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Exploring social media usage in improving public perception on workplace violence against healthcare workers

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ABSTRACT

Workplace violence against healthcare workers has been a major social problem in many countries. A misunderstanding between patients and physicians is the primary cause of violence . The recent rise of social media offered a new communication channel between the government and the public. This study aims to explore and examine the use of social media to improve public perception about the medical workplace violence by considering a recently issued policy in China. We collected 12,250 posts before, during and after the implementation of the policy from Weibo, which is similar to Twitter. Sentiment classification and topic clustering methods were used to analyze the data. One-way ANOVA was applied to assess the changes of public sentiments over time. Results showed that the proportion of posts with negative sentiment statistically significantly decreased after the release of the policy, indicating the effectiveness of social media in improving public perception about the medical workplace violence, to a large extent. Topic clustering results regarding the policy showed that most people supported the policy. However, some believe that punishment measures contained in the policy need to be strengthened and that more attention should be paid to the hospitals and medical staffs, as well as how to effectively protect the interests of patients. Based on these findings, we suggested government to effectively and scientifically use social media to address medical workplace violence from the perspective of the public and further consider its causes in terms of both patients and medical staffs, and building an expert witness system seems to be helpful. Measures for guaranteeing the safety of medical staffs should be built by comprehensively evaluating the potential risk. These results can help governments increase the engagement of their citizens.

Author statement

Ying Lian: Conceptualization, Methodology, Software, Investigation, Formal analysis, Software, Writing – original draft, Writing – review & editing, Funding acquisition. Xuefan Dong: Validation, Conceptualization, Resources, Writing – original draft, Visualization, Writing – review & editing, Supervision, Project administration.

1. Introduction

Workplace violence in hospitals refers to incidents where healthcare staffs are abused, intimidated or attacked in circumstances related to their work [1]. Liebman [2] even described it as the “bloody conflicts concerning the accumulation of power in society”. It has been paid highly attention in various countries, including but not limited to Japan [3], South Korea [4], Indonesia [5], Italy [6,7], Canada [8], Turkey [9], and China [10–12]. In general, workplace violence against healthcare workers is frequently associated with injuries or deaths; thus, its effects on society are serious [13]. It will not only threaten the personal safety of medical staff, including physicians and nurses [14], but also interfere with the normal running of hospitals and eventually damage the benefits to patients. Li et al. [15] stated that medical professionals have high risk of suffering violence from patients and their families. According to a survey conducted by the Indian Medical Association, more than 75% of physicians experienced violence at work over the course of their career [15].

The reasons for workplace violence against healthcare workers vary, andmisunderstandings between patients and physicians-not medical

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errors, are the most common [16–19], particularly for cases regarding children [20]. Hu et al. [10] found that complications and unsatisfactory results related to operations or treatments are two main causes of workplace violence in hospitals. In addition, it seems that the prosecution is rarely employed by patients to protect their rights and interests because they generally lack awareness of maintaining their legal rights. Furthermore, distrust between patients and physicians is widespread in the healthcare systems of many countries [21], which could be viewed as another source of workplace violence in hospitals. Patients perceive that the majority of physicians are just out to make money and therefore question the effectiveness of treatment decisions [21], despite the assurance from experts and hospitals. How to change this mistaken view and accordingly improve the relationship between patients and physicians has long been a difficult problem forgovernments in many countries [18,22].

Technology has become a tool for improving society. Recently, with the development of social media, such as Twitter and Weibo, the government has found a new way to maintain social harmony and stability [23–26]. Social media allows people to share and exchange ideas, thoughts, and opinions, influencing the public's attitudes and beliefs regarding numerous social issues. Al-Hussein stated that social media has significant correlations with social change [26]. Siyam et al. [21] proposed that social media has become an important channel for the government to release official information and guide public opinions during natural disasters. Ali et al. [19] identified a positive relationship between the use of social media and firms' innovation development. Compared to traditional survey-based approaches, social media-based data provides a better scientific manner and shapes a society's worldview [28], and it is gaining popularity and a higher level of trust [27]. To date, this kind of data has been applied in various areas, including but not limited to social science [29], education [30], transportation [31], and disaster management [32]. Social media has made significant contributions to raising public awareness and educating opinions on particular topics. Thus, social media seems to be an effective tool for improving the public's traditional perception of workplace violence in hospitals.

Even though many scholars have aimed to study the benefits social media has provided to governments [33], there is a scarcity of studies concerning the role of social media on public perception management, particularly for medical issues, which is an acutely sensitive area for people. Our study addresses such scarcity by focusing on a recently issued policy for governing workplace violence against healthcare workers in China.

Following a recent increase in public awareness towards health care system and patient rights in China, the number of hospital workplace violence cases substantively increased between 2006 and 2016, many of which resulted in a specific kind of violence [21] called "Yi Nao". "Yi Nao" can be defined as the extremely violent behaviors of patients in response to adverse treatment outcomes [15], such as burning paper money, smashing hospitals, attacking physicians, and even killing physicians. The available official data presentsa grim picture. According to the National Health and Family Planning Commission of China, there were 17,243 "Yi Nao" cases in 2010. To date, workplace violence against healthcare workers has been a major social problem in China. Being a medical staff member has been seen as a dangerous job, which leads to a decrease in the number of medical students, to some extent. In specific, the proportion of physicians 25–34 years old decreased from 31.3% in 2005 to 22.6% in 2014, while the proportion of those over the age of 60 increased by 9.1% during the same time period [34]. As a result, violence against medical professionals hinders the development of medicine. However, although China's government has long been working on reforming the healthcare system, the existing legal framework for addressing workplace violence in hospitals remains weak, and it is marred by confusion and controversy [21]. Therefore, understanding the perception of the public on current measures to prevent workplace violence in hospitals is of great significance. However, most of the existing studies have paid more attention to how to improve the treatment and service qualities of medical staff rather than how to address patients' distrustful perceptions on physicians and hospitals [35–38]. Thus, this study aims to contribute to the current research on social media by filling the gap concerning whether social media can be an effective tool for the government to address workplace violence against healthcare workers by improving publicperception.

2. The policy

At the end of September 2018, 28 departments, including the National Development and Reform Commission and the National Health Commission, jointly issued the Memorandum of Cooperation on Joint Punishment for Persons Responsible for Dishonest Acts that Seriously Endanger Normal Medical Order [39], which announced that people who attack medical staff will be placed on a blacklist after a formal hearing. The disciplinary measures are various, including but not limited to restrictions on registering as a legal representative of public institutions, restrictions on accreditation of certification agencies, and restrictions on enjoying preferential policies in investments and other fields. In other words, the job opportunities and income of persons who commit workplace violence in hospitals will be impacted. This was the first policy that directly focused on workplace violence in hospitals cases. In June 2019, based on this policy, 177 persons who seriously disrupted the normal medical order were blacklisted by the government [40], and they were jointly disciplined by the 28 departments. As this is the newest and the most targeted governance measure for workplace violence in hospitals in China, this paper draws on this topic. In addition, people participating in the discussion about this topic are nationwide; therefore, our paper offers a more diversified and comprehensive picture regarding the public's perspective.

3. Method

3.1. Data collection

In this study, Weibo, which is known as China's Twitter, was selected as the data source. According to the 42nd China Statistical Report on Internet Development released by the China Internet Network Information Center, Weibo's users has reached 300 million by the end of the first half of 2018, accounting for 42.1% of the Internet population in China. In addition, compared with other social media in China, Weibo is the only one that allows people to access information on the platform without the risk of infringing on personal privacy [41]. We used web crawler technology, which can effectively retrieve and grab information from social media platforms [42], to collect public opinions regardingour research topic. Octopus, a mature web crawler tool, was employed in this study, as it has shown great effectiveness on collecting data from Weibo in previous studies [41,42]. Information on how to use Octopus can be found on its official website: https://www.bazhuayu.com/.

In order to collect more appropriate data, both the original and comment data were considered in this study. First, using Octopus, we collected all information containing the keyword "workplace violence in hospitals" that could be found on the webpages of Weibo from July 2017 to September 2020, yielding 11,482 original posts in total. We employed five people to manually removeunrelated posts, which left 9,936 posts. Then, we classified these data into three groups based on the posting time, namely, *Before*, *In*, and *After*. In specific, posts generated between July 2017 and July 2018 were categorized as the *Before* group, those generated between August 2018 and August 2019 were categorized as the *In* group, and the remaining posts were categorized as the *After* group. We ranked the posts in each group based on the number of their comments. Those withmore than 100 comments were selected, and their comments were collected using Octopus, yielding 16,971 posts for analysis. Thus, we obtained 26,907 posts in total. Each collected post

contained four components: the username, user location, posting time, and content.

3.2. Text mining

For social media-based data, a relatively constructed analysis framework has been built, which mainly contained three steps: trend and spatial analysis, topic clustering, and sentiment analysis. By employing this framework, scholars in different areas conducted a series of valuable studies [32,42,43]. This paper followed this framework, and the analysis process is displayed in Fig. 1. Specifically, trend and spatial analysis was conducted through the statistics concerningthe number of posts and the user locations.

3.2.1. Sentiment analysis

Sentiment analysis was applied to determine how the public felt about the outcomes of our researched policy. In this study, we adopted the ROST Emotion Analysis Tool, a module contained in ROST Content Mining 6.0, to determine the sentiment tendency of each analyzed post, including *positive*, *neutral*, and *negative*. ROST Content Mining 6.0 is a free integrated software invented by the ROST virtual learning team at Wuhan University, which is famous in the era of big data. The basis of this software is self-developed dictionaries, in which all the words are given corresponding emotional values according to the psychological definitions [44]. In specific, there are three main steps: first, word segmentation is carried out to extract the keywords from a given online post; second, each extracted keyword is assigned to an emotional value based on the self-developed dictionaries; third, the sentiment tendency of a given online post is determined based on the results of the second step. The reason for employing this software is that it has shown great effectiveness in processing Chinese-text data [44–47]. Furthermore, it should be noted that in this study, only the sentiment of collected comment data was analyzed, as it can more directly reflect public perceptions compared to the original data. In addition, the gathered results were manually checked and revised to guaranteeaccuracy.

3.2.2. Topic clustering analysis

Topic clustering analysis was carried out using the Latent Dirichlet Allocation (LDA) method [48], a typical unsupervised machine learning model. LDA has shown great performance in identifying underlying topics from social media-based data [43,49–52], as well as from Chinese online posts [43,53,54]. Due to its highlighted advantages, such as not requiring specifying keywords *a priori* for the topics [55], the LDA model is still one of the mainstream methods usedtoday [41]. The basis of this method refers to the statistical correlation of words presented in researched documents without the consideration of word order [48]. In LDA, a document is regarded as a mixture of latent topics and a topic refers to a multinomial distribution over words [56]. Based on the LDA model, the document-topic distribution matrix and the topic-word distribution of the analyzed posts can be obtained. Then, for each post, a topic from the document-topic distribution was selected and several keywords from the topic-word distribution that were associated with this topic were sampled. In addition, two Dirichlet prior parameters α and β, as well as the number of latent topics K, must be predetermined, where α is a k-dimensional topic smoothing parameter and β is a k-dimensional word smoothing parameter. Based on the suggestions from topic modeling analyses in the literature [57,58], α and β were set as 0.1 and 0.01, respectively. With respect to K, by following related studies [59,60], the trial-and-error method was carried out to determine its optimum value. Although this method spends much time repeating the procedure with different K values, we believe that the accuracy of topic clustering can be ensured, to a large extent. In addition, it should be noted that for the word segmentation process, "jieba", a common applied Chinese word segmentation tool in Python [39], was used in the present paper.

3.3. Research design

In order to examine whether social media can be applied to improve public perception on workplace violence against healthcare workers, one-way ANOVA regarding the changes of public sentiments between the *Before* group and the *In* group, the *Before* group and the *After* group, and the *In* group and the *After* group were carried out to evaluate temporal variance. All statistics were performed using SPSS statistics 22. Statistical significance was defined as $P < 0.05$. It was assumed that if the proportion of posts with negative sentiment statistically significantly decreased and those with positive sentiment significantly increased after the implementation of the policy, social media could probably improve the public perception towards workplace violence against healthcare workers, to a large extent.

Although it seems that the change in public perception is partly related to the policy itself, the important role played by social media in promoting the policy and its derived positive and objective viewpoints should be highlighted as well. In other words, because of social media, more people can see the policy and its derived opinions and accordingly get a better understanding on the causes and fateful consequences of workplace violence in hospitals, the difficulties faced by healthcare workers in performing treatments, and the uncertainty of diseases. In addition, social media allows people to exchange personal viewpoints, which is helpful for the objective communication and fusion of opinions. Therefore, the effects of social media on improving public perception should not be neglected.

4. Results and discussions

4.1. Trend and spatial analysis

Figs. 2 and 3, respectively, show the trend and spatial distribution of selected posts. It can be noticed that there are two significant peaks in Fig. 2, where the first refers to the promulgation of the Memorandum of Cooperation on Joint Punishment for Persons Responsible for Dishonest Acts that Seriously Endanger Normal Medical Order,[1] and the latter is the announcement that 177 persons were blacklisted. In addition, the second peak is higher than the first one, which indicates that the public paid more attention to the implementation instead of the release of the policy, to a large extent. At the regional level, Fig. 3 shows that Guangdong, Beijing, Jiangsu, Shandong and Zhejiang, which are in the first echelon of economic development, have the largest number of related posts. Users located in eastern regions in China paid more attention to our researched policy. Two other provinces that were significantly concerned with the policy were Henan and Sichuan, with 1,355 and 1,321 related posts, respectively. According to the data shown in the Alpha dataset (https://alphalawyer.cn), a professional Chinese legal case database, most of these seven provinces were all places with high-rate occurrences of hospital violence cases in 2018.

4.2. Sentiment analysis

Using the ROST Emotion Analysis Tool, the sentiment tendency of each analyzed comment post was identified. Fig. 4 illustrates the sentiment distribution in each month, and Table 1 displays the number of posts with different sentiment tendencies in different groups.

Using the one-way ANOVA, we examined the temporal changes of sentiments between each two groups. Results are shown in Table 2, indicating that public sentiments changed significantly between each two groups, to a large extent. In specific, a significant increase and decrease could be respectively found in the proportion of comments with positive sentiment ($F = 35.856$, P-value $= 0.000$) and the

[1] As the policy was published in end of September 2018, most related posts were generated in the beginning of October 2018.

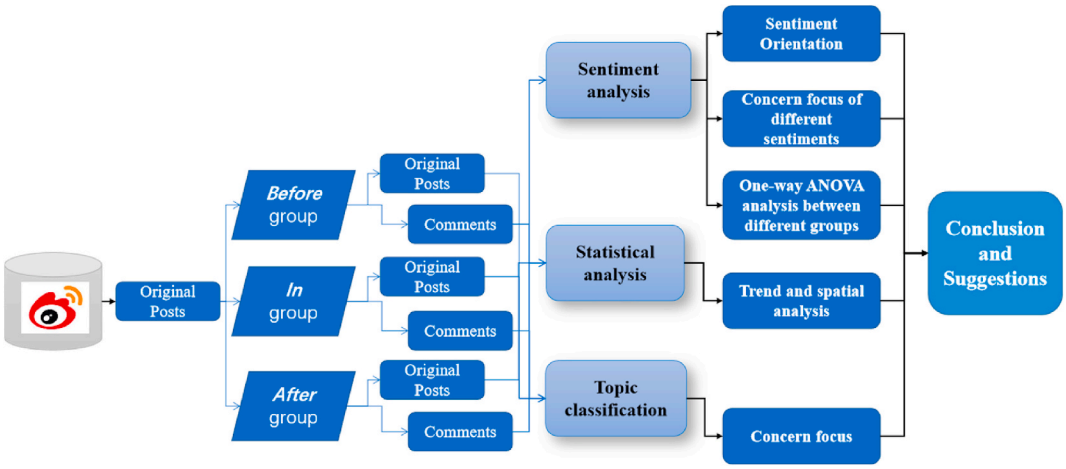

Fig. 1. Analysis process of the study (Note: original posts and comments were considered in both statistical analysis and topic classification, while only the comments were considered in sentiment analysis).

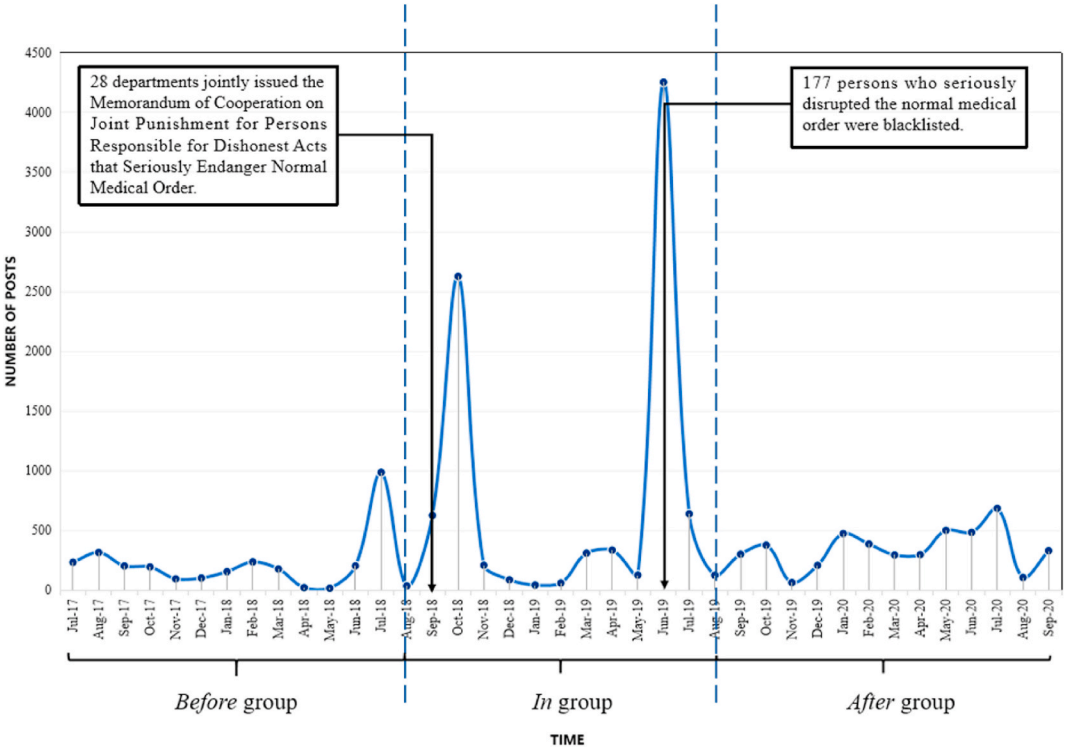

Fig. 2. Trend of analyzed posts.

proportion of those with negative sentiment (F = 36.678, P-value = 0.000) between the *Before* and *After* groups. The comments containing positive sentiment accounted for most of the total in both the *In* and *After* groups, with 59.57% and 58.51%, respectively. However, for the *Before* group, this proportion was only 22.56%, and the number of posts with negative sentiments accounted for 54.45%, which was 27.33% higher than that of the *After* group. It is worth noting that an increase of 37.01% in the number of positive posts can be identified between the *Before* and the *In* groups (F = 4.165, P-value = 0.052). In addition, the proportion of posts with the neutral sentiment was around 15%–25% in different groups. According to the findings, it seems that social media could probably improve the public perception on workplace violence against healthcare workers, to a large extent, as the proportion of online posts with negative sentiment statistically significantly decreased after the implementation of the policy. This mainly attributes to the use of social media in promoting the policy and opening up a channel for the public to express opinions and participate in the discussion. However, these findings cannot show what focus were concerned by these posts with different sentiments. Therefore, to further explore the public concern with different sentiments, we also paid attention to their respective word segmentation results. In specific, comments with positive sentiment mainly covered topics related to supporting the policy and respecting physicians and nurses. With respect to comments with negative sentiment, they illustrated that the rights of patients should be effectively protected and that some serious problems are common in Chinese hospitals, such as quacks and red envelopes [61], and illegal medical practices should be solved as a priority. In terms of comments with neutral sentiment, they highlighted the balance between patients and medical staffs in dealing with workplace violence in hospitals.

Fig. 3. Spatial distribution of analyzed posts.

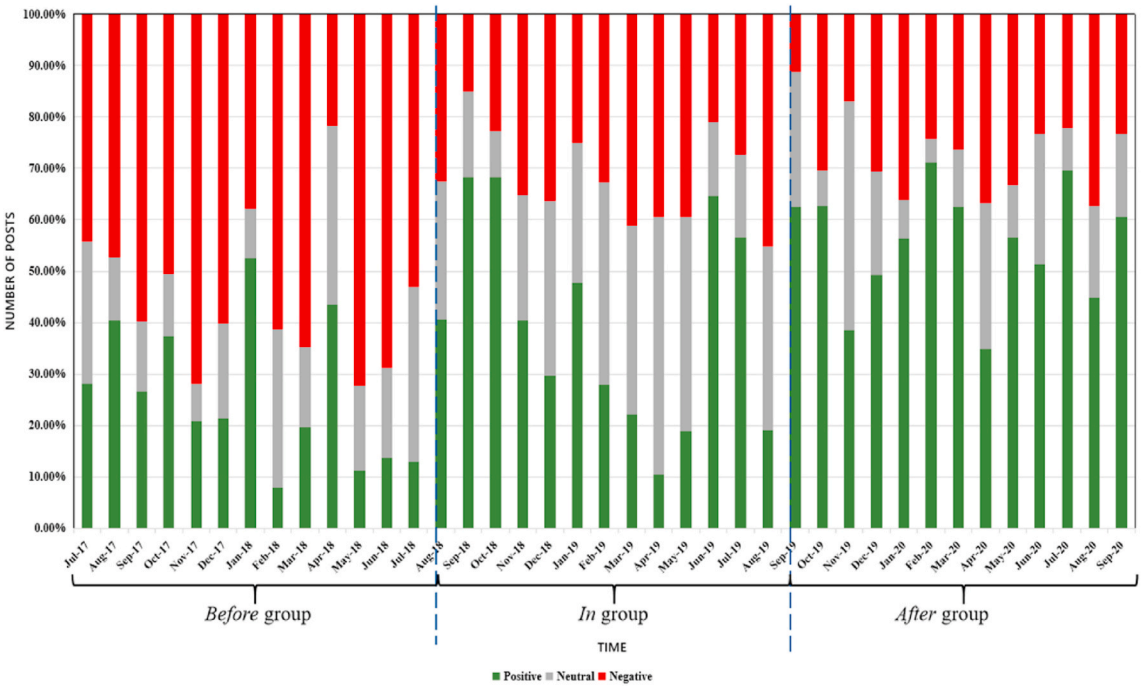

Fig. 4. Sentiment distribution of comments in each month.

4.3. Topic clustering

Using the "jieba", the word segmentation process was carried out for each analyzed post, and the results are shown as Fig. 5. Despite the words that are directly related to our researched policy, such as workplace violence, 177, joint disciplinary, implementation, and blacklist, those with higher frequencies mainly include order, against, damage, serious, violence, etc. This finding can roughly reflect what the public is concerned about regarding workplace violence in hospitals. To further explore public perceptions focusing on the policy and

Table 1
Number of posts with different sentiments in different groups.

Group	Positive		Neutral		Negative	
	Value	%	Value	%	Value	%
Before	667	22.55	680	23.00	1610	54.45
In	5653	59.57	1561	16.45	2276	23.98
After	2467	58.51	650	14.37	1227	27.12

Table 2
One-way ANOVA test results between each two groups.

	Groups	F	P-value
Positive	*Before* vs. *After*	35.856	.000
	Before vs. *In*	4.165	.052
	In vs. *After*	6.151	.021
Neutral	*Before* vs. *After*	0.196	.662
	Before vs. *In*	4.609	.042
	In vs. *After*	5.793	.024
Negative	*Before* vs. *After*	36.678	.000
	Before vs. *In*	24.353	.000
	In vs. *After*	1.985	.172

accordingly propose some useful suggestions, we extracted the main topics from the online posts in the *In* group using the LDA model. By employing the trial-and-error method, the number of topics *K* was set as six. Thus, six topics were identified. According to the clustering results, the top three topics were "Support *the policy*", "*Challenge punishment intensity*", and "*Question medical staffs*", accounting for 31.17%, 26.53%, and 20.09% of all posts, respectively. The following three topics, "*Suggest using legal means*", "*Question the industry sector of medical staffs*", and "*Appreciate physicians*", comprised 11.22%, 6.03%, and 4.96% respectively. However, the above proportions are the aggregate numbers of the posts about certain topics, which means that it is possible that the number of users is only a few, with some of them posting many posts. Thus, we calculated the average number of posts per user in our collected data, which is 1.037. That is to say, cases in which one user posted a large number of posts rarely appeared in our dataset.

Speficially, nearly one-third of the posts supported the policy, as these posts believed that workplace violence in hospitals would cause serious damage to the hospitals and medical staff. Many people expressed that individuals who attack medical staff should be severely published and held criminally responsible:

"Support! Give the hospitals justice!"

"Support the policy because it could improve the personal safety of medical staffs."

"Support! Hospital is a public place … behaviors of destroying common situation and causing serious loss of life and property of others must receive legal sanctions!"

According to these opinions, a blacklist is an effective way to deal with workplace violence against healthcare workers in China. In addition, we found that most posts that contained information about this topic were comments to the posts published by government departments' official accounts.

The second topic refers to "*Challenge punishment intensity*". There were various opinions regarding the intensity of the punishment measures contained in the policy, with many thinking they should be strengthened:

"The punishment is too light, isn't the life of the medical staff?"

"The policy should strengthen the discipline of the violator, in order to take precautions against the risk of workplace violence in hospitals."

This topic could be viewed as a supplement to the first topic, as both support intention and some suggestions are proposed by related posts.

Another topic is "*Question medical staffs*". More than one-fifth of the analyzed comments question the rationality and impartiality of the policy as it only considers the perspective of patients. These commentors believed that causes for workplace violence in hospitals are various and complex, and that not only the patients should be punished:

"*Everything has two sides. If there is no good physician, is there no physician without virtue? What are the reasons behind the violence? Do you know?*"

"*This policy only considers the rights of medical staffs, but how about patients? Overtreatment and high medical expenses are common in hospitals! To be honest, hospital is a profit-making organization, but sometimes, hospital is like a wolf's nest. Some physicians only pay attention to how to earn money.*"

In addition, some examples, including but not limited to "*physicians receive red envelops*", "*there are some quacks in the hospital*" and "*hospital service quality is poor*", were proposed along with negative sentiments, such as anger and discontent. They suggest that the solution for workplace violence in hospitals should focus on the improvement of patient-physician relationship and the understanding of the reasons for violent behavior.

The fourth topic suggests that patients protect their own rights and interests through legal channels:

"*When the rights and interests of patients are lost, the family members should not go to the hospital and make trouble but should take a proper way to solve the problem.*"

Fig. 5. Word cloud diagram of analyzed posts.

"*Why did so many people say that workplace violence could effectively protect the rights and interests of patients? That is totally wrong! There are so many legal ways to choose. Besides, violence doesn't work. It will hurt both physicians and patients.*"

They believe that the deficiency and incompetence of some government departments and shortcomings of litigation channels are the main reason for the occurrence of workplace violence in hospitals, which should be taken into consideration by the government. In this view, improving the service quality of hospitals and litigation channels for medical disputes are of great significance for preventing workplace violence in hospitals.

Posts contained in the fifth topic concerned the industry sector of medical staff. They demonstrated that medical staff, including physicians and nurses, should not be involved in the service industry. Instead, they are high-risk occupation. Some posts suggested that the industry division standard in China should be redrawn:

"*Physicians and nurses should not be involved in the service industry. When you go to the hospital, you should not think you are a master because you are a patient.*"

"*I don't know why the medical industry has become a service industry, but I absolutely believe this is wrong and ridiculous!*"

In addition, the term "medical education" and its related words "students" and "study" were frequently raised under this topic. Related posts mainly demonstrated that the frequent occurrences of workplace violence in hospitals has dramatically reduced the willingness of the youth to learn medicine:

"*My daughter is a medical student. She told me that her teacher said that the first thing they should do was to learn to protect themselves. How terrible!*"

Most posts that were classified into the sixth topic described personal warm memories of being patients and showed appreciation for physicians or nurses. These posts also voiced their support for the proposed policy, to a large extent. For instance, a post expressed that:

"*I will never choose to fight with the physician in my life. I had a car accident when I was four years old. Thanks to those physicians who have been persisting in saving me, there was a miracle that I snatched back from death.*"

5. Discussion and conclusion

Workplace violence in hospitals has been a major problem in healthcare system around the world [36,37], and it should be timely and effectively addressed. However, as workplace violence in hospitals generally contains ethical issues, the difficulties caused by the pressure of public opinion sometimes impede the implementation of policies. Therefore, understanding the public's attitude and improving their perceptions of workplace violence in hospitals are of great significance. It seems that social media is an effective tool for achieving this task. This study, therefore, examined social media's performance by focusing on a recently issued policy for addressing workplace violence against healthcare workers in China.

Overall, the results showed that the proportion of online posts with negative sentiment significantly decreased after the implementation of the policy, proving the important role of social media in improving public perception on workplace violence in hospitals. In particular, the improvement is mainly attributed to the use of social media in reporting the policy, which can enable the public to obtain a better and more rational understanding of the workplace violent behavior and the difficulties confronted by physicians when performing treatment. These findings are helpful for improving the patient-physician relationship and decreasing the occurrence of workplace violence in hospitals, to a large extent [18]. Therefore, in addition to addressing workplace violence in hospitals, we claim that social media could be used to improve public perception in many other areas, such as government credibility, climate change, health promotion, and food technologies. Indeed, previous studies have proven social media to be an effective tool for the government to address social problems from the perspective of the public [33,62,63]. However, social media can also have adverse effects on public perception, such as the dissemination of false information, "fake news" and conspiracy theories with the sole purpose of gaining attention rather than providing education and truth. Thus, the government should control the discourse power of official information released on social media.

Furthermore, we identified the main viewpoints of the public on the policy by using a topic modelling approach. We found that posts reflected the public using social media apps to support the policy, and there were also some people who thought that the policy's punishment measures should be strengthened. However, the policy's equality was also frequently questioned, as it failed to consider the perspective of medical staff regarding workplace violence in hospitals, as well as how to protect patients' rights and interests. In particular, some serious problems commonly encountered in Chinese hospitals were mentioned, including but not limited to illegal medical practice, quacks, poor service quality, and receiving red envelopes. These issues also refer to the main causes of negative sentiment among the public.

Based on the above findings, this study proposes the following suggestions to help the government better address workplace violence against healthcare workers. First, the government should effectively and scientifically use social media to improve public perception of workplace violence in hospitals, for instance by creating two-way dialogues and information exchanges with the public [64]. Second, the government should give more consideration to comprehensively understanding the causes of workplace violence in hospitals, not only from the perspective of patients, but also from the perspective of medical staff. Thus, improving the service quality of hospitals, increasing and optimizing the litigation channels for medical disputes, and preventing illegal medical practices seem to be helpful for effectively addressing workplace violence in hospitals. Implementing an expert witness system, which can be used to judge negligence and ascertain causality in medical dispute cases like in the United States, is a lesson to be learned [65]. Third, how to prevent the decreasing number of medical student should be considered as well, as the continued decline may lead to adverse effects on the healthcare system in the future. Workplace violence in hospitals could be viewed as one of the main causes of this decrease in medical students. Therefore, the government should further evaluate the potential risks that medical staff may face and accordingly take more targeted and useful security measures to ensure their safety. For instance, medical liability insurance should be covered by every hospital, as it can effectively transfer the hazards of medical organizations and medical staff. In particular, any disagreement or dispute between patients and medical organizations, medical staff can be settled through insurance in accordance with the court's decision. Therefore, medical liability insurance could effectively reduce the risk to hospitals and medical staffs caused by medical accidents and improve the efficiency of solving medical disputes [66]. Fourth, regarding the relationship between patients and physicians, a more transparent information communication mechanism must be formulated to ensure the impartiality of the appraisal and avoid the occurrence of bias. Furthermore, the government should continue to strengthen publicity and education for both patients and medical staff in various forms for better awareness of their respective authority and responsibility, as well as the corresponding legal consequences they bear when they fail in their duties.

This paper has the following limitations. First, the sample size is limited, which is due to the information access restrictions of Weibo. Second, it is possible that some users in our sample may have swayed toward positive posts due to the fear of reprisal from posting a negative

post on social media rather than the analyzed policy. Third, we did not control for multiple responses by a single user, which might sway the number of posts with positive and negative sentiments due to users making multiple posts. Finally, it is possible that some positive comments were posted by healthcare workers instead of the general public. In sum, this paper only provided a rough picture regarding the role of social media in improving public perception concerning workplace violence in hospitals. In future studies, we will collect posts about more topics that are related to workplace violence in hospitals to enlarge the sample and explore the psychological mechanism hidden behind posting behavior in social media. In addition, more additional research focusing on other different areas will be carried out in the future to further explore the utility of social media in addressing social problems.

Ethic consideration

This study was performed in accordance with the ethical guidelines from the Ethics Committee of Beijing University of Technology. All subjects gave their written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of Beijing University of Technology.

Declaration of competing interest

No conflict of interest exits in the submission of this manuscript, and manuscript is approved by all authors for publication. We have no relevant financial interests in this manuscript.

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References

[1] S. Lamont, S. Brunero, The effect of a workplace violence training program for generalist nurses in the acute hospital setting: a quasi-experimental study, Nurse Educ. Today 68 (2018) 45–52.
[2] B.L. Liebman, Malpractice mobs: medical dispute resolution in China, Columbia Law Rev. 113 (1) (2013) 181–264.
[3] N. Aoki, et al., Impact of miscommunication in medical dispute cases in Japan, Int. J. Qual. Health Care 20 (5) (2008) 358–362.
[4] H. Shin, et al., Medical dispute cases involving traditional Korean medical doctors: a survey, European Journal of Integrative Medicine 6 (4) (2014) 497–501.
[5] M. Nasser, Medical dispute in Indonesia health, in: R.G. Beran, R.G. Beran (Eds.), Legal and Forensic Medicine, Springer Berlin Heidelberg, Berlin, Heidelberg, 2013, pp. 1459–1470.
[6] N. Ramacciati, et al., Violence towards emergency nurses: the 2016 Italian national survey—a cross-sectional study, J. Nurs. Manag. 27 (4) (2019) 792–805.
[7] N. Ramacciati, et al., Violence towards emergency nurses. The Italian national survey 2016: a qualitative study, Int. J. Nurs. Stud. 81 (2018) 21–29.
[8] K.L. Hesketh, et al., Workplace violence in alberta and British columbia hospitals, Health Pol. 63 (3) (2003) 311–321.
[9] T.I. Agartan, Health workforce policy and Turkey's health care reform, Health Pol. 119 (12) (2015) 1621–1626.
[10] Y. Hu, et al., Analysis of the causes of surgery-related medical disputes in Taiwan: need for acute care surgeons to improve quality of care, J. Chin. Med. Assoc. 79 (11) (2016) 609–613.
[11] Y. Hu, Z. Zhang, Patient education – a route to improved patient experience in Chinese hospitals? Patient Educ. Counsel. 98 (12) (2015) 1651–1652.
[12] R.J.J. Teoh, F. Lu, X. Zhang, Workplace violence against healthcare professionals in China: a content analysis of media reports, Indian journal of medical ethics 4 (2) (2019) 95.
[13] S. Lyu, et al., Analysis of medical litigation among patients with medical disputes in cosmetic surgery in taiwan, Aesthetic Plast. Surg. 35 (5) (2011) 764–772.
[14] H. Tzeng, C. Yin, Crisis management systems: staff nurses demand more support from their supervisors, Appl. Nurs. Res. 21 (3) (2008) 131–138.
[15] N. Li, Z. Wang, K. Dear, Violence against health professionals and facilities in China: evidence from criminal litigation records, Journal of Forensic and Legal Medicine 67 (2019) 1–6.
[16] Y.H. Kim, C.J. Hwang, Patterns of medical accidents and disputes in the orthodontic field in Korea, Korean Journal of Orthodontics 44 (1) (2014) 5–12.
[17] J. Liu, et al., The weakness of the strong: examining the squeaky-wheel effect of hospital violence in China, Soc. Sci. Med. 245 (2020) 112717.
[18] N. Aoki, et al., Impact of miscommunication in medical dispute cases in Japan, Int. J. Qual. Health Care 20 (5) (2008) 358–362.
[19] L.P. Hoyle, et al., Media depictions of "unacceptable" workplace violence toward nurses, Pol. Polit. Nurs. Pract. 19 (3–4) (2018) 57–71.
[20] D. Wilkinson, S. Barclay, J. Savulescu, Disagreement, mediation, arbitration: resolving disputes about medical treatment, Lancet 391 (10137) (2018) 2302–2305.
[21] B.L. Liebman, Malpractice mobs: medical dispute resolution IN China, Columbia Law Rev. 113 (1) (2013) 181–264.
[22] W. Roh, et al., Analysis of anesthesia-related medical disputes in the 2009-2014 period using the Korean society of anesthesiologists database, J. Kor. Med. Sci. 30 (2) (2015) 207–213.
[23] S.A. Asongu, J.I. Uduji, E.N. Okolo-Obasi, Homicide and social media: global empirical evidence, Technol. Soc. 59 (2019) 101188.
[24] A. Ali, et al., Improving team innovation performance: role of social media and team knowledge management capabilities, Technol. Soc. 61 (2020) 101259.
[25] Y. Lian, Y. Liu, X. Dong, Strategies for controlling false online information during natural disasters: the case of Typhoon Mangkhut in China, Technol. Soc. 62 (2020) 101265.
[26] N. Siyam, O. Alqaryouti, S. Abdallah, Mining government tweets to identify and predict citizens engagement, Technol. Soc. 60 (2020) 101211.
[27] K. Al-Hussein, The use of social media and perceptions of corruption within the Jordanian political elite, Technol. Soc. 62 (2020) 101334.
[28] S.M. Salleh, From survey to social media: public opinion and politics in the age of big data, J. Comput. Theor. Nanosci. 11 (23) (2017) 10696–10700.
[29] M. Huang, T. Whang, X. Lei, The Internet, social capital, and civic engagement in asia, Soc. Indicat. Res. 132 (2) (2017) 559–578.
[30] J. Abbas, et al., The impact of social media on learning behavior for sustainable education: evidence of students from selected universities in Pakistan, Sustainability 11 (16836) (2019).
[31] E. Chaniotakis, C. Antoniou, F. Pereira, Mapping social media for transportation studies, IEEE Intell. Syst. 31 (6) (2016) 64–70.
[32] X. Han, J. Wang, Using social media to mine and analyze public sentiment during a disaster: a case study of the 2018 shouguang city flood in China, ISPRS Int. J. Geo-Inf. 8 (1854) (2019).
[33] N. Siyam, O. Alqaryouti, S. Abdallah, Mining government tweets to identify and predict citizens engagement, Technol. Soc. 60 (2020) 101211.
[34] S.S. Lien, et al., 10-year trends in the production and attrition of Chinese medical graduates: an analysis of nationwide data, Lancet 3881 (2016), 11-11.
[35] L. Zhang, et al., Workplace violence against nurses: a cross-sectional study, Int. J. Nurs. Stud. 72 (2017) 8–14.
[36] X. Chen, et al., Incidence and risk factors of workplace violence against nurses in a Chinese top-level teaching hospital: a cross-sectional study, Appl. Nurs. Res. 40 (2018) 122–128.
[37] J. Liu, et al., Workplace Violence against Nurses, Job Satisfaction, Burnout, and Patient Safety in Chinese Hospitals, Nursing Outlook, 2019.
[38] L. Lu, et al., Prevalence of Verbal and Physical Workplace Violence against Nurses in Psychiatric Hospitals in China, Archives of Psychiatric Nursing, 2019.
[39] N.H.C.O. China, Memorandum of Cooperation on Joint Punishment for Persons Responsible for Dishonest Acts that Seriously Endanger Normal Medical Order, 2018.
[40] N.H.C.O. China, 177 Persons Who Seriously Disrupt the Normal Medical Order Were Blacklisted, in Beijing Daily, 2019.
[41] Y. Wang, H. Li, Z. Wu, Attitude of the Chinese public toward off-site construction: a text mining study, J. Clean. Prod. 238 (2019) 117926.
[42] X. Liu, W. Hu, Attention and sentiment of Chinese public toward green buildings based on Sina Weibo, Sustainable Cities and Society 44 (2019) 550–558.
[43] P. Ji, Emotional criticism as public engagement: how weibo users discuss "Peking University statues wear face-masks", Telematics Inf. 33 (2) (2016) 514–524.
[44] Q. Luo, X. Zhai, I will never go to Hong Kong again!" How the secondary crisis communication of "Occupy Central" on Weibo shifted to a tourism boycott, Tourism Manag. 62 (2017) 159–172.
[45] X. Hao, S. Xu, X. Zhang, Barrage participation and feedback in travel reality shows: the effects of media on destination image among Generation Y, Journal of Destination Marketing & Management 12 (2019) 27–36.
[46] Y. Xiao, S. Xie, X. Wang, An analysis of tourists' perception on Wuhan's historical and cultural blocks based on online travelogues, Tourism Research 9 (1) (2017) 83e94.
[47] Y. Zhao, et al., Chinese public's attention to the COVID-19 epidemic on social media: observational descriptive study, J. Med. Internet Res. 22 (5) (2020) e18825-e18825.
[48] D.M. Blei, A.Y. Ng, M.I. Jordan, Latent dirichlet allocation, J. Mach. Learn. Res. 3 (4–5) (2003) 993–1022.
[49] J. Lüdering, P. Tillmann, Monetary policy on twitter and asset prices: evidence from computational text analysis, N. Am. J. Econ. Finance 51 (2018), 100875.
[50] L. Zhang, M. Hall, D. Bastola, Utilizing Twitter data for analysis of chemotherapy, Int. J. Med. Inf. 120 (2018) 92–100.
[51] A. Majumdar, I. Bose, Do tweets create value? A multi-period analysis of Twitter use and content of tweets for manufacturing firms, Int. J. Prod. Econ. 216 (2019) 1–11.

[52] C. Roque, et al., Topic analysis of Road safety inspections using latent dirichlet allocation: a case study of roadside safety in Irish main roads, Accid. Anal. Prev. 131 (2019) 336–349.
[53] S. Shan, et al., Disaster management 2.0: a real-time disaster damage assessment model based on mobile social media data—a case study of Weibo (Chinese Twitter), Saf. Sci. 115 (2019) 393–413.
[54] L. Su, S. Stepchenkova, A.P. Kirilenko, Online public response to a service failure incident: implications for crisis communications, Tourism Manag. 73 (2019) 1–12.
[55] A.H. Huang, et al., Analyst information discovery and interpretation roles: a topic modeling approach, Manag. Sci. 64 (6) (2018) 2833–2855.
[56] K. Xu, et al., Detecting bursts in sentiment-aware topics from social media, Knowl. Base Syst. 141 (2018) 44–54.
[57] H. Hao, et al., A tale of two countries: international comparison of online doctor reviews between China and the United States, Int. J. Med. Inf. 99 (2017) 37–44.
[58] W. Wang, Y. Feng, W. Dai, Topic analysis of online reviews for two competitive products using latent Dirichlet allocation, Electron. Commer. Res. Appl. 29 (2018) 142–156.
[59] S. Kaplan, K. Vakili, The double-edged sword of recombination in breakthrough innovation, Strat. Manag. J. 36 (10) (2015) 1435–1457.
[60] K. Bastani, H. Namavari, J. Shaffer, Latent Dirichlet allocation (LDA) for topic modeling of the CFPB consumer complaints, Expert Syst. Appl. 127 (2019) 256–271.
[61] K. Hu, W. Xu, Towards the end of "red envelopes" in China? Lancet 383 (9936) (2014), 2211-2211.
[62] S. Nisar, M. Shafiq, Framework for efficient utilisation of social media in Pakistan's healthcare sector, Technol. Soc. 56 (2019) 31–43.
[63] S. Arshad, S. Khurram, Can government's presence on social media stimulate citizens' online political participation? Investigating the influence of transparency, trust, and responsiveness, Govern. Inf. Q. 37 (3) (2020) 101486.
[64] T. Kaya, The changes in the effects of social media use of Cypriots due to COVID-19 pandemic, Technol. Soc. 63 (2020) 101380.
[65] C.Y. Wu, H.C. Weng, R.C. Chen, Time trends of assessments for medical dispute cases in Taiwan: a 20-year nationwide study, Intern. Med. J. 43 (9) (2013) 1023–1030.
[66] H. Shin, et al., Medical dispute cases involving traditional Korean medical doctors: a survey, European Journal of Integrative Medicine 6 (4) (2014) 497–501.