DSI DATA SCIENCE AND INFORMETRICS
VOL.3, NO.4, NOV. 2023

RESEARCH ARTICLE

How is pandemic perceived in China? A case study of COVID–19

Houqiang Yu[a]*, Longfei Li[b], Yinghua Xie[a]

a. School of Information Management, Sun Yat–sen University, Guangzhou, China
b. School of Information Management, Wuhan University, Wuhan, China

ABSTRACT

To help the government better understand and manage public sentiments, and help the public establish the values of rational participation in online discussions related to COVID-19, it is necessary to explore the themes and emotions of different subjects discussing the pandemic on social media platforms. The study takes a comprehensive view by combining social media and scholarly outputs data. In particular, WeChat articles are investigated to reveal the public concern and public sentiment towards COVID-19, and WeChat mentions to scholarly papers are identified to show the interaction between the public and researchers. Text analysis is conducted to construct co-occurrence networks and reveal the distribution of themes. VOSviewer is applied to network visualization. Statistical and comparative analysis showed that discussion about COVID-19 keeps hot on WeChat. WeChat offical accounts from the information industry dominate, suggesting a free and flexible discussing environment. Topics on WeChat overlap with that of scholarly papers but have a much broader scope. WeChat mentions to scholarly papers has bridged the public with the research and has a high coverage of 61.7%. Public sentiment in WeChat is positive, demonstrating good confidence in defeating the pandemic. These findings are helpful in understanding the social attitude towards and comprehensive perception of COVID-19 in China.

KEYWORDS

Altmetrics; Corona virus disease 2019 (COVID-19); WeChat; China National Knowledge Infrastructure (CNKI); Social media

1 Introduction

The corona virus disease 2019 (COVID-19) pandemic has evolved into a global pandemic in the last two years, inevitably, also exerting a complex impact on society, economy, and academic research. Consequently, information management research and practice have also changed under the global health challenges (Barnes, 2020). Compared with other publications, especially in biomedical research, papers related COVID-19 sharply increased, and their acceptance took less time, whereas international collaboration significantly reduced (Aviv-Reuven & Rosenfeld, 2021). Based on the perspective of informatics, several scientomet-

* Corresponding Author: yuhq8@mail.sysu.edu.cn

ric analyses were conducted to explore the significant effect on publication patterns resulting from the pandemic, and as the pioneer, China contributed the most publications and citations (Santos et al., 2022).

Most countries not only innovatively and rationally guide the public opinions, but also ensure the implementation of some academic ideas. At the center of the development of information technologies, social media platforms have significant advantages in information dissemination, thematic discussions, and emotional expressions about COVID-19 (Marin, 2021). In other words, the comprehensive impact due to the pandemic also urgently needs governments to utilize social media platforms to transform their role, maintain social stability, and rescue citizens from panic (Dwivedi et al., 2020). For example, Spanish published more than one thousand audiovisual pieces on YouTube to deal with the health crisis, and an array of views and discussions were also mined (Loiti-Rodriguez et al., 2021). And 304 posts on Facebook published by Portuguese municipalities were examined to clarify what factors could influence the social media behaviors of local governments at the beginning of the COVID-19 pandemic (Padeiro et al., 2021). Chinese governments at all levels have also taken active actions and strengthened cooperation to alleviate the severe epidemic situation (Wu et al., 2021). Grounded on social media data of government news agencies on Facebook, Instagram, and Twitter, evidence reveals that the interaction between good government perception mechanisms and providing reliable information could enhance public trust in the government during the COVID-19 pandemic (Mansoor, 2021). It is urgent for different crisis management subjects to cooperate to identify false information and discussions about COVID-19, but the preliminary attempt between WHO and social media platforms, including Facebook and Twitter, was deemed unsustainable and unrealistic due to a shortage of necessary resources and skills (Bunker, 2020).

However, public opinion plays a critical role in helping governments manage the pandemic. Evidence about Chinese consumers showed that external stimuli related to the pandemic could affect public opinion, emotion, and behavior (S. J. Song et al., 2021). And negative content related to the crisis on Reddit fueled political polarization and prevented the United States from effectively mitigating the coronavirus pandemic (Chipidza, 2021). Therefore, to help the government better understand and manage the orientation of public opinion, and help the public establish the values of rational participation in online discussions related to COVID-19, it is necessary to explore the themes and emotions of different subjects discussing the epidemic on social media platforms.

2 Related works

2.1 The themes and sentiments analysis about COVID-19 on international social media platforms

There were some studies investigating the topics and sentiments on Twitter and other foreign social networking sites during the COVID-19 pandemic, but little was about the public opinions on popular social media platforms in China. The international differences in public comments on national vaccination programs have been confirmed, for example, the public remains neutral attitudes in the United Kingdom and India, while Americans may be at odds with them (Bunker, 2020; Ilyas et al., 2022).

Based on deep learning and mixed approaches, prior studies about Twitter users revealed

that in the initial days of the crisis, the public was reasonably neutral toward COVID-19, and most were optimistic about the related lockdown (Praveen & Ittamalla, 2021; Mittal et al., 2020). However, as COVID-19 gradually became a global pandemic, only 10.4% of the discussions on Twitter expressed positive emotions (Blanco & Lourenco, 2022), but research also showed neutral sentiments also surprisingly accounted for a considerable percentage at the peak time of the crisis (Praveen & Ittamalla, 2021). In the United States, the public sentiment scores and opinions also varied with the COVID-19 cases (Luu & Follmann, 2023). As time went on, the number of tweets might decline, and 81.2% of tweets also expressed non-negative sentiments about COVID-19 vaccines, and positive tweets were more likely to be liked and retweeted (Mir et al., 2021). Another study showed that the U.S. government's tweets on COVID-19 knowledge and science popularization allowed the public to scientifically understand COVID-19. Tweets also have the function of emotional diffusion, and the public shifted from negative to positive emotions during the pandemic (Xi et al., 2022). But sentiments analysis could not accurately measure the public attitudes about wearing facial masks to prevent the spread of COVID-19 (He et al., 2021). More specifically, prior research also compared the number of tweets and the themes of tweets on workdays and weekends in America, sentiments analysis was also conducted based on the milestones of the pandemic, including the number of confirmed cases, the number of deaths, the policy of stay-at-home orders, and the reopening announcement (Feng & Zhou, 2022).

Social networking sites (SNSs) such as Baidu COVID-19 bar1 uses have surged to seek social support, and express emotions (Islam et al., 2020; Yao et al., 2021). The important topics of COVID-19 discussions on TripAdvisor, one of the Netherlands forums, were uncovered by constructing a topic modeling (Nilashi et al., 2021). And the public comments on the video of formal medical recommendations on YouTube were utilized to identify dominant topics and evolving trends (Obadimu et al., 2021). The nutrition-related topics in the Spanish press during the crisis were also identified (Roger-Monzo et al., 2021).

2.2 Studies related to COVID–19 on Chinese social media platforms

Some popular social media platforms in China such as Sina Weibo, news webpages, and WeChat were regarded as primary sources of public opinion. A study revealed that the risk to public opinion on Sina Weibo might increase due to the public health emergence (Liu et al., 2022). The public perception and sentiment about the COVID-19 vaccine on Sina Weibo also were probed and compared with Twitter (Luo et al., 2021). Many hospitals in mainland China utilized information technology to prevent and control the pandemic, correspondingly, related news webpages in the top 50 hospitals pages were also conducted a content analysis to identify focal topics (Yan et al., 2020). As the Internet + Public Service reformation, government agencies are increasingly relying on WeChat to deliver services, therefore, clarifying the utilization and improvement method of WeChat official accounts attracted researchers' interests (Jiang et al., 2021). The trust in WeChat affected the health information-seeking intention, and then affected the health information-sharing behavior (Riaz et al., 2021). Health misinformation, uncommon sentiments and language on WeChat were also recognized (Li et al., 2022). But research demonstrated that for youngsters, WeChat interactions correlated with self-disclosure and friendship (Amosun et al., 2022), had optimistic and negative modes exerting a profound effect on mental health such as depression and fear (Pang, 2020), compulsive WeChat use and perceived information overload might directly cause fatigue, and negative emotions such as stress and anxiety were also indirectly triggered (Pang, 2021).

2.3 The dissemination of scholarly papers on social media platforms during the COVID–19 pandemic

During the crisis, the communication of academic articles on social media platforms is different than before the outbreak. Based on Dimensions data, prior research measured the dissemination characteristics of scientific papers at the beginning of the pandemic, covering descriptive statistical distribution, the altmetric attention score, geographical distribution, occupational distribution, etc. (Li et al., 2021). By analyzing the attitudes and perceptions of academia and social media on COVID-19-related studies, Zhou & Zhang (2021) found that there are obvious differences in the themes that academia pays more attention to systematic research, while the public pays more attention to macro trends. There are different communication preferences between scientific communities and the public (Zhou & Zhang, 2021). Furthermore, a study based on Altmetric.com and PubMed analyzed scientific information sources, themes, and sentiments on Twitter at the beginning, of the global phenomenon, and the global pandemic respectively (Chong & Park, 2021). Similarly, evidence revealed Twitter data could reflect the diffusion features of the publications related to the COVID-19 on social media platforms, a negative correlation between the number of tweets and the number of publications was verified (Patel et al., 2021), while the number of views and the number of citations had a positive relation (Edakar & Shehata, 2022), and tweets were one of the vital warning signs for problems in publications (Haunschild & Bornmann, 2021).

In China, WeChat has advantages in information dissemination, and it was utilized by more academic journals to promote interesting articles. As the most widely used Chinese database, CNKI is based on the content of publications and is far superior to other databases in terms of filtering conditions, the classification of different subjects, and journals. The significant positive correlations between the number of readings on WeChat official accounts and citations in CNKI also have been confirmed (Zhang et al., 2022). Most of the prior studies have investigated the topics and sentiments of the discussions related to the pandemic on Twitter and other popular platforms, but WeChat official accounts have been absent so far. Chinese articles mentioning COVID-19 on WeChat official accounts seem to be a reasonable proxy for COVID-19 topics of interest, so they are available to be mined for academic research. That is why CNKI and WeChat official accounts are selected as data sources in this study. In all, we aim to explore the themes and sentiments of Chinese articles mentioning COVID-19 on WeChat official accounts and CNKI from a dynamic perspective. Text mining, statistical analysis, and word association thematic analysis are used to collect the related articles, categorize significant topics, and identify sentiment on WeChat and CNKI. Correlation analysis is used to explore the quantitative relation between WeChat discussions and academic research. Meanwhile, the study also investigates whether articles mentioning COVID-19 influence the nature of the pandemic discussions on WeChat afterward. Furthermore, it would be a significant attempt to help government agencies to clarify and guide reasonably the public opinion related to COVID-19 in China.

3 Methodology

3.1 Data source

As the most popular social media platform in China, WeChat is extensively used to discuss and comment on various socioeconomic affairs. Due to the reading needs and huge traffic of the academic community and the public, WeChat has been widely used for open academic

exchanges between academia and the public. It can also be used to publish academic frontiers, discuss knowledge discovery, and popularize academic knowledge. The platform is of great value to academic dissemination and exchanges. Meanwhile, CNKI is the most commonly used bibliographic database for studying Chinese scholarly publications. The purpose of this paper is to explore how scientific papers spread on social media in the Chinese context. In this study, WeChat and CNKI were used to harvest social media discussions and scholarly publications on COVID-19.

English term "COVID-19" and the corresponding Chinese term "新型冠状病毒肺炎" were used as keywords to collect data. Our reasons for choosing search terms are as follows. In the early days of the pandemic, the virus and disease were commonly referred to as "coronavirus" and "Wuhan coronavirus", sometimes called "Wuhan pneumonia". These terms are not consistent and may lead to confusion. For this reason, we have used the official names as established by the World Health Organization and the National Health Commission of China to avoid any confusion. " 新冠 " was shorthand for " 新型冠状病毒肺炎 " , which is commonly utilized in Chinese social media and academic papers.

To investigate the attention, mentions, and coverage of WeChat articles regarding COVID-19 topics and associated academic papers, we utilized Python and Fiddler to retrieve data related to WeChat articles. Subsequently, we submitted titles, links, and DOIs through the WeChat API for data retrieval and filtering. Then we constructed the dataset. It is found that for WeChat articles, as shown in Figure 1, the number of reads, comments, likes and zaikans is highly dispersed. It should be noted that zaikan is a unique user behavior in WeChat. When the user clicks on zaikan button, the WeChat article is recommended to all friends in a specific module. There is a strong willingness to share the motivation. COVID-19 has received a lot of attention on social media in China, with its total number of reads reaching 20,130,709. Overall, each article was read 12,863 times on average, and 94 users liked it.

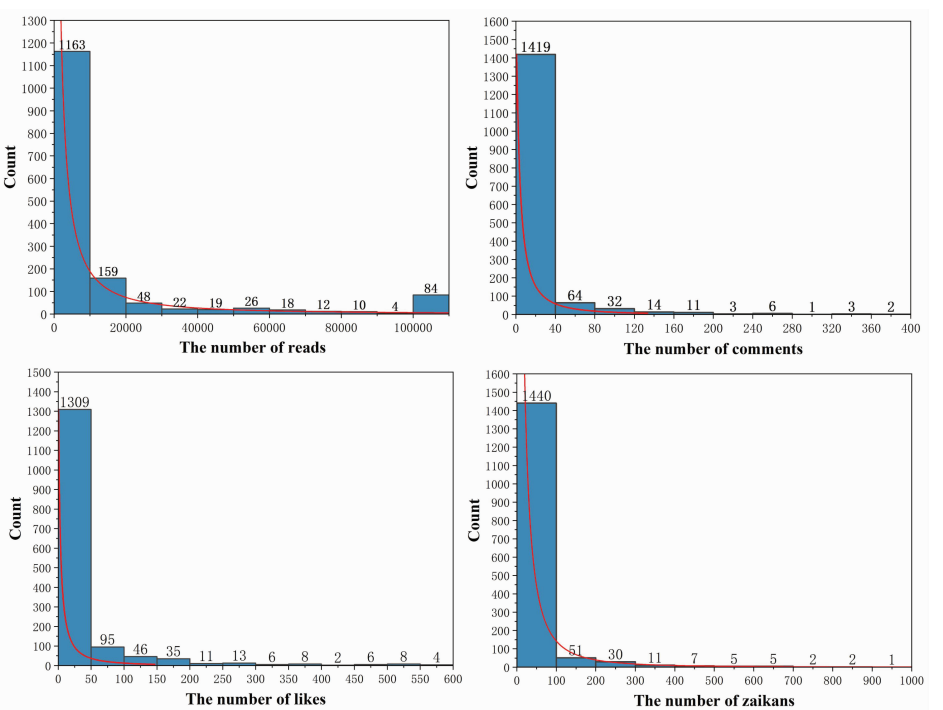


Figure 1 Distribution of attention indicators of WeChat articles

Each article received an average of 48 zaikans and 23 comments. But only 11 rewards were obtained on average.

5% of WeChat articles were read more than 100,000 times. These highly-read WeChat articles were selected because they were representative of the focus of the general public. After data cleaning, in total 1,565 WeChat articles and 2,966 scholarly papers were obtained, and all scholarly papers had more than 1 citation. In CNKI, the first scholarly paper on COVID-19 was published in January 2020. In WeChat, the Chinese meaning of COVID-19 (新冠) attracted more attention and reading after July 2021.

3.2 Data analysis

Statistical analysis and visualization were used to reveal the temporal distribution, account distribution and institutional distribution of relevant WeChat articles and scholarly papers. For analyzing the category and label of WeChat accounts, data from xiguaji.com, a professional data service company, were used.

For identifying the topics of WeChat discussions, Jieba (an open-source word segmentation tool for Chinese, with good word segmentation accuracy and speed) was used to segment sentences that mention the relevant terms. We enhanced the performance of the Chinese stop-word lists with advantage. Then, professional terms were added to the dictionary to improve the segmentation of WeChat articles. We calculated the co-occurrence frequency of any two subject words in titles and paragraphs respectively, and carried out a clustering analysis based on VOSviewer. There are positive correlations between co-occurrence frequency and node size, as well as between connection thickness and co-occurrence intensity. Co-occurrence analysis and clustering analysis were adopted for revealing the topics of discussion. Moreover, sentiment analysis was conducted based on Baidu sentiment analysis tools (https://cloud.baidu.com/) to clarify public sentiment in WeChat mentions to COVID-19. Based on deep learning training, the Baidu sentiment analysis method automatically learns deep semantic and syntactic features. It has a high generalization power, and can maintain a high effect even on relatively long sentences. This suits our cases.

To investigate the interaction between the general public conveyed by WeChat articles and the academic world conveyed by scholarly papers, WeChat mentions to scholarly papers of COVID-19 were retrieved by submitting the title, link, and DOI to search in WeChat search API, finally, a total of 1838 articles in CNKI are mentioned by WeChat official accounts, with in total 12,818 mentions to scholarly papers.

4 Results

4.1 Temporal distribution of articles that focus on COVID–19 in China

As shown in Figure 2, there were two main peaks of articles mentioning COVID-19 on WeChat official accounts. One is from January to March 2020, articles on COVID-19 and the corresponding Chinese term (新型冠状病毒肺炎) dominated; another was from July 2021 to May 2022, and the number of articles on 新冠 (new coronavirus) was remarkable. As shown in Figure 3, scholarly papers mentioning COVID-19 grew rapidly from January to February 2020, after reaching its peak in March 2020, the number of articles dropped at a slightly faster rate, then remained basically stable, which may be related to the outbreak's rebound and the emergence of the omicron virus.

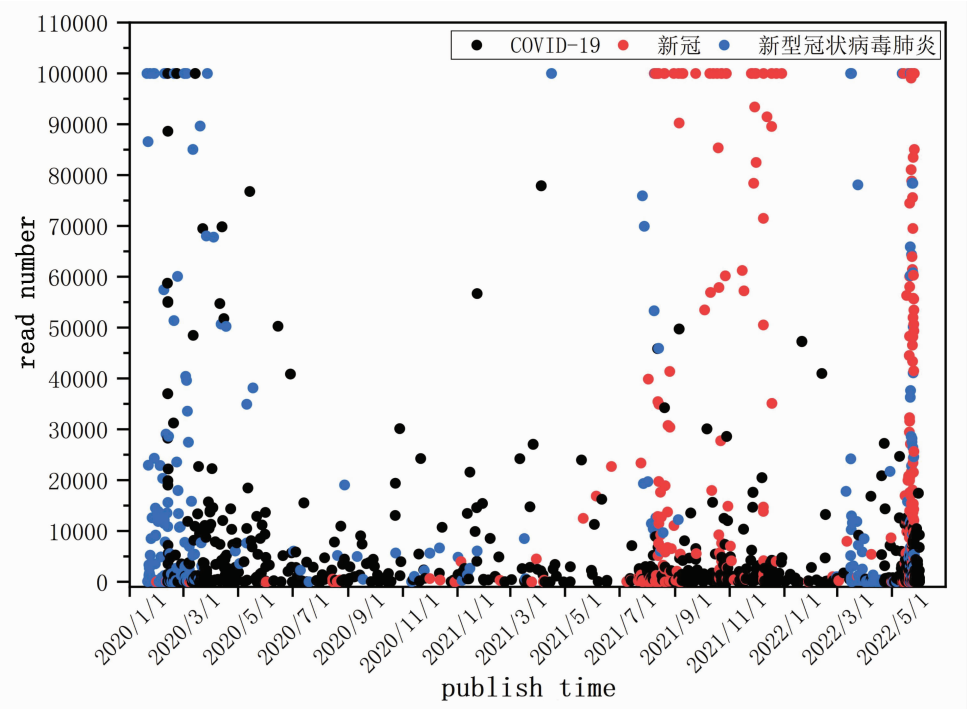


Figure 2 Time and the number of reads of articles mentioning COVID-19 in WeChat

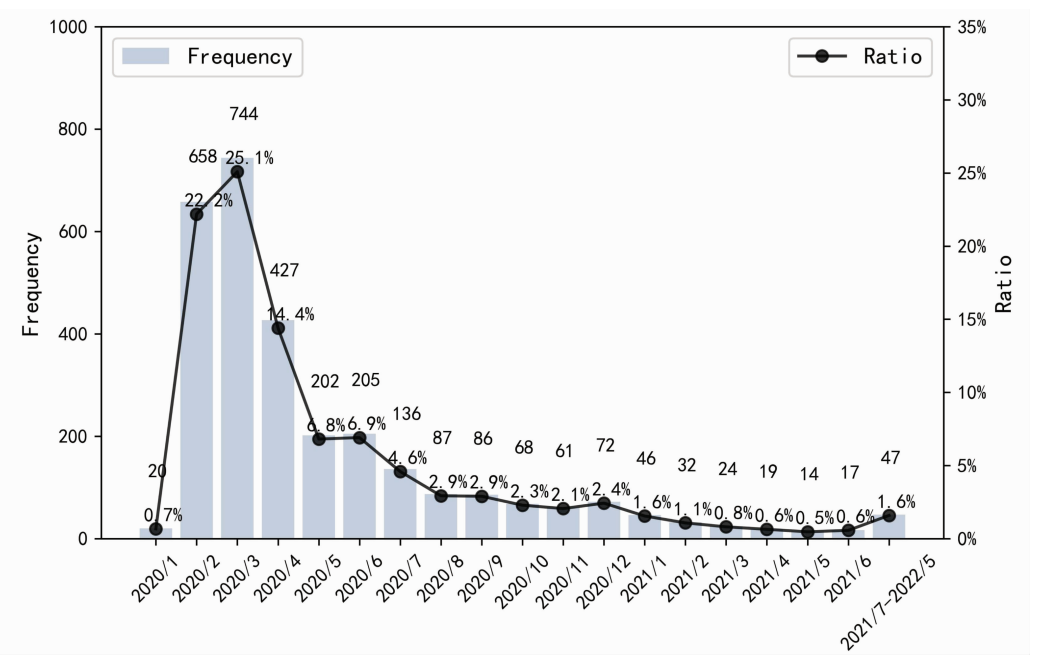


Figure 3 Time distribution of scholarly papers mentioning COVID-19 in CNKI

As shown in Table 1 (the correspondence between the code and the account is reflected in the appendix A), the first 20 WeChat articles that mention COVID-19 were all published between January 20 and 23, 2020, which might have close connections with the initial guess of

the pandemic made by academician Zhong Nanshan, the confirmed cases in Beijing, Shanghai and Guangzhou, and the COVID-19 was written into the law on prevention and control of infectious diseases by the National Health Commission. Thus, the *Diagnosis and treatment of pneumonia with novel coronavirus infection (trial)* released by A1 and the sources and transmission of COVID-19 made by academician Zhong Nanshan published by A4 were read

Table 1 The first 20 articles mentioning COVID-19 on WeChat

Code	Publish time	Title	Ranked by publication date	Read number	Like number
A1	2020/01/20	*Diagnosis and treatment of pneumonia with novel coronavirus infection (trial)*	1	100,001	5,834
A2	2020/01/20	*Novel coronavirus infection pneumonia*	2	75	0
A3	2020/01/20	*COVID–19*	3	164	1
A4	2020/01/21	*Zhong Nanshan: Human to Human Transmission of Novel Coronavirus Pneumonia*	4	86,594	479
A5	2020/01/21	*How does new coronavirus pneumonia protect itself? This article makes it all clear*	5	22,950	111
A6	2020/01/22	*Novel coronavirus pneumonia*	6	130	1
A7	2020/01/22	*Attention! What you must know about new coronavirus pneumonia*	7	724	23
A8	2020/01/22	*Novel coronavirus pneumonia is coming, don´t panic, you must know these four things*	8	3,341	14
A9	2020/01/22	*An article to explain to you what is new coronavirus infection of pneumonia!*	9	1,289	14
A10	2020/01/22	*Pneumonia with novel coronavirus*	10	264	4
A11	2020/01/22	*Hot spot concerns	how to prevent pneumonia with novel coronavirus infection? The authoritative answer is here*	11	473	4
A12	2020/01/22	*[One picture to understand] About pneumonia infected with novel coronavirus, look at what you want to know*	12	1,016	2
A13	2020/01/22	*CDC experts: new coronavirus infection pneumonia can be prevented and controlled, attention must be paid to do not panic*	13	811	1
A14	2020/01/22	*Santai county center for disease control and prevention reminds you: pneumonia infected with novel coronavirus is protected, controlled and curable*	14	1,660	15
A15	2020/01/22	*Knowledge: pneumonia in new coronavirus infections*	15	197	3
A16	2020/01/22	*Focus on the epidemic situation of new coronavirus infection pneumonia: clarification of doubts*	16	2,688	32
A17	2020/01/22	*Focus on novel coronavirus pneumonia*	17	377	7
A18	2020/01/22	*Three minutes to learn about coronavirus pneumonia*	18	1,674	15
A19	2020/01/23	*Novel coronavirus*	19	171	4
A20	2020/01/23	*360° detailed interpretation: new coronavirus infected pneumonia*	20	1,242	4

more than 100,000 and 80,000 times respectively, and the number of likes raised by them were much higher than other articles on WeChat. In addition, a popular science article on COVID-19 on WeChat was also read more than 20,000 times and received 111 likes, indicating that the pandemic attracted extensive attention from government agencies and the general public. However, the general public might find the occurrence and harm earlier, because only 3 articles mentioning COVID-19 were from WeChat official accounts found by professional institutions, and WeChat official accounts of other articles were relatively diverse.

4.2 WeChat accounts and academic institutions that focus on COVID–19

Combined with the industries and labels in data from xiguaji.com, we explored the industries distribution of 1,565 articles mentioning COVID-19. Results demonstrated that 1,565 articles mentioning COVID-19 came from 786 WeChat official accounts in 24 industries, of which 661 accounts had clear industry and label data. In a word, 34.4% of articles were from the information industry, 22.8% belonged to the health industry, media and technology industries accounted for 12.3% and 12% respectively, and accounts from the education industries and government agencies also published bits of COVID-19 articles. As shown in Figure 4, considering the widespread impact of COVID-19, most of the accounts were labeled with health, information, government & enterprise, current affairs, permaculture media, technology, legal system, cervical cancer, and law. In addition, the discussion on COVID-19 was not separated from the people' s livelihood and the guarantee of laws and regulations.

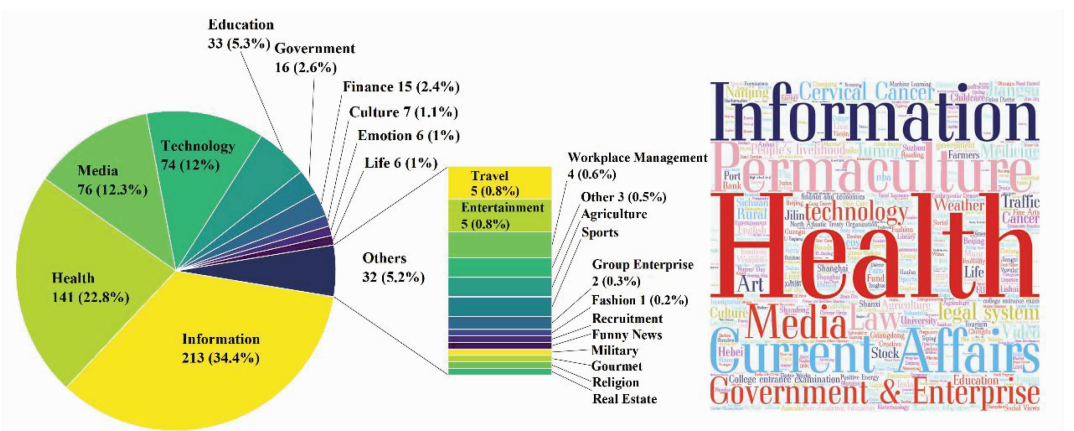


Figure 4 Industries and labels of WeChat official accounts that mention COVID-19

Table 2 listed the top 20 accounts with the most articles mentioning COVID-19. In the normalized epidemic, the reason why B1 published the most articles mentioning COVID-19 might be that it not only was one of the social media platforms for the general public to communicate, but committed to helping the public to answer or solve any questions and difficulties related to COVID-19. Besides, the B2, B3, and B4 also published more than 30 articles that mention COVID-19 from the public perspective. Unsurprisingly, the epidemic attracted extensive attention from WeChat public accounts in the medical field, B5, A1, and A4 all published 24 articles mentioning COVID-19, ranking joint fifth among all official accounts. In addition, the epidemic was one of the concerns of Nanjing WeChat accounts, for example, B9, B13, and B16 all published more than 10 articles related to COVID-19.

Table 2 Top 20 WeChat official accounts with the most articles mentioning COVID-19

Code	Brief introduction of the account	Ranked by number of articles	COVID–19 articles count	Read number
B1	More than a newspaper.	1	74	202,560
B2	Expect something fresh every time!	2	43	56,255
B3	The official account of the U.S. Embassy in Beijing publishes information about cultural activities at the U.S. Center in Beijing, visas to the United States, study in the United States, job opportunities at the U.S. Mission in Beijing, and so on.	3	39	547,814
B4	Agree or disagree, it helps improve our own perspective.	4	33	427,530
B5	Weibo 2016 top ten influences medical big V, Fruit shell network medicine talent. Popular knowledge of vaccines to solve the confusion in the process of vaccination.	5	24	304,359
A1	Dissemination of critical medical knowledge.	6	24	182,160
A4	Provide patient mobile service and payment, including whole–process closed–loop services such as consultation and registration, fee payment, report review, consultation guidance, consultation feedback, etc.	7	24	315,615
B6	Panda Guides is an expat service provider now focusing on jobs and news for foreigners living in China.	8	21	36,488
B7	News & Services for Expats & Returnees. WeChat ID: onetube_jobtube www.jobtube.cn	9	16	98,608
B8	Resource sharing, industry exchange!	10	15	15,242
B9	Deliver authoritative, important and temperature news in Nanjing. We not only pay attention to the current affairs and major policies, but also care about the pulse of Nanjing city and the joys and sorrows of Nanjing turnip. Here, there is material, depth, more numerous practical information, intimate service, emotional resonance...	11	15	98,313
B10	Professional healthy lifestyle platform	12	14	1,084,626
B11	This is an international social platform, where you can easily find foreign friends. Foreigner enhances your life in China as an easy social and tourism network.	13	13	17,872
B12	www.ebiotrade.com	14	13	19,192
B13	Authoritative release, fresh service. This is the new media platform of Nanjing Municipal Committee and Government.	15	13	949,320
B14	For ads WeChat ID: The waijiao–2	16	12	2,276
B15	Timely release hospital information and relevant announcements, and provide more convenient services to patient users	17	12	200,904
B16	Jiangsu City Channel is known as the "first terrestrial channel" in Jiangsu Province, and Nanjing Zero Distance has created a precedent for "people´s livelihood news" in China. Nice, fun and useful!	18	11	314,777
B17	New things, interesting things, unusual things, strange things, difficult things, welcome the first time we WeChat oh!	19	11	191,689
B18	We provide China news, in–depth reports and analysis.	20	10	139,382

Scholarly papers that were cited more than once were mainly published in the Chinese series of epidemic diseases, infectious diseases, tuberculosis, respiratory diseases, preventive medicine, and traditional Chinese medical journals. In terms of publishing institutions (including universities, affiliated hospitals, and research institutes), Huazhong University of Science and Technology published the most articles on COVID-19, which was in accord with the conclusions from the perspective of scientometrics (Pal, 2021), followed by Wuhan University, Peking University, Capital Medical University, Fudan University, Sichuan University, Sun Yat-sen University and so on.

Table 3 Top 20 journals and institutions of scholarly papers mentioning COVID-19

Rank	Journal	Count	Institution	Count
1	*Chinese Journal of Epidemiology*	121	Huazhong University of Science and Technology	489
2	*Chinese Journal Tuberculosis and Respiratory Diseases*	61	Wuhan University	335
3	*Chinese Journal of Preventive Medicine*	56	Peking University	250
4	*Journal of Chinese Herbal Medicine*	55	Capital Medical University	213
5	*Chinese Critical Care Medicine*	54	Fudan University	213
6	*Chinese Journal of Infectious Diseases*	51	Zhejiang University	174
7	*Journal of Traditional Chinese Medicine*	38	Sichuan University	171
8	*Chinese Medical Journal*	38	Sun Yat–sen University	132
9	*Chinese Hospital Management Journal*	34	Shanghai Jiao Tong University	113
10	*Chinese Journal of Infection Control*	31	Peking Union Medical College Hospital	108
11	*Chinese Journal of Laboratory Medicine*	29	Xi´an Jiaotong University	92
12	*International Journal of Virology*	28	Central South University	86
13	*Herald of Medicine*	26	Beijing University of Traditional Chinese Medicine	83
14	*Chinese Journal of Nosocomiology*	25	Nanjing Medical University	73
15	*Chinese Journal of Emergency Medicine*	25	Shanghai University of Traditional Chinese Medicine	68
16	*Chinese Journal of Radiology*	24	Guangzhou Medical College	65
17	*World Journal of Traditional Chinese Medicine*	24	Zhengzhou University	63
18	*Chinese Journal of Clinical Infectious Diseases*	23	Southern Medical University	57
19	*Chinese Hospital Management*	23	Tsinghua University	55
20	*China Journal of Chinese Materia Medica*	23	Tianjin University of Traditional Chinese Medicine	55

4.3 Topics of WeChat articles versus scholarly papers that mention COVID–19

We split up the sentences mentioning COVID-19 in articles to explore the topics on COVID-19 in WeChat official accounts. We rely on the keywords of academic papers mentioned in WeChat to perform the co-occurrence analysis of topic words. From the clusters formed, the relevant topics are summarized. In Figure 5 and Table 4, the pandemic was born with five topics.

Topic 1: Outbreak, production, and development of the pandemic in global and China. It

took with 新冠 (new coronavirus) and 患者 (patients) as the core nodes, and the strongly connected topic words were COVID, 研究 (research), 治疗 (treatment), and 国家 (country).

Topic 2: Detection, confirmation, and treatment of the COVID-19. It took 新冠肺炎 (COVID-19) and 核酸检测 (nucleic acid testing) as the core nodes, and the strongly connected topic words included 确诊病例 (confirmed cases), 新型冠状病毒肺炎 (COVID-19), 病例(cases), and 新增 (new cases).

Topic 3: Novel coronavirus vaccines developed for different populations and their vaccination situation. It took 新冠病毒 (Novel Coronavirus) and 接种 (vaccination) as the core nodes, and the strongly connected topic words were 疫苗 (vaccine), 新冠疫苗 (the COVID-19 vaccine), 免疫 (immunization), and 儿童 (children).

Topic 4: Prevention and control measures taken by experts from various industries and communities at all levels to cope with COVID-19. It took 疫情 (the epidemic) and 工作 (work) as the core nodes, and the associated topic words included 相关 (relevance), 症状 (symptoms), 地区 (region), and 做好(do well).

Topic 5: Infection and transmission mechanism of the COVID-19. It took 感染 (infection) and 病毒 (virus) as the core nodes, and the associated subject words were 风险 (risk), 传播 (transmission), 发生 (occurrence), and 预防 (prevention).

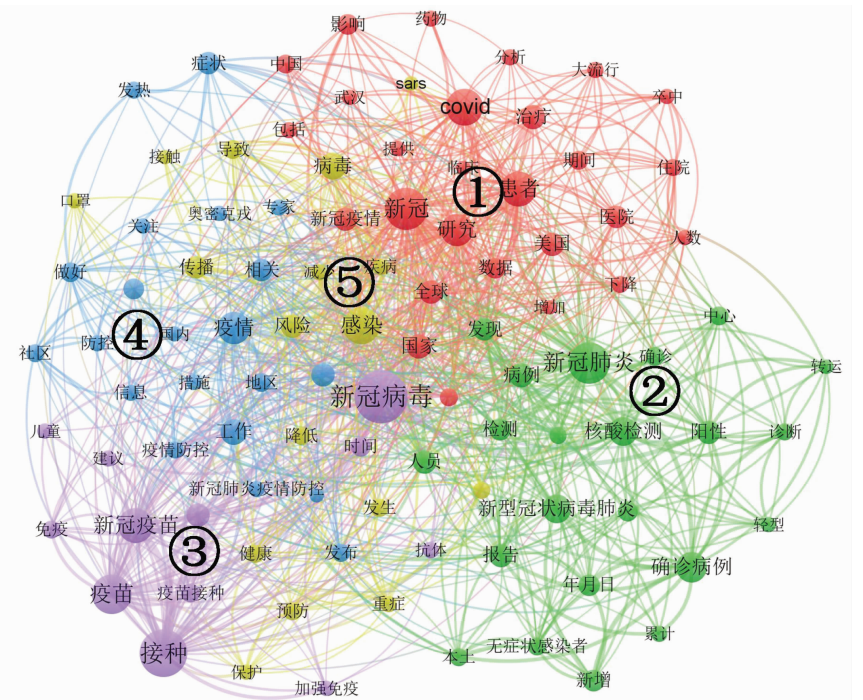


Figure 5 Topics of WeChat articles that mention COVID-19

The cluster analysis of scholarly papers mentioning COVID-19 is displayed in Figure 6 and Table 5.

Topic 1: Changes brought by the COVID-19. This cluster took 新型冠状病毒肺炎 (the COVID-19) and 新冠肺炎疫情 (the epidemic) as the core nodes, and mainly reflected the impact of COVID-19 on the government, the public, and medical staff, such as various changes in social governance and life patterns.

Topic 2: Biological expressions and syndromes closely associated with COVID-19. This clus-

Table 4 Major clusters and corresponding labels in the topic analysis of Wechat articles

Cluster	Label (Chinese)	Label (English)	Weights in datasets
1	新冠	new coronavirus	826
	COVID	COVID	630
	患者	patients	569
	研究	research	479
	治疗	treatment	273
2	新冠肺炎	COVID–19	812
	确诊病例	confirmed cases	444
	核酸检测	nucleic acid testing	395
	新型冠状病毒肺炎	COVID–19	384
	病例	cases	277
3	新冠病毒	novel coronavirus	1,315
	接种	vaccination	1,058
	疫苗	vaccine	729
	新冠疫苗	the COVID–19 vaccine	575
	人群	people	254
4	疫情	the epidemic	479
	工作	work	317
	情况	situations	268
	相关	relevance	245
	症状	symptoms	233
5	感染	infection	647
	病毒	virus	353
	风险	risk	265
	传播	transmission	240
	导致	lead to	175

ter took 新型冠状病毒 (novel coronavirus) and COVID-19 as core nodes.

Topic 3: Clinical and epidemiological characteristics of COVID-19. This cluster took 冠状病毒感染 (coronavirus infection) and 肺炎 (pneumonia) as the core nodes.

Topic 4: Prevention, diagnosis, and treatment measures for COVID-19 patients of different ages. This cluster took 治疗 (treatment) and 诊断 (diagnosis) as the core nodes.

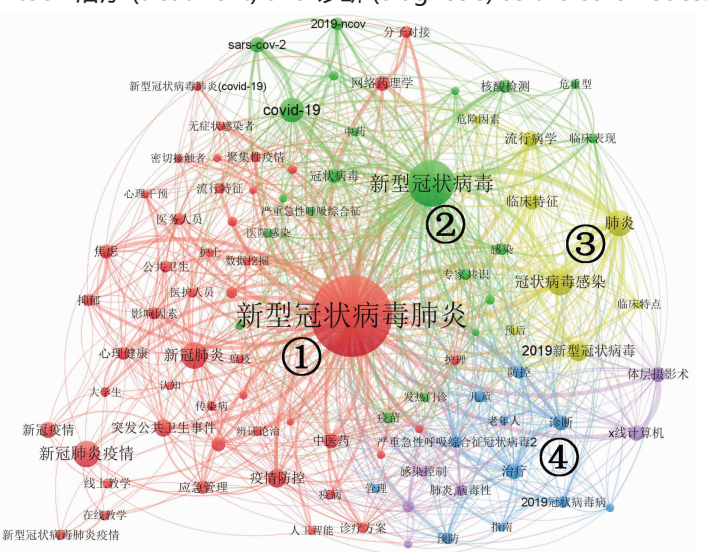


Figure 6 Topics of scholarly papers that mention COVID-19

Table 5 Major clusters and corresponding labels in the topic analysis of scholarly papers

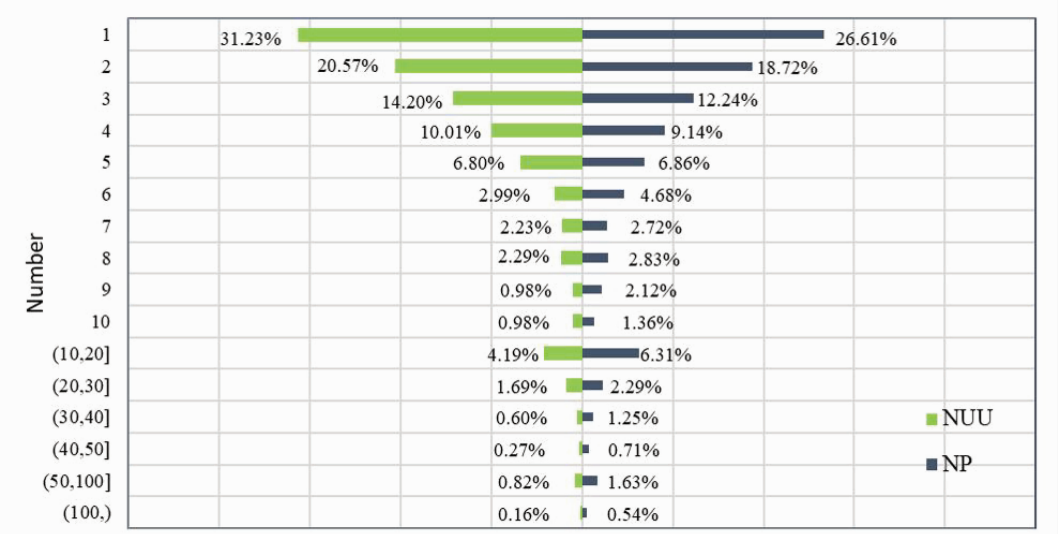
Cluster	Label (Chinese)	Label (English)	Weights in datasets
1	新型冠状病毒肺炎	the COVID–19	1,612
	新冠肺炎疫情	the epidemic	161
	新冠肺炎	Covid–19	154
	疫情防控	epidemic prevention and control	75
	突发公共卫生事件	emergency public health event	67
2	新型冠状病毒	novel coronavirus	509
	covid–19	Covid–19	135
	sars–cov–2	Sars–cov–2	53
	冠状病毒	coronavirus	45
	核酸检测	nucleic acid testing	40
3	冠状病毒感染	coronavirus infection	154
	肺炎	pneumonia	148
	2019 新型冠状病毒	2019 novel coronavirus	91
	临床特征	clinical characteristic	58
	流行病学	epidemiology	55
4	治疗	treatment	58
	诊断	diagnosis	49
	防控	protect and control	35
	儿童	children	32
	严重急性呼吸综合征冠状病毒 2	severe acute respiratory syndrome coronavirus 2	30

Generally, the articles mentioning COVID-19 in the two databases had their own emphasis. The discussion of the novel coronavirus on WeChat official accounts mainly focused on its generation, prevention, and spread. It was relatively comprehensive and closely related to the life of the general public. Scholarly papers mentioning COVID-19 mainly explored the clinical characterization of the pandemic from the medical perspective and analyzed in detail the impact of COVID-19 on all aspects of social life.

4.4 WeChat mentions to scholarly papers on COVID–19

In total, 61.7% of scholarly papers were mentioned by WeChat articles, which was similar to the coverage of academic papers on Twitter (Yu et al., 2017). There were 12,818 mentions that are distributed across 4,692 WeChat accounts. The top three WeChat accounts with the most mentions are 世界中医药杂志社 (one medical journal's official account), 感控小蜘蛛 (one online public education platform), CHKD 读者服务 (the specialized medical knowledge database affiliated with CNKI).

Considering the differences between the two altmetrics indicators of NP (number of posts) and NUU (number of unique users) (Yu, 2017), we used these two indicators to make a contrast. As shown in Figure 7, NUU is the number of different WeChat articles that mentioned academic papers, without counting the same academic paper that was mentioned in the same WeChat article. When considering the NP, 26.61% of the papers were mentioned by WeChat once, 18.72% were mentioned twice, and 12.24% were mentioned three times. A total of 57.57% of the academic papers were mentioned by WeChat no more than three times, and the average number of WeChat mentions per article was 7.0. When considering the NUU, 31.23% of the scholarly papers were mentioned in the WeChat once, 20.57% were mentioned twice, and 14.20% were mentioned three times. A total of 66.00% of the papers were mentioned in WeChat no more than three times, and the average number of WeChat mentions per article was 4.7.



NP: number of posts; NUU: number of unique users

Figure 7 Frequency of scholarly papers mentioned in WeChat articles

As shown in Figure 8, the proportion of academic papers mentioned by WeChat within 180 days after publication was 46.1%, among which 11.5% were mentioned within 1 day, 10.9% were mentioned within 7 days, and 11.8% were mentioned within 30 days. And 20.4% of scholarly papers were mentioned by WeChat even before they were officially published. However, the percentage of academic papers that were mentioned by WeChat beyond 360 days after publication was 15.4%. It indicates that WeChat articles pay more attention to new

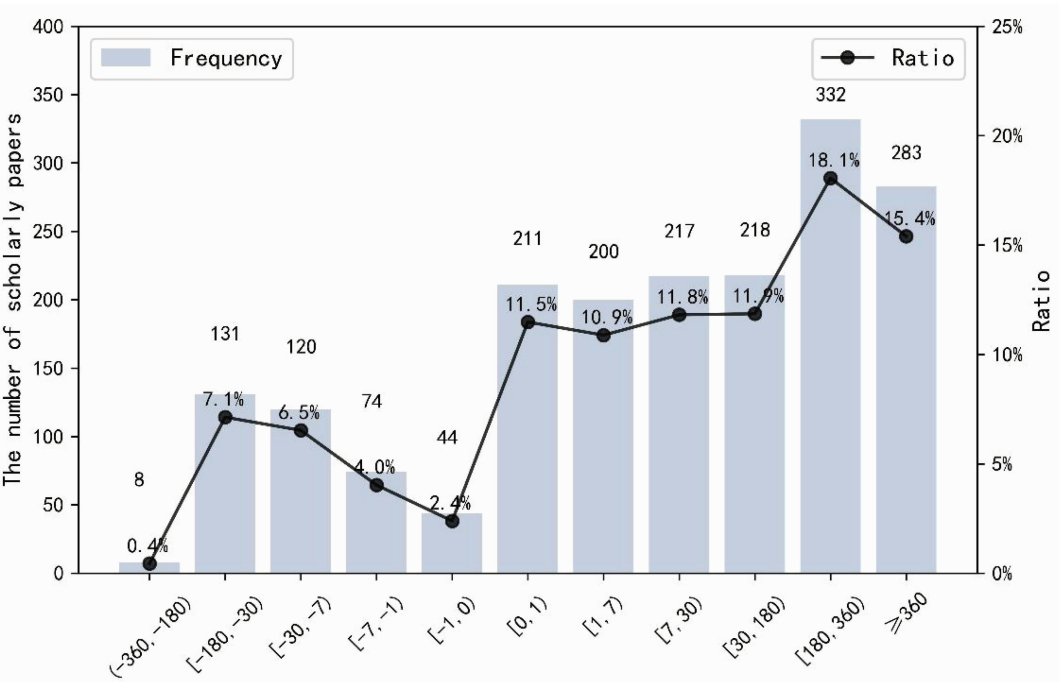


Figure 8 Immediacy distribution of academic papers mentioned by WeChat

academic papers.

The most popular papers in WeChat were related to expert consensus and suggestions regarding COVID-19, treatment plans, case observation and description of medical protective equipment. Meanwhile, there was an extremely weak positive correlation between citations and the WeChat mentions of an academic paper, and the correlation coefficient was 0.215 ($P<0.01$).

4.5 Sentiment towards COVID–19 on WeChat

In WeChat articles that mentioned COVID-19, 71.25% of titles were positive, and 24.09% expressed negative sentiment. However, as far as the comments from the general public, the positive tendency accounted for only 57.61%, and the negative accounted for 39.59% (Table 6). This might result from the fact that during the COVID-19 pandemic, WeChat official accounts assumed certain social responsibilities, contributed to maintaining social stability, and raised public confidence in the fight against the COVID-19 epidemic. Meanwhile, there was a weak negative correlation between the likes of articles, comments and the results of sentiment analysis, the correlation coefficients were -0.052 and -0.109, respectively ($P< 0.01$).

Table 6 Sentiments of titles and comments of WeChat articles mentioning COVID-19 (%)

Article elements	Negative	Neutral	Positive
Titles	24.09	4.66	71.25
Comments	39.59	2.80	57.61

5 Discussion

WeChat has been found to be the most commonly used platform for telemedicine services during pandemics (Ye et al., 2023), and this study further extends the findings, as we confirmed WeChat official accounts from information industries published the largest proportion of pandemic articles. In this study, we did not find a dominant role in social media platforms, which means the general public and scholars only differed in their focus and depth of discussion. However, these were unlike previous studies, as they found the dominance of scholars has been taken over by the public (Yang, 2022). At the same time, the study confirmed that there was also a high likelihood of academic outputs being mentioned on social media platforms in China, suggesting that promoting the localization of altmetrics also requires adequately mining Chinese social media platforms for mention data. Unlike previous studies, we did not find stress, anxiety, or panic from the public during the pandemic (J. Q. Song et al., 2021), which might be closely related to the developmental stage of the pandemic and the preventive and control measures.

There is great theoretical and practical significance in this study. Theoretically, the interaction between science and society involves various disciplines like sociology, communication, and education, which makes it challenging for scholars to quantify the characteristics of the interaction. However, we make clear the differences between the general public and scholars, including the scope of attention and depth of discussion. The findings complement social interaction studies based on qualitative analyses, and promote studies on science popularization. In practice, this study also has direct practical value in identifying the quality of information about the pandemic based on the discussion time, published subject, topic, and sen-

timent. Two major strategies when faced with public health emergencies are also revealed and confirmed. The government not only needs to prevent negative social sentiments but also explains core pandemic-related knowledge to the public with the help of scholarly outputs.

Inevitably, there are several limitations in this study. On the one hand, when obtained data from the "Search" engine in WeChat, we were limited in the frequency of access, which prevented obtaining the full dataset from 2019 to 2023. Thus, we are actively exploring the possibility of obtaining the full data directly from WeChat, hoping to reflect the evolutionary trend of science-society interactions. On the other hand, due to the late foundation of WeChat, we were not able to access public discussions about other public health emergencies such as SARS, and the contribution of results in this study to addressing public health emergencies was limited.

6 Conclusion

COVID-19 has significantly influenced China as well as the whole world. Despite the large loss and suffering, China has achieved great success in fighting the pandemic. It is interesting to know how Chinese people are discussing COVID-19. Different from previous studies that rely on Sina Weibo to uncover public opinion, this study has made use of WeChat official account articles to convey the sentiment. Moreover, the public topics are compared with that of scholarly papers, and the interaction between WeChat and scholarly papers is also investigated. The major conclusions are as follows.

(1) Discussion about COVID-19 keeps being hot on WeChat, while the number of scholarly papers about COVID-19 has become stable at relatively low level after peaking in the first several months. This indicates that COVID-19 is constantly occupying people's attention, probably because it is influencing their daily lives and the virus variation keeps disturbing. In comparison, research about COVID-19 has gone through the initial stage and entered the new phase of in-depth investigation. In other words, COVID-19 is no longer a new research object, especially after the vaccine was invented.

(2) WeChat accounts from the information industry have contributed the most mentions of COVID-19, it is followed by WeChat accounts from the health industry, and accounts from the media category and technology category have contributed approximately an equal number of mentions of COVID-19. This suggests that discussion about COVID-19 on WeChat is governed by public accounts and could reflect public opinion. Professional accounts from the health field play a positive role in delivering professional messages. Although the government is leading the fight against the pandemic, the accounts only publish necessary notice or bulletin and has no interference with public discussion.

(3) Topics of discussions on WeChat overlap with topics of scholarly papers, meanwhile presenting a much broader scope. Both the public and academic researchers pay close attention to the prevention, diagnosis and treatment of COVID-19. However, the general public discuss more about specific ways of fighting the disease. Therefore, they are concerned with the latest infection situation, the transmission channel, the testing method, the vaccination and experts' advice. In comparison, academic researchers focus more on uncovering the in-depth mechanism of the virus and observing the influence that the pandemic has brought to society.

(4) The general public are deeply connected with academic research via mentions to scholarly papers, and coverage of WeChat articles to scholarly papers is quite high and reaches

61.7%. The distribution of numbers of WeChat mentions is relatively dispersed compared with that of Twitter. WeChat mentions present good immediacy, 54.6% of WeChat mentions occurred within 30 days, and 66.5% occurred within 180 days. Scholarly papers about experts' consensus and suggestions towards COVID-19 are the major bridge between public users and academic researchers.

(5) In general, public sentiment in WeChat mentions to COVID-19 is positive, and the positive percentage is even higher when considering only the title. This suggests that in China the public is optimistic about the pandemic and has confidences in defeating the virus.

China is playing an important role in fighting against the global pandemic. This study has revealed how COVID-19 is discussed in Chinese social media and scholarly research. We have observed a quick response to the pandemic via the discussion on WeChat and academic studies. It remains a hot topic on WeChat and users are discussing various issues about it in a free and flexible way. While government is critical in disseminating authoritative messages, various types of public users dominate the discussions. We also find good interaction between public concern and academic interest, from both the overlapped topics and WeChat mentions to scholarly papers. The positive sentiment demonstrates the holistic confidence of the public towards defeating the pandemic. These findings are helpful in understanding the social attitude towards and comprehensive perception of COVID-19 in China.

Acknowledgments

The research was funded by the National Natural Science Foundation of China (72274227) and Humanity and Social Science Foundation of the Ministry of Education of China (22YJA870016).

References

Amosun, T. S., Chu, J. X., Rufai, O. H., Muhideen, S., Shahani, R., Shah, Z. K., & Koroma, J.(2022). WeChat usage during COVID–19 pandemic lockdown: the mediating role of online self–disclosure on quality of friendship and well–being. *Global Knowledge Memory and Communication, 71* (3), 121–139. http://doi.org/10.1108/GKMC–09–2020–0136

Aviv–Reuven, S., & Rosenfeld, A. (2021). Publication patterns' changes due to the COVID–19 pandemic: A longitudinal and short–term scientometric analysis. *Scientometrics, 126* (8), 6761–6784. http://doi.org/10.1007/s11192–021–04059–x

Barnes, S. J. (2020). Information management research and practice in the post–COVID–19 world. *International Journal of Information Management, 55*, 102175. http://doi.org/10.1016/j.ijinfomgt.2020.102175

Blanco, G., & Lourenco, A. (2022). Optimism and pessimism analysis using deep learning on COVID–19 related twitter conversations. *Information Processing & Management, 59* (3),102918. http://doi.org/10.1016/j.ipm.2022.102918

Bunker, D. (2020). Who do you trust? The digital destruction of shared situational awareness and the COVID–19 infodemic. *International Journal of Information Management, 55* (12), 102201. http://doi.org/10.1016/j.ijin–fomgt.2020.102201

Chipidza, W. (2021). The effect of toxicity on COVID–19 news network formation in political subcommunities on Reddit: An affiliation network approach. *International Journal of Information Management, 61*, 102397. http://doi.org/10.1016/j.ijinfomgt.2021.102397

Chong, M., & Park, H. W. (2021). COVID–19 in the Twitterverse, from epidemic to pandemic: information–sharing behavior and Twitter as an information carrier. *Scientometrics, 126* (8), 6479–6503. http://doi.org/10.1007/s11192–021–04054–2

Dwivedi, Y. K., Hughes, D. L., Coombs, C., Constantiou, I., Duan, Y. Q., Edwards, J. S., Gupta, B., Lal, B.,

Misra, S., Prashant, P., Raman, R., Rana, N. P., Sharma, S. K., & Upadhyay, N. (2020). Impact of COVID–19 pandemic on information management research and practice: Transforming education, work and life. *International Journal of Information Management, 55* (2), 102211. http://doi.org/10.1016/j.ijinfomgt.2020.102211

Edakar, M., & Shehata, A. (2022). Measuring the impact of COVID–19 papers on the social web: An altmetric study. *Global Knowledge Memory and Communication, 71* (1–2), 1–26. http://doi.org/10.1108/GKMC–11–2020–0179

Feng, Y. H., & Zhou, W. J. (2022). Work from home during the COVID–19 pandemic: An observational study based on a large geo–tagged COVID–19 Twitter dataset (UsaGeoCov19). *Information Processing & Management, 59* (2), 102820. http://doi.org/10.1016/j.ipm.2021.102820

Haunschild, R., & Bornmann, L. (2021). Can tweets be used to detect problems early with scientific papers? A case study of three retracted COVID–19/SARS–CoV–2 papers. *Scientometrics, 126* (6), 5181–5199. http://doi.org/10.1007/s11192–021–03962–7

He, L., He, C. Y., Reynolds, T. L., Bai, Q. S., Huang, Y. C., Li, C., Zheng, K., & Chen, Y. A. (2021). Why do people oppose mask wearing? A comprehensive analysis of US tweets during the COVID–19 pandemic. *Journal of The American Medical Informatics Association, 28* (7), 1564–1573. http://doi.org/10.1093/jamia/ocab047

Ilyas, H., Anwar, A., Yaqub, U., Alzamil, Z., & Appelbaum, D. (2022). Analysis and visualization of COVID–19 discourse on Twitter using data science: A case study of the USA, the UK and India. *Global Knowledge Memory and Communication, 71* (3), 140–154. http://doi.org/10.1108/GKMC–01–2021–0006

Islam, A., Mantymaki, M., Laato, S., & Turel, O. (2020). Adverse consequences of emotional support seeking through social network sites in coping with stress from a global pandemic. *International Journal of Information Management, 62*, 102431. http://doi.org/10.1016/j.ijinfomgt.2021.102431

Jiang, T., Wang, Y., Lin, T., & Shangguan, L. (2021). Evaluating Chinese government WeChat official accounts in public service delivery: A user–centered approach. *Government Information Quarterly, 38* (1), 101548. https://doi.org/10.1016/j.giq.2020.101548

Li, J. P., Sun, L. M., Feng, X., He, P. Y., & Zhang, Y. (2021). Social media communication of the scientific and technological literature in emergency under COVID–19. *Library Hi Tech, 39* (3), 796–813. http://doi.org/10.1108/LHT–10–2020–0268

Li, Y. L., Fan, Z. J., Yuan, X. J., & Zhang, X. (2022). Recognizing fake information through a developed feature scheme: A user study of health misinformation on social media in China. *Information Processing & Management, 59* (1), 102769. http://doi.org/10.1016/j.ipm.2021.102769

Liu, J., Liu, L. Y., Tu, Y., Li, S. X., & Li, Z. M. (2021). Multi–stage Internet public opinion risk grading analysis of public health emergencies: An empirical study on Microblog in COVID–19. *Information Processing & Management, 59* (3), 102796. http://doi.org/10.1016/j.ipm.2021.102796

Loiti–Rodriguez, S., Genaut–Arratibel, A., & Cantalapiedra–Gonzalez, M. J. (2021). Crisis communication in audiovisual format: information from Spain's National Health System on YouTube in 2020. *Professional De La Lnformación Information Professional, 30* (4). http://doi.org/10.3145/epi.2021.jul.16

Luo, C., Chen, A. F., Cui, B. T., & Liao, W. (2021). Exploring public perceptions of the COVID–19 vaccine online from a cultural perspective: Semantic network analysis of two social media platforms in the United States and China. *Telematics and Informatics, 65, 101712*. http://doi.org/10.1016/j.tele.2021.101712

Luu, T. J. P., & Follmann, R. (2023). The relationship between sentiment score and COVID–19 cases in the United States. *Journal of Information Science*, *49* (6), 1615–1630. http://doi.org/10.1177/01655515211068167

Mansoor, M. (2021). Citizens´ trust in government as a function of good governance and government agency´s provision of quality information on social media during COVID–19. *Government Information Quarterly, 38* (4), 101597. http://doi.org/10.1016/j.giq.2021.101597

Marin, L. (2021). Three contextual dimensions of information on social media: lessons learned from the COVID–19 infodemic. *Ethics and Information Technology, 23* (SUPPL 1), 79–86. http://doi.org/10.1007/s10676–020–09550–2

Mir, A. A., Rathinam, S., & Gul, S. (2021). Public perception of COVID–19 vaccines from the digital footprints left on Twitter: analyzing positive, neutral and negative sentiments of Twitterati. *Library Hi Tech, 40* (2), 340–356. http://doi.org/10.1108/LHT–08–2021–0261

Mittal, R., Ahmed, W., Mittal, A., & Aggarwal, I. (2020). Twitter users exhibited coping behaviours during the COVID–19 lockdown: An analysis of tweets using mixed methods. *Information Discovery and Delivery,49* (3), 193–202. http://doi.org/10.1108/IDD–08–2020–0102

Nilashi, M., Asadi, S., Minaei–Bidgoli, B., Abumalloh, R. A., Samad, S., Ghabban, F., & Ahani, A. (2021). Rec–ommendation agents and information sharing through social media for coronavirus outbreak. *Telematics and Informatics, 61*,101597. http://doi.org/10.1016/j.tele.2021.101597

Obadimu, A., Khaund, T., Mead, E., Marcoux, T., & Agarwal, N. (2021). Developing a socio–computational ap–proach to examine toxicity propagation and regulation in COVID–19 discourse on YouTube. *Information Pro–cessing & Management, 58* (5), 102660. http://doi.org/10.1016/j.ipm.2021.102660

Padeiro, M., Bueno–Larraz, B., & Freitas, A. (2021). Local governments´ use of social media during the COVID–19 pandemic: The case of Portugal. *Government Information Quarterly, 38* (4),101620. http://doi.org/10.1016 /j.giq.2021.101620

Pal, J. K. (2021). Visualizing the knowledge outburst in global research on COVID–19. *Scientometrics, 126* (5), 4173–4193. http://doi.org/10.1007/s11192–021–03912–3

Pang, H. (2020). Unraveling the influence of passive and active WeChat interactions on upward social compari–son and negative psychological consequences among university students. *Telematics and Informatics, 57* (3), 101510. https://doi.org/10.1016/j.tele.2020.101510

Pang, H. (2021). How compulsive WeChat use and information overload affect social media fatigue and well–being during the COVID–19 pandemic? A stressor–strain–outcome perspective. *Telematics and Informatics,* 64,101690. http://doi.org/10.1016/j.tele.2021.101690

Patel, V. M., Haunschild, R., Bornmann, L., & Garas, G. (2021). A call for governments to pause Twitter cen–sorship: using Twitter data as social–spatial sensors of COVID–19/SARS–CoV–2 research diffusion. *Scien–tometrics, 126* (4), 3193–3207. http://doi.org/10.1007/s11192–020–03843–5

Praveen, S. V., & Ittamalla, R. (2021). An analysis of attitude of general public toward COVID–19 crises – senti–mental analysis and a topic modeling study. *Information Discovery and Delivery, 49* (3), 240–249. http://doi. org/10.1108/IDD–08–2020–0097

Riaz, M., Wang, X. W., Sherani, & Guo, Y. (2021). An empirical investigation of precursors influencing social media health information behaviors and personal healthcare habits during coronavirus (COVID–19) pandem–ic. *Information Discovery and Delivery, 49* (3), 225–239. http://doi.org/10.1108/IDD–06–2020–0070

Roger–Monzo, V., Cabrera–Garcia–Ochoa, Y., & Moreno–Castro, C. (2021). Restricted diets: analysis of the press discourse on nutrition in times of Covid –19. *Professional de la Information, 30* (6). http://doi.org/ 10.3145/epi.2021.nov.18

Santos, B. S., Silva, I., Lima, L., Endo, P. T., Alves, G., & Ribeiro–Dantas, M. D. (2022). Discovering temporal scientometric knowledge in COVID–19 scholarly production. *Scientometrics, 127* (3), 1609–1642. http://doi. org/10.1007/s11192–021–04260–y

Song, J. Q., Jiang, R. H., Chen, N., Qu, W., Liu, D., Zhang, M., Fan, H. Z., Zhao, Y. L., & Tan, S. P. (2021). Self–help cognitive behavioral therapy application for COVID–19–related mental health problems: A longitudi–nal trial. *Asian Journal of Psychiatry, 60*, 102656. http://doi.org/10.1016/j.ajp.2021.102656

Song, S. J., Yao, X. L., & Wen, N. A. (2021). What motivates Chinese consumers to avoid information about the COVID–19 pandemic?: The perspective of the stimulus–organism–response model. *Information Processing & Management, 58* (1), 102407. http://doi.org/10.1016/j.ipm.2020.102407

Wu, J., Wang, K., He, C., Huang, X., & Dong, K. (2021). Characterizing the patterns of China´s policies against COVID–19: A bibliometric study. *Information Processing & Management, 58* (4), 102562. http://doi.org/10. 1016/j.ipm.2021.102562

Xi, H., Zhang, C., Zhao, Y., & He, S. (2022). Public emotional diffusion over COVID–19 related tweets posted by major public health agencies in the United States. *Data Intelligence, 4* (1), 66–87. http://doi.org/10.1162/ dint_a_00101

Yan, A. H., Zou, Y., & Mirchandani, D. A. (2020). How hospitals in mainland China responded to the outbreak of COVID–19 using information technology–enabled services: An analysis of hospital news webpages. *Journal of the American Medical Informatics Association, 27* (7), 991–999. http://doi.org/10.1093/jamia/ocaa064

Yang, Z. (2022) Inadequate interactions and unbalanced power between scientists and the public in Chinese knowledge sharing network: Social network analysis of the topic of genetically modified food on Zhihu. *Social*

Science Computer Review, 41 (5), 1836–1856. http://doi.org/10.1177/08944393221087668

Yao, Z., Tang, P. F., Fan, J. R., & Luan, J. (2021). Influence of online social support on the public´s belief in overcoming COVID–19. *Information Processing & Management, 58* (4), 102583. http://doi.org/10.1016/j.ipm.2021.102583

Ye, J. C., He, L., & Beestrum, M. (2023). Implications for implementation and adoption of telehealth in developing countries: a systematic review of China´s practices and experiences. *NPJ Digital Medicine, 6* (1), 174. http://doi.org/10.1038/s41746–023–00908–6

Yu, H. Q. (2017) Context of altmetrics data matters: An investigation of count type and user category. *Scientometrics, 111* (1), 267–283. http://doi.org/10.1007/s11192–017–2251–z

Yu, H.Q., Xu, S.M., Xiao, T.T., Hemminger, B.M., Yang, S. L. (2017). Global science discussed in local altmetrics: Weibo and its comparison with Twitter. *Journal of Informetrics, 11* (2), 466–482. http://doi.org/10.1016/j.joi.2017.02.011

Zhang, B., Sun, J., Zhang, H., & Xu, C. (2022). Can promotion on WeChat official accounts improve scholarly journals´ academic impact? A micro–level correlation comparison study. *Learned Publishing, 35* (2),163–174. https://doi.org/10.1002/leap.1440

Zhou, Q., & Zhang, C. (2021). Breaking community boundary: Comparing academic and social communication preferences regarding global pandemics. *Journal of Informetrics, 15* (3), 101162. https://doi.org/10.1016/j.joi.2021.101162

Appendix A List of WeChat official accounts and corresponding code in Table 1 and Table 2

Code	Account	Code	Account
A1	重症医学 (Critical Care Medicine)	B1	上海日报 SHINE (Shanghai Daily SHINE)
A2	小小熊树洞 (Little Bear Tree Cave)	B2	北京人 (The Beijinger)
A3	野丫头服装潮店 (Wild girl clothing fashion store)	B3	美国驻华大使馆 (U.S. Embassy in China)
A4	广州医科大学附属第一医院 (The First Hospital of Guangzhou Medical University)	B4	外国人关注 (Expat Focus)
A5	家在鼓楼 (Home in Gulou)	B5	疫苗与科学 (Vaccines and Science)
A6	运动风云 (sporting clouds)	B6	熊猫指南 (Panda Guides)
A7	家乡美卫 (Hometown Beauty and Health)	B7	每日新闻 (OneTube Daily)
A8	益美传媒 (Yimei Media)	B8	生物制品圈 (Bioproducts Circle)
A9	北京朝阳健康教育 (Beijing Chaoyang Health Education)	B9	南京日报 (Nanjing Daily)
A10	普思电子电源事业部 (Pulsar Electronics and Power department)	B10	丁香医生 (Dingxiang physician)
A11	微徐泾 (Micro Xujing)	B11	Laowai 在华 (foreigners in China)
A12	山丹微生活 (Shandan MicroLife)	B12	生物通 (BioPass)
A13	福尚兴隆台 (Fushang Xinglongtai)	B13	南京发布 (Nanjing Releases)
A14	三台县教体局 (Santai County Education and Sports Bureau)	B14	外焦 (The Waijiao)
A15	防城港发布 (Fangchenggang Release)	B15	中日友好医院 (China–Japanese Friendship Hospital)
A16	央视今日亚洲 (CCTV Asia Today)	B16	南京零距离 (Nanjing Zero Distance)
A17	茂名高校通 (Maoming Higher Education Access)	B17	扬子晚报 (Yangtse Evening News)
A18	成都医学院 (Chengdu Medical College)	B18	中国日报 (CHINA DAILY)
A19	格林色彩大师 (Grimm´s Colour Masters)		
A20	小荷健康科普 (Xiaohe Health Science)		