

# Effects of Content Features and Lingual Form of Government Information Release on the Regulation of Public Negative Emotions During COVID-19 Epidemic in Wuhan

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## Research Article

**Keywords:** Public Health, Negative emotions, Government information release, Rhetorical strategies

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# Effects of content features and lingual form of government information release on the regulation of public negative emotions during COVID-19 epidemic in Wuhan

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## **Abstract.**

**Background:** Emergencies and their associated negative emotions have a great effect on public health. As a key part of the emergency management, government information release (GIR) not only meets the public's health information seeking, but also helps to eliminate the breeding and spreading of negative social emotions.

**Method:** From the two aspects of content features and lingual forms, a regression model was built to explore the mechanism of GIR on the regulation of netizens' negative emotions by adopting the theoretical methods of content analysis, emotion calculation, and case analysis.

**Results:** During the emergency outbreak, if the government can timely release information on the incident and respond to the public using rational language, netizens' negative emotions can be alleviated. During the emergency peak, the government should release the event progress, resolution and disposal information to improve the recognition of netizens and eliminate negative emotions.

**Conclusions:** According to different stages of emergencies, the government should timely and reasonably utilize the attitude tendency, content type and lingual form of GIR to effectively regulate the negative emotions of netizens.

Keywords: Public Health, Negative emotions, Government information release, Rhetorical strategies

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## 1. Introduction

It is well known that emergencies and their associated social emotions, especially the interweaving and collision of various negative emotions, have a great effect on public health [1,2]. During emergencies, positive psychological suggestion will make positive emotions generate, so as to avoid the influence caused by negative emotion, which is of a great help in controlling disease and restoring healthy life [3,4].

As a key part of the emergency management, the government information release (GIR) not only meets the public's health behaviour, but also helps to eliminate the netizens' negative emotions, avoid secondary crises, and stabilize the social order[5]. In recent years, governments at all levels have formed a relatively complete communication system in terms of the information disclosure of emergencies [6]. However, in practice, such chronic diseases as the lack of dominant agenda setting, the information release delay, the misjudgment of public concern, and the loss of negative emotion guidance are still serious [6,7]. On the basis of scientifically analyzing the rules of negative emotion infection-evolution, how to explore GIR strategies to effectively adjust and channel social emotions derived from emergencies has become a new topic to improve government emergency management level [8].

At present, the research on the GIR strategy during emergencies is still in its infancy. And most of them are many qualitative studies, but few systematic studies on the mechanism of GIR on the regulation of netizens' negative emotions. The existing studies focus on the perspectives of public opinion and analyze the distribution characteristics of positive and negative emotions at each stage of emergencies. Most of the proposed release strategies are descriptive and speculative, with weak operability [8,9]. In terms of specific release strategy formulation, such as release timing, content composition, language style selection and emotional guidance, no specific quantitative feasible plan is provided, which cannot provide decision support for information release strategy in emergency management and effective regulation of negative social emotions [10,11].

Therefore, in view of the shortcomings of existing studies, this paper tries to explore the mechanism of GIR on the regulation of netizens' negative emotions based on the content type, attitude orientation, lingual form so as to accurately grasp the distribution of the

netizens' emotions in emergencies and to effectively regulate the social negative emotions.

The contributions of this paper: (1) deconstructed the content type and attitude tendency of GIR and measuring the polarity of emotion by using content analysis, and text mining; (2) conducted empirical researches on the influence of content features and lingual forms of GIR on netizens' emotions through the construction of regression model; (3) tested mechanism of GIR on the regulation of netizens' negative emotions, and put forward some suggestions based on the case of COVID-19 epidemic in Wuhan.

The rest of the paper is organized as follows. First, we review previous literature on GIR. Second, we introduce our theoretical foundation and the analysis procedure of the influence of GIR content features. Next, we state data collection procedures, data analysis and results. The effect of GIR lingual forms on regulating public negative emotion are conducted and discussed. Finally, implications as well as opportunities for future studies are discussed.

## 2. Related works

### 2.1. Content components of the GIR

Scholars have explored and revealed the content components of GIR using theoretical methods of journalism, public management, administration, and communication etc. They believe that the cause, nature, degree of harm, and disposal measures of the incident are the main components of information disclosure content. For instance, Choi proposed that the GIR based on journalism theory, should release authoritative information first time, fully satisfy the public's information demands in emergencies, and guide social public opinion, while strengthening the collection, monitoring and analysis of Internet public opinions [12]. Henderson et al. conducted a survey on emergency managers in the New York area and found that after in case of the emergency, the public hopes that the government can release relevant information in as much detail as possible at all stages of the event evolution [13]. Most scholars at home and abroad think that the content of government's emergency information disclosure is closely related to the development stage of the incident, and it varies at the three stages of the early warning period, the outbreak period, and the post-restoration period, each with its own emphasis. However, in practice, it still needs to be enriched and improved on how to optimize the

content components of GIR information disclosure [14].

## 2.2. Disclosure strategy of the GIR

Scholars mostly are based on the case analysis and content analysis methods to summarize the existing problems in the GIR disclosure on emergencies, and also to propose improvement measures [15]. For example, Zhou et al. found that GIR disclosure is mainly neutral and original, and the disclosure frequency is compatible with different stages of the emergency event, but there are problems like delayed response, serious imbalance of information volume, and weak interaction; then, they put forward the suggestions such as improving the audience participation and interaction, releasing key posts to guide public opinion, and adherence to the audience-based release philosophy [15]. Taking the stampede in Shanghai bund as the research example, Zhang and Wang analyzed the disclosure form, response time, response speed, micro-blog content and interaction of the GIR in case of the emergency, and found that the information disclosure about the incident by Shanghai government has the defects of rigid language style, lack of flexible and diverse intonation and voice mode, and lack of interaction mechanisms, so they further proposed specific methods and suggestions for enriching information disclosure forms, strengthening close cooperation between departments, and achieving crisis information sharing [16]. Wang and Hu built a theoretical framework for GIR based on the information-relationship-cognition. They believed that in the early stage of the event, familiar scenes should be constructed to repair the damaged social order; in the middle stage, the cognitive gap between the government and the public should be reduced; in the late stage, the social cognitive gap needs to be reflected later to reach a social consensus [17].

Existing research shows that the current GIR disclosure focuses on eliminating the strangeness of the people and reducing the intrusion of the social order by the incident, but pays little attention to the adjustment of negative emotions [15,18,19], resulting in the defects such as a slow response, lack of guidance of topic setting, and insufficient guiding role for emotions etc [20], so the relevant countermeasures have been proposed; however, most of them are descriptive with low operability [9,16].

## 2.3. Rhetorical features of the GIR

Rhetorical strategy is an important means to improve the persuasiveness of information posted by the GIR and effectively express their positions and opinions [21-23].

Based on Aristotle's rhetoric theory of three persuasive audience appeal, Lim analyzed the specific manifestations of the lack of emotional appeal, lack of rhetorical personality, and messiness of rational appeal in the response of local governments to crisis events, and proposed that the use of multiple rhetoric methods should be emphasized when dealing with emergencies [21]; Arendt et al. believed that charismatic political language and pro-political behavior can help the government to alleviate the short-term crisis; in the case of H1N1 Flu, the government adopted language expressions such as "appropriate measures, joint efforts, and confidence", and narrow the political distance from the public through political behaviors such as condoling the infected patients and medical workers, thereby winning the dominant right and establishing a positive image of the government [22].

In summary, the scholars have summarized the problems in GIR based on the micro-blogs data, and verified the effectiveness of the strategy through simulation. These results provide theoretical references for this study, but there are still some shortcomings: (1) They focus on the information dissemination of emergencies, construct the content of released information, and clarify the form of information content, but rarely involving the mechanism of action, and paying less attention to the content type and components of GIR, attitudes, and the influence of lingual forms on social emotional communication; (2) The improvement measures and policy suggestions are mostly descriptive and speculative discussion.

## 3. Research on the influence of the GIR content features on the netizens' emotions

### 3.1. Data collection and processing

Considering the event types, timeliness, attention and social impact of public emergencies, the authors selected recent seven typical emergencies as research cases. The GIR of the above incidents were selected for the trial survey. On this basis, the number of published micro-blogs and their forwards, comments,

and likes were used as indicators of activity, and the GIR with more active performance were selected as samples. It collected a total of 413 pieces of GIR, and 203,854 comments from the public social media platform-Sina Micro-blogs (<http://www.weibo.com/>).

Based on the trial survey, inspired by reference [15], this paper divides the content features of the GIR samples into the following two aspects:

- Attitudes. There are three main types of attitudes: Positive attitudes (i.e., affirmative and positive evaluation, and behavioral tendencies regarding the events, people, and issues involved in the released information); neutral attitude (i.e., an objective neutral attitude towards the released information, with the purpose of only describing the facts, and not including its own subjective opinions); negative attitudes (i.e., negative evaluation and behavioral tendencies on the events, people and issues involved).
- Content types. It includes 6 types, namely event progress (mainly share relevant information about emergencies); popular science (based on popular science information released during the incident); rumor-removal (the rumor-refuting information released); resolution and disposal (related information on how to resolve emergencies issued by the GIR); summary and reflection (mainly the summarized and reflective information); others.

When classifying the emotions of the GIR comment data in this study, the authors adopted the classification method of seven emotions, that is, anger, disgust, fear, joy, love, sadness, and surprise. The manual coding was used to classify the types of GIR samples. "NLPIR Chinese word segmentation system" were applied to perform GIR recognition and emotion computing. The evaluation of emotions should take into account the GIR comment data.

Through kappa calculator, the reliability test was performed on the variables of the GIR content type, to obtain the reliability value of about 86.8%. This indicates a higher reliability. For emotion analysis of comments, 1,000 comments were randomly selected for manual labeling, and then compared with the emotional analysis results of the NLPIR sharing platform, to obtain the reliability value of the information expression form for about 75.2%, indicating that the platform is credible for emotional analysis on GIR to a greater degree.

### 3.2. Descriptive statistical analysis

Through screening all 15,200 comments, a total of 165 met the requirements. Emotion analysis was then performed on these comments. In terms of the number of likes, there were 446,076 comments from netizens, of which the comments with anger had the highest proportion of up to 38.04%, and those with surprise and joy was the lowest, to be 0.97% and 0.10% respectively. Therefore, this paper selects anger, sadness, disgust, fear, and love as research objects, excluding surprises and joy.

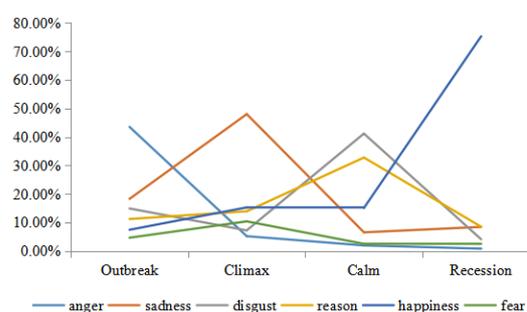


Fig. 1. Emotional changes in various periods.

Netizens have different emotional characteristics for GIR in various phases, which indicates that GIR information has an influence on netizens' emotions in emergencies (see in Fig.1). It can be seen that the number of netizens in anger was relatively high during the outbreak phase of an emergency; as the government continues to release information, the proportion of netizens in anger constantly declines; sadness peaks during the climax phase; the proportion of disgust is relatively high in the flat phase; the proportion of netizens' negative emotions declines in the recession phase, and the proportion of love reaches a peak.

Therefore, in the outbreak and climax phases, the GIR should play a good role in guiding public opinion and better assuming the government's social responsibility, and efforts should also be done to emotional channeling in the flat phase, but during the recession phase, the frequency of information disclosure should be reduced accordingly to allow emergencies to slowly withdraw from the public eye.

### 3.3. The influence of GIR's attitudes on netizens' emotions

As above, the attitudes of GIR information disclosure were divided into three types: positive, neutral, and negative. The statistical analysis of the samples shows that most of the information disclosed by the GIR was neutral, which mainly describe facts objectively, accounting for 66.06% of the total; positive attitudes accounted for 26.67%; negative attitudes accounted for 7.27%. This indicates that in the process of resolving emergencies, the GIR adhered to the principle of rational and objective information disclosure, conveyed objective and positive information to the public, guided the public to treat emergencies in a positive manner, and effectively exerted the leading role of online public opinion, thus assuming the social responsibility of correctly guiding the public opinion.

In order to study the relationship between netizens' emotions and attitudes, independent sample mean test was used to statistically analyze three qualitative variables: positive, neutral, and negative. A regression model of GIR attitude tendency and netizen emotions was established

$$attitude_i = a_1 \ln(fear) + a_2 \ln(anger) + a_3 \ln(sadness) + a_4 \ln(disgust) + \varepsilon \quad (1)$$

Here,  $attitude_i$  indicates three tendencies of attitudes: positive, negative and neutral; fear, anger, sadness, and disgust respectively indicate four types of negative emotions.

The results of regression analysis validate: (1) A positive attitude to posting information has a significant effect on the "fear" emotion of netizens ( $P < 0.01$ ), and the mean number of "fear" emotion (0.767) using a positive attitude in posting information was significantly lower than that (1.412) in other types of attitudes, indicating that positive attitudes can relieve the fear emotions of netizens. Meanwhile, positive attitudes in posting information is significant for the netizens' disgust emotions ( $P < 0.05$ ), and the mean number of disgust (2.057) generated by using positive attitudes was significantly lower than that (2.771) in other types of attitudes, indicating that using positive attitudes in posting information can reduce the netizens' disgust emotions. (2) The neutral attitude in posting information shows significance for netizens' fear emotions ( $P < 0.01$ ), and the mean number of fear emotions (1.526) using positive attitudes was significantly higher than that (0.684) caused by other types of attitudes, indicating that using a neutral

attitude can stimulate netizens' fear emotions. (3) The use of negative attitudes in the information disclosure can reduce the fear and sadness of netizens, while significantly stimulating their angers. For example, in the Wuxi viaduct collapse incident, the GIR, Wuxi's Release was questioned for the delayed disclosure of the emergency information, while it posted short comments to criticize online rumors, which triggered a wider range of controversy. This shows that the GIR should talk to netizens with an equal attitude when facing public opinions, rather than criticize netizens with a negative attitude.

### 3.4. The influence of GIR content types on netizens' emotions

There are 6 content types of GIR information: event progress, popular science, rumor removal, resolution and disposal, summary and reflection, and others. Through statistical analysis of the 165 pieces of information released, it can be seen that the GIR information content is mainly the event progress, and the resolution and disposal; the information on the event progress accounted for the vast majority, up to 41.2%, followed by information on incident resolution and disposal, accounting for 25.5%.

The independent sample mean test was used to study the relationship between the content type of information and the netizens' emotions. The regression model is constructed as:

The results of the regression coefficients and their significance show that: (1) The disclosure of event progress information by the GIR shows significance for netizens' fear emotions ( $P < 0.01$ ), and the mean number of "fear" emotions (1.529) generated by disclosing event progress was significantly higher than that by the release of other types of information (1.038). This shows that the disclosure of event progress by the GIR can easily stimulate the fear of netizens. (2) The disclosure of popular science information by the GIR is significant for "anger" and "sadness" emotions ( $P < 0.01$ ). From the mean numbers of these two emotions, the disclosure of popular science information by the GIR can easily dispel netizens' anger and sadness. (3) The disclosure of rumor removal information by the GIR has a significant effect on netizens' "anger" ( $P < 0.1$ ) and "sadness" emotions ( $P < 0.05$ ). From the mean of these two emotions, the disclosure of rumor removal information by the GIR can easily dispel netizens' anger and sadness. (4) The disclosure of resolution and disposal information by the GIR is significant for

netizens' sadness emotions ( $P < 0.05$ ), and the mean number of sadness emotions (3.909) generated by disclosing such information was significantly higher than that by the release of other types of information (2.75). This shows that the disclosure of resolution and disposal information by the GIR can easily stimulate the sadness emotions of netizens. (5) The disclosure of summary and reflection information by the GIR shows significance for netizens' negative emotions such as fear, anger, sadness, and disgust. From the mean numbers of these four emotions, the disclosure of summary and reflection information by the GIR can easily dispel these emotions of the netizens. (6) The disclosure of other information by the GIR has no significant influence on negative emotions.

#### **4. Research on the influence of GIR lingual forms on netizens' emotions**

##### *4.1. Theoretical analysis and main hypothesis*

Rhetoric is the art of persuasion for the audience, allowing them to form some kind of judgment, and recognize, approve and adopt the opinions or take some action. Aristotle's rhetorical theory divides lingual forms into three types, namely, ethos, pathos, logos.

Wang cited the three elements of propaganda in journalism: truth, emotion, and reason as theoretical references, and divided the lingual form of GIR into three major categories: character appeal, emotional appeal, and logic appeal [17].

Similar to ethos, the character-based lingual form is concise in text, with a clear attitude and a firm tone; it mainly uses imperative sentences, supplemented by rhetorical methods such as parallelism and contrast. Based on the facts, the government's attitude can be stated most directly in emergencies through the good use of words and direct appeal.

The emotional appeal-based lingual form mainly uses interrogative and exclamatory sentences, and makes good use of implicit expressions with the diverse texts and soft tone. It appeals to the audience by emotions, and caters to their psychological proximity. Because of its role of emotional guidance in emergencies, the micro-blogs in this lingual form mainly adopt the pragmatic principle of politeness, aiming at regulating the interpersonal relationship between the two parties in communication, so that speech can act smoothly in a harmonious atmosphere.

This is similar to the "pathos" in the Aristotle's theory of rhetoric.

The logic appeal-based lingual form is characterized by personalized positioning, strict wording, and neutral tone, with statements mostly, and updated and profound content. It delivers the facts and publicly presents the information of the functional departments from the perspective of serving the public interest. This is particularly important during periods of information imbalance in emergencies. The flexible use of psychological cues and truth is a characteristic of such lingual form. This is similar to the "logos" in the Aristotle's theory of rhetoric.

Wang's classification method of the micro-blogs is based on the theory of three persuasive audience appeals, and it is more suitable for the classification of the GIR lingual form. Thus, in this paper, the GIR lingual form was classified in terms of character appeal, emotional appeal, and logic appeal.

Studies have shown that in case of an emergency, when the government express its position and views to the public through the GIR information disclosure, a "venting" response and dishonest manner are likely to cause public outrage [23], and a positive response to netizens' concerns, and a frank and humble attitude can win the favor of netizens and resolve the crisis of public opinion.

Hovland's persuasion model considers the objectivity and credibility of the disseminator as the basic conditions for persuasion. Among them, credibility depends mainly on the qualifications and reliability of experts [21]. This is similar to Aristotle's reliance on the "character" element to increase the credibility of the persuasive, and to improve the persuasive effect. Both of them emphasize the credibility of the information disseminator to achieve the purpose of persuading the audience. Therefore, the following hypotheses have been made.

H1: The character appeal-based GIR disclosure has a dispelling effect on negative emotions.

In terms of different negative emotions, H1 can be clearly defined as the following hypotheses:

H1a: The character appeal-based GIR disclosure has a dispelling effect on fear.

H1b: The character appeal-based GIR disclosure has a dispelling effect on anger.

H1c: The character appeal-based GIR disclosure has a dispelling effect on sadness.

H1d: The character appeal-based GIR disclosure has a dispelling effect on disgust.

With the development of the incident, the GIR disclosure is adjusted timely in a humane and daily language style. This will not only show the

government's confidence and ability to handle the incident to the public, but also minimize public panic [16]. The key to relief of the public's "hate" is to alleviate the repression of institutions on them in terms of information, power, and discourse [17], and rely on metaphorical rhetoric, symbolic and mythical interpretive policy discourse systems in information disclosure. Thus, it can better achieve the purpose of maintaining and realizing the public interest, and actively lead the public's feelings to positive emotion, thereby forming a harmonious atmosphere of public opinion [23].

Therefore, the following hypotheses have been made:

H2: In emergencies, the emotional appeal-based GIR disclosure is prone to sadness, but alleviates other negative emotions of the public, thereby improving the netizens' recognition of government work.

In terms of emotion classification, H2 can be clearly defined as:

H2a: The emotional appeal-based GIR disclosure has a dispelling effect on fear.

H2b: The emotional appeal-based GIR disclosure has a dispelling effect on anger.

H2c: The emotional appeal-based GIR disclosure is prone to sadness emotions.

H2d: The emotional appeal-based GIR disclosure has a dispelling effect on disgust.

H2e: The emotional appeal-based GIR disclosure is prone to love emotions.

Studies have shown that accurate numbers in authoritative information released by government departments are more effective than vague numbers in reducing public anxiety [17-20]. Accurate numbers can also increase the credibility of information disseminators. Zhou et al. found that the structure of the speech according to the steps of the current situation of the incident, the cause of the incident outbreak, and the measures taken by the government is relatively clear, allowing the audience to understand the content of government leaders' speech clearly [11]. Thus, the following hypotheses have been made:

H3: The logic appeal-based GIR disclosure has a dispelling effect on negative emotions.

In terms of emotion classification, H3 can be clearly defined as:

H3a: The logic appeal-based GIR disclosure has a dispelling effect on fear.

H3b: The logic appeal-based GIR disclosure has a dispelling effect on anger.

H3c: The logic appeal-based GIR disclosure has a dispelling effect on sadness.

H3d: The logic appeal-based GIR disclosure has a dispelling effect on disgust.

#### 4.2. Research design

In this paper, a multiple regression model was adopted to study the influence of the GIR lingual form on netizens' emotions. It usually includes the following steps:

##### (1) Variable selection

The lingual form of GIR information disclosure was used as independent variables, the netizens' emotion ratio was used as the dependent variable, and GIR content features were used as control variables [10] (shown in Fig. 2).

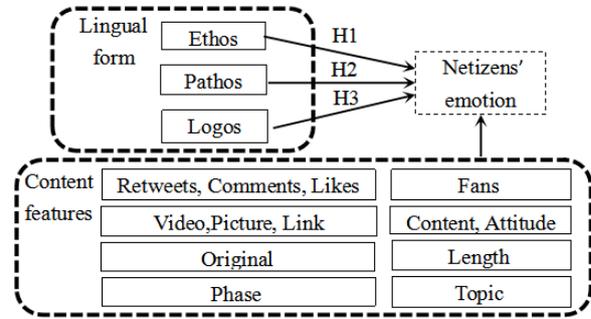


Fig. 2 Conceptual model

##### (2) Model construction

The regression model was analyzed using the multivariate regression analysis method. The basic regression model established was as follows:

$$\begin{aligned}
 Emotion = & \beta_0 + \beta_1 Ethos + \beta_2 Pathos + \beta_3 Logos + \beta_4 phase \\
 & + \beta_5 video + \beta_6 picture + \beta_7 link + \beta_8 topic \\
 & + \beta_9 original + \beta_{10} len + \beta_{11} content + \beta_{12} attitude \\
 & + \beta_{13} follower + \beta_{14} forward + \beta_{15} comment \\
 & + \beta_{16} like + \varepsilon
 \end{aligned}$$

(3)

Here, *Emotion*, as the dependent variable, indicates the emotional characteristics of netizens' comments on the GIR, including five types of emotions: love, anger, sadness, fear, and disgust; the number of netizens' emotions was calculated by adding the number of comments and likes; *Ethos*, *Pathos*, *Logos* are the lingual forms of the GIR, which are character appeal, emotional appeal, and logic appeal; *phase* is the stage of GIR information disclosure, which is divided into outbreak phase, climax phase, flat phase, and recession phase [34]; *video*, *picture*, and *link* indicate whether there are related videos, pictures, external links in the GIR disclosure; *topic* indicates whether it is included in the information; *original* refers to whether the information is original; *len* refers to the

length of the micro-blog words; *content* refers to the content type, including event progress, popular science, rumor removal, resolution and disposal, summary and reflection, and others; *attitude* means the attitude tendency, which is divided into positive, neutral, and negative; *follower* refers to the number of GIR fans; *forward* and *comment* are the number of GIR messages forwarded and commented by netizens; *like* is the number of likes of the GIR information.

### 4.3. Empirical analysis

According to the regression analysis results of Model 1,  $R^2$  was adjusted to 0.402, indicating the

influence of the GIR information disclosure on netizens' loves. The coefficient of the emotional appeal-based lingual form was 0.213, which indicates that this lingual form can increase the love emotion of netizens, while the coefficients of the character appeal-based and logic appeal-based lingual forms were -0.361 and -0.401, indicating that these two lingual forms will reduce the proportion of netizens' love emotion. In addition, the coefficient of original was 0.107, and that of video was 0.002, indicating that the original micro-blog disclosure by the GIR, attached with video can improve the recognition of netizens (as shown in Table 1).

Table 1  
Regression results of language forms on the netizens' emotions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
	Happiness	Fear	Anger	Sadness	Disgust
Con	<b>1.335**</b>	<b>0.063***</b>	<b>3.759**</b>	<b>-1.74**</b>	<b>0.461*</b>
Outbreak	-0.267	-0.113	<b>0.126*</b>	<b>0.254*</b>	<b>0.114*</b>
Climax	-0.101	-0.104	0.035	0.156	0.026
Calm	-0.067	-0.043	-0.03	-0.069	0.07
Video	<b>0.002*</b>	<b>0.052**</b>	0.008	-0.005	-0.081
Picture	-0.005	<b>0.044*</b>	<b>0.041*</b>	<b>0.063*</b>	0.036
Link	0.027	0.017	0.039	-0.058	<b>0.09***</b>
Topic	0.076	-0.092	<b>-0.153**</b>	0.023*	0.031
Original	<b>0.107**</b>	0.007	0.001	<b>0.023**</b>	<b>-0.033*</b>
Length	-0.007	-0.009	0.118	0.055	<b>0.071*</b>
Fans	0.043	0.012	-0.335	-0.017	-0.162
Retweets	0.094	0.026	0.036	0.017	0.038
Comments	<b>0.498*</b>	<b>0.574***</b>	<b>0.483**</b>	<b>0.656***</b>	<b>0.691***</b>
Content	—	—	—	—	—
Attitude	—	—	—	—	—
Ethos	<b>-0.361**</b>	<b>-0.259**</b>	<b>-0.035*</b>	0.095	-0.054
Pathos	<b>0.213***</b>	<b>-0.326**</b>	<b>-0.119**</b>	<b>0.097***</b>	<b>-0.179*</b>
Logos	<b>-0.401**</b>	<b>-0.129***</b>	<b>-0.102*</b>	0.089	<b>-0.15*</b>
$R^2$	0.464	0.424	0.532	0.703	0.595
<i>Adj R</i> <sup>2</sup>	0.402	0.357	0.477	0.668	0.549
N	165	165	165	165	165

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

For Model 2,  $R^2$  was adjusted to 0.357, indicating the influence of the GIR information disclosure on netizens' fear. The coefficients of the lingual forms based on character appeal, emotional appeal, and logic appeal were -0.259, -0.326, and -0.129 respectively, which indicates that these three forms can all reduce

the fear of netizens, and the emotional appeal-based lingual form has the greatest influence. Meanwhile, the coefficients of the pictures and videos in the GIR were positive, and passed the significance test, indicating that the GIR attached with pictures and videos are more likely to generate fear.

According to the regression analysis results of Model 3,  $R^2$  was adjusted to 0.477, indicating the influence of the GIR information disclosure on netizens' anger. The coefficients of the lingual forms based on character appeal, emotional appeal, and logic appeal were -0.035, -0.119, and -0.102, respectively, which indicates that these three forms can all reduce the anger of netizens. Among them, the emotional appeal-based lingual form has a greater dispelling effect on anger emotion, followed by the logic appeal-based language. In addition, the topic contained (“# #”) in the message can dispel the anger.

For Model 4,  $R^2$  was adjusted to 0.668, indicating the influence of the GIR information disclosure on netizens' sadness. The coefficient of emotional appeal-based lingual form was 0.097, which indicates that this form can easily lead to the sadness emotion of

netizens. Also, the pictures and original information in the GIR can easily cause the netizens to have sadness emotions.

For Model 5,  $R^2$  was adjusted to 0.549, indicating the influence of the GIR information disclosure on netizens' disgust. The coefficients of emotional appeal-based and logic appeal-based lingual forms were -0.179 and -0.15, which can dispel the disgust emotion of netizens. What's more, the GIR information with external links and more length will also cause netizens to have disgust. The original video will have a dispel effect on disgust.

According to the results of regression analysis, the authors concluded the influence of the GIR lingual form on the emotions of netizens and the verification of their hypotheses, as shown in Table 2.

Table 2  
Regression results of lingual forms on the netizens' emotions

Lingual Form	Happiness	Fear	Anger	Sadness	Disgust
Ethos	Negative	Negative (H1a support)	Negative (H1b support)	(H1c unsupported)	(H1d unsupported)
Pathos	Positive (H2e support)	Negative (H2a support)	Negative (H2b support)	Positive (H2c support)	Negative (H2d support)
Logos	Negative	Negative (H3a support)	Negative (H3b support)	(H3c unsupported)	Negative (H3d support)

## 5. Case study

The outbreak of COVID-19 emergency in Wuhan in December 2019. @Wuhan has a strong influence in this emergency. From December 31, 2019 to January 19, 2020, @Wuhan published a total of 31 related reports, with an average of 1.9 per day. This paper selected the influential government affairs micro-blogs and corresponding comments from Dec 30, 2019 to Feb 14, 2020, with a total of 116 government affairs micro-blogs messages and 14,682 pieces of corresponding comment data, altogether a total of 5,733 popular comments.

In the initial stage (from Dec 30, 2019 to Jan 20, 2020), the GIR was limited, and the early warning was delayed. Moreover, netizens pay less attention to the epidemic data, and the comments are mainly about like, fear, disgust and no emotion. Netizens are temporarily neither happy nor angry. According to the emotional analysis data, this paper calculates the daily proportion of various emotions as well as the emotion changes in the proportion of preference, fear, aversion and no emotion (shown in Fig.3).

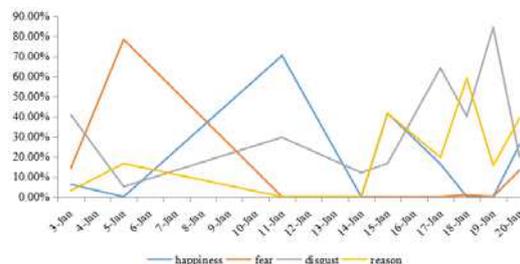


Fig.3. Emotional changes at the beginning of the outbreak

From Fig.3, it can be seen that on Jan 3th, netizens' feelings of disgust, sadness and fear were relatively high, mainly because "@Pingan Wuhan" claimed that 8 rumor mongers had been punished according to law, and netizens were disgusted with 8 rumor mongers. On Jan 5th, Wuhan Health Commission reported 59 cases of "viral pneumonia of unknown cause", without obvious human-to-human transmission or medical infection. The netizens' fear emotions increased, while the proportion of disgust and sadness emotions decreased. At the same time, some netizens gave emotionless rational suggestions such as "remember to wear a mask".

From January 6 to 10, Wuhan Health Commission had no announcement. On January 11, Wuhan Health Commission reported 41 cases of COVID-19, saying

that there were no new infected patients after January 3, and no obvious human-to-human transmission or medical infection was found. Netizens' feelings of "liking" increased, indicating that they approve of government work and at the same time fear feeling decreased, but about 20% expressed disgust and questioned the authenticity of the figures released by the Commission. On Jan 14, Wuhan Health Commission announced no new COVID-19, saying that no clear human-to-human transmission has been found, and limited human-to-human transmission has not been excluded, and the proportion of sadness among netizens has increased.

From January 15 to 17, Wuhan Health Commission reported no new COVID-19 cases for three consecutive days, but the proportion of netizens' "disgust" still gradually increased. On January 17, the proportion of netizens' disgust reached its first peak, with their believing that the government did not release information in time. On January 18, Wuhan Health Commission reported 4 new cases of COVID-19, and then another new cases of COVID-19 were reported on the same day. Experts explained that the initial impression of this outbreak is that the COVID-19 is not contagious, but the proportion of netizens' disgust has reached a peak with about 80% of them questioning the data. On January 20, the State Council included the COVID-19 into the statutory infectious disease, and at the same time Zhong Nanshan confirmed that the new coronavirus can spread "from person to person" through the CCTV news. The same day, Wuhan Health Commission reported a total of 136 new cases of COVID-19 within two days with netizens' concern reaching a peak. As a result of relevant measures taken by the State, netizens' dislike has decreased and their preference has increased. However, netizens' fear has also increased, with about 40% of them giving rational suggestions.

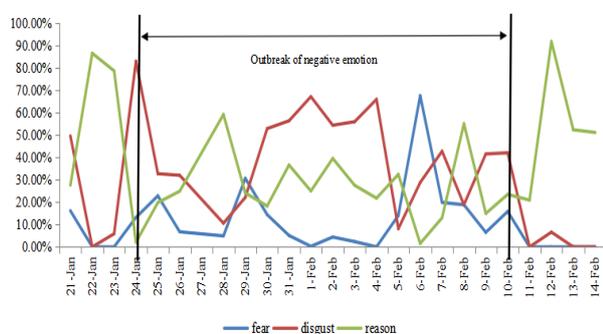


Fig.4. Emotional changes during the outbreak development period

During the outbreak development period (From January 21 to February 13), anger, disgust and no emotion accounted for the largest proportion of netizens' emotions accounting for 91.19%. Fig.4 shows the changes in the proportion of the above emotions during the outbreak development period.

After January 20, the government micro-blog release increased significantly, and the more corresponding measures were constantly introduced. On January 21, Hubei province start the secondary emergency response for public emergencies. The same day, Hubei Health Commission announced 105 new cases in the province. On the early morning of 2.39 am, January 23, @ Wuhan announced the news of blockading the Wuhan city. Due to the strong emergency measures, the proportion of netizens' disgust and anger has dropped rapidly. From January 24 to February 10, @Wuhan was deeply trapped in the vortex of public opinion. Most netizens had higher proportion of negative emotions such as anger and disgust to @Wuhan.

### 5.1. Analysis of @Wuhan content features

By reference to the content classification method of Ebola outbreak, the study divided content type into the following categories: data report, epidemic situation, prevention and control measures, research progress and science popularization, rumour refuting, summary and reflection, charity and voluntary behavior, medical workers' moving story, others, labeling 116 government micro-blog information types.

At the initial stage of the event (from December 31, 2019 to January 20, 2020), @Wuhan released a total of 41 pieces of information, including 8 pieces of information on scientific research progress and popular science, 9 pieces of information on prevention and control measures, 8 pieces of notifications, 14 pieces of information on the current situation of the COVID-19, and 2 pieces of information on refuting rumors. Compared with an average of 68.08 messages per day after January 21, less information was released in the early stage and had less impact.

In the case of public health emergencies, the government needs to release epidemic data timely. The academic world generally believes that transparent and open data can help the public correctly understand public health events, curb the spread of rumors or false information, avoid social panic, and help to establish feasible prevention mechanisms. At the early stage, only 8 pieces of notifications, 14

pieces of information on the current situation of the COVID-19 were released. During the period, the authorities successively gave public "reassurance pills" (Information that can soothes people's nerves, for example, on January 11, Wuhan Health Commission reported 41 cases of COVID-19, saying that there were no new infected patients after January 3, and no obvious human-to-human transmission or medical infection was found). However the government did not have further information disclosure, netizens' attention is relatively low and their dislike feeling is increasing.

On January 13, 2020, a total of 14,840 new cases were diagnosed in Hubei. The public did not have much concern about the data, and the proportion of favorite feelings even increased. During the period, there were less scientific research progress and popular science information, which did not function as an early warning role. The best way to avoid public panic is to popularize the knowledge of epidemic prevention. Only one popular science message was released before January 19, during which netizens' fear increased.

During the development period (from January 21, 2020 to February 13, 2020), @Wuhan had insufficient response to major negative public opinions, too little information on prevention and control measures, and too many touching deeds of charity, voluntary behavior and medical care, but with little influence.

From January 26 to February 10th, the proportion of aversion feelings among netizens continued to remain high. After analyzing the review it was found that netizens are not satisfied with the government response. During the period of disease development, some significant negative public opinion events were exposed, but the response of @ Wuhan did not respond timely and their priority is on the rumor refuting, which cannot reassure the users, and thus leads to negative emotions during this period.

Concerned with other GIR type at the same period, it was found that most of GIR focused on forwarding media charity and voluntary behavior and medical moving story. Disastrous accidents often cause public accountability, which in turn lead to anger and resentment. From the perspective of public opinion management, it is not conducive to social stability and the government image. The emotional guidance and disciplining has become an important part of government work in terms of public opinion guide. Through we-media or other means, netizens are exposed to many touching stories about the fight against epidemic, while they pay little attention to the front line stories of the fight against epidemic

forwarded by the government micro-blog. Thus there were less comments, less forwarding, and less impact. At present, there are few information about the data notification, the epidemic status and prevention and control measures released by @Wuhan. In the later period, government micro-blogs should focus on public information, thoroughly publicize major decisions and arrangements of the CPC central committee, and fully report the effectiveness of joint prevention and control measures of various regions and departments.

The refutation of rumors in this case cannot effectively alleviate the negative emotions of netizens. In all 1801 related pieces of information, the keyword # micro-blog rumor refuting# was searched, and a total of 72 refuting rumors were obtained. According to the number of forwarding, comments and thumb up, 7 refuting rumors with great influence were found. Emotional analysis was conducted on the popular comments, which shows most netizens were skeptical about the rumor refuting information issued by the government micro-blog. And disgust emotions accounted for the highest proportion.

@Wuhan tends to be positive on the whole, but lacking of summary and reflection. In all samples, articles with a positive attitude account for the majority, seven times as many as those with a negative attitude. Reports with strong positive emotions frequently appeared, but there is short of revealing, questioning and reflecting on the existing problems. After the outbreak, on January 28th, the Supreme People's Court rectified the wrong doing of the government on punishing the eight rumor mongers. February 11, Zhong said "Wen-liang Li is a hero". @Wuhan only reposted @pinging Wuhan on January 29, saying that "the Public Security Bureau (PSB) has carried on the education to eight rumor mongers, while the warning, a fine or detention punishment had not been given." No further comment was made. After the news of Li Wenliang's death was disseminated on February 6, the proportion of "anger" and "sadness" among netizens increased rapidly. Netizens urged the government and the PSB to apologize, but neither the two departments gave any response on that.

## 5.2. Analysis of @Wuhan lingual forms

In the early stage of the epidemic, 41 pieces of information were classified according to the lingual forms. A total of 9 pieces of information were in the form of "character appeal", 9 pieces of information were in the form of "emotional appeal", and 23 pieces

of information were in the form of "logic appeal". In the initial stage, there were too little information concerned with the government's comments. The attitudes changed from "no evidence of human-to-human transmission, no infection of medical staff" to "unexplained viral pneumonia was preventable and controllable", and to "not ruling out the possibility of limited human-to-human transmission". The attitude change gradually gave rise to netizens' alert and disgust, and finally the aversion was rising at the beginning of the epidemic. In the early development of the epidemic, it can be found that information release tone is rigid, which cannot effectively channel the netizens' mood.

During the development period, @Wuhan forwarded most of the information from other media, and did not express its attitude in persuasive and informing language (character appeal-based). Most of government micro-blog forwarded charity and voluntary deeds and medical moving stories. In all relevant 1801 pieces of information, the themes of all the 664 pieces of information are concerned with "Wuhan anti-epidemic line", "Wuhan will win", "Wuhan, we are together", "Wuhan stays strong", "Wuhan holds on", etc. Basically all are in the form of emotional language to spread the positive energy. Because of the homogeneity with other media, there were less netizens' thumb up, forward, comment, so the influence is small.

## 6. Conclusion

By using content analysis and regression analysis, this paper analyzed the content features of GIR and the influence mechanism of lingual forms on netizens' emotions, and made a case analysis based on the COVID-19 emergency in Wuhan. The results show that: (1) The event progress information issued by GIR tends to generate negative emotions such as anger, sadness and disgust; Refuting rumors can reduce netizens' sadness, but it is also positively correlated with "disgust", indicating that refuting rumors may increase netizens' disgust. (2) The positive attitude released by GIR can stimulate netizens' "likes" and relieve their "fears" and "dislikes". And the neutral information can increase netizens' "fear" emotion. While the negative information can stimulate "anger" and relieve "fear" and "sadness". (3) The use of character appeal-based lingual form has a dispelling effect on negative emotions like "anger" and "fear", that is, it can dispel netizens' negative emotions and

improve the proportion of rational emotions. While The emotional appeal-based form can help eliminate negative emotions such as fear, anger and disgust, and increase the proportion of "sadness" and "preference". The use of the logic appeal-based lingual form has a good dispelling effect on netizens' negative emotions such as "fear", "anger" and "disgust", could promote netizens to be rational, but it will reduce the goodwill of netizens to government agencies.

## Abbreviations

COVID-19: Corona Virus Disease 2019; GIR: Government Information Release; CCTV: China Central Television; NLPPIR: Natural Language Processing & Information Retrieval Sharing Platform

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None

## Authors' contributions

zhu and zhang Wei conceived the idea and developed the empirical analysis. Wen wrote the background, methodology and empirical results. Zhang mei developed the validation model and wrote the validation section. Zhu, Wen, and Qin reviewed the manuscript and made intellectual input. All authors read and approved the final manuscript.

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## Availability of data and materials

The data used in this study are crawled from Sina Microblog--the social media platform ([www.weibo.com/](http://www.weibo.com/)). It is publicly available for all.

## Ethics approval and consent to participate

This was an observational study using social media data from public platform. It is publicly available for all.

## Consent for publication

Not applicable

### Competing interests

The authors declare no conflict of interest.

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# Figures

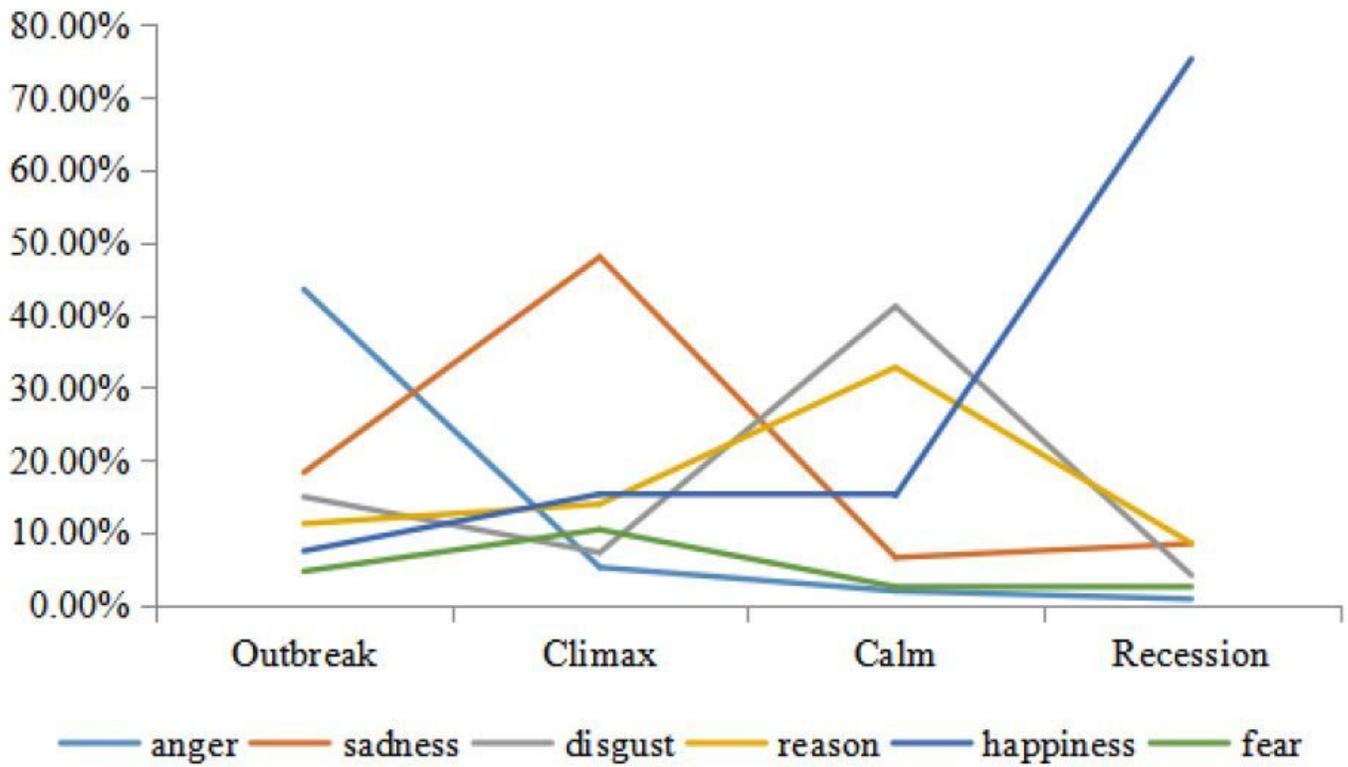


Figure 1

Emotional changes in various periods.

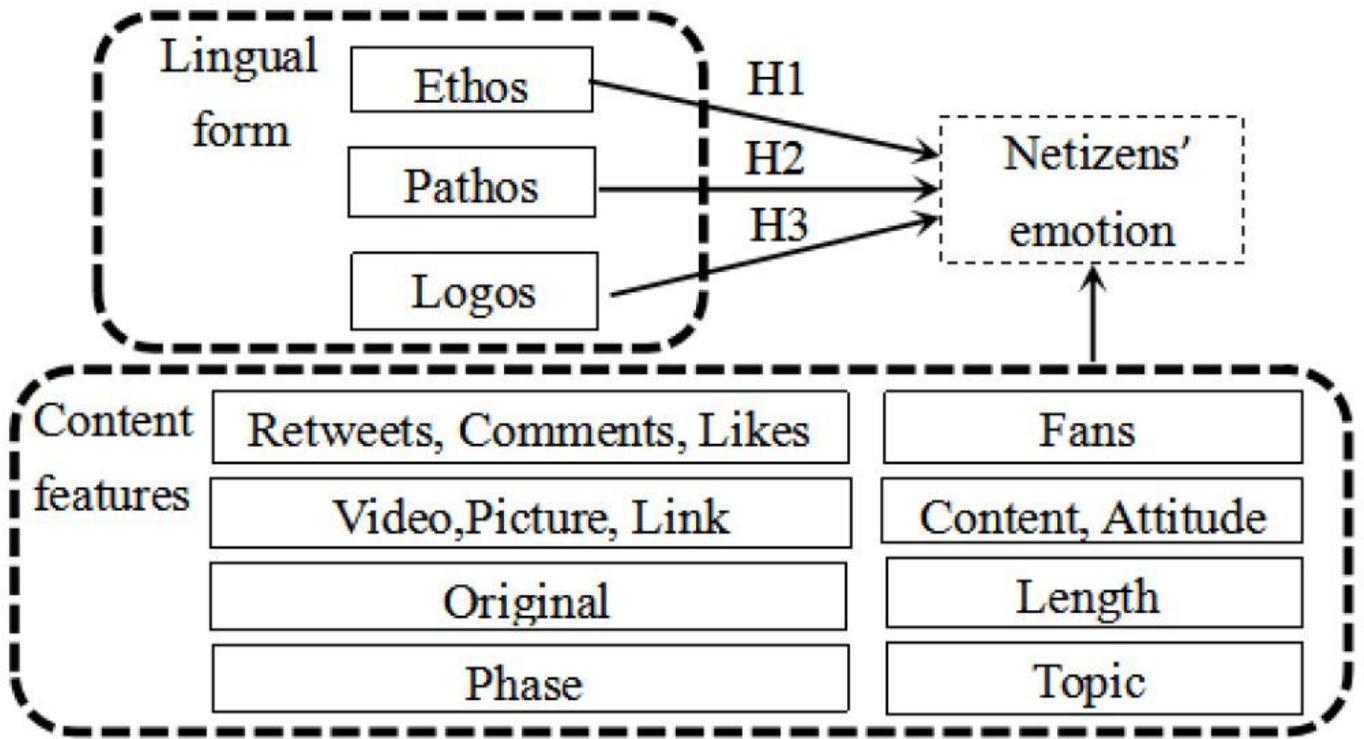


Figure 2

Conceptual model

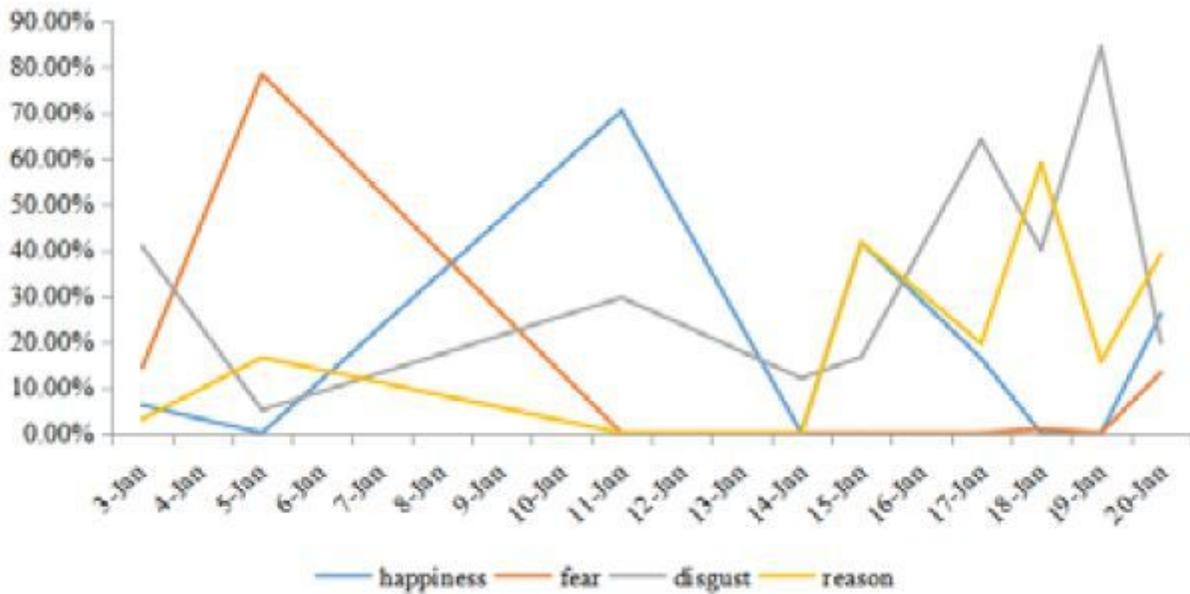
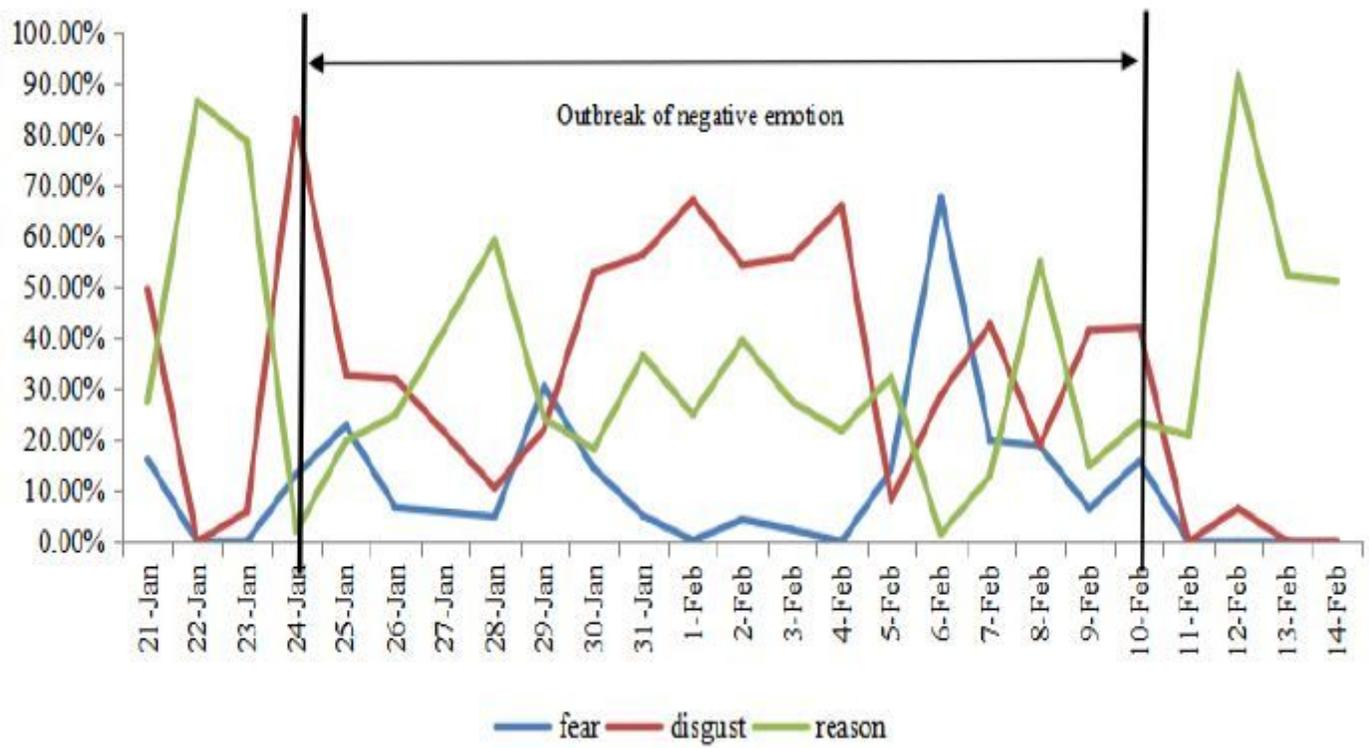


Figure 3

Emotional changes at the beginning of the outbreak



**Figure 4**

Emotional changes during the outbreak development period