A Framing Analysis and Regional Comparison of Newspaper Media Reports of COVID-19 in Shanghai: Based on the LDA Topic Model

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Abstract

In this study, we analyzed reports published by local and non-local newspapers on the 2022 COVID-19 outbreak in Shanghai using the Latent Dirichlet Allocation (LDA) topic modeling technique. Framing Theory suggests that both coverage types would typically produce similar media frames, notwithstanding the presence of slight differences in bias. We identified the media frames used by local and non-local newspapers on the Shanghai outbreak and our analysis subsequently informed our discussion on the similarities and differences that were uncovered. The paper offers suggestions for media reporting on how to better cover the outbreak.

Keywords: COVID-19, framing, Chinese newspapers, topic modeling

1. Introduction

On March 1, 2022, a confirmed case of COVID-19 was reported in Shanghai, signaling another epidemic in the city. It spread throughout the entire Shanghai area and across many other Chinese provinces and cities. The Shanghai epidemic garnered media attention from national newspapers.

For a long time, the press in mainland China has been perceived as the government's propaganda arm. Paper media outlets are financially supported by the Chinese government and are under its jurisdiction (Repnikova, 2017). Press releases are strictly controlled and subject to restrictions by government authorities. However, with the development of social media, as well as the reform and opening-up, paper media have further embraced their role as a public institution and developed their enterprise management. As a result of general enterprise management and economic liberalization, they have gained more freedom and flexibility (Duan, Zwickle, & Takahashi, 2017). The Chinese media network is thus transitioning from totalitarianism to market authoritarianism (Winfield & Peng, 2005).

Chinese politics are regarded as a fragmented authoritarian model, where decision-making occurs within a "black box" from which many voices and perspectives are excluded. Policymaking in this compartmentalized decision-making system can only be accomplished through bargaining and mutual compromise (Oksenberg, 2001). The fragmented authoritarian model emphasizes that different levels of government may have distinct interests and political goals. The complex and sometimes conflicting relationships between government agencies at different levels shape their negotiations and may affect policy implementation (Lieberthal, 1992). As a result of the fragmented authoritarian model, journalists are more likely to resist the state's regulatory power (Lei, 2016). A local environment that is marked by political fragmentation and economic competition creates more opportunities for journalism (Lei, 2016). Shanghai, as China's economic powerhouse with the second-highest number of media outlets in the country, also offers favorable conditions for local journalism development.

Examining news discourse production through the lens of frame analysis reveals that factors such as news routines, social systems, and journalists' ideologies play a significant role in news production (Caiqin, 2010). News producers in Shanghai and other regional media outlets in the country are equally affected by these factors. While it is understood that they constrain news production in Shanghai and other parts of China, this paper will unpack how they are related to the news framing of the epidemic coverage. Based on the above literature, we expect that the local media in Shanghai will frame the issue differently than media outlets in the rest of China. This paper aims to answer the following research questions:

RQ1: How did Shanghai's local newspapers frame the epidemic in their media coverage?

RQ2: How did newspapers outside Shanghai frame the epidemic in their media coverage?

There is very little research on the impact of the media's framing of the Shanghai epidemic (Ophir, 2021) and on the distinctions between the various regional newspapers' media reports on the topic in China. So the final research question is articulated:

RQ3: Are there differences in how Shanghai's local newspapers and newspapers outside the city framed the Shanghai epidemic?

2. Literature Review

2.1 The Coverage of Epidemics

The media is essential to communicating information about risk to the public (Reynolds, 2005). However, the information provided by news outlets during epidemics can be selective. State censorship affects news coverage levels (Fox, 2021). Also, journalists tend to process and edit information based on their needs (Johan Galtung, 1965), dramatizing stories and diseases in particular (Bennett, 1983) and creating media frames (D'Angelo, 2018).

Studies on the framing of epidemics have been discussed. For example, scholars have examined how print media framed public health epidemics caused by mad cow disease, the West Nile virus, and the avian flu, identifying frames such as the "action" and "consequence" (Shih, Wijaya, & Brossard, 2008). Lee (2014) studied the coverage of H1N1 in Singapore and identified various media frames, including theme, episodic vs. thematic framing, emotion appeal, tone, gain vs. loss, and outbreak vs. non-outbreak situation. Other scholars have used general frames or pre-existing frames in their study of outbreak reporting, such as human interest and conflict (An & Gower, 2009), or "CERC (Crisis and Emergency Risk Communication)", frameworks (Ophir, 2018).

The literature review reflects that the framing of epidemics has not been much discussed. Also, most studies are driven by theory, and while a deductive approach is important, the framework is constantly changing. An inductive approach can support the discovery of new changes to the framework (Ophir et al., 2021), given that coverage may change over time due to changes in journalistic routines and practices (Van Gorp, 2007).

2.2 The Concept and Operation of News Frames

Scholars have not yet reached a unanimous definition of a frame. The relevant conceptual differences are not discussed in this paper. Instead, we focus on the optimal method for measuring news frames. We follow the widely used definition of a frame as a "central organizing idea or storyline that provides meaning to an unfolding strip of events [. . .] The frame suggests what the controversy is about, the essence of the issue" (Gamson, 1989).

Several scholars have attempted to develop approaches to frame measurement (Van Gorp, 2007). Manual coding is the most common. However, it requires large amounts of time and vast human resources (Grimmer & Stewart, 2017). Moreover, human inter-coder reliability is an issue (Burscher, Odijk, Vliegenthart, de Rijke, & de Vreese, 2014).

Researchers have therefore turned to automated tools for identifying frame elements (Ophir et al., 2021). The most widely used methods are K-means, Evolutionary Factor Analysis, and the topic model. The latter has been considered suitable for narrower data sets (Nicholls & Culpepper, 2020) and is an effective approach to avoid the pitfalls of manual coding. Given the narrow data reported in this paper (less than 4000 case), we conducted a data-driven, LDA topic model analysis to study the reporting framework for the Shanghai COVID-19 epidemic.

3. Method

Traditional content analysis methods for measuring news frames require creating codebooks, training coders, and a lengthy manual coding process. This makes the efficient and reliable estimation of the relative use of frames in a news article difficult for human coders (Walter & Ophir, 2020). Recently proposed computer-assisted methods that treat individual topics as frames (DiMaggio, Nag, & Blei, 2013) saves time and effort while providing reliable conclusions.

Previous framing studies relied heavily on theory-driven approaches, but coverage can change dramatically over time, and using inductive methods can better help identify emerging or evolving frames (GORP, 2009). An inductive approach can assist in highlighting changes in the framework's application, at least during the discovery phase. This study used a computer-assisted, LDA(Latent Dirichlet Allocation)topic modeling method to answer RQ1, RQ2, and RQ3.

3.1 Data Sources

We downloaded national paper media news reports during the Shanghai epidemic using the Wisers News Retrieval System. This platform includes comprehensive information on hundreds of news websites, weekly news publications, and radio stations in mainland China, Hong Kong, Taiwan, and Australia. On March 1, 2022, the people of Shanghai were notified of the first COVID-19 case that would launch a new outbreak. On April 1, Shanghai declared a region-wide crisis as the epidemic reached critical levels and the city adopted strategic measures for outbreak management. On May 1, Shanghai announced that residents in the precautionary zone could travel within a limited

range outside their community to do activities, and the epidemic gradually ended. Therefore, we opted to select news reports on the epidemic in Shanghai that were published during the more severe period, from March 1, 2022, to May 1, 2022. A total of 783 articles, including 359 articles from non-local newspapers and 424 articles from Shanghai newspapers, were divided into two corpora, after deleting duplicate or irrelevant reports.

3.2 Data Processing

Because we required only text for the analysis, irrelevant content such as Wisers' news number markers, article numbers, and page marker symbols was removed by Python before we collated 424 documents. Following this content removal, a deactivation dictionary was created to filter words and emoticons such as conjunctions, prepositions, pronouns, and other words without accurate, meaningful text. A custom dictionary was created; otherwise, subsequent operations would cut specific words apart. For example, "上海疫情"(Epidemic outbreak in Shanghai) was cut into 上海"(Shanghai), "疫情"(Epidemic). The document was divided into multiple-word units due to the unique specifications of LDA topic model analysis. Therefore, the text was processed by Chinese word separation using the Jieba pack of Python after the deactivated words were removed, but the custom words were kept. The corpus was therefore pruned. It was anticipated that the vocabulary would contain a significant number of uncommon words due to the distribution of languages. Therefore, we used relative pruning to eliminate words that appeared in the corpus either too frequently or too infrequently. This operation shrank the corpus and increased model speed by eliminating all words that appeared more than 99% of the time or less than 0.5% of the time.

3.3 Model Selection

Model selection is the process of determining the parameters of the model. We used a perplexity test to identify the optimal number of topics (k) for the model, where a lower perplexity value indicates a higher model accuracy. To keep the model simple, we compared the perplexity measure and intrinsic coherence values for models with k = 1 to 30 topics. Two researchers also discussed the two best topic models. For corpus I we found that k=23 provided the most reasonable topic solution (the confusion degree was -7.57, and the intrinsic coherence was 0.45). Both the consistency and confusion values of k=23 were appropriate and suitable, so we decided support the model with this parameter. The same perplexity and thematic consistency tests were performed for corpus II. The consistency and perplexity values of k=13 were found to be acceptable, so that model was supported.

3.4 Framing Detection

Topic modeling was used first to split the corpus into separate topics. Next, frames were identified by examining FREX words.

Walter and Ophir (2019) argue that while topic modeling is an effective starting point for frame discovery, other methods should be applied to group topics into frame categories. Therefore, themes were grouped into frames based on the themes detected in previous frame studies. To validate the frame discovery results, 10% of the articles in this paper were sampled for content coding and compared with the frame results from topic modeling. Cohen's Kappa coefficient of 0.72 indicated that the two analyses were broadly consistent.

4. Results

We first examined the framing of the epidemic coverage by Shanghai's local newspapers (RQ1). A model of 23 topics was selected. After FREX words, 11 topics were removed because their topic assignments could not be explained, and 12 topics were kept (Table 1). After assigning a title to each topic, the latter was manually classified based on judgment, and a frame name was assigned based on previous academic achievements. This process led to the identification of five frames.

The most prevalent frame was the first one, Economic Consequences (20.7 %), which includes forecasts of changes and fluctuations in the stock market, the latest actions of enterprises, the market conditions of the automobile industry, and the resumption of production in various industries.

The second frame, Fighting COVID-19, focuses on the work of local hospitals in Shanghai to combat the outbreak. The third frame refers to the supply of medical and material supplies, and it includes the logistics and transportation of shortage materials, such as vegetables, online shopping in the community, and the supply of medical equipment. The fourth frame related to political response relates mainly on political coverage, such as the portrayal of typical party members, the work of leaders, and central government policies. Finally, there is the Social Response frame, which includes education during the epidemic and medical support in various locations.

Table 1. Topic model and keyword distribution (newspapers in Shanghai)

Frame, Topic, FREX words, Proportion
Frame 1: Economic Consequences
● Topic 2: Stock market（9.9%）
● Market, Shanghai Stock Exchange, bank, finance, capital
● Topic 7: Enterprise（6.9%）
● JD e-commerce platform, stores, supermarkets, customers, products
● Topic 13: Automobile industry（3%）
● New energy, brand, discount, model, cars
● Topic 22: Resumption of work and production（0.9%）
● Recovery, production, business, outlets, employees
Frame 2: Fighting COVID-19
● Topic 1: Critical care, treatment, medical treatment, admission, shelter（17.4%）
Frame 3: Medical and Material Supplies
● Topic 3: Supply of fresh goods（6.9%）
● Vegetables, distribution, supply chain, fresh, tons
● Topic 4: Online shopping（6.3%）
● Express, logistics, group purchase, order, neighborhood committee
● Topic 18: Medical supplies（2%）
● Surgery, dispensing, medical care, emergency, medicine
Frame 4：Political Response
● Topic 9: Leadership response（5%）
● Clearing, Sun Chunlan, epidemic prevention and control work, policy, Wu Fan
● Topic 15: Party member work（2.2%）
● Chen Chen, Party member, emergency response, guidance, supply guarantee
Frame 5: Social Response
● Topic 12: Medical support（3.7%）
● Medical team, support, arrangement, arrival, participation
● Topic 23: Education（0.6%）
● Children, students, boys, closed, residential area

Next, we examined the covering of non-local newspapers (RQ2). After checking the FREX words, two topics were removed because their topics could not be explained and 11 topics were marked (Table 2). After assigning a title to each topic, they were manually classified, and a frame name was assigned based on previous papers. We identified four frames.

Frame 1, Outbreak, includes measures to control the epidemic in Shanghai and its associated areas, the latest domestic outbreak data (new cases and developments), and the latest international imported cases. The second frame we identified, Economic Consequences, refers to reports on the resumption of work and working from home. The third frame corresponds to Supply of Fresh Goods, which involves reports on supplies during the Shanghai outbreak, about issues such as logistics distribution and vegetable transportation. Lastly, we identified the Social Response frame, which mainly details the donations and volunteer activities for Shanghai happening across the country.

The last step of the study involved comparing how local and non-local newspapers covered the Shanghai epidemic (RQ3). There are some similarities between how the media framed the event, but we also noticed local and non-local outlets adopted specific media frames. Shanghai local newspapers' most important reporting frames were Economic Consequences and Fighting COVID-19 (38.1%), while the prevalent non-local newspapers' frame was Outbreak (37.6%). There were common media frames: Economy Consequences, Material Supplies, and Social Response. However, the specific themes within each differ. For example, local newspapers in Shanghai paid more attention to the impact of the shifting financial stock market on the economy. In comparison, non-local newspapers focused on economic factors related to people's livelihood. Similarly, in the Social Response Frame, Shanghai newspapers lacked the coverage on donations and volunteer activities outside the region, emphasizing instead local reports.

Table 2. Topic model and keyword distribution (non-local newspapers)

Frame, Topic, FREX words, Proportion
Frame 1: Outbreak
●   Topic 1: Control measures（17.1%）
●   Region, measures, control, COVID-19 in Shanghai, policies
●   Topic2: Epidemic situation（14.4%）
●   Virus, Omicron, pneumonia, infection, dynamic
●   Topic 7: International import（6.1%）
●   Persistence, variation, import, Omicron, accumulation
Frame 2: Economic Consequences
●   Topic 3: Resumption of work and production（10.5%）
●   Return to work, economy, finance, market, production
●   Topic 13: Working from home（1.8%）
●   Home, overtime, office, overtime pay, company
Frame 3: Supply of Fresh Goods
●   Topic 4: Logistics, distribution, vegetables, shopping, transportation（10.1%）
Frame 4: Social Response
●   Topic 9: Material support（5.2%）
●   Donation, love, people, tons, bamboo shoots
●   Topic 11: Voluntary support（3.7%）
●   Support, team, province, country, region

5. Discussion

In this paper, we found that Shanghai's local newspapers and newspapers outside city used both similar and different media frames to cover the epidemic. This paper offers a rationale for the high similarity between the reporting frameworks that is grounded in our analysis. We focus on the following: the principles of running newspapers, the reporting objects, the reporting style, the national values, and Shanghai's urban status.

5.1 "Statesman-run-newspapers" Is an Important Principle Adhered to in the Shanghai COVID-19 Reports

On February 19, 2016, at the "Party's Forum on Journalism and Public Opinion Work," the request for politicians to run newspapers was reiterated.

During the Shanghai outbreak of COVID-19, the principle of "Statesman-run newspapers" was apparent in media reports produced by Shanghai and non-local newspapers. The statesman-run-newspapers paradigm means that the overwhelming priority is given to the party's interest within journalistic practice(Wang, 2015). The significant overlap in their media frames may be due to the common focus on the local government's epidemic prevention policy services. The subtle difference is that Shanghai's paper media reporting framework targets local news and audiences. On other hand, the media in different regions performed their role as disseminators of public information, by releasing the number of cumulative confirmed cases and sharing the latest official bulletins, epidemic prevention policies, and dynamic epidemic data, in a timely manner.

5.2 Both Focus on the Advanced Nature of the Reported Objects

One journalism mechanism involves controlling the scale of reports by managing the amount of coverage and the order in which a subject is reported, to enlarge or dilute the importance or influence of a news event. In reports on COVID-19 in Shanghai, individuals or groups with excellent quality occupied an important part of all the reports. However, Shanghai newspapers appeared more inclined to establish a personal image. Communist Party members were mentioned many times, suggesting that media in the Shanghai area were more willing to promote the establishment of individual models than the media in other regions, rather than a collective model. A number of news and stories in the Shanghai area focused on the promotion and recognition of community leaders and members of the Party. Therefore, the Political Response frame was unique to Shanghai's local papers.

Furthermore, there was less propaganda in Shanghai related to the volunteer organizations than outside the city. Non-local newspapers, while presenting typical official anti-epidemic actions such as the role of outstanding individuals in fighting COVID-19, also highlighted the vital role of volunteer organizations and donations. They paid more attention to the balance between individual and collective reports. Non-local newspapers illustrated the importance of collective support in the Social Response frame through two topics: material support and voluntary support. However, whether reporting on individuals such as leaders or members of the Party, or organizations, Shanghai's local and non-local newspapers appear to have reported on subjects in a similar fashion; the difference lies in the emphasis they place on the stories. Because they both publicized the progressive nature of reported objects, the reporting framework was very similar.

5.3 The Reporting Frames and Narrative Styles Are Mainly Positive

The internal structure plays a vital role in the construction of the news frame. The upbeat narrative style of Shanghai

COVID-19 reports was formed through the periodic adjustment of the internal structure of the news text. Although Shanghai's local and non-local newspapers reported on themes differently, with various angles, the mainstream coverage was largely positive.

In the subject keywords, there were none that were negative. Even within the Fighting COVID-19 and Outbreak frames, Shanghai's local and non-local newspapers objectively explained the situation, while providing optimistic and encouraging reports. We found that both Shanghai's local newspapers and non-local newspapers chose positive reporting frames and narrative styles. It is possible that the official media tried to shift the focus of Shanghai citizens through agenda-setting to promote a positive attitude towards combating the epidemic, given that this is also a requirement for official Chinese news media. In fact, during the COVID-19 epidemic in Shanghai, there were many doubts about the prevention policies and large-scale, online protests were held. Many negative messages appeared on Weibo and on social media like WeChat public accounts. However, this discourse is nearly not reflected in traditional paper media; only a few media stories euphemistically questioned these policies.

5.4 The Collective Sense of Belonging of the Chinese Nation Lends to Similar Topics Across Media

Liu Qi believes that national identity includes two levels: "one is a political identity, that is, identity from the state power; the second is the identity of groups or individuals, or the interaction of ethnic groups in specific time and space situations, which is dynamic and changing"(Qi, 2016). After the founding of the People's Republic of China, the Chinese nation formed a new political identity. Its strong collectivist characteristics have intensified feelings of group identity in individuals, thus strengthening interactions between ethnic groups. We believe that this is why the Social Response and Materials Supplies frames were identified in both Shanghai's local and non-local newspapers. In the selected reports in this study, non-local newspapers focused on which parts of the country donated what materials to Shanghai and how many people were dispatched to support Shanghai's epidemic prevention work, while the newspapers in Shanghai reported on donations across the country. Such mutual reports demonstrate a robust national identity in a multi-ethnic country. Driven by national values, to a certain extent, this national identity determines the "frame limit" of media reports, which restricts Chinese media's coverage of sudden public health events such as COVID-19 to fixed subjects and lenses. The standard national values inspired non-local newspapers to care about the dynamics of the epidemic in Shanghai, and the media in Shanghai responded. This interval interaction gives the invisible wind vane of news production about the epidemic in Shanghai, thus making the theme of production content similar.

5.5 Shanghai's Important City Status Strengthens the Connection Between National Reports

Shanghai is China's international economic, financial, trade, shipping, science, and technological innovation hub as approved by the State Council. It is essential to China's economy; Shanghai and the remainder of the country are inextricably linked. Outside Shanghai, many enterprises had economic problems such as supply chain interruption, the inability to withdraw funds, and failure to hold specific exhibitions due to the lockdown in the city. When business with Shanghai could not be carried out, this led to employment problems. In addition, the outflow of infected people from this prominent hub to other regions caused the spread of the virus, which affected the urban operations in and out of Shanghai to varying degrees. Therefore, the Economic Consequences frame appears in both Shanghai's local and non-local newspapers and in each case, similar themes are involved, such as Resumption of Work and Production, which focuses on the development of specific industries during the COVID-19 epidemic.

The analysis of non-local newspapers revealed there were many reports that enterprises outside Shanghai were affected by the epidemic and could not operate normally. They were very concerned about the dynamics of the epidemic and about the resumption of production activities. However, Shanghai's newspapers paid more attention to their urban development during this period. Apparently, the impact of COVID-19 outside Shanghai was not weaker than in Shanghai. Therefore, Shanghai's local and non-local newspapers paid particular attention to the progress of COVID-19 in Shanghai and adopted their own perspectives in their reporting frameworks.

Based on the above analysis, we found that while news media used similar reporting frameworks to report COVID-19 in Shanghai, they reported bias given that China is a large country. To some extent, the positive narratives told through traditional paper media reports did not fully reflect the social reality during the epidemic. Guiding public opinion through positive reports was undoubtedly a task assigned to newspapers. However, reasonable reporting on negative incidents and the provision of guidance can also help achieve better communication outcomes. Although discourse is strictly limited in this context, sharing diverse perspectives is generally beneficial to the prevention and control of epidemics. Many netizens stated that they questioned the media, such as Caixin in Shanghai, because they reported negative news during the epidemic. Several individuals believe their reports were not able to guide public opinion given their tone. However, these were rare voices.

In order to improve news coverage so that it supports COVID-19 prevention and control in large cities like Shanghai, we make the following recommendations: First, newspapers should target public opinion hot spots and speak out

authoritatively to correct incorrect sources (Wei, 2022). The mainstream media's timely input could guide public opinion and provide their audiences with direction, which should be a priority for the official Chinese media. Secondly, the paper media should also pay attention to the development of the epidemic and adapt their framing to the various stages to ensure the content reflects the updated situation (Shim et al., 2021). Finally, while focusing on guiding positive public opinions, media should ensure that their media reports are comprehensive. Negative social phenomena are still an indispensable part of the prevention and control of the COVID-19 epidemic, and the reasonable reporting of negative news by the media may be conducive to better outcomes.

6. Conclusion and Limitations

In summary, it is generally believed that Shanghai newspapers are influenced by its economic development and commercial success. While it can be assumed that reporting frames on the 2022 COVID-19 outbreak in Shanghai would differ from other regions, this was not the case. The study concludes that during this time, the framing of the epidemic by Shanghai's local newspapers only slightly differed from that which was reported by non-local newspapers. There were several frames that were either consistent (such as Economic Consequences and Social Response) or highly similar (such as Medical and Material Supplies and Supply of Fresh Goods). Of course, the topics within these frameworks varied based on media agenda settings, and there were also a few different frames (such as Fighting COVID-19 and Outbreak). We argue that local and non-local newspapers reporting on the Shanghai epidemic have highly similar frames because media in Shanghai are still highly controlled by the Shanghai Municipal Party Committee. Moreover, local governments also control newspapers in non-Shanghai areas. Their reporting frameworks and choices of subjects for their media reports will also have been strictly controlled. It would be unusual to have a reporting framework on the epidemic that differs from the influence of the collective values of the Chinese nation. And yet, given the critical status of Shanghai, many individuals, enterprises, and industries affected by the epidemic had to pay more attention to the situation in the city, requiring Shanghai media outlets to emphasize local matters in their reports.

To understand the impact of our findings, the limitations of the study should be discussed. First, our selection was limited to 359 articles from non-local newspapers and 424 articles from local Shanghai newspapers; the sample did not include all news on COVID-19 in Shanghai. Second, although we explained the stages of the outbreak development in Shanghai into stages, we did not classify the reports into those stages. Had we done so, we anticipate a slight change in our results. Third, we identified themes in the reports using LDA topic modeling, and then classified topics into frames. However, the process of frame delineation may reflect researcher bias. Future studies should use well-developed codebooks with reliability testing to improve accuracy. Thus, in order to ensure the comprehensiveness of the research, a further in-depth examination is needed in the future. For the in-depth study of this paper, we believe that in addition to classifying the reports according to the development stage of the COVID-19 and then analyzing the data, we can also divide the non-local region more carefully, and compare the framework differences between a specific area newspapers and Shanghai newspapers, which will make the conclusions of the paper more representative.

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