



Original Article

Mapping Vaccine Narratives and Emotional Framing in Ideologically Divergent Social Media Communities During COVID-19

Agata Zdun-Ryżewska^{1*}, Wiktoria Grabowska², Katarzyna Milska-Musa¹, Natalia Nadrowska¹, Magdalena Błażek¹

¹Division of Quality of Life Research, Department of Psychology, faculty of Health Sciences, Medical University of Gdansk, Gdansk, Poland

²Health Psychology, Medical University of Gdansk, Gdansk, Poland

*Corresponding Author: Agata Zdun-Ryżewska, Email: azdun@gumed.edu.pl

Abstract

Introduction: Social media increasingly structure public dialogue on vaccination by shaping the visibility, framing, and interpretation of information, as well as the attitudes individuals develop toward immunization.

Methods: We conducted an archival qualitative content analysis of 496 original posts from three private but publicly searchable national Facebook groups during the initial vaccine rollout (December 31, 2020 - January 7, 2021): knowledge-seeking (n=40), pandemic-denial (n=183), and anti-denial/satirical (n=273). Two independent health-psychologist coders applied a predefined scheme (post type, interaction style, emotional tone, thematic content), with discrepancies resolved by a third reviewer (consensus-adjudication approach). Data were summarized descriptively; no personal data were collected.

Results: The analysis revealed substantial differences in communication dynamics. The knowledge-seeking group emphasized inquiry and fact-sharing in a neutral or anxious tone. The anti-denial group employed irony and satire, maintaining a constructive yet emotionally detached communication style. The denial group favored video-based, morally charged, and confrontational discourse, characterized by anger and distrust. Vaccination emerged as the most frequently discussed topic across all groups, though framed in radically different ways. Scientific articles were virtually absent from all communities, even in those oriented toward knowledge.

Conclusion: These findings suggest that online discourse on public health is shaped not only by the content of beliefs but also by emotional tone and rhetorical framing. Understanding these dynamics is essential for designing more effective health communication strategies, particularly in digital environments characterized by polarization and misinformation.

Keywords: COVID-19, Vaccination, Social media, Health communication, Persuasive communication, Emotions, Disinformation

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Introduction

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, was officially declared a global pandemic by the World Health Organization on March 11, 2020, following its rapid spread from the initial outbreak in Wuhan, China. In Poland, a state of epidemic was announced on March 20, accompanied by strict public health measures such as isolation, quarantine, school closures, and a transition to online learning. Vaccine development began early in 2020, with the Pfizer-BioNTech mRNA vaccine receiving the first regulatory approval in December of that year.¹ Beyond physical health concerns, the pandemic had profound effects on economic, social, and psychological well-being, as confirmed by numerous meta-analyses.¹⁻⁵

Although the acute phase of the COVID-19 pandemic has passed, public discourse on vaccinations and infectious diseases remains a critical concern. Vaccine hesitancy continues to pose a serious threat to public health.⁶ The

post-pandemic period has been marked by a resurgence of vaccine-preventable diseases, such as measles and diphtheria, driven by declining immunization rates and the persistent anti-vaccine narratives online.⁷⁻¹⁰ In many countries, public health authorities report rising parental refusal of childhood immunizations and misinformation about routine childhood immunizations.¹¹ Collectively, these trends illustrate how reduced uptake and insufficient booster coverage can facilitate the re-emergence of vaccine-preventable diseases.

Social media remain a primary arena for the formation, reinforcement, and contestation of vaccine-related beliefs. Understanding how narratives are communicated, framed, and affectively charged is therefore critical for public-health communication. Empirical studies demonstrate that online misinformation reduces vaccination intentions; that emotional signals from social media help predict uptake, and that and that moral and



affective framing is aligned with vaccine attitudes.^{12–15} Taken together, this evidence supports analyzing framing and emotional dynamics when designing policies and interventions to sustain vaccination coverage and prevent the re-emergence of vaccine-preventable diseases once coverage declines below herd immunity thresholds.

To explore the nature of online discussions around COVID-19 and vaccinations, our analysis was guided by two complementary theoretical frameworks: the Theory of Framing and Appraisal Theory. Framing, as conceptualized by Goffman and later expanded across multiple domains refers to the ways in which information is presented and structured to influence interpretation.^{16–19} Each communicative frame reflects a specific worldview, conveyed through distinct metaphors, narratives, and linguistic conventions. During the pandemic, social media groups adopted divergent frames (for example, medical-scientific, conspiratorial, or satirical), shaping perceptions of risk, trust and „truth”. In parallel, Appraisal Theory provides a nuanced framework for analyzing the emotional, attitudinal, and evaluative dimensions of language.^{20,21}

Together, these frameworks offer a more comprehensive perspective: while Framing Theory explains the structural and narrative patterns that shape interpretation, Appraisal Theory captures the emotional tones and evaluative stances through which these frames are enacted and reinforced in online communication. Appraisal Theory also provides a basis for examining how speakers position themselves in relation to others, express affective states, or evaluate behaviors and events. Applying both theories enables analysis of the thematic content of posts as well as the emotional climates and interactional styles that characterize online communities during health crises.

Given the persistence of vaccine hesitancy, the circulation of misinformation, and the global resurgence of vaccine-preventable diseases, it is crucial to investigate how such attitudes are constructed and sustained in online discourse. These contextual challenges directly inform our analytical focus. This study examines how divergent beliefs about COVID-19 and vaccination are expressed and emotionally charged within distinct online communities. To that end, we formulated the following research questions:

1. How do the types of content and communication styles differ between social media groups with contrasting attitudes toward the pandemic?
2. What emotional tones and evaluative expressions dominate within each group?
3. How are dominant narrative frames, such as scientific, conspiratorial, or critical, constructed and sustained in each online environment?

The primary aim of this study is to compare the framing strategies and emotional dynamics in online discourse about COVID-19 and vaccination, based on a systematic

analysis of original social media posts from groups characterized by opposing attitudes toward the pandemic.

Methods

This study employed a systematic archival content analysis with the competent judges technique.²² It compared communication patterns in three private but searchable Polish Facebook groups active since 2020, representing three orientations: information-seeking, pandemic denial, and satire of anti-vaccine narratives.

Three researchers independently identified Polish Facebook groups that were private but discoverable, ensuring natural online environments accessible for observation. After collective review, three groups were selected, prioritizing large membership, high activity, and public visibility, while excluding small or inactive groups. Observers then joined the groups. Original posts published between December 31, 2020, and January 7, 2021, were archived with full anonymity. This period, coinciding with the initial vaccine rollout in Poland and Europe, captured intense online debate. Content was analysed using predefined interpretive categories.

The study was approved by the Independent Bioethics Committee at the Medical University of Gdańsk.

Sample Description

The first group, “Coronavirus SARS-CoV-2, COVID-19 in Poland” (Polish: „Koronawirus SARS-CoV-2, Covid-19 w Polsce”), served as an informational hub for individuals seeking science-based updates on the pandemic. Established on January 24, 2020, it was the first Polish Facebook group dedicated to COVID-19 and, at the time of data collection, had ~61,400 members. The group was private but searchable; only members could access content, and admission required agreement to rules promoting respectful communication and verified information sharing. Posts could be published by all members under these terms, with active moderation in place. Communication was dominated by rapid exchange of factual content. For this study, it is referred to as the knowledge-seeking group.

The second group, “I Do Not Believe in the COVID Hoax – Support Group – You Are Not Alone” (Polish: „Nie wierzę w Koronawirusa – Grupa wsparcia / Nie pozostaniesz SAM”), reflected a conspiratorial framing of the pandemic. Created on May 7, 2020, it had ~4,400 members at the time of observation. The group was private but discoverable, with unrestricted membership and no active moderation or community rules. Members could freely publish posts, averaging ~26 per day, most of which expressed distrust toward official narratives, questioned the virus’s existence, and attributed pandemic messaging to manipulative motives of governments and pharmaceutical companies. For this study, it is referred to as the pandemic-denial group.

The third group, “Stop the Tinfoil Hats – or How Not to Become One” (Polish: „Stop Foliarzm – czyli jak nie być Szurem”), was established on September 2, 2020, and had ~3,200 members at the time of data collection. It satirized conspiracy thinking related to COVID-19 and vaccination. The group was private, but joining required answering entry questions, indicating some degree of content filtering. With two administrators and two moderators, members could freely post. A pinned post explained the term “tinfoil hats” as a pejorative label for conspiracy believers who distrust mainstream media yet remain unaware of their own susceptibility to manipulation. This framing positioned the group as a space for satire and critical reflection on disinformation. For this study, it is referred to as the anti-denial group.

Analytical Procedure and Coder Validation

Each group was analysed using a structured qualitative coding scheme applied independently by two health psychologists, with a third resolving disagreements. The coding framework comprised four categories: type of post, interaction style, emotional tone, and thematic content. The categories were developed on the basis of our theoretical framework and initial exploratory review of the data.

The first category, type of post, included twelve formats: questions, statements, reposts, videos, speeches, live broadcasts, memes, scientific and popular-science articles, daily press, pseudo-scientific online articles, and shared groups.

The second category, *type of interaction*, distinguished between constructive and non-constructive communication. This distinction was informed by Social Interdependence Theory, which differentiates between positive interdependence, broadly associated with cooperation, mutual support, and goal alignment; and negative interdependence, characterized by rivalry, resistance, and oppositional dynamics in which individuals obstruct or undermine one another.²³ These theoretical constructs provided the foundation for distinguishing between supportive, knowledge-oriented interactions and those marked by conflict, criticism, or antagonism.

Constructive interactions involved sharing information, experiences, and offering emotional support or encouragement, whereas non-constructive interactions included criticism, offensive language, displays of superiority (e.g., patronizing, lecturing, or adopting an “I know better” attitude), threats, distraction or topic diversion (content redirecting the thread away from the focal issue), or dismissing and ignoring the issue.

The third category, *emotional tone*, comprised the following classifications: neutral, fear, anger (expressions of negative affect such as irritation, frustration, or moral outrage, without language that demeans, intimidates, or threatens a specific target), aggression (target-directed

language intended to demean, intimidate, or threaten, including insults, demeaning labels, dehumanization, and explicit or implicit threats or wishes of harm), sadness, and joy or humour.

The fourth category, *thematic content*, comprised two domains: COVID-19 and vaccination. COVID-19 posts were classified into beliefs about infectiousness and risk, testing and diagnosis (including antibody testing), medical complications, restrictions, and broader social, political, and economic consequences. Vaccination posts encompassed all attitudes, beliefs, and theories concerning immunization.

Six trained coders participated in the classification process. Each post was independently assessed by two coders, and a third adjudicating disagreements. We employed a consensus adjudication procedure, which emphasizes shared meaning-making rather than mechanical agreement indices. Before coding, coders calibrated on a pilot subset and refined operational definitions. During main coding, few items required adjudication, and all disagreements were resolved according to pre-specified rules in an audit trail.

Only original posts (excluding comments or replies) were included in the analysis.

The final dataset consisted of 40 posts from the group “Coronavirus SARS-CoV-2, COVID-19 in Poland”, 183 posts from “I Do Not Believe in the COVID Hoax – Support Group – You Are Not Alone”, and 273 posts from “Stop the Tinfoil Hats – or How Not to Become One”.

Comparative analysis used percentage distribution and dispersion analysis in Microsoft Excel to identify patterns in communicative style, emotional tone, and thematic framing. Visualizations were generated using the Matplotlib library in Python.

Results

Type of Post

Substantial differences were emerged across the three groups in posts types. In the knowledge-seeking group, over half of all posts (55%) were *questions*, reflecting an active search for information and clarification.

The anti-denial group most often shared external posts (47%), indicating a communicative style oriented toward reaction and circulation of external content. By contrast, the pandemic denial group was dominated by *video materials* (47%), underscoring the centrality of audiovisual content in disseminating conspiracy-related narratives.

The most striking contrast concerned the use of questions: 55% in the knowledge-seeking group, compared to 8% in the anti-denial group and 1% in the denialist group.

Scientific articles were virtually absent, with no instances in the knowledge-seeking or anti-denial groups and only

0.4% in the denialist group. By contrast, popular science articles appeared mainly in the knowledge-seeking group (10%), while daily news articles were shared with similar frequency across groups (10-12%). Pseudo-scientific online content was concentrated in the denialist group (9%), underscoring its reliance on alternative sources of information.

These patterns indicate that the groups differed not only in dominant communication formats but also in the perceived credibility of external content. The clearest contrast was the central role of questions in the knowledge-seeking group (55%), virtually absent in the denialist group (1%), highlighting their fundamentally different communicative orientations. Results are presented in Figure 1, with detailed percentage in the Supplementary Data file: Table S1.

Types of Interaction

Clear differences in interaction style emerged between the groups (Figure 2; full dataset in the Supplementary Data file: Table S2). In both the knowledge-seeking group and the anti-denial group, the most frequent interaction was constructive and informative, providing information based on one's own knowledge, accounting for 55% and 37% of posts, respectively.

Sharing of personal experiences, also classified as constructive interaction, was more frequent in the knowledge-seeking group (32%) than in the anti-denial (8%) or pandemic-denial (4%) groups. These results suggest that constructive communication, encompassing both knowledge and experience-sharing, was a defining feature of the knowledge-oriented environment.

In contrast, the pandemic-denial group was dominated by non-constructive interactions. The most frequent was criticism (31%), and superiority or moralizing tones (30%). Although 26% of posts conveyed information,

the overall communication style was confrontational, dismissive, or patronizing.

The anti-denial group displayed a hybrid pattern: 37% of posts were informative, while 29% engaged in criticism, consistent with its aim of mocking conspiracy narratives. Extreme non-constructive interactions (e.g., aggression or personal insults) were rare compared to the pandemic-denial group.

Overall, constructive exchange characterized the knowledge-seeking group, confrontational criticism defined the pandemic-denial group, the anti-denial group occupied an intermediate, hybrid position.

Emotional Tone of Posts

Across groups, neutrality was the predominant emotional tone. It was most pronounced in the knowledge-seeking group (70% of posts without explicit emotional content) and also common in the anti-denial group (54%). The latter, however, showed a substantial share of humour and joy (29%), consistent with satirical orientation.

In contrast, the pandemic-denial group demonstrated a distinct emotional profile: 40% of posts were neutral, 40% expressed anger, and 15% conveyed aggression. This group had the highest concentration of negative affect, indicating a communication style rooted in confrontation and distrust.

Despite its provocative name referencing “tin foil hats,” the anti-denial group showed a relatively restrained tone: only 5% of posts expressed aggression, the lowest among the groups.

The knowledge-seeking group had the highest frequency of fear (10%) and sadness (5%), likely reflecting concern about health risks, uncertainty, or empathy. Combined with its constructive tone, this pattern indicates an environment oriented toward support and information-seeking during a time of crisis.

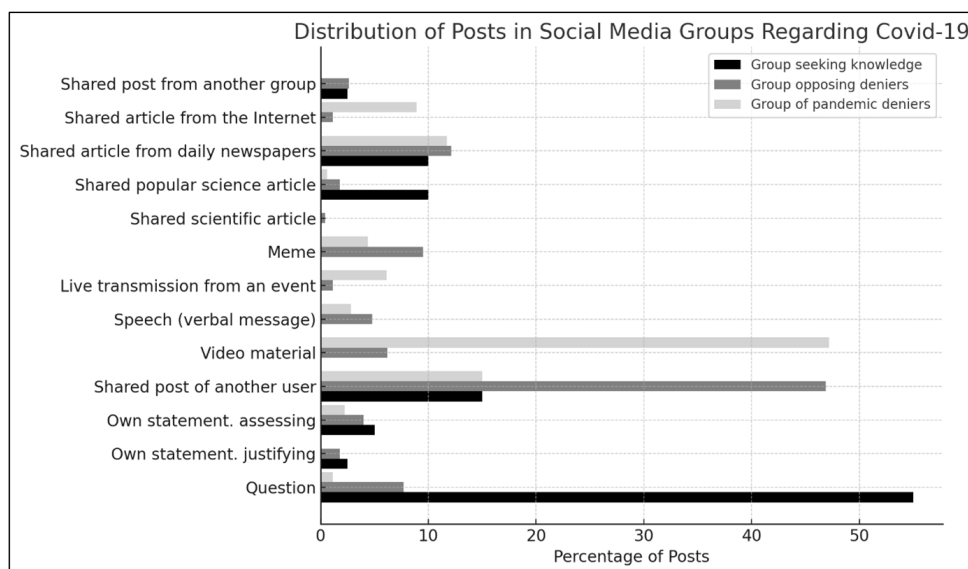


Figure 1. Types of posts in three social media groups

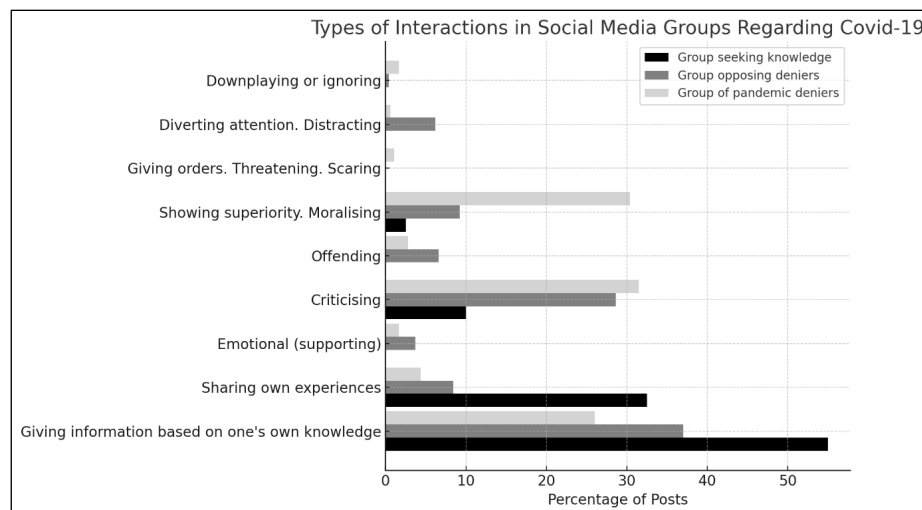


Figure 2. Types of interactions in three social media groups

Overall, the results show clear emotional differentiation across groups. The knowledge-seeking group, though predominantly neutral, displayed the highest levels of fear and sadness; the anti-denial group combined neutrality with humour/satire; and the pandemic-denial group exhibited the strongest anger and aggression. Results are presented in Figure 3 and the Supplementary Data file: Table S3.

Content of Posts

Across groups, the most prominent topic was COVID-19 vaccination and related beliefs or narratives. This theme appeared in 40% of posts in the knowledge-seeking group, 45% in the pandemic-denial group, and 60% in the anti-denial group, underscoring the central role of vaccine discourse across stances.

The knowledge-seeking group addressed a broad spectrum of pandemic-related topics, including infectiousness, testing and diagnosis, medical complications, and public health restrictions. Posts concerning social, political, and economic consequences of the pandemic were rare (2.5%).

In contrast, the pandemic-denial group focused on systemic impacts: 25% of posts addressed political, social, or economic consequences, and another 25% criticized pandemic-related restrictions. This pattern reflects a framing of the pandemic as a sociopolitical phenomenon rather than a medical one.

The anti-denial group, despite its satirical orientation, engaged with multiple topics. In addition to its dominant focus on vaccinations (60%), 15% of posts discussed infectiousness and 12% addressed the broader consequences of the pandemic.

Overall, the distribution of post content (Figure 4) reflected not only differing thematic priorities but also distinct framings of the pandemic: as a health issue, a political construct, or a social phenomenon. The

knowledge-seeking group emphasized medical and scientific aspects, the pandemic-denial group highlighted sociopolitical consequences, and the anti-denial group focused on vaccination narratives, blending satire with substantive debate. Detailed percentages are provided in the Supplementary Data file: Table S4.

Discussion

The findings provide insights into how divergent attitudes toward COVID-19 and vaccinations are articulated in online communities. The results demonstrate clear differences in thematic content, communication styles, and emotional framing, highlighting the role of social media in shaping public discourse during health crises, consistent with conclusions from comparable studies.^{24,25}

Framing Strategies and Communication Styles

Guided by the applied theoretical frameworks, particularly Framing Theory, we assumed that the three groups construct their understanding of the pandemic through distinct interpretive lenses, and engage in different communication styles.^{26,27} This assumption was confirmed: each group displayed a consistent combination of discursive framing and interactional patterns shaping how COVID-19 and related issues were negotiated.

The knowledge-seeking group adopted an informational-exploratory frame, marked by frequent questions (55%) and factual or experiential sharing. Its communication style was largely constructive, oriented toward collective clarification. The anti-denial group operated within a satirical-critical frame, recontextualizing conspiracy-oriented posts for critique and ridicule. While mostly constructive, its discourse was shaped by ironic detachment, reflected in the prevalence of humorous posts (28.9%). The pandemic-denial group advanced a narrative of deception and mistrust, portraying COVID-19 as a manipulated or exaggerated.

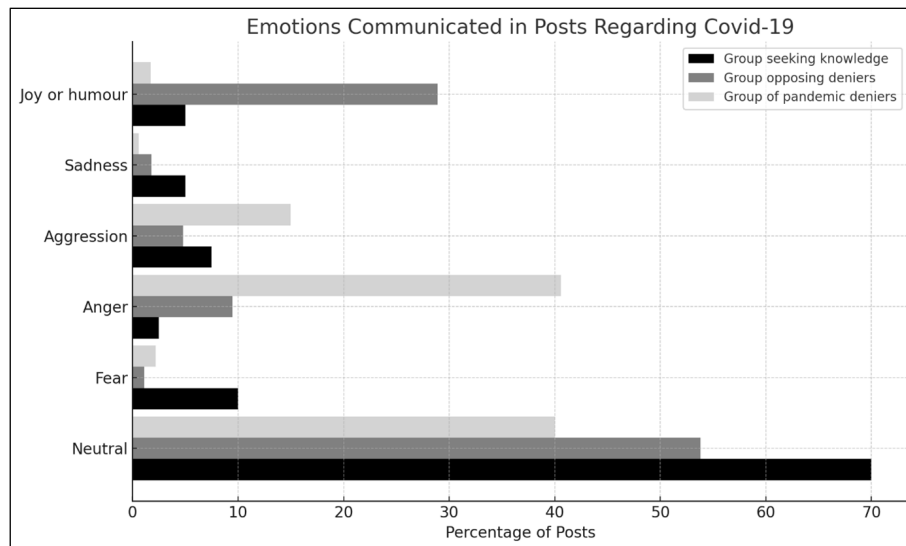


Figure 3. Emotional tone in three social media groups

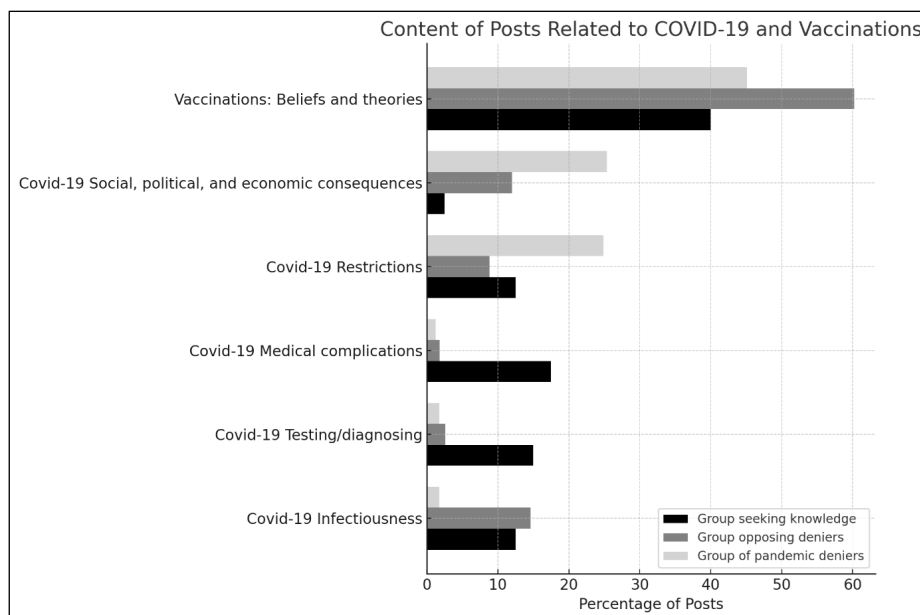


Figure 4. Content of posts in three social media groups

Its communication was dominated by non-constructive styles, moralizing, antagonism, and confrontation, amplified by emotionally charged video content (47.2%) and moralizing posts (30.4%).

The comparison of groups reveals three parallel information ecosystems operating on the same platform but shaped by distinct interpretive and affective logics. As described in Pariser's concept of the "information bubble", algorithmic personalization fosters cognitive enclaves where users are primarily exposed to belief-congruent content.^{28–31} This mechanism was evident across all three communities: *the world you search for becomes the world you inhabit*.

Importantly, this world is not only a cognitive construct, but also an emotional environment. As proposed by Appraisal Theory, emotional expressions in language

shape how individuals position themselves in relation to others, affirm or contest values, and make sense of social reality. In our analysis, emotions were not incidental but constitutive of each group's identity and communicative function. Interpretive frames thus organized knowledge, while also functioning as emotional ecosystems, shaping interactional tone and reinforcing group-specific norms and values.

Emotional Tone

The knowledge-seeking group was predominantly neutral in tone (70%), with the highest proportion of fear-related posts (10%), likely reflecting personal health concerns. The anti-denial group, though adversarial, also remained largely neutral (53.8%), with humor serving as a key mode of interaction and cohesion. In contrast, the pandemic-

denial group displayed the most emotionally charged discourse, with anger (40.6%) and aggression (15.0%) nearly equaling neutrality (40.0%).

These emotional profiles reflected each group's cognitive orientation and sustained the social and affective bonds among members.^{32,33}

Dominant Discussion Topics and Public Health Implications for Vaccinations

Vaccination-related beliefs emerged as the central theme across all groups, most concentrated in the anti-denial group (60.2%). The knowledge-seeking group engaged in a wider range of topics, including medical complications, diagnostics, and restrictions, while the pandemic-denial group focused on government-imposed measures (24.9%) and socio-political consequences (25.4%). This divergence highlights a communication gap: health authorities emphasize medical risk and vaccine efficacy, whereas parts of the public focus on personal freedoms and political implications. Such misalignment may fuel resistance to health messaging and underscores the need for targeted and audience-specific communication strategies.

Lack of scientific discourse

Our findings also highlight another issue: scientific discourse was virtually absent across all groups. Even in the knowledge-seeking group, users relied primarily on simplified popular science sources rather than original research articles. This pattern reflects a broader detachment of academic science, often communicated in highly specialized language, from the everyday realities of lay audiences, including those who otherwise display a science-oriented worldview.

During periods of social disruption, information circulates in simplified and accessible forms. Scholars emphasize not only the need to generate evidence-based knowledge and policy, but also to translate scientific findings into language and formats that are intelligible and relevant to diverse audiences.³⁴ This imperative is especially critical for vaccination, where public understanding and trust determine the effectiveness of interventions,³⁵ particularly amid rising vaccine hesitancy.³⁶

In the Internet era, social media has become the most accessible source of information, providing both reliable content and facilitating the rapid spread of disinformation. Early surveys on Twitter and Facebook, conducted shortly after the pandemic was declared, revealed that less credible content often outperformed highly reliable sources in reach and engagement.³⁷

Simultaneously, the increased use of the keywords "pandemic" and "infodemic" in academic databases reflected growing awareness of risks linked to viral misinformation.³⁸ A large-scale analysis of 325 million

posts across Facebook and Twitter (March-May 2020), further showed that, compared with the same period in 2019, COVID-19-related content was 0.37 times more likely to link to unreliable sources and 1.13 times more likely to reference credible ones.³⁹

In 2020, Jaron Harambam highlighted the absence of science and technology scholars from public discourse, despite their conceptual and methodological tools being well-suited to addressing the uncertainty of the pandemic's early stages.⁴⁰

The framing of pandemic-related topics, whether through inquiry, satire, or rejection, shapes not only content, but also how its emotional and social communication online. Such patterns may reinforce initial attitudes, and entrench specific belief systems within online communities. Experimental studies demonstrated that applying Framing Theory to vaccination messages can increase vaccine acceptance.²⁶

A promising direction for future research is to examine mechanisms of information exchange across ideologically divergent groups. In this regard, the concept of intercultural communication competence, traditionally applied to cross-cultural context, may help bridge divides between online communities with conflicting worldviews. While direct dialogue between such groups is unlikely, understanding these dynamics could inform interventions aimed at reducing polarization.

This study highlights the complexity of online discourse on infectious diseases and vaccinations. Our findings indicate that communication style is not only a reflection of belief systems but also a mechanism through which attitudes are stabilized, polarized, or disrupted. The tone and structure of digital interactions may function as protective or risk factors in public health communication, influencing openness to evidence, resistance to correction, and vulnerability to misinformation.

Future strategies for public engagement should address not only informational deficits but also differences in communicative expectations, emotional registers, and rhetorical styles. Public health messaging that neglects these dimensions risks being misunderstood or rejected, particularly in polarized digital environments.

Conclusion

Our findings suggest that public-health messaging should be tailored to the emotional and discursive profiles of online communities: clear and actionable in knowledge-seeking spaces, pre-emptive but non-ridiculing in satirical groups, and validation- and transparency-oriented in denialist groups. More broadly, communication should align with dominant formats, provide visible source cues, and be evaluated through discourse quality rather than reach. This study also underscores that scientific knowledge alone is insufficient to sustain informed public discourse; researchers and institutions must

act as communicators capable of negotiating meaning within socially diverse and emotionally dynamic online environments. As the post-pandemic world continues to grapple with vaccine hesitancy and evolving health challenges, nuanced understanding of these dynamics is essential for inclusive, responsive, and effective science communication and policy.

Limitations

This study has several limitations. First, the analysis was limited to a single platform and may not capture dynamics in other online environments. Second, although the three selected groups were diverse, they do represent the full spectrum of public opinion. Third, the observation window was limited to one week during the vaccine rollout, restricting temporal generalizability. These limitations should be considered when interpreting the findings and in designing future research.

Authors' Contribution

Conceptualization: Katarzyna Milska-Musa, Magdalena Błażek, Agata Zdun -Ryżewska, Natalia Nadrowska

Data curation: Katarzyna Milska-Musa, Agata Zdun-Ryżewska, Natalia Nadrowska

Formal analysis: Wiktoria Grabowska.

Funding acquisition: Magdalena Błażek.

Investigation: Katarzyna Milska-Musa, Agata Zdun-Ryżewska, Natalia Nadrowska.

Methodology: Katarzyna Milska-Musa, Agata Zdun-Ryżewska, Natalia Nadrowska.

Project administration: Agata Zdun -Ryżewska.

Resources: Magdalena Błażek.

Software: Wiktoria Grabowska.

Supervision: Magdalena Błażek.

Validation: Wiktoria Grabowska, Agata Zdun-Ryżewska.

Visualization: Agata Zdun - Ryżewska.

Writing—original draft: Agata Zdun - Ryżewska.

Writing—review & editing: Agata Zdun – Ryżewska, Natalia Nadrowska, Katarzyna Milska-Musa, Wiktoria Grabowska, Magdalena Błażek.

Competing Interests

We declare no conflict of interest.

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Supplementary Files

Supplementary file 1 contains Table S1-S4.

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