The purpose of this study was to examine how pharmaceutical companies communicate and engage with

the public on their Twitter accounts. The results of this study showed a low level of engagement on pharmaceutical companies' Twitter accounts. Only one tweet from the top five pharmaceutical companies replied to other users, and less than a third of tweets used mentions to discuss the topic with other users. Notably, the audience's response to pharmaceutical companies' tweets, such as the number of replies, retweets, and likes that the companies received from other users, comprised a very small portion of pharmaceutical companies' tweets. This is consistent with the results of lower levels of engagement on other types of health organizations' Twitter accounts, such as non-profit organizations, government agencies, and local health departments (Chung, 2016; Guidry et al., 2017; Neiger et al., 2013a).

When looking at the topic of pharmaceutical companies' tweets, the most frequently appearing topic was disease treatment and prevention, followed by information about their own business or products, CSR/social marketing campaigns, others (that is, other health-related organizations' events), and medical research progress or outcome. This is consistent with previous research on pharmaceutical companies' social media usage, which showed that the most frequently appearing topics on pharmaceuticals' social media posts were mostly about disease awareness and treatment information, followed by business updates, and community outreach projects or CSR initiatives (Huhmann and Limbu, 2016; Jackson et al., 2015). However, this study showed that pharmaceutical companies make less effort to deliver news about medical research progress or outcomes. This may be due to FDA guidance to pharmaceutical companies about the requirement to provide important risk information on Twitter (US Food and Drug Administration, 2014). Indeed, the character-limiting environment of Twitter would make it difficult for pharmaceutical companies to include risk information on medical research progress or outcomes, such as new drug testing.

Regarding the relationship between the number of posts on a certain topic and the number of audience responses to them, the results showed that frequently appearing topics were not significantly associated with either pharmaceutical companies' interaction activity or a greater audience response to the topic. Although disease was the most frequently appearing topic, there were very few conversational features (mentions) and interactions (likes) for tweets about disease treatment and prevention. This is consistent with previous findings about the lack of interactivity by organizations on tweets for high-mortality diseases (Chung, 2016). On the other hand, there was greater use of the mention feature on tweets about their own pharmaceutical company, such as their own products or events. Tweets directly related to pharmaceutical companies' own information received more likes compared to tweets about disease treatment and prevention. In other words, pharmaceutical companies are more likely to engage and reach out to stakeholders via Twitter regarding

their own business practices rather than other topics so that they get the greater number of likes on tweets about their company's information. This result confirmed the previous findings about consumers' behavioral reactions to pharmaceutical companies' social media posts, in that investor information generated more likes on Facebook and more retweets/shares on Twitter and Facebook (Huhmann and Limbu, 2016). This indicates that pharmaceutical companies need to engage with patients or health communities to increase awareness or knowledge of disease and treatment rather than engaging with the audience mostly for their own business goal—that is, that pharmaceutical companies should focus more on help-seeking information to help consumers who are actively seeking health or drug information on social media, rather than product promotion or reminder messages about their companies or events.

In terms of message framing in pharmaceutical companies' Twitter feeds, there were significant differences in the framing (thematic vs. episodic) associated with the topics of tweets and the level of engagement. Pharmaceutical companies used more episodic framing than thematic framing in promoting their company information, while thematic framings were used for almost all other topics. To be more specific, when pharmaceutical companies used their Twitter feeds to promote their own business, products, or services, they utilized a more personal connection to an issue on Twitter. However, when the topic of tweets was related to disease, social marketing campaigns, or research progress, pharmaceutical companies addressed the issues more broadly using thematically framed tweets. Previous research on episodic-thematic frames showed that episodic frames were effective in evoking emotional responses and increasing individual contribution to an issue, while thematic frames were effective in evoking attitude changes about preventing health problems (Dudo et al., 2007; Kang et al., 2010; Kenterelidou, 2012). Interestingly, the findings of this study showed that pharmaceutical companies used more episodic frames for their company's information to encourage people to consider individual actions regarding their business. The greater use of personalized relevance to their own business activities with customers or investors, and the less frequent use of episodic frames on other topics, may be due to regulatory requirements, such as the issue of privacy information and breaches of patient confidentiality (Enyinda et al., 2018). Pharmaceutical companies are reluctant to disclose more personal information of the public due to privacy issues, so they would be more likely to frame topics other than their own business information more generally and broadly. However, regarding the level of engagement between episodic and thematic frames of pharmaceutical tweets, the mention function was used more frequently for episodically framed tweets than for thematically framed tweets, while thematic frames were retweeted more often than episodic frames.

Pharmaceutical companies utilized mentions more in episodically framed tweets to initiate conversations with specific users, whereas users were more likely to share thematically framed tweets with others.

Overall, this study not only examined the aggregated number of pharmaceutical companies' posts on a certain topic and engagement rate with audiences but also explored the relationship between the topic of tweets and the audience response. The findings of this study showed that pharmaceutical companies mostly communicate about their own companies with their stakeholders or customers, rather than using the conversation features of Twitter to discuss various health-related topics. Moreover, this study explored the topics of tweets and episodic-thematic frames that pharmaceutical companies select, along with the level of engagement. While previous research noted that pharmaceutical companies generally posted on their social media platforms about their business activities to enhance their ethical reputation, which helps the growth of sales, as well as information for investors, corporate advertising, and other topics such as conferences (Huhmann and Limbu, 2016), this study showed that the most frequent topics were disease treatment and prevention, followed by their own business information and CSR. There were very few posts about medical research progress. Interestingly, this study showed that pharmaceutical companies have tried to tailor tweets about their own business practices and product information mostly by using episodic frames, which generated more likes towards the issue of their own business practices than the most common topic: disease treatment and prevention. On the other hand, thematically framed tweets on other topics were retweeted more than episodically framed tweets about their business activities. These findings reflect the nature of the audience of pharmaceutical Twitter accounts and suggest that pharmaceutical companies should increase engagement not only with consumers or stakeholders but also with patients and health communities. By using the conversational features of Twitter, such as reply or mention, pharmaceutical companies can evoke more engagement with audiences and receive more replies, likes, and retweets from a broader audience.

LIMITATIONS AND RECOMMENDATIONS

There are several limitations to this study that should be considered in future research. Given the lack of two-way conversational features on pharmaceutical companies' Twitter feeds, it would be meaningful to identify the key audiences with whom pharmaceutical companies have interacted on their Twitter accounts by analyzing the types of @usernames they have mentioned in their tweets. Additionally, this study did not include visual cues to assess whether the use of photos or videos in tweets correlates with the level of engagement. Thus, future research should explore the effect of visual cues in

pharmaceutical companies' tweets on the engagement rate.

Considering the limitations of content analysis research, this study does not provide explanations for why pharmaceutical companies engage less on other topics compared to their own company information. Future survey or in-depth interview studies with pharmaceutical communications professionals should be conducted to examine the perceptions of these professionals regarding Twitter communications with their key publics. It would also be useful to measure the public's perception of pharmaceutical companies' Twitter management and their engagement efforts.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

REFERENCES

Allen M (2017). The sage encyclopedia of communication research methods. Thousand Oaks, CA: Sage.

Chen X, Hay JL, Waters EA, Kiviniemi MT, Biddle C, Schofield E, Li Y, Kaphingst K, Orom H (2018). Health Literacy and Use and Trust in Health Information. Journal of Health Communication 23(8):724-734.

Chung J (2016). A Smoking Cessation Campaign on Twitter: Understanding the Use of Twitter and Identifying Major Players in a Health Campaign. Journal of Health Communication 21(5):517-526.

Dezzani L (2017). Top 10 Pharmaceutical Companies 2017. Available at: https://igeahub.com/2017/03/14/top-10-pharmaceutical-companies-2017/

Dudo AD, Dahlstrom MF, Brossard D (2007). Reporting a potential pandemic a risk-related assessment of avian influenza coverage in US newspapers. Science Communication 28(4):429-454.

Entman RM (1993). Framing: Toward a clarification of a fractured paradigm. Journal of Communication 43(4):51-58.

Enyinda CI, Ogbuehi AO, Mbah CH (2018). Building pharmaceutical relationship marketing and social media impact. International Journal of Pharmaceutical and Healthcare Marketing 12(2):198-230.

Eslami SP, Ghasemaghaei M, Hassanein K (2021). Understanding consumer engagement in social media: The role of product lifecycle. Decision Support Systems 113707.

Gamson WA, Modigliani A (1987). The changing culture of affirmative action. In: R.G. Braungart (Ed.), Research in political sociology. Greenwich, CT: JAI Press 3:137-177.

Gearhart S, Craig C, Steed C (2012). Network News Coverage of Obesity in Two Time Periods: An Analysis of Issues, Sources, and Frames. Health Communication 27(7):653-662.

Gearhart S, Trumbly-Lamsam T (2017). The Scoop on Health: How Native American Newspapers Frame and Report Health News. Health Communication 32(6):695-702.

Guidry J, Yan J, Orr CA, Marcus M, Meganck S (2017). Ebola on Instagram and Twitter: How health organizations address the health crisis in their social media engagement. Public Relations Review 43(3):477-486.

Higgins J, Naylor PJ, Berry T, O'Connor B, McLean D (2006). The Health Buck Stops Where? Thematic Framing of Health Discourse to Understand the Context for CVD Prevention. Journal of Health Communication 11(3):343-358.

Huhmann BA, Limbu YB (2016). Content and compliance of pharmaceutical social media marketing. Marketing Intelligence and Planning 34(7):977-999.

Iyengar S (1991). Is anyone responsible?: How television frames political issues. Chicago: University of Chicago Press.

Jackson W, Park B, Toscani M, Hermes-DeSantis E (2015). Analysis of

Social Media Interactions Between Pharmaceutical Companies and Consumers: The Power of the "Like". Therapeutic Innovation and Regulatory Science 49(3):387-391.

Jiang H, Luo Y (2017). Social Media Engagement for Crisis Communication: A Preliminary Measurement Model. In: Y. Jin and L. Austin (Ed.), Social media and crisis communication. New York: Routledge pp. 401-422.

Kang S, Gearhart S, Bae HS (2010). Coverage of Alzheimer's Disease From 1984 to 2008 in Television News and Information Talk Shows in the United States: An Analysis of News Framing. American Journal of Alzheimer's Disease and Other Dementias® 25(8):687-697.

Kenterelidou C (2012). Framing public health issues: the case of smoking ban in Greece, Public Health Policy Framing equals Healthy Framing of Public Policy? Journal of Communication in Healthcare 5(2):116-128.

Lee JY, Sundar SS (2013). To tweet or to retweet? That is the question for health professionals on Twitter. Health Communication 28(5):509-524.

Lee ST (2014). Predictors of H1N1 Influenza Pandemic News Coverage: Explicating the Relationships between Framing and News Release Selection. International Journal of Strategic Communication 8(4):294-310.

Lee Y, Park S, Lee H, Willis E, Cameron GT (2019). Resources aren't everything, but they do help: assessing local TV health news to deliver substantive and useful health information. Journal of Communication in Healthcare 12(1):13-22.

Long A, Jain P, Roark J (2022). PTSD Coverage in the New York Times: Implications for the State of Mental Health in the U.S. Journal of Health Communication 27(7):471-483.

Moorhead S, Hazlett D, Harrison L, Carroll J, Irwin A, Hoving C (2013). A New Dimension of Health Care: Systematic Review of the Uses, Benefits, and Limitations of Social Media for Health Communication. Journal of Medical Internet Research 15(4):e85.

Neiger BL, Thackeray R, Burton SH, Thackeray, CR, Re ese JH (2013a). Use of twitter among local health departments: an analysis of information sharing, engagement, and action. Journal of medical Internet research 15(8):e177.

Neiger BL, Thackeray R, Burton SH, Giraud-Carrier CG, Fagen MC (2013b). Evaluating Social Media's Capacity to Develop Engaged Audiences in Health Promotion Settings: Use of Twitter Metrics as a Case Study. Health Promotion Practice 14(2):157-162.

Neuendorf KA (2017). The content analysis guidebook. 2nd edition. Thousand Oaks, CA: Sage.

O'Brien J (2023). Whither Twitter? Health and wellness brands try to make sense of the Elon Musk era. Medical Marketing and Media. Available at: https://www.mmm-online.com/home/channel/features/whither-twitter-health-and-wellness-brands-try-to-make-sense-of-the-elon-musk-era/

Park H, Reber BH, Chon M (2016). Tweeting as Health Communication: Health Organizations' Use of Twitter for Health Promotion and Public Engagement, Journal of Health Communication 21(2):188-198.

Pershad Y, Hangge PT, Albadawi H, Oklu R (2018). Social Medicine: Twitter in Healthcare. Journal of Clinical Medicine 7(6):121.

Pfeffer J, Zorbach T, Carley KM (2014). Understanding online firestorms: Negative word-of-mouth dynamics in social media networks. Journal of Marketing Communications 20(1-2):117-128.

Price V, Tewksbury D (1997). News values and public opinion: A theoretical account of media priming and framing. In: G.A. Barett and F.J. Boster (Ed.), Progress in communication sciences: Advances in persuasion. Vol. 13. Greenwich, CT:Ablex pp. 173-212.

Son J, Lee HK, Jin S, Lee J (2019). Content features of tweets for effective communication during disasters: A media synchronicity theory perspective. International Journal of Information Management 45:56-68.

US Food and Drug Administration (2014). Guidance for industry: internet/social media platforms with character space limitations; presenting risk and benefit information for prescription drugs and medical devices. Available at: https://www.fda.gov/media/88551/download