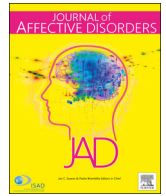




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Research paper

Emotional “inflection point” in public health emergencies with the 2019 new coronavirus pneumonia (NCP) in China



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ABSTRACT

Background: The outbreak of the new coronavirus pneumonia (NCP) in Wuhan, Hubei, has caused very serious consequences and severely affected people's lives and mental health. The outbreak will cause bad emotions such as tension, anxiety, fear, and so on. College students who have returned home from school face infection, isolation, and delay in starting school, and thus, their emotional stress should be observed.

Methods: This study used self-designed questionnaires and artificial intelligence (AI) to assess and analyze the emotional state of over 30,000 college students during the outbreak period in January (T1) and home quarantine in February (T2). This survey used online questionnaire (www.wjx.cn) to investigate the emotion information of college students.

Results: In the T1 survey, the “Typhoon Eye Effect” appeared. College students in Hubei are calmer than those outside Hubei in T1. However, in T2, an emotional “infection point” appeared, there was an “Exposure Effect”, the negative emotions of students in Hubei largely increased and became higher than students outside Hubei.

Conclusion: This survey found that there is an emotional “infection point” in February among college students, especially in the Hubei area. College students in Hubei are calmer than those outside Hubei in T1. In contrast, college students in Hubei were more nervous and scared than those outside Hubei in T2. This epidemic has caused the students to experience significant pressure and negative emotions. Therefore, universities and society should pay attention to their emotional adjustment, there are some suggestions such as establish the mental health organizations, test students' emotion status regularly.

1. Introduction

Since December 2019, there has been a large-scale outbreak of new coronavirus pneumonia (NCP) in Wuhan (Chen et al., 2020). Patients

with pneumonia have been diagnosed in all 34 provincial administrative regions (Huang et al., 2020). The scale and severity of the pneumonia outbreak caused many cities, including Wuhan (Lupia et al., 2020), to close, especially the prefecture-level cities in Hubei Province

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(Kai and Jon, 2020). This public health emergency made Wuhan, Hubei, China the focus of the world (Wilson and Chen, 2020). On February 11, 2020, the World Health Organization (WHO) proposed naming the new coronavirus COVID-19; and on February 8 (Team, 2020), the Chinese State Council announced that the new Coronavirus-infected pneumonia was temporarily named "Novel coronavirus pneumonia", or NCP for short.

Public health emergencies are major infectious disease outbreaks that cause or are likely to cause serious damage to and affect public health, including mass unexplained diseases, major food and occupational poisoning, and other events. Infectious diseases have become one of the major global public health threats in the 21st century (WHO, 2007). Emergencies are divided into four levels in China according to the severity of the event, and this new coronavirus pneumonia belongs to the particularly significant level I. The last public health emergency in China was SARS in 2003 (Chen et al., 2020). The SARS epidemic of 2003 spread rapidly to over 30 countries with more than 8000 reported cases, resulting in 774 deaths worldwide (WHO, 2005). However, the current pneumonia outbreak is even more severe than that of SARS in 2003 (Riou and Althaus, 2020). Compared with other diseases, COVID-19 has a longer incubation period, is more prone to mutation, has a wider spread, and is more infectious, it will cause more serious physical and mental problems. Fortunately, our experience with SARS has provided valuable information about how to make a rapid response (Wenshe et al., 2020). China has moved quickly to contain the outbreak (Pan et al., 2020). Live animal markets throughout the country have been suspended (Khan, 2020). Previous studies showed that public events would devastate communities in terms of lives and property, and they are difficult to recover from without outside help. For example, a study of PTSD after earthquake over half of people exhibited internalizing problems requiring clinical intervention (Jang et al., 2020). Another study showed that the exposure to an outbreak of a severe infectious disease can, like other disaster exposures; lead not only to PTSD but also to other psychiatric conditions, such as alcohol abuse/dependence (Wu et al., 2008). Other studies also revealed that the residents in high disaster-prevalent regions consistently developed more intense symptoms of intrusion, and avoidance (Lee et al., 2006). In previous studies, many researchers have studied the psychological state of people after the SARS epidemic, such as the psychological stress of the medical staff after SARS (Feng et al., 2020; Lee et al., 2005) and COVID-19 (Wu et al., 2020). Raphael et al. (1980) documented that rescue workers often suffer from psychiatric and posttraumatic distress. A study of the long-term psychiatric morbidities among SARS survivors by Mak (Mak et al., 2009) revealed that PTSD was the most prevalent long-term psychiatric condition. PTSD refers to individuals who have experienced, witnessed, or encountered one or more actual deaths involving themselves or others; who are threatened with death or severely injured; or whose physical integrity is threatened, resulting in delayed appearing and persistent mental disorders (Kashdan et al., 2006). Some scholars (Andreski et al., 1998; North et al., 2004) have perceived that pain severity was a factor associated with PTSD at 30 months post-SARS, which is consistent with previous disaster studies. Another significant factor currently associated with PTSD is the Functional Impairment Checklist disability score. It was shown that the disability score was a stronger predictor for chronic PTSD compared with the symptoms score, which measures subjective lung function and fatigability (Mak et al., 2010). In the follow-up research on the psychological stress of college students in the future, these two methods can be used. The 2019-nCoV infection caused clusters of severe respiratory illness similar to severe acute respiratory syndrome coronavirus and was associated with ICU admissions and high mortality (Huang et al., 2020). The researcher Chew found that forty-one percent had scores indicative of a posttraumatic stress disorder (PTSD) after SARS; about 30% had likely anxiety and depression (Chew et al., 2006). Therefore, we need to pay more attention to the PTSD caused by public health emergencies.

Emotion is a collective term for a series of subjective cognitive experiences, and it refers to a person's attitude and experience towards objective things and corresponding behavioral responses. Public events will influence emotions, a previous research found that participants were exposed to unprecedented horror following the Indian Ocean tsunami in Khao Lak, Thailand (Sattler et al., 2014). In addition, some researchers studied adolescent emotion status following 2013 Boston Marathon terrorist, which demonstrate that adolescents who engaged in catastrophizing had greater PTSD symptoms postattack, with more tension and depression (Jenness et al., 2016). Although emotion is a subjective psychological reaction, it often affects people's external performance and people's cognition. Sylvie and Warren (2007) said "The emotional valence of experience is thought to distort our subjective sense of time". In contemporary society, people are under great pressure, and crises such as this new coronavirus pneumonia are prone to cause psychological stress (Kjaer et al., 2004). Some researchers (Obergruesser and Stoeger, 2020) found that joy or boredom can affect students' learning strategies to a certain extent. Therefore, this study takes the emotional reactions of college students in the face of public health emergencies as the research content, and discusses their emotional states, degree of response, emotional responses, and self-regulation to give relevant suggestions.

In this survey, college students are selected as the research samples. As of the end of 2018, Wuhan has 84 ordinary colleges and universities, which makes it the capital city with the largest number of colleges and universities in China and the largest number of students in the world. The college students surveyed in this survey will be the mainstay of society in the future. Their mental health is the focus of our attention, and it deserves the attention of society. In addition, young people (aged 15–29 years) are more susceptible to outside influence (Li et al., 2020), which will cause more emotion changes. At the same time, the working forms and methods of mental health education is weak, which causes the emerging problems of mental health that college students have been confronted (Li, 2020). Prior to this study, a number of scholars have investigated the social stress responses after a public crisis event, but their research samples of college students were very small; therefore, this investigation is necessary.

In past research, researchers have discovered a very special phenomenon of regional perceived risk: Typhoon Eye Effect (Gilovich et al., 2000), which is when the recognition of risk events by groups at the center of risk events is lower than the perceived risk of the surrounding areas. Domestic researchers have made similar findings on the public's perceived risk during the SARS period. Chinese researchers found that people's risk awareness and psychological stress during the peak period of SARS were lower than those during the low peak period. And there is another "exposure effect", which means that as the epidemic became worse, residents at the center of epidemic exposed a more severe negative emotion.

According to the theory of the "typhoon eye effect" and "exposure effect", we can suppose that there is an emotional "infection point" among college students in the Hubei area, it refers to an emotion change among college students (Negative emotion: Hubei is lower than outside Hubei in T1, Hubei is higher than outside Hubei in T2.)

2. Methods

2.1. Samples of participants

In the second week after Wuhan was closed, that is, January 29–30, 2020, a total of 17,935 people filled out the questionnaire, of which 47.99% were located in Hubei Province ($n = 8607$, age 19.56 ± 1.79 , 54.19% female) and 52.01% were located outside Hubei Province ($n = 9328$, age: 19.98 ± 2.05 , 58.55% female). In the fourth week, February 17–18, 2020, 16,428 people around the country filled out the questionnaire. Among them, 54.03% were in Hubei Province at that time ($n = 8876$, age: 20.99 ± 2.19 , 57.59% female), and 45.97% were

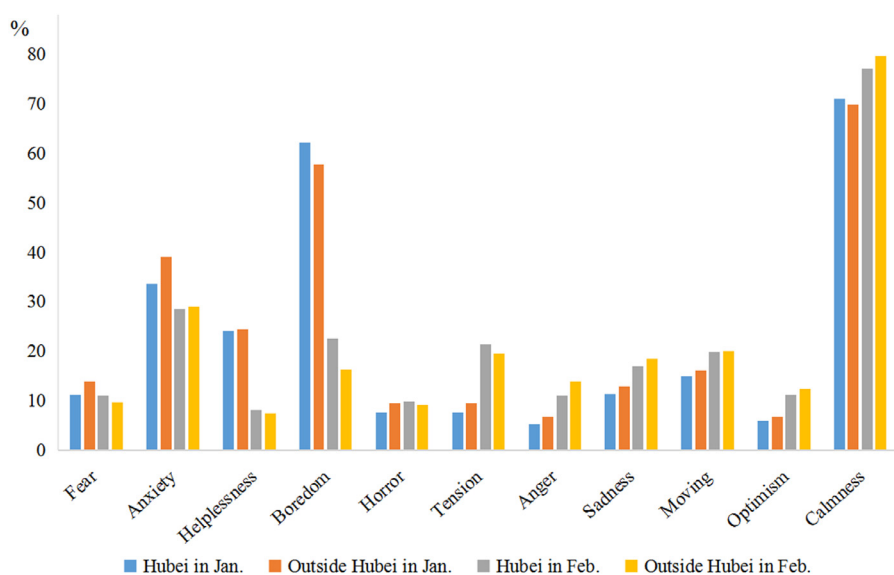


Fig. 1. Emotional comparison between T1 and T2.

outside Hubei Province ($n = 7562$, age: 20.02 ± 2.85 , 57.23% female).

2.2. Procedures

The study was designed in accordance with the tenets of the Declaration of Helsinki. Approval from the ethical authority of the School of Educational Science, Huazhong University of Science and Technology was granted. Confidentiality was ensured by assigning anonymous codes to the self-reported questionnaires, and participants signed a statement confirming informed consent. This survey used online questionnaire (www.wjx.cn) to investigate the emotion information of college students in T1 and T2. We distributed questionnaires online through Wechat, QQ, and Sina microblog. Participants provided informed consent, then provided socio-demographic information and completed measures of emotion.

2.3. Measures

Two surveys utilized the same questionnaires. We used a self-designed questionnaire to collect emotional state data. Socio-demographic information included: age, gender, marital status, education level, and physical conditions (Whether be infected with the NCP). The measurement questions included two dimensions: 1. emotional status in recent week, it consisted of the following question: *What's your major emotion in the recent week?* The options included *calmness, tension, anger, fear, horror, boredom, anxiety, etc.* 2. The reason why cause this emotion, it consisted of the following questions: *Face the epidemic, what worries you most? What scares you most?*

2.4. Statistical analyses

The statistical analyses were performed using SPSS 20.0 for Windows (SPSS Inc., Chicago, Illinois). The statistical methods and data analysis results are described in detail as follows. As for the survey used the online questionnaire (www.wjx.cn), we can choose to refuse any empty questions during the questionnaire preparation, so the survey can ensure that each questionnaire collected is valid. Moreover, we utilized artificial intelligence (AI) technology to count the data of 34 provinces, import the averages and percentages of variables in T1 and T2, and Python to export the maps of statistic automatically.

3. Results

3.1. Results of the T1 survey

In the T1 survey on emotional states, the descriptive analysis of SPSS revealed that the emotional states of most students was calm, which indicates that most students can maintain a relatively calm state of mind in the face of sudden epidemic situations without excessive panic. Then the Chi Square Test found that in T1, college students in Hubei Province were significantly calmer than students outside Hubei Province (percentage: $0.71 > 0.70$, $p < 0.05$). At the same time, the percentage of variable "bored" of students in Hubei Province was also significantly higher than students outside Hubei Province ($0.62 > 0.58$, $p < 0.001$). It was found in the investigation that the students in the most serious epidemic area, Hubei, were more bored and calmer than those outside Hubei. However, other negative emotions exist among college students outside Hubei, such as horror ($0.10 > 0.08$, $p < 0.001$), fear ($0.14 > 0.11$, $p < 0.001$), anxiety ($0.39 > 0.34$, $p < 0.001$), tension ($0.22 > 0.18$, $p < 0.001$), anger ($0.07 > 0.05$, $p < 0.001$), sadness ($0.13 > 0.11$, $p < 0.01$), moving ($0.16 > 0.15$, $p < 0.05$) and optimism ($0.07 > 0.06$, $p < 0.05$), which are significantly at higher levels than those of the students in Hubei. It indicated that students outside Hubei Province are more sensitive to the epidemic in T1, and they are under greater psychological pressure and negative emotions than students from Hubei Province. This is the Typhoon Eye Effect of disaster psychology. The subjects in the most serious epidemic areas had lower anxiety levels than those in the peripheral epidemic areas (Fig. 1), which is correspond to the hypothesis.

In addition, more than half of the college students are bored. A considerable number of students (36.25%) also expressed their concern. They were most worried about the following: newly diagnosed and suspected cases (69.38%), a shortage of medical supplies (67.03%), and infected persons who were not isolated (64.7%). About one-third of the students have large negative emotions and need active guidance and care.

3.2. Results of the T2 survey

Using the same Chi Square Test to analyze the data of T2, we found that the results were reversed. In T2, the students in Hubei Province had significantly higher levels of horror ($0.10 > 0.09$, $p < 0.05$), nervousness ($0.21 > 0.20$, $p < 0.01$), and fear ($0.11 > 0.10$, $p < 0.01$) than those outside Hubei. The positive emotions of students in Hubei,

such as calmness ($0.77 < 0.80, p < 0.001$) and optimism ($0.11 < 0.12, p < 0.05$), are significantly lower than those of college students outside Hubei. The negative emotions easily generated by bystanders such as anger ($0.11 < 0.14, p < 0.001$) and sadness ($0.17 < 0.19, p < 0.01$) are significantly lower than outside Hubei Province. From these data, it indicated that during the period of home isolation, college students in Hubei Province showed more negative emotions due to their long-term exposure to the epidemic. This is called the "Exposure Effect", the multi-view effect, (simple) Exposure Effect, (pure) contact effect, etc.

3.3. The comparison between T1 and T2 in emotional reactions

From the comparison of the results of the T1 and T2 sentiment surveys through Chi Square Test, we can see that fear ($0.12 > 0.11, p < 0.01$), anxiety ($0.35 > 0.31, p < 0.001$), tension ($0.21 > 0.20, p < 0.05$), anger ($0.10 > 0.08, p < 0.001$), sadness ($0.15 > 0.14, p < 0.001$), helplessness ($0.18 > 0.17, p < 0.05$) increased significantly. However, boredom decreased significantly ($0.39 < 0.42, p < 0.001$).

To contrast emotion changes between T1 and T2, we used artificial intelligence (AI) technology to calculate the data of the 34 provinces, autonomous regions, municipalities around the country, and the Hong Kong and Macao special administrative regions regarding tension (Fig. 2), anxiety (Fig. 3) and optimism (Fig. 4).

4. Discussion

4.1. "Typhoon eye effect" of emotions in T1

In the T1 survey, college students in Hubei were more optimistic than those outside Hubei, the "Typhoon Eye Effect" appeared, the students in Hubei did not realize the severity of the epidemic and felt that the virus was far away from them (Zheng et al., 2015). The Hubei Provincial Government did not take strong measures in time (Zhang et al., 2020). The information received by people is not symmetrical with the facts, it will cause greater panic later (Forsell et al., 2019). This sent a false signal to the people: this new disease is not serious and can be prevented and controlled. Thus, the true situation of the epidemic was concealed. Furthermore, the students outside the province appeared to be more panicked due to the asymmetry of information, and the media reported that the epidemic was very serious. In addition, humans by nature are more sensitive to dangerous atmospheres, Fear can activate long-term memory, and people can remember bad things for longer (Rafiq et al., 2020), so psychological negative emotions, such as tension, fear, anxiety, and horror are generated. Therefore, the emotional responses of students outside Hubei Province are stronger. The T1 survey results also showed that more than half of college students are bored. This may be caused by the outbreak

and having to stay at home while quarantined, but to some extent, it also exposes the problems that college students are incapable of organizing their own time and that their daily lives are relatively empty (MacCann et al., 2012).

4.2. The "Exposure effect" of emotions in T2

However, regarding the "Emotion Map" in T2, some negative emotions' distributions were reversed and there was an "Exposure Effect". Negative emotions such as fear, horror, and tension among the students in Hubei Province started to increase. The negative emotions of college students in Hubei exposed because they were in it, the one near the disaster were prone to be in panic (Derrick et al., 2019; Johnson et al., 2018). While the negative emotions except anger and sadness of the participants outside Hubei Province began to decline. This is because after T2, the central government set up an investigation team to go to Wuhan to discover the truth for the public. Meanwhile, anger and sadness of students in T2 increased, these emotion usually appear on bystanders (Buttelmann and Buttelmann, 2017). Only then did the public realize that the number of confirmed cases had skyrocketed, and that students in Hubei had gradually realized the severity of the outbreak. People in the hardest hit area of the epidemic started thinking seriously about the dangers they may be facing, they became more nervous and scared than before (Birstein and Gusky, 2020). Due to the outbreak of the epidemic, coupled with the restrictions on medical treatment in Wuhan, many confirmed diagnoses and suspected cases were not counted, the citizens were in danger (Gao et al., 2020). A large number of cases were cleared on February 13, and more than 10,000 new cases were exposed on that one day. In particular, the media frequently reported the news of the deaths of the frontline medical staff, which made students in the severely affected areas no longer dare to despise the epidemic, and they became more nervous and fearful. After the state put forward protective measures requiring home isolation for fourteen days, cutting off transportation, banning group activities, and installing roadblocks in urban villages, these measures have created intense tension among the people living in groups. There is also the stress symptom of "seeming as being infected" caused by too much browsing of the relevant news every day, which directly affects the emotions of students, they became more sensible and anxious to disease, this is a mental tension (Peng et al., 2019). In particular, they see the resumption of work in various places and the resumption of classes in other areas being just around the corner, but the resumption of classes in Hubei universities is far away, which makes students of Hubei universities feel anxious. Most importantly, students in Hubei's hardest-hit areas still have many difficulties. For example, living resources are scarce, and medical resources and health protection still have problems. In addition, from time to time, unbelievable false news becomes

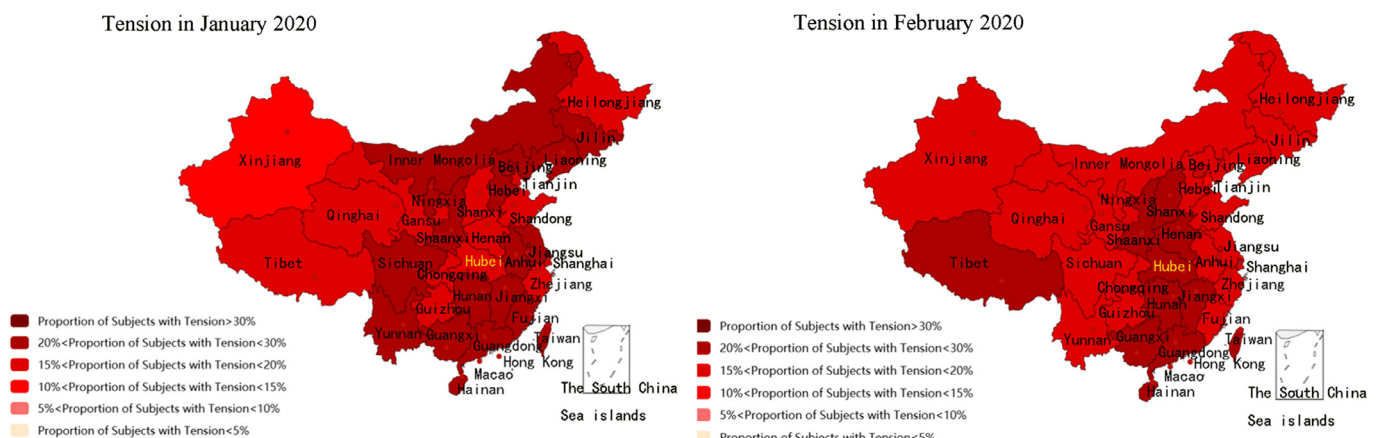


Fig. 2. Map of tension in T1 and T2.

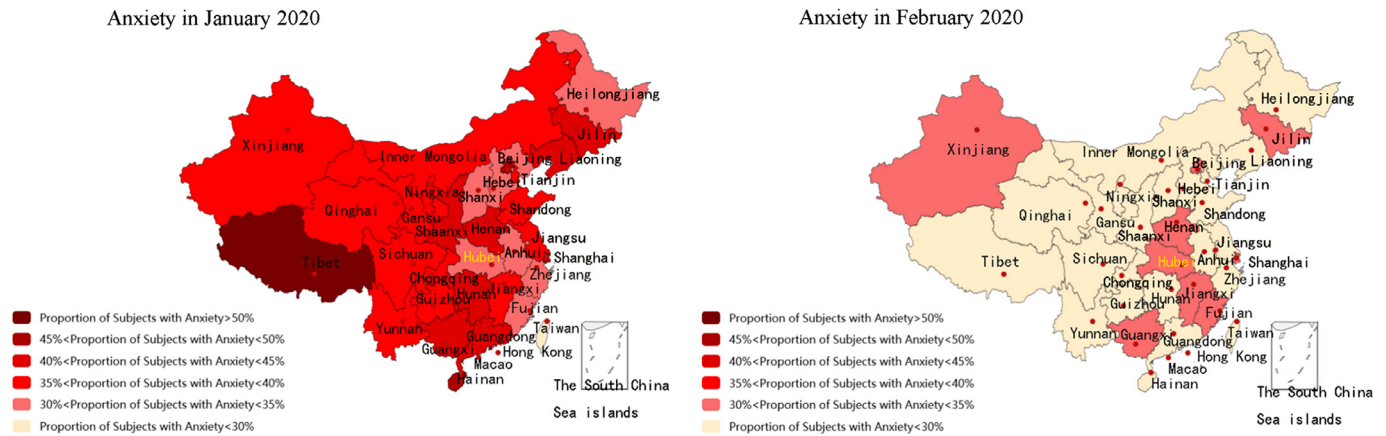


Fig. 3. Map of anxiety in T1 and T2.

popular, severely disturbing the emotions of college students in Hubei who cannot distinguish between true and false and resulting in high levels of wide-ranging anxiety.

4.3. Emotional "inflection points"

This study have found an emotional inflection point during the outbreak of epidemic in February, this was an innovation, and full of value. We can seize the emotion changes to guarantee our mental health, which is valuable. After February 4, the number of confirmed cases around the country, except Hubei Province, continued to decline. By February 23, there had been no new confirmed cases in 24 provinces. In addition, the appearance of cured patients in February injected people with hope, and the number of cured patients increased. On February 22, more than 20,000 people were cured nationwide, which has increased people's confidence in fighting the epidemic. College students across the country have generally experienced a decline in the negative emotions such as fear, anxiety, helplessness, and boredom and a continuous rise in moving, optimistic, and calm emotions. However, the establishment of a large number of square-level hospitals, the fixed-point support of multiple medical teams across the country, the high number of confirmed patients in Hubei Province in T2, and the news of medical staff deaths cause the emotions of fear, tension, and sadness to constantly increase. In addition, some students said that because of the epidemic situation, some people discriminate against Hubei citizens, and the information was leaked, which made Hubei college students angry.

The survey also showed that in the description of students' recent

state, the word most frequently mentioned was "stress". The stressors include worrying about infecting family members, feelings of uncertainty, inadequate staffing levels (Taylor et al., 1999), the virulence of the disease and inappropriate equipment (Carolyn and Karen, 2003), personal danger, and nosocomial spread.

The severity of the new coronavirus pneumonia is self-evident. College students are full of anxiety and concerned about the epidemic. Although most students can maintain calm emotions in the face of such major public health events, the government and society still cannot ignore the groups with higher trauma exposure. In particular, students in the worst-hit areas, Hubei Province, have witnessed and experienced the epidemic every day, and even the relatives and friends around some students have been diagnosed. They need to intervene in advance in psychological crises, and their traumatic stress responses must be treated.

5. Suggestions

5.1. Reducing negative emotions through properly handling bad news

Since the outbreak of the epidemic, a lot of negative information about the epidemic has appeared on the Internet and even on many mobile phone software programs. We know that terrible information will bring pressure and worry to people and will affect people's emotions. So the way college students handle negative news is particularly important. Some researchers have found that people will usually want positive news rather than negative news (Alex and Stephen, 2004; Fredrickson et al., 2003). Though the current study has found that the

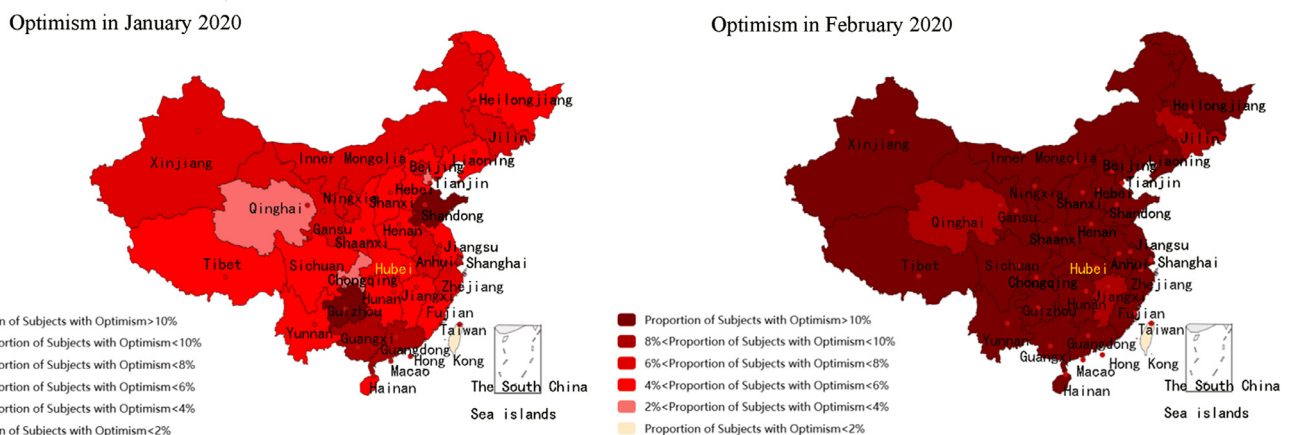


Fig. 4. Map of optimism in T1 and T2.

majority of college students could properly handle bad news, a part of students are irrational, we should pay attention to this group.

The researcher [Lyrakos et al. \(2014\)](#) has found that social events and education can reduce stress, worry and emotions. The outbreak area of this emergency was in Hubei Province, which is the hardest hit area. There are a large number of new cases every day. As things happen near them, students in the hardest hit area are more likely to feel fear and worry, especially when they did not return to their hometown in the New Year. Importance should be attached to whether students that are stranded at school can be guaranteed to be able to live normally. The government and universities should provide favor to students. We provide the following major suggestions. (1) Universities should set up psychological counseling hotlines to provide psychological counseling for students in the hardest hit areas. (2) Psychological protection teams should be set up in each community to regularly assess the psychological situations of students in the hardest hit area. (3) Students are recommended to strengthen their psychological construction, exercise more, maintain regular work and rest, and stabilize their emotions. Long-term health problems and the loss of function of students in the worst-hit areas may play an important role in forming PTSD ([Carr et al., 1997](#)). (4) People should talk and exercise when they are in a bad mood and seek intervention and other methods to guide them. (5) Officials should follow up on the psychological condition of the students in the severely affected area in a timely manner after the epidemic, and prepare necessary post-traumatic psychological stress treatment programs.

5.2. Reducing anxiety through time management and home learning

The outbreak of the new coronavirus pneumonia disrupted the original life and study plans of college students. This study has found that more than half of the students expressed that they were bored at home, which also exposed some problems to a certain extent, such as college students do not reasonably arrange their free time. If school or family education can teach students how to arrange their time independently and how to find their own interests and long-term development, this problem may be solved. They should use positive emotions to bounce back from negative emotional experiences ([Tugade and Fredrickson, 2004](#); [Veruska et al., 2013](#)).

Thus, we provide the following suggestions: (1) Cultivate students' core literacy, increase students' self-learning section, and enable students to learn to arrange their study time rationally; and (2) Cultivate students' personalized interests and hobbies, develop them in an all-round way, and guide students to persist in their hobbies for a long time.

5.3. Reducing negative emotions through emotional grooming and self-adjustment

Stress is an emotional response that may be caused by emergencies. In any biological disaster, themes of fear, uncertainty, and stigmatization are common and may act as barriers to appropriate medical and mental health interventions ([Xiang et al., 2020](#)). The number of confirmed cases increasing every day, urgent needs for medical supplies in major hospitals, and other negative news will bring pressure and negative emotions to college students. Stress and trauma research has traditionally focused on the negative sequelae of adversity ([Meyerson et al., 2011](#)). Therefore, letting students learn to relieve stress and find suitable channels is also what contemporary society and schools have to do.

The education department should add mental health courses at all levels of schools and educational institutions; organize group counseling once a week; and teach students how to properly treat their emotional problems, how to control themselves, and how to seek help if they cannot control it.

5.4. Grasp the emotional inflection point for psychological intervention

Through this survey, we know that there will be an emotional inflection point during public events, so the government and schools of all levels should emphasize students' mental health and grasp the emotional inflection point, to prevent mental diseases.

The government and schools should: (1) Pay attention to students' mental health regularly; (2) Contact with the group as a unit, communicate troubles, and timely report to schools. (3) Schools and families should communicate closely, and problems should be resolved in time.

6. Conclusion

This survey found that there is an emotional "infection point" in February among college students, especially in the Hubei area. College students in Hubei are calmer than those outside Hubei in T1. In contrast, college students in Hubei were more nervous and scared than those outside Hubei in T2. This epidemic has caused the students to experience significant pressure and negative emotions. Therefore, universities and society should pay attention to their emotional adjustment, there are some suggestions such as establish the mental health organizations, test students' emotion status regularly.

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CRediT authorship contribution statement

Yan Zhang: Conceptualization, Visualization, Funding acquisition. **Xiaochen Cao:** Formal analysis. **Pu Wang:** Conceptualization, Visualization. **Guixiang Wang:** Formal analysis. **Guanghui Lei:** Funding acquisition, Formal analysis. **Zhexing Shou:** Conceptualization, Visualization. **Simiao Xie:** Formal analysis. **Fei Huang:** Formal analysis. **Na Luo:** Formal analysis. **Mingyan Luo:** Formal analysis. **Yueran Bian:** Formal analysis. **Jingyuan Zhang:** Formal analysis. **Qiang Xiao:** Formal analysis.

Declaration of Competing Interest

This manuscript has not been published or presented elsewhere in part or in entirety. All study participants provided informed consent, and the study design was approved by the appropriate ethics review boards. All the authors have approved the manuscript and agree with submission to your esteemed journal. There are no conflicts of interest to declare. All authors have no conflict of interest.

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The study was designed in accordance with the tenets of the Declaration of Helsinki. Approval from the ethical authority of School of Educational Science, Huazhong University of Science and Technology was granted. Confidentiality and the statement confirming informed consent was managed by placing anonymous coding of one self-report questionnaires.

References

- Alex, L.P., Stephen, J., 2004. Positive change following trauma and adversity: a review. *J. Trauma Stress* 17 (1), 11–21.
- Andreski, P., Chilcoat, H., Breslau, N., 1998. Post-traumatic stress disorder and somatization symptoms: a prospective study. *Psychiatry Res.* 79 (2), 131–138.
- Birstein, E., Gusk, J., 2020. Treatment of panic disorder by trigeminal nerve manipulation: a case series. *J. Bodyw. Mov. Ther.* 24 (3), 161–164.
- Buttelmann, F., Buttelmann, D., 2017. The influence of a bystander agent's beliefs on children's and adults' decision-making process. *J. Exp. Child. Psychol.* 153, 126–139.
- Carolyn, F., Karen, B., 2003. Responding to the severe acute respiratory syndrome (SARS) outbreak: lessons learned in a Toronto emergency department. *J. Emerg. Nurs.* 29 (3), 222–228.
- Carr, V.J., Lewin, T.J., Webster, R.A., Kenardy, J.A., Hazell, P.L., Carter, G.L., 1997. Psychosocial sequelae of the 1989 Newcastle earthquake: II. Exposures and morbidity profiles during the first 2 years post-disaster. *Psychol. Med.* 27 (1), 167–178.
- Chen, Z., Zhang, W., Lu, Y., Guo, C., Guo, Z., Liao, C., 2020. From SARS-CoV to Wuhan 2019-nCoV Outbreak: Similarity of Early Epidemic and Prediction of Future Trends. *Chinese Medical Journal* 133 (9), 1112–1114.
- Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., Zhang, L., 2020. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet Respir. Dis.* 395 (10223), 507–513.
- Chew, W., Ng, A., Lee, L., Kwek, S., Ong, K., Leow, M., Kaw, G., 2006. Quality of life and psychological status in survivors of severe acute respiratory syndrome at 3 months postdischarge. *J. Psychosom. Res.* 60 (5), 513–519.
- Derrick, K., Green, T., Wand, T., 2019. Assessing and responding to anxiety and panic in the emergency department. *Australas. Emerg. Care* 22 (4), 216–220.
- Feng, Z.-h., Cheng, Y.-r., Chen, J., Ye, L., Zhou, M.-Y., Wang, M.-W., 2020. Chinese medical personnel against the 2019-nCoV. *J. Infect.* 80 (5), 578–601.
- Forsell, E., Kraepelin, M., Blom, K., Isacson, N., Jernelov, S., Svanborg, C., Kalso, V., 2019. Development of a very brief scale for detecting and measuring panic disorder using two items from the panic disorder severity scale-self report. *J. Affect. Disord.* 257, 615–622.
- Fredrickson, B.L., Tugade, M.M., Waugh, C.E., Larkin, G.R., 2003. What good are positive emotions in crises? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *J. Pers. Soc. Psychol.* 84 (2), 365–376.
- Gao, W., Veeresha, P., Baskonus, H.M., Prakasha, D.G., Kumar, P., 2020. A new study of unreported cases of 2019-nCoV epidemic outbreaks. *Chaos Solitons Fractals* 138, 109929.
- Gilovich, T., Medvec, V.H., Savitsky, K., 2000. The spotlight effect in social judgment: an egocentric bias in estimates of the salience of one's own actions and appearance. *J. Pers. Soc. Psychol.* 78 (2), 211–222.
- Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., Cao, B., 2020. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet N. Am. Ed.* 395 (10223), 497–506.
- Jang, M., Lee, S.-h., Kim, L.-j., 2020. Post-traumatic stress disorder and behavioral problems of parents and children after the 2015 Nepal earthquakes. *Int. J. Ment. Health* 49 (1), 3–16.
- Jenness, J.L., Jager, Kim, L.-j., 2020. Post-traumatic stress disorder and McLaughlin, K. A., 2016. Catastrophizing, rumination, and reappraisal prospectively predict adolescent PTSD symptom onset following a terrorist attack. *Depress. Anxiety* 33 (11), 1039–1047.
- Johnson, A.L., McLeish, A.C., Shear, P.K., Privitera, M., 2018. Panic and epilepsy in adults: a systematic review. *Epilepsy Behav.* 85, 115–119.
- Kai, K., Jon, C., 2020. Will novel virus go pandemic or be contained? *Science* 367 (6478), 610–611.
- Kashdan, T.B., Uswatte, G., Julian, T., 2006. Gratitude and hedonic and eudaimonic well-being in Vietnam war veterans. *Behav. Res. Ther.* 44 (2), 177–199.
- Khan, B.T., 2020. Coronavirus in China. *Lancet N. Am. Ed. Respir. Med.* 8 (3), 238
- Respiratory medicine.
- Lee, S.H., Juang, Y.Y., Su, Y.J., Lee, H.L., Lin, Y.H., Chao, C.C., 2005. Facing SARS: psychological impacts on SARS team nurses and psychiatric services in a Taiwan general hospital. *Gen. Hosp. Psychiatry* 27 (5), 352–358.
- Kjaer, F.A., Hanspeter, M., Ulrich, S., 2004. Does acute stress disorder predict post-traumatic stress disorder in traffic accident victims? Analysis of a self-report inventory. *Nord. J. Psychiatry* 58 (3), 223–229.
- Lee, T.M.C., Chi, I., Chung, L.W.M., Chou, K.-L., 2006. Ageing and psychological response during the post-SARS period. *Aging Ment. Health* 10 (3), 303–311.
- Li, J., 2020. Instructional research on mental health education for college students from the perspective of positive psychology. *Psychology* 11 (01), 49–53.
- Li, W., Dorstyn, D.S., Jarmon, E., 2020. Identifying suicide risk among college students: a systematic review. *Death Stud.* 44 (7), 450–458.
- Lupia, T., Scabini, S., Pinna, S.M., Perri, G.D., Rosa, F.G.D., Corcione, S., 2020. 2019-novel coronavirus outbreak: a new challenge. *J. Glob. Antimicrob. Resistance.* 21, 22–27.
- Lyrakos, G., Ypofandi, M., Chasapis, A., Aslani, E., Spinaris, V., 2014. EPA-1595 - Factors affecting negative emotions of depression, anxiety and stress in online social networking services. *Eur. Psychiatry* 29, 1.
- MacCann, C., Fogarty, G.J., Roberts, R.D., 2012. Strategies for success in education: time management is more important for part-time than full-time community college students. *Learn Individ. Differ.* 22 (5), 618–623.
- Mak, I.W.C., Chu, C.M., Pan, P.C., Yiu, M.G.C., Chan, V.L., 2009. Long-term psychiatric morbidities among SARS survivors. *Gen. Hosp. Psychiatry* 31 (4), 318–326.
- Mak, I.W.C., Chu, C.M., Pan, P.C., Yiu, M.G.C., Ho, S.C., Chan, V.L., 2010. Risk factors for chronic post-traumatic stress disorder (PTSD) in SARS survivors. *Gen. Hosp. Psychiatry* 32 (6), 590–598.
- Meyerson, D.A., Grant, K.E., Carter, J.S., Kilmer, R.P., 2011. Posttraumatic growth among children and adolescents: a systematic review. *Clin. Psychol. Rev.* 31 (6), 949–964.
- North, C.S., Kawasaki, A., Spitznagel, E.L., Hong, B.A., 2004. The course of PTSD, major depression, substance abuse, and somatization after a natural disaster. *J. Nerv. Ment. Dis.* 192 (12), 823–829.
- Obergriesser, S., Stoeger, H., 2020. Students' emotions of enjoyment and boredom and their use of cognitive learning strategies – How do they affect one another? *Learn. Instr.* 66, 101285.
- Pan, X., Ojcius, D.M., Gao, T., Li, Z., Pan, C., Pan, C., 2020. Lessons learned from the 2019-nCoV epidemic on prevention of future infectious diseases. *Microbes Infect.* 22 (2), 86–91.
- Peng, W., Jia, Z., Huang, X., Lui, S., Kuang, W., Sweeney, J.A., Gong, Q., 2019. Brain structural abnormalities in emotional regulation and sensory processing regions associated with anxious depression. *Prog. Neuropsychopharmacol. Biol. Psychiatry* 94, 109676.
- Rafiq, S., Batool, Z., Liaquat, L., Haider, S., 2020. Blockade of muscarinic receptors impairs reconsolidation of older fear memory by decreasing cholinergic neurotransmission: a study in rat model of PTSD. *Life Sci.* 118014.
- Raphael, B., Singh, B., Bradbury, L., 1980. Disaster: the helper's perspective. *Med. J. Aust.* 2 (8), 445–447.
- Riou, J., Althaus, C.L., 2020. Pattern of early human-to-human transmission of Wuhan 2019 novel coronavirus (2019-nCoV), December 2019 to January 2020. *Euro Surveill. Bull. Eur. sur les Mal. Transm. Eur. Commun. Dis. Bull.* 25 (4), 2000058.
- Sattler, D.N., Assanangkornchai, S., Moller, A.M., Kesavathana-Dohrs, W., Graham, J.M., 2014. Indian Ocean tsunamis: relationships among posttraumatic stress, posttraumatic growth, resource loss, and coping at 3 and 15 months. *J. Trauma Dissociation Off. J. Int. Soc. Trauma Dissociation (ISSD)* 15 (2), 219–239.
- Sylvie, D.-V., Warren, H.M., 2007. How emotions colour our perception of time. *Trends Cognit. Sci. (Regul. Ed.)* 11 (12), 504–513.
- Taylor, S., White, B., Muncer, S., 1999. Nurses' cognitive structural models of work-based stress. *J. Adv. Nurs.* 29 (4), 974–983.
- Team, E.E., 2020. Note from the editors: world Health Organization declares novel coronavirus (2019-nCoV) sixth public health emergency of international concern. *Euro Surveill. Bull. Eur. sur les Mal. Transm. Eur. Commun. Dis. Bull.* 25 (5), 200131e.
- Tugade, M.M., Fredrickson, B.L., 2004. Resilient individuals use positive emotions to bounce back from negative emotional experiences. *J. Pers. Soc. Psychol.* 86 (2), 320–333.
- Veruska, S., Flavia, P., Valeska, P., Oscar, A.-C., Cardoso, S.A., Giovanni, C.M., Sergio, M., 2013. The role of positive emotion and contributions of positive psychology in depression treatment: systematic review. *Clin. Pract. Epidemiol. Ment. Health CP & EMH* 9, 211–237.
- WHO, 2005. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. Retrieved May 20, 2005. http://www.who.int/csr/sars/country/table2004_04_21/en/.
- WHO, 2007. The World Health Report 2007: a safer future: global public health security in the 21st century. Available:http://www.who.int/whr/2007/whr07_en.pdf.
- Wenshe, L., S. M.J., Tyler, L., Shiqing, X., 2020. Learning from the past: possible urgent prevention and treatment options for severe acute respiratory infections caused by 2019-nCoV. *Chembiochem Eur. J. Chem. Biol.* 21 (5), 730–738.
- Wilson, M.E., Chen, L.H., 2020. Travelers give wings to novel coronavirus (2019-nCoV). *Journal of travel medicine.* 27 (2), taaa015.
- Wu, P., Liu, X., Fang, Y., Fan, B., Fuller, C.J., Guan, Z., Litvak, I.J., 2008. Alcohol Abuse/Dependence Symptoms Among Hospital Employees Exposed to a SARS Outbreak. *Alcohol Alcohol.* 43 (6), 706–712.
- Wu, W., Zhang, Y., Wang, P., et al., 2020. Psychological stress of medical staffs during outbreak of COVID-19 and adjustment strategy. *J. Med. Virol.* 1–9.
- Xiang, Y.-T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., H. N.C., 2020. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry* 7 (3), 228–229.
- Zhang, S.X., Huang, H., Wei, F., 2020. Geographical distance to the epicenter of Covid-19 predicts the burnout of the working population: ripple effect or typhoon eye effect? *Psychiatry Res.* 288, 112998.
- Zheng, R., Rao, L.L., Zheng, X.L., Cai, C., Wei, Z.H., Xuan, Y.H., Li, S., 2015. The more involved in lead-zinc mining risk the less frightened: a psychological typhoon eye perspective. *J. Environ. Psychol.* 44, 126–134.