Reputation of Pharmaceutical Companies: Corporate Communication Strategies on Social Media During COVID-19

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Abstract :

During the COVID-19 pandemic, Big Pharma faced a wave of rumors, fake news, and conspiracy theories that challenged their reputation. This study explores how pharmaceutical companies utilized social media, particularly Twitter, to counter these challenges and enhance their reputations. We collected and analyzed communications from six big pharmaceutical companies spanning 2020 and 2021, using a combination of manual analysis and automated techniques. Transformer models like BERT were employed to generate contextual embeddings for each post, alongside NRC sentiment analysis and engagement metrics. The findings highlight key strategies that pharmaceutical companies can leverage on social media to improve their reputations and manage misinformation during health crises.

Keywords: Corporate Reputation, Reputation Management, Corporate Communication, Fake News, Engagement Metrics.

Introduction

Corporate reputation, often regarded as an intangible asset, plays a crucial role in business success, particularly in the pharmaceutical industry, where it impacts not only the company but also public health. An organization's reputation is shaped by its past decisions, actions, and history (Ion *et al.*, 2021). However, building, managing, and restoring a corporate reputation has become increasingly challenging due to various factors, particularly in the digital era, where social media users continually challenge corporate reputations. Moreover, similar concepts apply to individual online identities, an individual's online reputation can significantly differ from their offline persona because online platforms allow users to create and share information (Ryan, 2019). Pharmaceutical companies, despite their roles as providers of Direct-to-Consumer Advertising (DTCA) and scientific knowledge on social media (Tyrawski and DeAndrea, 2015) often struggle with negative reputations (Müller, 2022). Public distrust toward pharmaceutical companies arises due to several factors, including their perceived focus on maximizing profit over patient safety, lack of transparency, and apparent political involvement (Hernandez, 2015). According to a study published in 2023, approximately sixty percent of patients affected by cardiovascular disease expressed distrust toward pharmaceutical companies, leading to detrimental effects such as lower medication adherence, reluctance to participate in clinical trials, and refusal of prescription drugs (Singh, Eisenberg and Sood, 2023). Similarly, another study highlighted distrust in pharmaceutical companies as a key reason behind vaccine hesitancy (Lanyi *et al.*, 2022). On the other hand, one study examined pharmaceutical companies' COVID-19 and non-COVID-19 communications through sentiment analysis, revealing a predominant sense of joy (Gyftopoulos *et al.*, 2024). To rebuild and maintain public trust, pharmaceutical companies also engaged patient influencers to connect directly with patients and share their personal experiences and knowledge to assist others in managing their diseases (Willis *et al.*, 2023). Social media platforms, including Twitter, are increasingly utilized by pharmaceutical companies to communicate directly with the public and implement marketing strategies aimed at promoting their drugs (Tyrawski and DeAndrea, 2015).

Understanding the communication strategies employed by pharmaceutical companies during the COVID-19 pandemic is vital for evaluating their initiatives to enhance reputation, which significantly impacts patients' choices regarding vaccines, treatments, and other healthcare

issues. This study seeks to offer valuable insights for healthcare decision-makers, pharmaceutical organizations, and patients. The research questions guiding this research are as follows:

- What are the main topics of pharmaceutical companies' posts during Covid-19
- Is there a difference in the level of engagement across the topics of pharmaceutical posts?
- How are pharmaceutical companies using social media to combat misinformation and address health challenges during the COVID-19 pandemic?
- How do pharmaceutical companies engage with users on social media, and to what extent do their replies aim to foster emotionally-centered interactions and build trust, thereby influencing their reputation?

Conceptual Framework, Literature Review and Research Model

Corporate Reputation

Corporate reputation is a result of a company's interaction with its stakeholders, creating value and trust through mutually beneficial communication (Ng, 2021). Companies gain a strong reputation by creating a unique set of skills valued by their customers. They differentiate themselves by developing good ideas, translating them into products and marketing them well (Chajet *et al.*, 2018). Due to social media's transparency and credibility, stakeholders have an essential role in reputation management (Ji *et al.*, 2017). According to Gallup's annual survey conducted in 2019, the pharmaceutical industry is the least admired industry among Americans (GALLUP, 2019). GlobScan published a report in 2012 addressing the challenges faced by pharmaceutical companies in different regions, including high drug prices, concerns over product safety, limited access to medications, prices in poor countries, insufficient investment in R&D, quality related issues, proliferation of counterfeit drugs, lack of affordable healthcare options, issues related to generic drugs, and allegations of profit-focused and unethical marketing (*GlobeScan.*, 2013). Likewise, according to Smart Pharma Consulting, the main reasons behind the poor reputation of pharmaceutical companies include the perception of excessive high prices of drugs, the priority given to developing 'me-too' drugs rather than innovative new treatments, illegal marketing practices, and a focus on maximizing profits. The influence of media outlets and journalists in shaping the public perception of pharmaceutical companies during the COVID-19 pandemic has been substantial (Zaynab, 2024). To enhance their reputation, these companies must invest significantly in R&D and innovation, implement access initiatives, and adhere to

ethical standards across all aspects of their practices and marketing (Peny, 2016).

Communication and Interactive Communication

Corporate communication plays a vital role in implementing strategy and enhancing a company's brand and reputation (Forman and Argenti, 2005). Corporate communication serves as the channel through which organizations engage with their diverse stakeholder groups. However, several factors and influences can impact the effectiveness of these communication strategies (Roper and Fill, 2012). Key factors that enable companies to build strong and favorable reputations with their primary stakeholders include credibility, reliability, trustworthiness, and a sense of responsibility (Chajet *et al.*, 2018). According to Fombrun and Van Riel, companies with high reputational scores excel in five key areas: visibility, distinctiveness, consistency, transparency, and authenticity. Visibility is crucial, as companies that engage directly with stakeholders and maintain open dialogue tend to build stronger reputations. Distinctiveness allows companies to stand out, particularly when their communications focus on a core theme that reflects their identity. Authenticity is essential for building trust, as emotionally appealing and genuine communications resonate with the public, fostering long-term credibility. Transparency, through frequent and broad communication about the company's activities, enhances consumer trust, as openness is highly valued. Lastly, consistency is key to reputation management. Companies that maintain a unified message across all departments and platforms demonstrate reliability, while fragmented efforts can harm their reputation (Fombrun, 2004). Corporate communication is an essential tool for integrating various corporate-level marketing constructs, as they are often interdependent (Balmer and Greyser, 2006). The swift and decisive actions taken by Johnson & Johnson during the Tylenol cyanide poisoning crises of 1982 and 1986 serve as a powerful example of how effective crisis management and transparent communication can significantly impact corporate reputation. By prioritizing consumer safety, recalling all Tylenol products, and actively engaging with the public through hotlines and advertising, the company not only mitigated the immediate damage; it also rebuilt trust, regaining over 90% of its customer base. J&J's response set a new standard for corporate responsibility, demonstrating that social responsiveness in times of crisis can transform public perception and strengthen a company's long-term reputation (Johnson & Johnson's Tylenol scare). Social media offers pharmaceutical companies a platform to engage with consumers, allowing them to build more direct and personalized connections. Research indicates that

interactive corporate communication boosts message credibility and fosters stakeholder identification, especially when perceived as authentic. Two-way, symmetrical communication that values stakeholder input can enhance a company's reputation and promote positive word-of-mouth. Despite these advantages, negative user evaluations can undermine these benefits by adversely affecting the company's reputation (Eberle, Berens and Li, 2013). A single post can make or break a reputation. Managers must understand the differences between online and offline worlds to build, maintain, protect, and enhance their companies' reputations (Sagapova, Dušek and Pártlová, 2022). Building on the conceptual framework and literature review, this study investigates the influence of corporate and interactive communication on social media, with a particular emphasis on Twitter, in shaping the reputation of pharmaceutical companies during the COVID-19 pandemic. By analyzing communication patterns, stakeholder engagement, and responses to misinformation, the aim is to understand how social media communication strategies affect the public perception of these companies. The model focuses on two key dimensions of communication: corporate communication and interactive communication. Corporate communication refers to the dissemination of messages by pharmaceutical companies, while interactive communication involves direct engagement between companies and users on social media platforms, particularly through replies.

Data and Methods:

Twitter as a source for this study allowed us to follow the activities of pharmaceutical companies on social media, identify the nature of pharmaceutical messages, and monitor digital marketing strategies. Data extraction was automated using the Twitter academic search API v2 with the "academictwitteR" package. A total of **6,466** posts, including replies, were collected from the global Twitter accounts of six major pharmaceutical companies (@Pfizer, @NovoNordisk, @AstraZeneca, @Sanofi, @Merck, and @Novartis) over the period from January 1, 2020, to December 31, 2021. These companies, which are among the top 20 pharmaceuticals globally, played a crucial role during the COVID-19 pandemic. Their contributions included developing and discovering COVID-19 vaccines and treatments, ensuring the delivery of essential medicines, supporting healthcare systems in managing non-COVID-19 patients, and engaging in various philanthropic efforts such as donating to non-profit organizations.

The table below outlines the distribution of tweets for each pharmaceutical company.

Screen Name	Twitter handle	Number of Posts 2020-2021
AstraZeneca	@astrazeneca	1027
Merck	@merck	1151
Novartis	@novartis	550
NovoNordisk	@novonordisk	1099
Pfizer	@pfizer	1648
Sanofi	@sanofi	991

Table1*: Number of Posts Collected for Each Pharmaceutical Company (2020-2021)*

Data Analysis Techniques

In this study, transformer models such as BERT were employed to generate contextual embeddings for each tweet, capturing the semantic meaning of the content. After tokenizing the tweets using the BERT model, the embeddings were processed through mean pooling to produce a single vector representing each tweet's overall context. These embeddings were then scaled using MinMaxScaler to normalize the data. KMeans clustering was applied to the scaled embeddings for each pharmaceutical company separately, categorizing their posts into four distinct clusters. The decision to use four clusters was supported by the silhouette index, which demonstrated that this configuration provided the best balance between cluster cohesion and separation. A targeted keyword-based analysis was conducted to specifically extract tweets related to managing misinformation and combating fake news.

Engagement scores were measured through likes and retweets, as these actions are typically classified as positive engagement. When a user likes or retweets a pharmaceutical company's post, it indicates their alignment with the company. Retweets further propagate positive word-of-mouth, enhancing the company's role and reputation. To further explore the relationship between topic types and engagement, a one-way ANOVA analysis was conducted, followed by a Tukey HSD post-hoc test, using the engagement data associated with the various content clusters identified in the earlier analysis. The NRC sentiment analysis framework was chosen due to its robust capacity for identifying and categorizing a range of emotional responses, particularly in the replies of pharmaceutical companies. The NRC lexicon includes a comprehensive list of

words associated with eight emotions, such as joy, sadness, trust, and fear, enabling a nuanced understanding of the emotional tone conveyed in the replies from pharmaceutical companies.

Results

Topics of Pharmaceutical Companies' Posts

Eight dominant topics were identified across the posts from pharmaceutical companies, including their replies. This comprehensive approach was necessary because these companies sometimes respond to their own posts, making it important to capture the full scope of their communication strategies.

The Corporate Social Responsibility (CSR) topic reflects the companies' commitment to addressing societal issues, promoting health equity, and fostering partnerships that respect environmental sustainability. The User Engagement and Supportive Care topic showcases efforts to provide valuable resources and patient support. Additionally, Novartis emphasizes its Patient Assistance Programs, and Merck focuses on World Cancer Day initiatives. AstraZeneca and Novartis also prioritize Adverse Event Reporting and User Support, underlining their commitment to patient safety and transparency regarding adverse events related to their pharmaceutical products.

Under Scientific Advancements and Global Health Leadership topic, companies highlight their research innovations and contributions to global health, often promoting clinical trials and including URLs that mention new treatments that have not yet received regulatory approval. Meanwhile, Disease Awareness and Medical Education topic illustrates the power of pharmaceutical companies to provide vital medical information, inspire healthy habits, and encourage disease prevention and early diagnosis. Pfizer, in particular, adopts a proactive approach in combating misinformation and addressing public health challenges through Scientific Insights and Health Challenges topic.

The graph below illustrates the distribution of topics across six pharmaceutical companies.

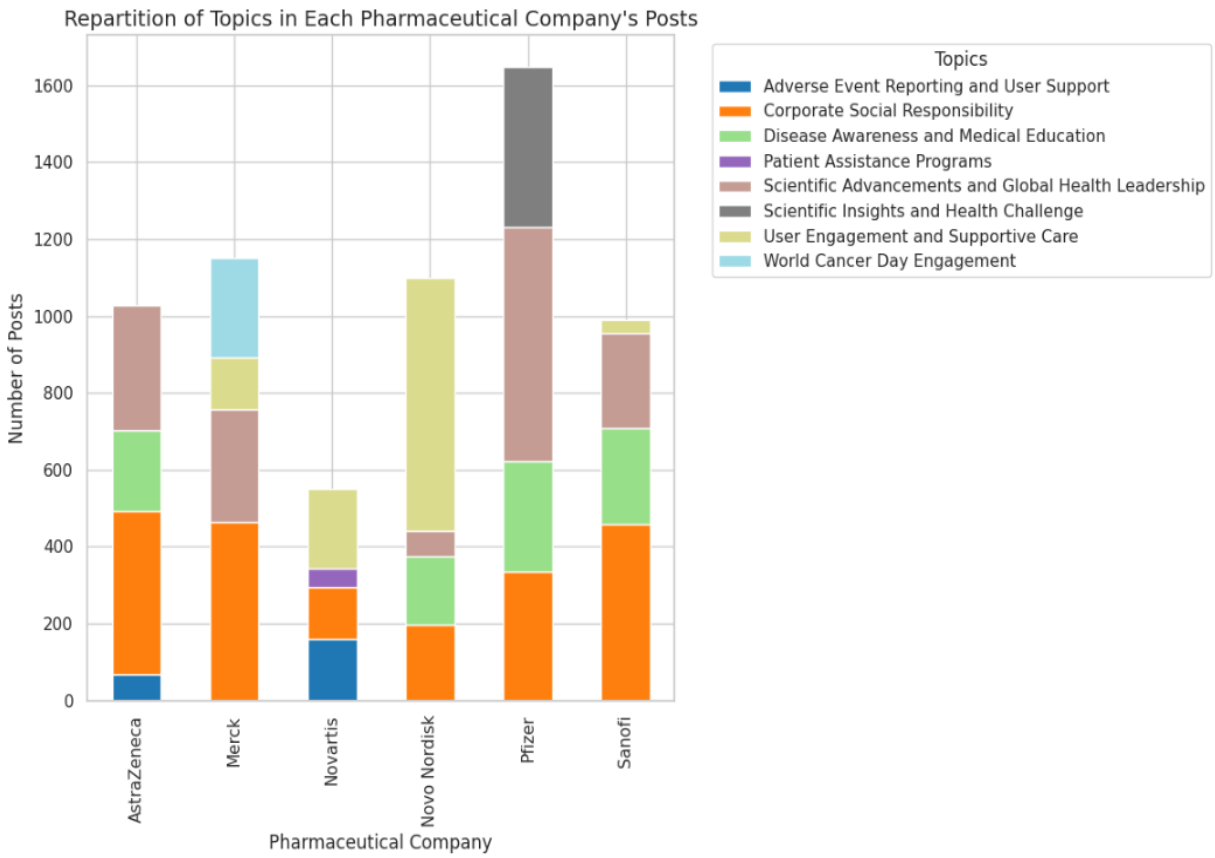

Figure1: *Topic Distribution across six pharmaceutical companies.*

Managing Fake News: How Pharmaceutical Companies Addressed Misinformation

Pharmaceutical companies employed two key strategies to counter misinformation:

Direct Confrontation: Companies tackled misinformation head-on through social media, highlighting the threat and potential negative consequences posed by false information while providing accurate responses to counter it.

Evidence-Based Communication: Companies shared credible medical information, emphasizing science-based evidence to indirectly counter misinformation. This strategy focused on disseminating reliable data to build trust and credibility.

To better analyze and categorize these strategies, posts were identified using specific keywords. For Direct Confrontation, keywords included "Disinformation," "Conspiracy," "Bias," "Fake," "Scam," "Fraud," "Infodemic," "Misconceptions," "Myth," "Claims," "Inaccuracy," and "Misinform." For Evidence-Based Communication, keywords included "Verify," "Inspection,"

"Evidence," "Science-based," "Data-driven," "Verification," "Fact," "Credibility," "Reliability," "Trust," "Transparency," and "Accountability."

Direct Confrontation Communication: A total of 22 posts were identified from pharmaceutical companies actively engaging in direct confrontation to address misinformation. Pfizer was the most proactive in this area, contributing half of the posts (10 out of 22), demonstrating a strong commitment to debunking myths and addressing misinformation. Their strategy involved counteracting vaccine myths, such as the misconception that flu vaccines can cause the flu, supporting social media platforms in combating misinformation, and hosting events like the "Infodemic Conference" to address the growing concern of misinformation. Other pharmaceutical companies, such as Sanofi, AstraZeneca, and Merck, also contributed, with posts focusing on topics like online misinformation about COVID treatments, asthma misconceptions, and HIV stigma. Notably, Pfizer's efforts generated the highest average engagement score (719.6), reflecting the public's strong interest and interaction with their posts. (Appendix 1)

Evidence-Based Communication: In the analysis of evidence-based communication, Pfizer stands out in this category, with 36 posts and a notably high average engagement score of 1499.33. The most frequent words in Pfizer’s posts include "covid," "vaccine," "fact," and "approved," reflecting their focus on clarifying factual information about COVID-19 vaccines and their approval processes. This strategy emphasized educating the public on the distinction between authorized and approved vaccines, particularly addressing concerns around safety and efficacy. Novo Nordisk follows with 14 posts and a very high average engagement score of 2776.0, reflecting strong public interest in their evidence-based messaging about COVID-19, obesity, and related health challenges. In contrast, AstraZeneca's 24 posts, which focused on clinical data and transparency, generated a much lower average engagement score of 37.04. (Appendix2).

Engagement Metrics of Pharmaceutical Companies' Posts

The table below presents a descriptive summary of engagement levels across eight distinct content clusters as illustrated by the bar chart in Figure2. It shows the average engagement score for each cluster, calculated as the sum of likes and retweets, based on the tweets shared by the pharmaceutical companies. The ANOVA test results show a statistically significant difference in engagement levels between across the eight topics ($F(10.49) = 6.046$, $p < 0.001$), indicating that

the topic shared by pharmaceutical companies significantly influences user engagement. Tukey post-hoc tests revealed that Scientific Insights and Health Challenges are particularly pivotal for maximizing user engagement, especially during the COVID-19 pandemic (Appendix 3).

Cluster Label	**Number of Posts**	**Average Engagement** (Likes and Retweets)
Adverse Event Reporting and User Support	227	1.42
Corporate Social Responsibility	2019	59.03
Disease Awareness and Medical Education	922	46.72
Patient Assistance Programs	48	0.12
Scientific Advancements and Global Health Leadership	1537	87.36
Scientific Insights and Health Challenges	417	406.88
User Engagement and Supportive Care	1038	63.53
World Cancer Day Engagement	258	2.41

Table 2: Descriptive Summary of Cluster Engagement

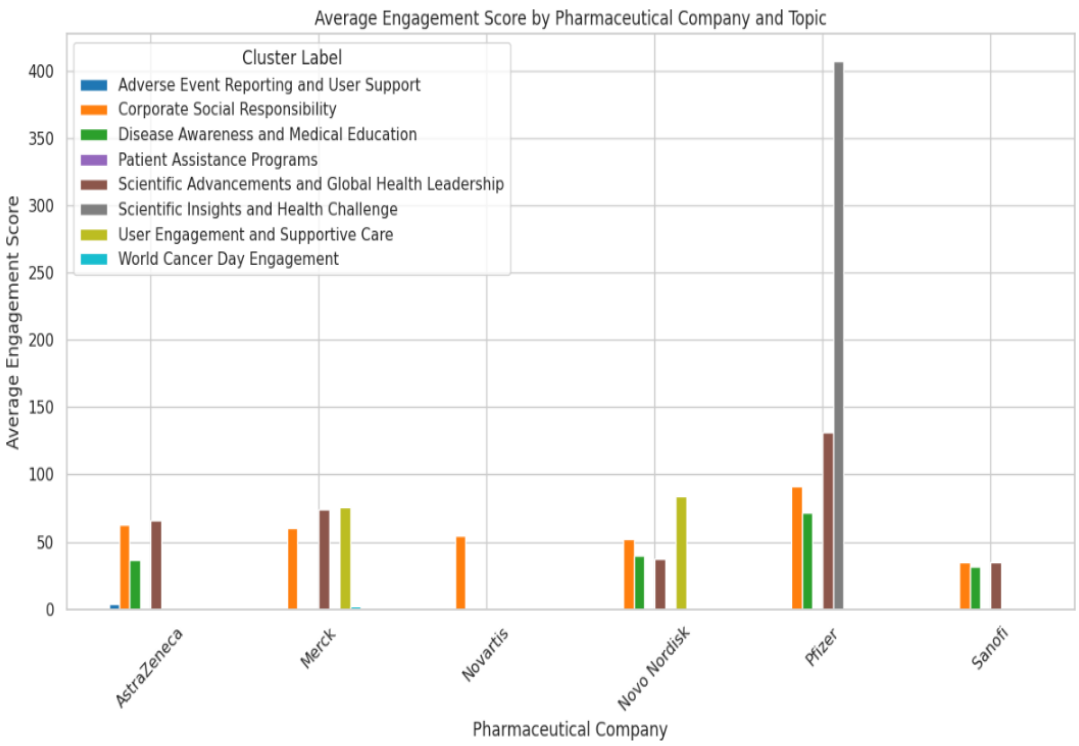

Figure 2: Bar Chart 'Average Engagement by Topic'.

Interactive Communication

Pfizer was the most active company on Twitter during the pandemic, with 1648 posts, but only 4% of these were replies. In contrast, Novartis was the least active in overall communication but had the highest reply ratio, with approximately 69% of their 550 posts being replies. This indicates that Novartis utilized Twitter more for direct user engagement than for general communication during the crisis. Novo Nordisk also leveraged Twitter for both communication and interaction, with roughly 48% of their posts being replies. AstraZeneca had a lower reply rate, with only 6.33% of their posts being replies. After excluding self-replies, Sanofi (~3%) was the least interactive with users but frequently used self-replies to enhance the visibility of their posts. Table 3 illustrates the distribution of replies, excluding self-replies, for each pharmaceutical company.

screen_name	reply_count	total_posts	reply_percentage
AstraZeneca	65	1027	6.33%
Merck	246	1151	21.37%
Novartis	379	550	68.91%
Novo Nordisk	529	1099	48.13%
Pfizer	69	1648	4.19%
Sanofi	29	991	2.93%

Table3: Percentage of replies after excluding self-directed replies

Pharmaceutical companies employ various strategies to engage with users on social media, with 'User Engagement and Supportive Care' being the most prominent. This approach involves answering questions, offering advice, and providing medical information. For example, Novo Nordisk responded empathetically to a user, demonstrating their commitment to addressing patient concerns and fostering supportive dialogue. Another topic is 'Adverse Event Reporting and User Support', where companies respond to user complaints while adhering to social media guidelines. AstraZeneca exemplifies this by directing users to official reporting platforms, ensuring compliance with regulatory requirements.

'World Cancer Day Engagement' is also prevalent, with companies like Merck using replies to foster community engagement around this event. Novartis frequently highlights its 'Patient Assistance Programs', providing consistent support to patients.

A significant aspect of this engagement is the inclusion of URLs in replies, with 45.6% of replies containing links. These links direct users to official websites, contact pages, or specific resources, enhancing transparency and facilitating further communication. For instance, Pfizer shares its contact page URL, guiding users to appropriate channels for assistance.

Novo Nordisk frequently references its Community Guidelines, underscoring its commitment to maintaining a respectful and supportive environment on social media. This strategy sets clear expectations for interactions, fostering positive engagement and providing a safer space for discussions.

Sentiment Analysis of Pharmaceutical Companies' Replies:

The NRC sentiment analysis of replies from pharmaceutical companies, excluding self-replies (see Figure 3), reveals a dominant presence of terms associated with trust. This emotion was the most prevalent across the replies of five out of six companies, with AstraZeneca being the

exception, as their responses were more neutral and lacked emotionally charged language. The focus on trust is crucial in the pharmaceutical industry, where the credibility and reliability of information significantly influence public perception. The frequent use of trust-related terminology in these replies reflects a strategic effort by pharmaceutical companies to engage authentically with users, address their concerns, and build confidence in their products and services. Beyond trust, the analysis also underscores the importance of anticipation, which mirrors users' desire for engagement and information. These emotions, trust and anticipation, are key in setting user expectations and fostering continued dialogue, both essential for cultivating long-term relationships with the public. However, the presence of emotions such as fear and sadness pose challenges to a company's reputation. These sentiments often reflect genuine concerns, particularly when addressing severe health issues or diseases. Nevertheless, they also provide opportunities for pharmaceutical companies to demonstrate empathy and responsiveness, using these interactions as a platform to support users emotionally.

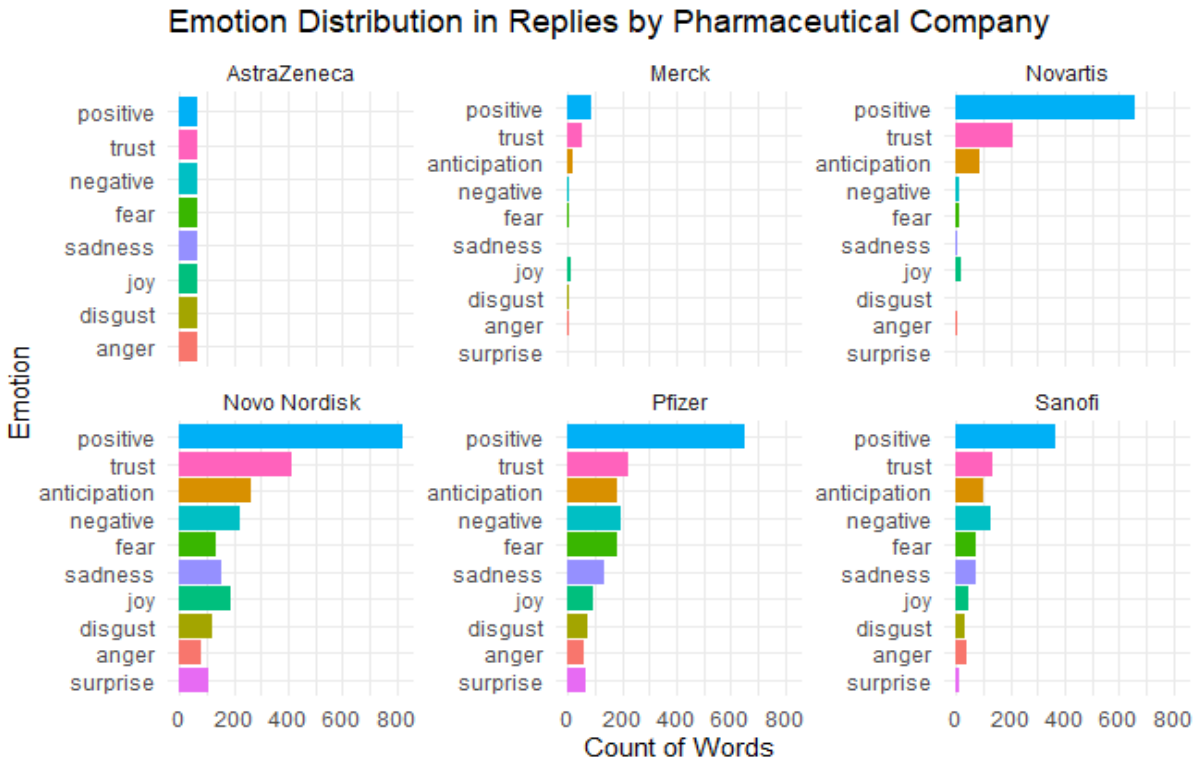

Figure3: *Emotion distribution in replies of pharmaceutical companies.*

Discussion

In this chapter, an in-depth examination was conducted on how pharmaceutical companies interacted with users on Twitter during the COVID-19 pandemic, focusing on topic identification, sentiment analysis, and the management of misinformation. The topics covered in these communications were crucial in enhancing the reputation of pharmaceutical companies. Through themes such as Corporate Social Responsibility (CSR), Disease Awareness and Medical Information, User Engagement and Support Care, and Scientific Advancement and Global Health Leadership, these companies aimed to foster direct relationships with users, marking a shift from traditional communication strategies. However, there were notable differences in how each company approached these topics. Comparing AstraZeneca and Pfizer in their communication about vaccine efficacy and development, Pfizer showed a stronger emphasis on public education and tackling misinformation, highlighting its proactive approach on social media. The NRC sentiment analysis of replies revealed a predominant use of language associated with trust. Trust-related terms were the most frequently observed, reflecting the companies' efforts to communicate credibly and transparently with users, especially in addressing concerns during the pandemic. In examining engagement behaviors, companies like Novartis and Novo Nordisk showed significant interaction with external users, thereby strengthening their reputation through responsive and empathetic communication. Conversely, Pfizer and AstraZeneca exhibited lower engagement with external users, indicating that while these companies were responsive, their public-facing interactions could be improved to build stronger relationships with their audiences.

Conclusion

Big Pharma has long been chastised in many ways, and the consequences have been disastrous throughout COVID-19 (Zaynab, 2024). The COVID-19 pandemic has highlighted the profound impact of hearsay, conspiracy theories, and celebrity influencers in the promotion of off-label drugs (Hua *et al.*, 2022). The notion that "Big Pharma," a term used to describe the largest publicly traded pharmaceutical companies, primarily focuses on profit through vaccine sales has fueled skepticism among the public (Bonnevie *et al.*, 2020). This skepticism is further exacerbated by the rapid dissemination of fake news and misinformation, which often outpace accurate information (Vosoughi *et al. 2018)*. For instance, rumors suggesting that COVID-19 is merely a ruse to sell vaccines have circulated more widely than factual scientific information

regarding the virus on social media platforms. As a result, trust in major pharmaceutical companies has eroded, with many perceiving these entities as prioritizing revenue over patient health (Jamieson, 2021). Our study confirms that pharmaceutical companies actively employ diverse themes on social media to bolster their reputation, counter misinformation, and engage with health challenges while striving to build trust and confidence among users. However, it is important to note that certain controversial practices, such as promoting medications through hidden links or encouraging unnecessary diagnoses, contribute to a phenomenon known as pharmaceuticalization (Blume, 2020). These practices can further complicate their communication efforts and potentially harm their credibility (Zaynab, 2023).

Managerial implications

This study provides valuable insights for managers in the pharmaceutical industry regarding the topics that drive the most engagement, underscoring the necessity for targeted communication strategies to bolster corporate reputation. Additionally, it emphasizes the critical need for effectively managing misinformation, promptly responding to user inquiries, ensuring transparency, and regulating the dissemination of drug information on social media to foster trust among patients and stakeholders.

Appendix 1

Pharma Company	Number of Tweets	Example Tweet	Average Engagement Score
Pfizer	10	myth or fact: getting the fluvaccine can give me the flu. learn the truth.	719.6
Sanofi	2	want to buy a covid treatment online? it doesn't exist! two days before our joint campaign on fake medicines online, learn more how to buy safely online your medicines. relyonyouth	13.0
AstraZeneca	3	it's a common disease, but misconceptions about asthma persist. one is that patients prescribed blue reliever (saba) inhalers are effectively controlled when, in fact, risks may remain. learn more: worldasthmaday breakoverreliance	56.0
Novo Nordisk	2	hi solveig. we're so glad you appreciate our video. when people like you help us increase the public understanding of obesity, a lot of misconceptions can be corrected. so feel free to share the video with your family and friends. and read mor	56.5
Merck	4	we partnered with hiv activists, like josh robbins, to empower young americans to fight stigma and misinformation that can enable the spread of hiv. learn how you can use your voice in owninghiv:	17.75
Novartis	1	we saw your tweet. novartis is aware of employment scams which makes false use of our company name to defraud job seekers. novartis does not make job offers without interview and never asks candidates for money. we strongly suggest that you	0.0

Table 1: Number of Posts Related to Direct Confrontation Communication, with an Example Post and Average Engagement Score per Company

Appendix2

Pharma Company	Number of Tweets	Most Frequent Words	Average Engagement Score
Pfizer	36	been, covid, vaccine, have, or, see, fact, has, emergency, not, approved, licensed, but, authorized, prevent, ages, fda, sheet, learn, us	1499.33
Novo Nordisk	14	fact, we, as, people, more, raise, awareness, not, over, can, get, obesity, uf, help, covid, should, its, i, make, goal	2776.0
AstraZeneca	24	our, evidence, realworld, data, were, are, care, clinical, can, improve, we, disease, as, transparency, treatment, reduce, sciencebased, whatsciencecando, learn, important	37.04
Novartis	2	our, global, about, cop, as, pandemic, progresses, so, do, response, sciencebased, understanding, covid, thanks, having, me, enjoyed, conversation, latest, shifts	12.0
Sanofi	7	our, polio, covid, will, more, today, well, flu, cardiovascular, new, evidence, vaccination, people, eradication, about, asthma, from, help, ceo, paul	52.71
Merck	8	our, we, know, their, about, more, commitment, were, proud, trust, vaccine, amp, facts, patients, work, science, national, company, confidence, its	18.62

Table 2: Number of Posts Related to Evidence-Based Communication, with Most Frequent Words and Average Engagement Score per Company.

Appendix3

Multiple Comparison of Means - Tukey HSD, FWER=0.05

group1	group2	meandiff	p-adj	lower	upper	reject
Adverse Event Reporting and User Support	Corporate Social Responsibility	57.6043	0.975	-117.6151	232.8238	False
Adverse Event Reporting and User Support	Disease Awareness and Medical Education	45.3016	0.9957	-140.154	230.7573	False
Adverse Event Reporting and User Support	Patient Assistance Programs	-1.2979	1.0	-398.939	396.3432	False
Adverse Event Reporting and User Support	Scientific Advancements and Global Health Leadership	85.9349	0.8267	-92.0396	263.9095	False
Adverse Event Reporting and User Support	Scientific Insights and Health Challenge	405.4524	0.0	198.9998	611.905	True
Adverse Event Reporting and User Support	User Engagement and Supportive Care	62.1031	0.9705	-121.2938	245.5001	False
Adverse Event Reporting and User Support	World Cancer Day Engagement	0.9841	1.0	-226.7912	228.7593	False
Corporate Social Responsibility	Disease Awareness and Medical Education	-12.3027	1.0	-111.7911	87.1856	False
Corporate Social Responsibility	Patient Assistance Programs	-58.9022	0.9997	-424.4465	306.642	False
Corporate Social Responsibility	Scientific Advancements and Global Health Leadership	28.3306	0.9725	-56.3988	113.06	False
Corporate Social Responsibility	Scientific Insights and Health Challenge	347.8481	0.0	213.2121	482.484	True
Corporate Social Responsibility	User Engagement and Supportive Care	4.4988	1.0	-91.0971	100.0947	False
Corporate Social Responsibility	World Cancer Day Engagement	-56.6203	0.9688	-222.1065	108.866	False
Disease Awareness and Medical Education	Patient Assistance Programs	-46.5995	0.9999	-417.1593	323.9602	False
Disease Awareness and Medical Education	Scientific Advancements and Global Health Leadership	40.6333	0.9373	-63.6309	144.8976	False
Disease Awareness and Medical Education	Scientific Insights and Health Challenge	360.1508	0.0	212.439	507.8626	True
Disease Awareness and Medical Education	User Engagement and Supportive Care	16.8015	0.9998	-96.4704	130.0734	False
Disease Awareness and Medical Education	World Cancer Day Engagement	-44.3175	0.9949	-220.6061	131.971	False
Patient Assistance Programs	Scientific Advancements and Global Health Leadership	87.2328	0.9964	-279.64	454.1057	False
Patient Assistance Programs	Scientific Insights and Health Challenge	406.7503	0.0271	25.2488	788.2518	True
Patient Assistance Programs	User Engagement and Supportive Care	63.401	0.9996	-306.1327	432.9347	False
Patient Assistance Programs	World Cancer Day Engagement	2.282	1.0	-391.1672	395.7312	False
Scientific Advancements and Global Health Leadership	Scientific Insights and Health Challenge	319.5175	0.0	181.315	457.7199	True
Scientific Advancements and Global Health Leadership	User Engagement and Supportive Care	-23.8318	0.9965	-124.3886	76.725	False
Scientific Advancements and Global Health Leadership	World Cancer Day Engagement	-84.9509	0.7916	-253.3516	83.4498	False
Scientific Insights and Health Challenge	User Engagement and Supportive Care	-343.3493	0.0	-488.4679	-198.2306	True
Scientific Insights and Health Challenge	World Cancer Day Engagement	-404.4683	0.0	-602.7271	-206.2095	True
User Engagement and Supportive Care	World Cancer Day Engagement	-61.119	0.9641	-235.2405	113.0025	False

Table 3: Topic Comparisons from Tukey Post-Hoc Test

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