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Emotional Governance in Online Public Opinion during Major Public Health Emergencies

-- A Case of COVID-19

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Abstract

The coronavirus disease 2019 pandemic, initially identified as the 'COVID-19' in China at the end of 2019 has posed significant global public health challenges, highlighting the need for effective online public opinion during crises. This study investigates the evolution of public sentiments on social media during the pandemic, applying text mining and using data collected from Chinese microblogging platforms related to the outbreak based on Python. Sentiment data were categorised and analysed across five major phases of the outbreak, capturing the frequency and types of emotional expressions to explore public opinion dynamics. Results reveal distinct patterns: negative emotions, such as panic and anxiety, were prevalent during the initial outbreak; positive emotions increased during containment phases; and mixed emotions emerged during policy adjustments and case surges. Positive sentiment peaked as pandemic control efforts succeeded and normalcy resumed. The findings further indicate that uncertainty and heightened negative emotions can drive surges in public opinion, while timely, reasonable, and effective government responses can alleviate public anxiety and reduce the risk of secondary crises. These insights highlight the critical role of sentiment analysis in public health communication and crisis management, offering actionable recommendations for mitigating public sentiment risks during future pandemics.

Keywords

COVID-19; Online Public Opinion; Sentiment Analysis.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic, the most severe public health emergency since the founding of the People's Republic of China, revealed numerous challenges of infectious disease prevention and control in the era of globalisation. These challenges included the rapid spread of the virus, widespread infections, and difficulties in prevention, highlighting the pandemics complex nature. In March 2020, at the special Group of Twenty (G20) summit addressing the pandemic, General Secretary Xi Jinping declared that 'major infectious diseases are the enemies of all mankind' and called for global cooperation to address this threat. The seriousness, complexity, urgency, and uncertainty of the pandemic have made social opinions highly sensitive in countries worldwide and may evolve into potential drivers of new outbreaks owing to the extensive use of new media, further amplifying the negative impact of the pandemic. Public health emergencies, which involve diverse social interests, are characterised by high public concerns, long durations, and high specialisation[1]. The rise of new media has exponentially increased the extent of information dissemination, facilitating the spread of rumours and challenging the government's ability to manage online public opinion. In his report to the 20th National Congress of the Communist Party, General Secretary Xi Jinping emphasized the importance of 'fully implementing the system of responsibility for ideological

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work and strengthening mainstream ideological opinion in the new era'. Initially, the government's response to public health emergencies was relatively passive[2]. Therefore, it is necessary to fully understand the laws of public opinion and improve the mechanisms of its management.

Since the outbreak of the chronic non-cancer pain (CNCP) epidemic, there has been surge in reports on major social networks and short video platforms, along with increased public attention to the epidemic, providing a valuable database for understanding the development of public opinion. This study applies text mining and sentiment analysis techniques to analyse large-scale microblogging content related to the epidemic posted on the Sina Weibo platform (domestic version) during the epidemic period and understand the evolution of public sentiment in online public opinion during China's response to the COVID-19 pandemic. Ultimately, this study addresses the following questions: (1) What are the characteristics of public sentiment at different stages of the epidemic? (2) How does public sentiment change along the timeline of an event? (3) From the perspective of public opinion management, how should authorities address the public's emotional response during public health emergency? The Xinguang epidemic is a major public health crisis and a test of the global governance system. Effectively responding to such crises in the context of information technology and globalisation, while maintaining social stability, is crucial for scholars and policymakers worldwide.

2. Literature Review

Emotion is an individual's psychological experience that affects social interaction and governance. Since the 20th century, the social function of emotions has gradually attracted attention, leading to the emergence of emotional governance a research interest. The theory of emotional governance emphasises that power subjects maintain social order and cohesion by managing and public emotions[1]. Initially, research focused on the impact of individual emotions on behaviour and decision-making[2]; however, with the development of social sciences, the collective effect of emotions and social emotions has gradually become a key research focus.

The study of emotional governance began in psychology, with a focus on individual emotions, before expanding to sociology and political science[3]. In the 1960s, psychologists explored how emotions influenced decision-making and judgement. Subsequently, the role of emotions in social interactions was gradually incorporated into the study of politics and governance. Rime's theory of the 'social sharing of emotions' suggests that emotions are both intrinsic to the individual and shared and amplified through interpersonal interactions[4]. Early research on emotion governance focused on the role of emotions in crisis management and collective behaviour[5]. Sociologists have examined how emergencies trigger the mobilisation of collective emotions, further influencing the social order and evolution of public opinion. The theory of emotion governance has subsequently developed into a significant area of research, particularly in crisis response[6], management[7] and social mobilisation[8].

In the 21st century, the rise of the Internet and social media has shifted research on sentiment governance to digital space, focusing on how to manage and guide public sentiment online to maintain social stability[9]. Scholars have revealed the complex role of online sentiment in shaping public opinion using sentiment analysis, sentiment lexicons[10], machine learning[11], and deep learning techniques[12][13]. In the digital era, individuals use the Internet to share information and express their opinions anytime and anywhere, creating a powerful public opinion platform. This also leads to contradictions and challenges, with opinions circulating through social networks affecting the direction of public opinion. Thus, public health emergencies have significant impact on public sentiment, economic, and social development.

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2.1. Public Sentiment as Core Driving Force for Public Opinion Formation

In the digital space, the boundary between virtual space and reality is gradually blurring, with public emotions playing a central role in shaping online public opinion. The openness of the Internet allows individuals to express their views and emotions anytime, particularly during emergencies. Public feelings such as anger, fear, and anxiety quickly accumulate and spread through social networks. For example, public health emergencies, with their suddenness and uncertainty, are very likely to trigger the public's negative emotions, leading to public opinion crises. These major social events affect economic and social development and significantly alter the public's emotional state.

The theory of emotional governance highlights the close association between public emotions and public opinion formation. The severity of an incident, media reporting, and transparency of information have a significant impact on the public's emotional responses. Public emotions are usually expressed as anger, fear, sympathy, and emotional resonance, and the diffusion of these emotions drives the evolution of public opinion. For example, during a public health crisis, fear triggers widespread public anxiety, which spreads rapidly online, resulting in the rapid growth of public opinion. Lerner, a foreign scholar, has demonstrated that fear and anger significantly affect people's risk perception and decision-making, highlighting the complex interaction between public emotions and the development of public opinion in emergencies[3]. The accumulation of public emotions accelerates the evolution of public opinion in a network environment where information spreads rapidly. On social media platforms, individuals express their emotions through retweets, comments, likes, and other interactions, forming an emotional mobilisation mechanism. As public emotions intensify, the strength and persistence of public opinion have increased significantly. In health emergencies, if government information lacks transparency, public panic escalates, thus intensifying public opinion crises.

2.2. Paths and Modes of Communication of Emotionally Driven Public Opinion

Public sentiment significantly shapes public opinion and directs its spread. The dissemination of online public opinion is an emotion-driven process. Public emotions continue to intensify through social media interactions, causing public opinion to spread rapidly. With the advent of the Internet, social networks have become key channels for information dissemination, significantly increasing the speed and reach of information. Emotional resonance makes online public opinion less controllable, especially in emotionally charged events, where collective emotions often present in the form of group polarisation. For instance, anger and fear drive the rapid spread of negative information, particularly under the guidance of opinion leaders. This negative opinion creates a large-scale dissemination effect, intensifying social conflicts.

The dynamics of online public opinion are particularly pronounced during public health emergencies. During crisis, the public often experience strong negative emotions, which intensify and spread via social networks. Studies have shown that the timely and accurate release of information is crucial in controlling public opinion dissemination. If official information is delayed, public anxiety spreads rapidly online and may trigger online rumours. For example, Hidalgo et al. identified three stages in the expression of online emotions: initial emotional response, emotional sharing, emotional and cognitive feedback followed by emotional enhancement and rational return[8]. These stages highlight the cyclical nature of public emotions in the public opinion process. Additionally, the constant flow of online opinions influences social relations and steer public opinion[14]. The expression of public sentiment involves an individual's psychological response and social behaviour, which is further amplified through group interaction[15]. For example, when faced with social injustice, anger triggers collective public protests and intensifies public opinion. By contrast, positive emotions, such as hope or motivation, can moderate social conflicts and promote the restoration of social order.

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Emotional governance theory emphasises the need for effective emotional guidance in public opinion communication[16]. Governments and the media should assist the public in regaining rationality from emotional impulses through reasonable emotional guidance[17]. During public health emergencies, timely and accurate information releasee can prevent escalation of public opinion[18] and encourage the expression of positive emotions. In the digital era, emotional governance has become a core task of online public opinion management. Emotional governance is particularly important during public health emergencies. Through effective emotional guidance, the government can alleviate public uneasiness and avoid the further deterioration of public opinion. Concurrently, academics have been exploring the use of sentiment analysis techniques to accurately identify and predict emotional fluctuations in online public opinion, providing policymakers with more effective tools for public opinion management[19]. Sentiment management involves social and public opinion stability in the digital era.

2.3. Guiding Negative Emotions in Online Public Opinions

The advent of the Internet has created increasingly diversified channels for the public to access information and participate in discussions; however, the risk of public opinion being triggered by the dissemination of complex information with emotional attributes through the Internet has been frequent. During major public health emergencies, online public opinion is characterised by suddenness, uncertainty, and emotionality, often mixed with negative emotions. The main reasons for these characteristics are as follows: first, a lack of psychological security owing to information asymmetry[20]; second, the public's expression on the Internet is affected by the herd mentality and group pressure, and their speech and emotions tend to be emotional and irrational, with a prominent polarisation effect[21]; third, the panic arising from the disruption of the order[22].

To effectively manage online public opinion during such emergencies and reduce the impact of negative emotions, the theory of emotional governance can provide valuable insights into improving public opinion guidance mechanisms. Emotional governance emphasises understanding, regulating, and managing public emotions to achieve social governance goals. Regarding online public opinion guidance, Lorenz-Spreen et al. highlighted the role of online content and social media in shaping public opinion, suggesting the use of cues to indicate the quality of online content and algorithmic decision-making[23]. By incorporating an emotional governance framework, algorithms can moderate the spread of negative emotional information and amplify positive emotions. Additionally, Secret Yuqing argues that socialist core values should serve as guiding principles for online public opinion regulation[24], ensuring emotional resonance and the social order stability. Regarding the monitoring online public opinion, Li introduced the public opinion monitoring and early warning model in modern public policy, using technology to enhance the government's responsiveness in emotional governance[25]. Similarly, Xiao Wentao's emphasis on monitoring and early warning mechanism can be used to understand the emotional changes in public opinion in real time to scientifically steer the public's emotions[26]. By monitoring the spread of negative emotions, governments can respond to public concern in a more targeted manner and guide the transformation of emotions in a positive direction in a timely manner. Therefore, building online public opinion guidance and monitoring mechanisms based on emotional governance[27] can better resolve the negative emotions of the public during emergencies, alleviate social conflict, and enhance the effectiveness of governance[28].

Overall, foreign scholars have provided prospective research on online public opinion during major public health emergencies, with earlier and in-depth research on emotions offering traceable research directions. However, the research on emergencies and online public opinion is relatively broad. Studies both domestically and internationally primarily focus on three

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aspects: first, the communication mechanism of online public opinion during emergencies; second, the evolution process of online public opinion; and third, the governance and guidance of online public opinion. However, the complexity of online public opinion evolution, combined with the unpredictable and prolonged nature of public health emergencies, poses challenges in accurately describing the overall evolution of online public opinion and analysing emotional characteristics across extensive textual data. Furthermore, the existence of numerous emotionally charged individuals in the cyberspace complicates efforts to track and predict the evolution of public opinion trends. By integrating online public opinion, emotional dynamics, and the context of emergencies, researchers can elucidate the formation, generation, and dissemination of emotions based on contextual features. This approach ensures studies on online public opinion during emergencies, offering better strategies for addressing public emotions under the online public opinion of emergencies.

3. Data and Methodology

3.1. Data Sources

To measure the emotional evolution of online public opinion during the major outbreak of Chlamydia pneumoniae in China, especially the evolution of negative emotions such as panic, worry, and anxiety, this study utilised data from the social media platform, Sina Weibo ('Weibo'). Sina Weibo is one of the most popular social media platforms in China, where trending and highly trafficked information on Weibo is highlighted in the popular search list. The number of searches and views on various topics directly reflects the public's attention and attitude towardse topics[24].

Social sentiment measurement based on social media data involves microblog posts from Sina Weibo users during the epidemic period of 27 December 2019 to 31 March 2021 including user nicknames, microblog body, posting location, posting topics, and posting time. Using web crawler technology, and approximately 24,700 items were extracted.. Based on further semantic computation and data cleaning, the distribution results of positive and negative emotions are counted using sentiment analysis techniques.

3.2. Data Preprocessing

Public opinion data obtained by crawlers are filled with a large amount of uncleaned data, which are prone to large errors if directly analysed for sentiment analysis. Therefore, preprocessing the data is an indispensable part of text mining before performing sentiment analysis, that is, removing null values, duplicate values, and invalid comments from public opinion data. Firstly, the whole line of data containing duplicates in the microblog text crawled with the keywords "epidemic" and "COVID-19" is deleted to avoid the negative impact of duplicates on the accuracy of the subsequent sentiment analysis results. Subsequently, all rows containing empty and erroneous data were deleted. Finally, characters such as emoticons, special symbols, and user nicknames contained in the text data of the microblog body are repeatedly removed, and the first and second steps are repeated to obtain relatively pure text data of online public opinion. After preprocessing the text data, the purity of the text data was significantly improved, which is convenient for subsequent sentiment analysis.

Additionally, using the word-splitting function in the ROSTCM6 text mining system to perform word-splitting processing on 24,700 microblog body contents, words without real meaning in the word-splitting results were compared with the body contents. They also were recombined with the context to form new words to ensure the credibility of the word-splitting results. After the above operation, it is necessary to filter words and symbols without real meaning because filtering deactivated words can quickly improve the efficiency of text mining. In this study, the deactivated word list of HIT, the deactivated word list of Baidu and the deactivated word

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database of Sichuan University are summarised and integrated, and a total of 3885 deactivated words are obtained after deleting the duplicated deactivated words.

3.3. Analysis of Public Opinion Sentiment Exploration

To better analyse the characteristics of the emotional evolution of online public opinion during the epidemic in China, this study analysed the emotional tendency of online public opinion based on the five stages of protest proposed in 'China's Actions to Combat the COVID-19 Epidemic'. Stage 1: Swift response to the outbreak (27 December 2019 to 19 January 2020). During this stage, unexplained pneumonia was detected by surveillance in Wuhan, Hubei Province, China. The outbreak was swiftly reported, and authorities initiated aetiological and epidemiological investigations. Stage 2: Initial containment of the spread of the epidemic (20 January 2020–20 February 2020). The rapid increase in the number of new confirmed cases across the country: China implemented strict measures, including closing transportation routes to mitigate the spread of the virus, resolutely and decisively closing the channel away from Han and Hubei, Wuhan, and Hubei, and the full-scale defence of the war. Stage 3: The number of new cases in the territory gradually declined to single digits (21 February 2020 to 17 March 2020). The Central Committee of the Communist Party of China (CPC) made a major decision to coordinate the prevention and control of the epidemic, economic and social development, and resume production in an orderly manner. Phase 4: Achieving decisive results in the defence of Wuhan and Hubei (18 March 2020 to 28 April 2020). During this phase, the spread of the national indigenous epidemic with Wuhan as the main battleground was blocked. Restrictions on travels from Han and Hubei were lifted, and hospitals in Wuhan reported no new cases of patients with Crown Pneumonia in hospitals. Stage 5: The national epidemic prevention and control enters normalisation (29 April 2020–31 March 2021), the overall domestic epidemic is sporadic, local areas of the epidemic cases are caused by the aggregation of the epidemic, and the imported cases from abroad are controlled.

For word frequency analysis, the opinion text in the microblog posts was subdivided into words, and word frequency statistics were conducted. The results showed variations in high-frequency words and their word frequency across the five major phases, with frequencies ranging from a maximum of 2,903 occurrences to a minimum of 1. Owing to the long event time of the research object and the relatively large amount of text data, visually presenting each emotion word is impractical. Therefore, displaying the top-ranked word frequency of each stage is essential. High-frequency words usually represent highly heated and sensitive topics or events of interest to the subjects under study. Generally, the higher the frequency of words in the body content of microblogs, the higher is the frequency of words, which reflects the overall direction and common perspective of public opinion on specific issues.

Subsequently, sentiment analysis was performed using the ROST EA sentiment calculation tool of the ROST series for text content mining analyses. This tool supports various text mining tasks such as text preprocessing, sentiment calculation, classification algorithms, and clustering algorithms. During the research process, microblog text data from the five major stages of protest were imported into the custom word list of ROST EA, and the default bounding value of 5 was used to distinguish between the positive and neutral bounding values and the neutral and negative bounding values. The 'default' option was selected because of the absence of the medical field in the domain sentiment word list, allowing the generation of detailed sentiment analysis results, including statistical distribution, fine-grained sentiment details, and additional relevant sentiment files. These results files contain scores for the most positive and most negative statements, sentiment value, Likert scale value, average sentiment value per comment, and the proportion of positive, negative, and neutral sentiments.

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4. Characterisation of the Evolution of Online Public Opinion Sentiment under Major Epidemics

The study used the 'COVID-19' as a special case to examine the evolution of online public opinion sentiment. It analysed the number of microblog posts and high-frequency words at each stage of evolution and calculated the proportion of positive and negative emotions at each stage of the epidemic's public opinion evolution.

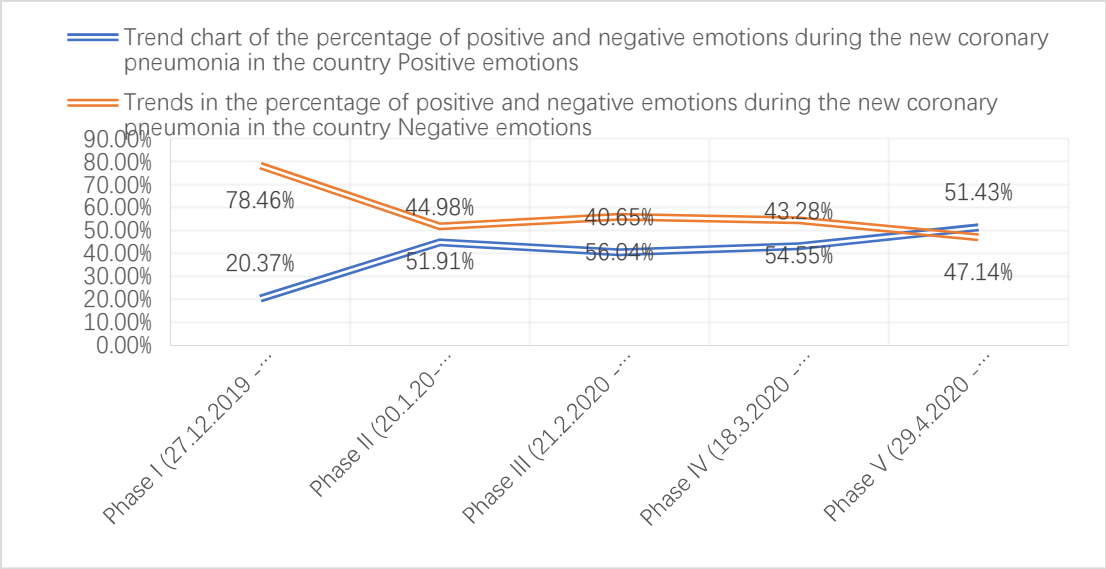

Figure 1. Trends in the percentage of positive and negative sentiment during COVID-19 in the country

(Source: Author's own production)

4.1. Phase I: Rapid Response Outbreaks

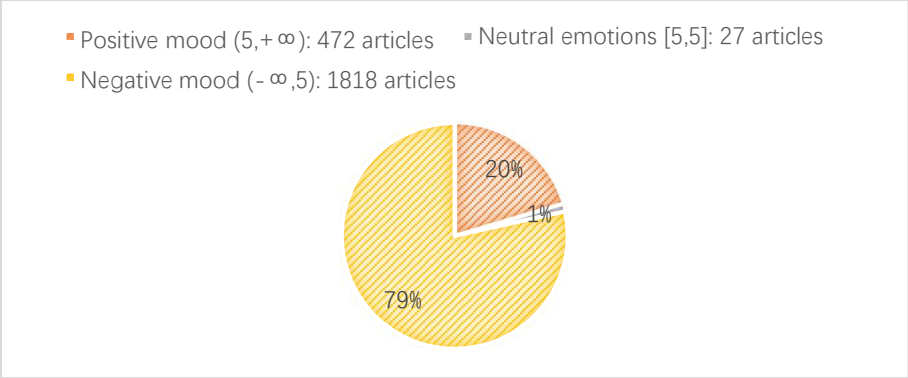

Figure 2. Statistical results of the distribution of emotions in Phase I

(Source: Author's own production)

During the rapid response phase of the outbreak, 2,328 pieces of microblog content were collected. These data primarily consisted of epidemic notifications and authoritative releases. After filtering, 2,317 valid posts were analysed, revealing that the majority expressed either negative or positive emotions, with a significantly low proportion of neutral emotions. Specifically, positive emotions accounted for 20.37% of the posts, while negative emotions accounted for 78.46%, indicating a predominantly negative emotional response during the first stage of the 'COVID-19 epidemic'. The 2,317 tweets were subdivided into words, and the most frequent emotion words were identified. The top 50, including 'virus', 'new type', 'case', 'fever',

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and 'notification', were found to be commonly used (Table 1). These terms suggest that the emotion expressed by the public opinion text in the first stage type is the negative emotion of anxiety and panic regarding the unknown aspects of the COVID epidemic.

Table 1. High-frequency words in phase I

list of words	*word frequency*	*list of words*	*word frequency*	*list of words*	*word frequency*	*list of words*	*word frequency*
pneumonia	2903	body temperature	252	cough	398	South Korea	175
Wuhan	1214	health commission	248	hygiene	390	viral	174
virus	1029	Wuhan City	239	doctor	364	personnel	165
case	729	rule out	233	child	341	vaccine	164
new type	685	pathogen	232	hospital	340	measure	163
coronavirus	684	baby	220	Shanghai	340	notification	158
cause	682	respiratory tract	200	detection	330	time	158
unknown	638	China	199	health	321	new increase	158
epidemic	569	nation	183	influenza	289	prevention	149
infection	545	fever	181	breathing	280	child	147
patient	434	mask	179	cold	263	expert	143
treatment	412	fever	177	symptom	279	report	142

(Source: Author's own production)

4.2. Phase II: Initial Containment of the Spread of the Epidemic

In contrast to the 'events of the "COVID-19', on 20 January 2020, Zhong Nanshan stated that the Xin Guan virus was homologous to SARS and that the epidemic was in the escalating stage. He emphasized that the virus was likely to be both infectious and dangerous. At this time, the proportion of negative sentiment in the data of the 1,256 valid tweets was still as high as 51.91%. However, there was a notable difference from the previous stage: the proportion of positive sentiment was close to half of the total at 44.98%. On 21st January, provinces across China began reporting confirmed cases of new cases of crown pneumonia and infected doctors. On 23rd January, Zhejiang Province became the first to initiate a Level 1 response to the major public health emergency, prompting netizens' sentiments to shift from fear to demand for other regions to follow Zhejiang's example. On 24th January, provinces such as Guangxi, Fujian, and Shandong also activated the Level 1 response, fulfilling netizen's demands, boosting positive online public opinion.

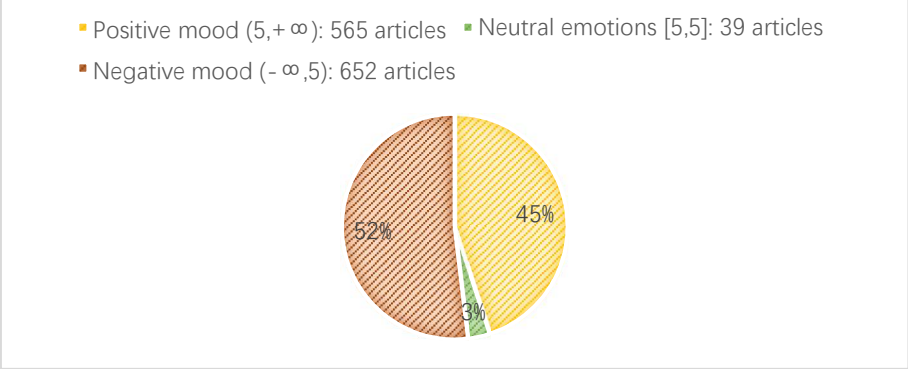

Figure 3. Statistical results of the distribution of emotions in phase II
(Source: Author's own production)

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Table 2. High-frequency words in phase II

list of words	*word frequency*	*list of words*	*word frequency*	*list of words*	*word frequency*	*list of words*	*word frequency*
pneumonia	5982	COVID-19	4447	virus	2920	Wuhan	2688
epidemic	2548	new type	1969	hospital	1902	infection	1704
confirmed case	1642	case	1589	coronavirus	1526	personnel	1196
China	888	mask	861	isolation	838	fight against	824
treatment	777	Hubei	736	people	726	medical care	559
cheer	516	protection	413	new increase	400	contact	395
medical staff	322	news	266	nation	250	spread	229
united as one	210	center	139	supplies	127	medical visit	121
symptom	119	time	119	medicine	117	health	116
hospitalization	115	discharge	115	help	111		
national	110	fever	107	test	111		

(Source: Author's own production)

4.3. Phase III: Gradual Decline in the Number of New Local Cases to Single Digits

With the normalised prevention and control of the pandemic, the emotions of netizens gradually stabilized, with positive and negative emotions accounting for half of the total. During this phase, microblog text data mainly focused on epidemic prevention and control initiatives and resumption of work and production decisions. In the effective text information, compared with the previous stage, we found that the positive sentiment slightly decreased to 40.65%, while the negative sentiment had a relatively small increase, accounting for 56.04%.

An analysis of the 'new coronary pneumonia epidemic' reveals that on 18 February 2020, the Joint Prevention and Control Mechanism of the State Council reported that 'three firsts' had been achieved on 17 February. These included: (1) a decrease in the number of new confirmed cases to fewer than 2,000 on a single day in China's mainland; and (2) the number of new confirmed cases outside Hubei Province had dropped to less than 100 cases.'Spain', 'global', and the actual situation that the importation of cases from abroad is also a hot event at this stage. Furthermore, CCTV news reported that many frontline workers made significant sacrifices during the epidemic, all of which likely contributed to fluctuations in negative sentiments in the online public opinion.

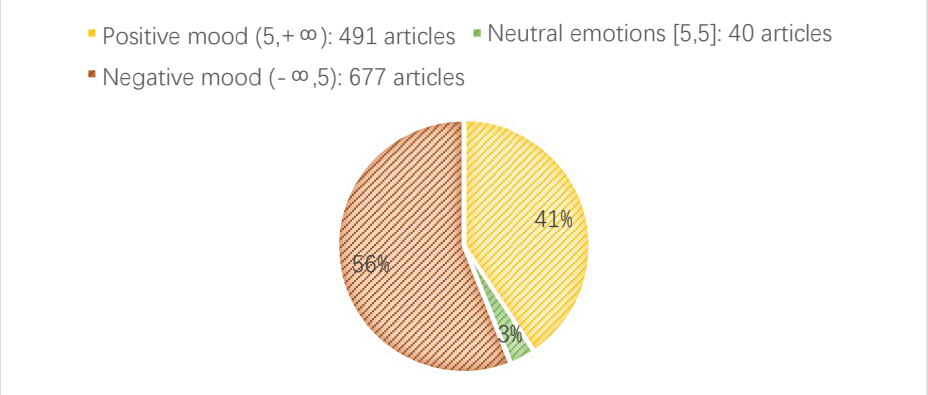

Figure 4. Statistical results of the distribution of emotions in phase III
(Source: Author's own production)

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Table 3. High-frequency words in phase III

list of words	word frequency	list of words	word frequency	list of words	word frequency	list of words	word frequency
COVID-19	1899	pneumonia	1707	epidemic	1456	confirmed case	768
virus	633	US	591	China	515	personnel	475
case	467	test	466	president	397	infection	393
Brazil	324	hospital	278	time	274	isolation	261
nation	255	patient	239	government	219	health	213
mask	211	Wuhan	211	news	204	UK	197
cumulative	189	report	187	overseas	185	medical care	176
Italy	172	measure	169	center	166	new increase	165
death	157	people	156	global	156	media	147
negative	143	Spain	142	imported	136	recovery	130
hygiene	127	accept	126	organization	125	fight against	125
webpage	123	Iran	123	do well	122		
community	117	management	117	new type	118		

(Source: Author's own production)

4.4. Phase IV: Achieving Decisive Results in the Defence of Wuhan and the Defence of Hubei

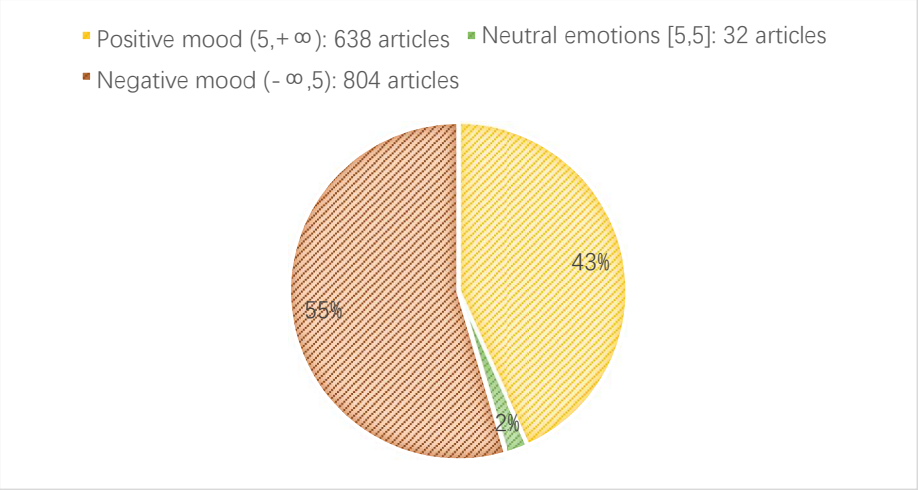

Figure 5. Statistical results of the distribution of emotions in phase IV
(Source: Author's own production)

In this stage, the spread of the national local epidemic with Wuhan City as the main battleground was basically blocked, and the control measures for the channels away from Han and Ezhou were lifted.According to the statistical results of the distribution of emotions, the positive emotions accounted for 43.28% and the negative emotions accounted for 54.55% compared to the third stage, both of them fluctuating in a small range, and the online public opinion gradually entered into the stage of weakening.On March 14, 2020, the State Council's Joint Prevention and Control Mechanism (JPCM) press On 14 March 2020, the State Council's Joint Prevention and Control Mechanism (JPCM) held a press conference announcing that the majority of counties in the country were low-risk by 14 March, and that relevant provinces had published lists of counties and districts at high, medium, and low risk. On 18 March the State Council's JPCM held a press conference announcing that the number of new cases of CKD in the country was zero, at which point the public gradually saw hope that the CKD outbreak would have a relatively small impact on the population. 8 April, Wuhan The full "unsealing" of the

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Internet users' mood is high, the national epidemic prevention and control work has entered a new stage, and the whole country is gradually beginning to recover, as localities start to prepare for the resumption of work and production.

Table 4. High-frequency words in phase IV

word frequency	list of words	word frequency	list of words	word frequency	list of words	word frequency	list of words
COVID-19	2296	pneumonia	2022	epidemic	1525	case	823
US	789	China	696	confirmed case	662	virus	502
patient	404	Wuhan	399	hospital	394	death	381
time	359	new increase	328	cumulative	313	nation	292
fraud	273	global	272	school reopening	264	news	263
personnel	258	infection	254	health	226	people	222
impact	199	medical care	191	mask	191	do well	178
government	175	hygiene	173	student	162	UK	161
isolation	159	development	153	meeting	153	treatment	151
discharge	150	Japan	149	CCTV	143	organization	143
expert	141	period	140	school	140	report	138
research	134	relief fund	133	Beijing	131	impoverished household	131

(Source: Author's own production)

4.5. Phase V: Normalisation of National Outbreak Control and Prevention

In the fifth stage, the epidemic within the country was generally sporadic and distributed, national epidemic prevention and control entered the norm, public opinion gradually weakened, relevant issues gradually withdrew from the public view, and the impact of the incident gradually diminished. According to the results of the emotion distribution, the proportion of positive emotions exceeded that of negative emotions for the first time, jumping to more than half of the total, accounting for 51.43% of the total. On 31 May 2020 China's State Council's Joint Prevention and Control Mechanism held a press conference to report that China's local COVID-19 cases had been reported for 21 consecutive days with zero cases, and that most of the country's provinces had entered the stage of normalisation of prevention and control, with the country implementing the policy of resuming work and production, and public opinion of the outbreak gradually heading towards the decline phase.

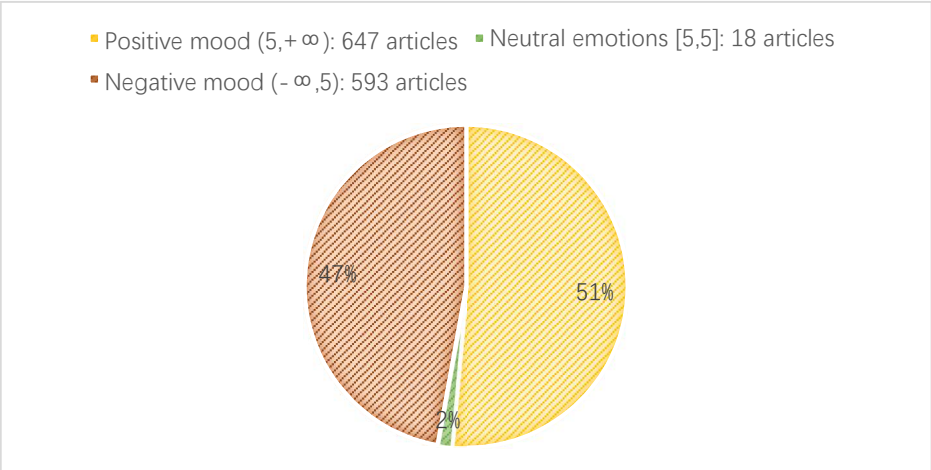

Figure 6. Statistical results of the distribution of emotions in phase V
(Source: Author's own production)

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Table 5. High-frequency words in phase V

list of words	word frequency	list of words	word frequency	list of words	word frequency	list of words	word frequency
COVID-19	2179	epidemic	1894	pneumonia	1856	Case	1146
confirmed case	1010	US	838	China	793	Virus	623
Beijing	540	new increase	463	test	421	Personnel	396
people	371	cumulative	371	nation	341	Hospital	328
patient	326	time	316	news	286	Market	273
health	264	global	264	report	253	Death	253
infection	240	Beijing City	226	nucleic acid	225	do well	216
hygiene	212	contact	210	imported	203	Symptom	195
medical care	178	government	175	measure	175	Organization	175
CCTV	170	notification	167	isolation	166	Wuhan	165
mask	161	treatment	158	youth	157	human rights	157
fever	154	community	152	center	149	National	149

(Source: Author's own production)

5. Analysis of the Motivating Factors for the Evolution of Online Public Opinion Emotions Induced by Major Public Health Emergencies

In the era of rapid information exchange, emotion are crucial play a crucial role in social interaction. They are central to addressing key challenges in economic and social development, particularly in the evolution of online public opinion, and serve as a prominent manifestation of social mentality. By analysing the complex changes in public emotions during the five phases of the domestic candidiasis epidemic mentioned above, an in-depth analysis of the causes of the evolution of emotions induced by online public opinion and analysis of the impact of public emergencies on online public opinion will be crucial in the accurate study and disposal of public opinion risks, scientific decision-making, and even in the promotion of social harmony.

5.1. Network Agglomeration Effects Continue to Intensify

The rapid development of the Internet has transformed traditional public opinion dynamics, breaking the monopoly of traditional official media and diversifying the communication patterns of public opinion. The rise of the mobile Internet has positioned mobile phone users as the primary force in cyberspace, while self-media applications, closely integrated with mobile phones, have made online activities faster, convenient, and cost-effective. Self-media and mobile Internet complement each other, significantly reducing the digital divide, achieving decentralisation, and enhancing the openness, convenience, and interactivity of cyberspace[29]. However, when a sensitive event occurs, the demands and aspirations of stakeholders are often voiced online, leading to public resonance and aggregation. This results in public opinion spreading quickly, forming a clustering effect. The development of the outbreak remains uncertain, and the public has doubts about its impact, effectiveness of prevention and control measures, and future trends. Negative information or adverse events are frequently amplified by netizens online, triggering worries and panic and intensifying the clustering effect. With the rise of social media platforms, such as Weibo, WeChat, and Shake, which allow individuals to create and share content, the speed and scope of information dissemination have significantly increased, causing epidemic-related information to spread rapidly across the Internet. Under such circumstances, inaccurate information, rumours, and negative sentiments tend to spread

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and intensify rapidly, triggering more attention and discussion, which creates a clustering effect of negative public opinion and exacerbates the public's emotional volatility.

5.2. Highlighting the Effects of Group Polarisation

Group polarisation, originally proposed by American scholar Keith Sunstein, centres on the tendency of group members to favour their own prejudices during deliberation, ultimately leading to extreme opinions[30]. In cyberspace, this phenomenon is amplified by the virtual world, which exacerbates extreme emotions, attitudes and behaviours. The virtual and anonymous nature of cyberspace facilitate group polarisation, making online participants more susceptible to group influence, often leading to emotional and irrational tendencies.

During the pandemic, different opinions, views, and information sources emerged from experts, governments, media, and social networks. The public often seek information that align with their views, making it easy to form an 'information cocoon'. This process is further influenced by group dynamics, leading to biased and distorted information, and may even lead to certain groups being more likely to believe rumours or false information, causing panic and anxiety. Additionally, the public tends to form groups based on shared views, creating significant cognitive differences and divergent opinions that trigger antagonism and conflict, leading to fluctuations and instability in public sentiment, which is inherently volatile. Additionally, the response measures of governments and experts may be affected by group polarisation. During an epidemic, governments and experts may take preventive and control measures and make policy adjustments; however, these measures are often opposed and questioned by the public and different interest groups. Some groups may express dissatisfaction and distrust towards government measures, further exacerbating negative and variable public sentiment. These phenomena highlight the need to remain cautious of the possible adverse effects of group polarisation on the Internet and its wider social implications.

5.3. Information Asymmetry Spreads Panic

The theory of information asymmetry originates from the findings of three American economists, Akerlof, Spence, and Stiglitz in the last century, who discovered the existence of information asymmetry in the poor functioning of the lemon, labour, and credit markets [20]. This phenomenon is prevalent in economic and social life, often manifesting when one party possesses more or more accurate information while the other either lacking or misled, leading to the distortion and negative impact of information dissemination. New media in the internet era, such as microblogging and WeChat, have changed the characteristics of information dissemination, giving information asymmetry the possibility of large-scale dissemination.

Information asymmetry in the early stages of the outbreak prevented the public from accurately understanding the nature of the virus, its transmission routes, and preventive measures. Information from governments and expert organisations was often insufficient or delayed, whereas information on social media and other channels may be interspersed with rumours and inaccuracies, leading to bias and confusion in the public's understanding of the outbreak. Due to insufficient information and non-transparent communication, the public developed a sense of uncertainty about the risks and consequences of the outbreak, which led to emotional instability and negativity. People may respond with panic-driven overprotection or ignore preventive measures owing to a lack of information, further amplifying their anxiety and panic about the outbreak. Additionally, when the public perceives the asymmetry and opacity of information, they tend to be sceptical about the guidance and decision-making of the government and experts, leading to a weakening of trust in the government and experts. This reduces the effectiveness of public health measures, exacerbating the spread of the epidemic and increasing societal instability. Ensuring transparency and timely disclosure of information is crucial for reducing information asymmetry and maintaining social stability.

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6. Conclusion of the Study

This study examines the 'COVID-19', which began in China at the end of 2019, as a representative case of major public health emergencies. By dividing the incident into stages, we collected user data from microblogging platforms for each stage, analysed the emotions expressed by users, and classified the types of emotions and the frequency of the emotional words in public opinion. Our analysis revealed the following emotional trends during the pandemic: (1) emotional evolution of public opinion exhibited clear stage-specific characteristics. During the rapid response period, netizens' awareness of the danger of the unknown 'new coronavirus' was limited, with panic and anxiety being the dominant emotions. Positive emotions increased during the initial containment period. In the third stage, as the number of cases increased and epidemic prevention and control policies were adjusted, negative emotions slightly increased as compared with the initial stage. During the fourth stage, netizens' positive emotions predominated the negative emotions, reflecting the success of Wuhan's epidemic control efforts, with the control of the epidemic nationwide entering into normalcy and production gradually resuming. (2) In an emotional state, netizens experienced uncertainty and strong negative emotions, leading to an outbreak of public opinion. (3) The timeliness, reasonableness, and effectiveness of the official government's response to the public's needs and measures in managing public opinion can effectively alleviate the negative emotions of online public opinion and reduce the possibility of secondary public opinion crises.

Combined with the research content of this paper, online public opinion governance should extend beyond responding to the outbreak of negative social emotions but should become a stabiliser that maintains social stability and promotes orderly development. Emotional governance must not only calm public opinion but also reflect on and address underlying structural issues and fundamental causes. Effective social governance is essential for maintaining stability and enabling high-quality development. To further improve public opinion guidance and governance of major public health emergencies, the following suggestions were proposed:

First, an online public opinion monitoring system should be established to improve the quality of media information. Owing to the special nature of public health emergencies, the public has limited access to information resources. Online media, as a powerful online emotion-guiding force, can control the direction of public opinion and people's emotions by interpreting online public opinion. Distorted facts and false communications can promote negative online emotions. The government should use big data technology and artificial intelligence to dynamically monitor public opinion and establish an automated online public opinion monitoring platform that can capture and analyse information on the Internet, social media, news websites, forums, and other platforms in real time. An early warning system for public opinion should be established to automatically issue alerts when certain keywords or events spread rapidly, enabling a quick response. Additionally, the government should establish a synergistic cooperation mechanism with mainstream and emerging media with high credibility to ensure the timely dissemination of official information and reduce the spread of misleading reports.

Second, the government should enhance its awareness of the responses and create effective contingency plans. Timely responses to public opinion situations through emergency measures are crucial to prevent the spread of online emotions or irrational behaviour of social groups, which helps to reduce online public opinion crises in the event of emergencies. First, authorities should prioritise crisis prevention and proactive action, conduct regular crisis drills, and establish a multi-departmental joint mechanism. These measures ensure that all departments and institutions are familiar with the emergency response plan, enabling effective coordination, resource-sharing, and synergy to respond. Second, governments should formulate regional contingency plans based on regional characteristics. However, as new technologies and

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diseases emerge, the government should continually update its contingency plans to incorporate new countermeasures and medical technologies to ensure their applicability.

The third is the public opinion information disclosure system, which enables netizens to express their interests. Timely information disclosure can eliminate the anxiety caused by incident uncertainty. First, we should ensure effective information guidance through official platforms with broad coverage. This includes building channels of communication and mutual trust through various channels such as TV, government microblogs, official public numbers, and SMS notifications. Authoritative information should be released promptly and comprehensively to expand mainstream voices, build social consensus, and create healthy and positive mainstream public opinion. Urgent attention must be given to establishing rapid response mechanisms to dispel rumours and clarify online rumours and inaccurate information in a timely manner, preventing misleading public sentiment and public opinion. Subsequently, we should establish an online mechanism for netizens to express their opinions and suggestions on the government's response measures, policy adjustments, and other issues. Additionally, a public opinion feedback channel should be created to regularly collect and collate suggestions, providing feedback to the relevant decision-making departments. In response to complaints and emergency reports, a transparent handling process should be established to ensure timely responses to netizens' demands, ensuring that the public's voices are heard and addressed.

Fourth, a permanent and stable mechanism for public-opinion research and judgement. Establishing a regular and stable mechanism for public opinion research and judgement is crucial for effectively responding to online public opinion. First, comprehensive multiplatform monitoring should cover mainstream media, social media, forums, video platforms, and other diversified public opinion platforms. By using big data technology and natural language processing technology, real-time monitoring and data collection of public opinion on the whole network can be achieved through a hierarchical monitoring mechanism, focusing on high-risk public opinion and formulating corresponding judgement and disposal strategies for different levels of public opinion. Second, an internal public opinion data-sharing platform should be established to integrate public opinion data and analysis results from various departments, build a unified public opinion database, and make use of machine learning and artificial intelligence technologies to automate the processing and in-depth analysis of a large amount of public opinion data. This will improve the efficiency and accuracy of public opinion research and judgement and provide comprehensive data and information support for research and judgment. Additionally, a deeper analysis of public opinion should be conducted to analyse its root causes, development trends, and possible consequences to grasp public sentiment and behaviour in real time and provide a scientific basis for government decision-making.

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