Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

International Journal of Information Management 54 (2020) 102143

Contents lists available at ScienceDirect

International Journal of Information Management

journal homepage: www.elsevier.com/locate/ijinfomgt

# Information resource orchestration during the COVID-19 pandemic: A study of community lockdowns in China

Shan L. Pan[a], Miao Cui[b,*], Jinfang Qian[c]

[a] School of Information Systems and Technology Management, UNSW Business School, University of New South Wales (UNSW), Room 2015, West Wing, Quadrangle, Sydney, 2052, Australia
[b] School of Economics and Management, Dalian University of Technology, Room D622, School of Economics and Management, 2#Linggong Road, Dalian 116024, China
[c] School of Economics and Management, Dalian University of Technology, Room E411, School of Economics and Management, 2#Linggong Road, Dalian 116024, China

ARTICLE INFO

*Keywords:*
Information behavior
Lockdown
Resource orchestration
COVID-19

ABSTRACT

The outbreak of the COVID-19 pandemic has created significant challenges for people worldwide. To combat the virus, one of the most dramatic measures was the lockdown of 4 billion people in what is believed to be the largest quasi-quarantine in human history. As a response to the call to study information behavior during a global health crisis, we adopted a resource orchestration perspective to investigate six Chinese families who survived the lockdown. We explored how elderly, young and middle-aged individuals and children resourced information and how they adapted their information behavior to emerging online technologies. Two information resource orchestration practices (information resourcing activities and information behavior adaptation activities) and three mechanisms (online emergence and convergence in community resilience, the overcoming of information flow impediments, and the application of absorptive capacity) were identified in the study.

## 1. Introduction

The outbreak of Coronavirus Disease 2019 (COVID-19) was a humanitarian emergency that was first reported in December 2019. After an investigation, it was declared by the World Health Organization (WHO) to be a public health emergency of international concern on January 31, 2020, and a pandemic on March 11, 2020. Since its initial outbreak, the coronavirus has spread to 209 countries, with 3,040,000 confirmed cases and 211,000 reported deaths globally as of April 28, 2020. The impact of this public health emergency has severely affected countries and communities in terms of economic factors, socio-psychological factors, and international relations.

Regarding the ongoing COVID-19 crisis and its multidimensional damages to society, the global health crisis is rapidly becoming an information crisis that requires serious attention (Xie et al., 2020). With this study, we respond to the call issued by fellow information scientists to take action and contribute to the understanding of information crises during global health crises (Xie et al., 2020). In particular, we investigate the information behavior of six Chinese families who were part of the recent two-month community lockdown. As is well known, in the last three months, lockdowns have been part of the social distancing strategy deployed across the globe to slow the rapidly spreading disease. In this paper, we argue that an in-depth understanding of citizens' information behavior during lockdowns will help global citizens survive the COVID-19 pandemic, deal with the aftermath, and be better prepared for future crises.

While there are a handful of studies (Tim, Pan, Bahri, & Fauzi, 2018; Zhao, Wang, Wei, & Liang, 2013) on individuals' information behaviors and technology use during natural emergencies, research about individuals' information behaviors in emergent health situations is lacking (Given, Willson, Albrecht, & Scott, 2016). The need for individuals (citizens under lockdown) to adapt to a new information environment is crucial to surviving the pandemic. First and foremost, citizens under lockdown have to find new sources of information, as previous information sources are unlikely to be crisis-centric or relevant to essential needs during a community lockdown. In a lockdown, citizens are physically isolated in their own homes and are often given very little time to prepare before the commencement of the lockdown order. Second, citizens have to expeditiously adapt to emerging online technologies (for living needs, communication, and work/education purposes) so that they are better informed, connected, and even protected from a public health standpoint (Roy et al., 2020).

Notably, citizens' information behavior during an emerging global health crisis is a novel topic to many, especially in the context of a new virus, such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). To date, this topic has been a mystery, which results in citizens

* Corresponding author at: Room D622, School of Economics and Management, 2#Linggong Road, Dalian 116024, China.
*E-mail addresses:* shan.pan@unsw.edu.au (S.L. Pan), cuimiao@dlut.edu.cn (M. Cui), judy_jf@mail.dlut.edu.cn (J. Qian).

https://doi.org/10.1016/j.ijinfomgt.2020.102143
Received 19 April 2020; Received in revised form 5 May 2020; Accepted 5 May 2020
Available online 11 May 2020
0268-4012/ © 2020 Elsevier Ltd. All rights reserved.

having to deal with uncertainties and fears during difficult periods. Therefore, as governments have ordered lockdowns and prescribed these lockdowns as the primary social distancing strategy to combat the virus, both the interaction between people and information and the interaction between people and information technologies have been characterized by significant challenges. With millions of global citizens currently being isolated in their homes, frustrations are strongly felt by all age groups in different socioeconomic classes. Against this backdrop, we adopt a resource orchestration perspective to study information behavior with the following research question: How is information resourced by citizens, and as a result, how should they adapt to emerging online information technologies during a community lockdown?

## 2. Theoretical background

Information behavior is people's behavior related to how they need, seek, give and use information in different contexts. The focal point of information behavior studies in recent years has been the construction of a conceptual and theoretical framework of information behavior in various contexts and the testing of antecedents and consequences of information behavior to discover how people interact with information (Pettigrew, Fidel, & Bruce, 2001).

Existing studies have examined people's information behavior in diverse contexts, and disasters have been one of the concerns. It is widely recognized that information has a crucial role in disaster management activities (Chen, Sharman, Chakravarti, Rao, & Upadhyaya, 2008; Van de Walle & Turoff, 2007; Pan, Pan, & Leidner, 2012) due to these activities' information-intensive nature. To cope with uncertainty, people seek information (Allen, 2011; Wilson, 1999) to mitigate tensions and anxiety and become informed about the disaster response (Yang & Hsieh, 2013). Therefore, the relevant literature has focused primarily on investigating the information seeking and sharing behavior (Rahmi, Joho, & Shirai, 2019) of the people affected. Some authors have further distinguished the information behavior of different groups of people. For instance, Pang, Karanasios, and Anwar (2019) investigate elderly individuals' information behavior and key activities of preparing for, responding to, and recovering from disasters.

Recent information technological advancements, especially the development of social media, have inspired authors to rethink people's interaction with information (Allen, Given, Burnett, & Karanasios, 2019; Allen, Karanasios, & Slavova, 2011) in computerized settings. Social media refers to a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0 and allow the creation and exchange of user-generated content (Roy, Hasan, Sadri, & Cebrian, 2020; Son, Lee, Jin, & Lee, 2019). Pang and Ng (2016) examine emotive cue information-seeking and information-sharing behavior on Twitter over the lifecycle of a violent riot. Lai and Tang (2018) compare the foundation, processes, and effects of American, Chinese and Australian individuals' curation of information from social media and mobile devices in disaster management.

Previous information science studies have also explored information behaviors and technology use in emergency departments by focusing on the experiences of healthcare practitioners (Ayatollahi, Bath, & Goodacre, 2013; Johnson et al., 2011). However, the information behaviors of citizens – including those who are the most affected by disasters, the first responders to disaster impacts (Daramola, Oni, Ogundele, & Adesanya, 2016) and the targets of crisis response efforts who are isolated due to natural hazards or even lockdowns in crises – have not been examined extensively.

Information resources play a vital role in disaster management (Leidner, Pan, & Pan, 2009). However, information flows inevitably face severe impediments during disasters (Day, Junglas, & Silva, 2009). To overcome these impediments, it is indispensable to orchestrate information resources from diversified stakeholders in disaster management (Yang & Hsieh, 2013). Orchestrating information resources enables stakeholders to access and use information in a decentralized way.

Resource orchestration, a dynamic development of the resource-based view, refers to acting on static resource elements, such as by structuring, bundling and leveraging, to outperform others (Sirmon, Hitt, Ireland, & Gilbert, 2011). Existing studies have had two main foci: the impact of resource orchestration, e.g., its impacts on financial performance (Chirico, Sirmon, Sciascia, & Mazzola, 2011) and innovation (Cui, Pan, Newell, & Cui, 2017), and specific resource orchestration actions in diverse contexts. For instance, Baert, Meuleman, Debruyne, and Wright (2016) extend the resource orchestration perspective to the portfolio entrepreneurship context and identify specific resource orchestration actions.

We adopt resource orchestration as the theoretical lens, as we can leverage its advantages to focus simultaneously on information resources and resource-focused actions to explore how individuals resourced information and acted on information resources to adapt to the online transitions to cope with the sudden lockdown.

## 3. Research design: case study

To develop insights into information behavior during the pandemic, we chose the case study method for two reasons. First, the case study method is suitable to investigate "how" questions, as it allows us to address operational links that must be traced over time (Yin, 2009). Second, the case study method enables us to present rich detail on the phenomenon and document its evolution as the pandemic has unfolded (Pan & Tan, 2011).

We selected six families to examine their information behavior under lockdown. These families are very typical Chinese families, so they provide a useful perspective for learning about the information resourcing and adaptation behavior of elderly, young and middle-aged individuals and children. Before the pandemic, this group of people had a reasonably traditional offline lifestyle. However, as the lockdown began, they had to adapt to a fully digital lifestyle almost overnight. The Chinese family has been shaped by the one-child policy and migration patterns since the 1980s. The most typical Chinese family structure includes four grandparents, two parents and one child (4-2-1), with the two young parents working and the grandparents taking care of the one child and other household duties. In addition, it is also quite common for elderly individuals to live alone since many of their children move to larger cities for better job opportunities, leaving the elderly behind in villages; their information behavior may differ from that of those living with young and middle-aged people. Details are provided in Appendix A.

We employed personal experience, observation, secondary data, and virtual interviews as the main data sources. Since all three authors have been under lockdown for two months (since February 2020), we have been able to draw on our personal experience. Meanwhile, a massive amount of secondary data is available due to the media's interest in the pandemic. We read dozens of articles and watched numerous videos describing how people live under the lockdown before we interviewed the six families using the video call function of WeChat, a widely used social application (app) in China.

The interviews focused on the families' lifestyles before and after the lockdown, especially regarding how the informants sourced information and how they adapted to novel online technologies. In total, we interviewed 37 people, including 29 people from the six families, four community workers, and four online emergent individuals (listed in Appendix A). The two community workers were individuals who provided technical assistance to seniors living alone. Each interview lasted 30 − 60 min. We digitally recorded the conversations with the permission of the informants and then transcribed them for analysis. The transcriptions and the photos we took exceeded one hundred pages.

For data analysis, guided by the approach proposed by Pan and Tan (2011), we first developed an understanding of the pandemic leading to the lockdown announcement. As we analyzed the data, we observed how residents adapted their ways of seeking, sharing, and using

information. We then conceptualized the phenomenon as information behavior, which describes how people interact with information (Wilson, 2010). The next step was to collect additional data by reading media reports, articles, and watching videos on the Internet. The additional insights allowed us to form a clearer picture of the phenomenon before we chose resource orchestration as the theoretical lens. Using selective coding (Strauss & Corbin, 1990), we drew on a narrative strategy to organize the voluminous primary and secondary data and tables and figures to identify the data structure. We then developed an initial summary framework (to illustrate our findings) by integrating the theoretical lens and the data analyzed.

Finally, we continuously compared the theory, data, and emergent model to achieve theory-data-model alignment as we reached the point of theoretical saturation when we finalized the analysis. This step lasted several weeks until we reached theoretical saturation, at which point the findings of the case study were comprehensively explained and no additional data could be collected or added to improve the emergent model (Eisenhardt, 1989).

## 4. Case description: information behavior under lockdown

On December 31, 2019, the first case of pneumonia of unknown etiology was reported in China. Then, a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (with the resulting disease subsequently named COVID-19), was announced by the WHO on January 12, 2020. Nine days later, the WHO announced that the virus could be transmitted from person to person. By mid-January, the virus had infected a total of 830 people, among which 495 were citizens of Wuhan and 549 were citizens of other cities and rural areas of Hubei Province and other parts of China. The Chinese government shut down all of Hubei Province, suspending all public transportation and closing passage through airports, train stations, and national highways.

During the lockdown, to strictly control the movements of people, each household was allowed to have only one person go out for necessities every two days. All over China, people were restricted and isolated to their homes. Almost all the stores and public places, such as shopping malls, cinemas, restaurants, schools, and gyms, were closed, while grocery stores, hypermarkets, and pharmacies remained open. Behind the sobering objective of social distancing lay a new challenge for many: hours inside the same confined space with no office socializing or social contact, with children to entertain, and with household chores to complete with no external support.

### *4.1. Technological struggles of elderly individuals*

The outbreak and lockdown dramatically changed the way millions of elderly individuals lived. In China, due to their unique cultural background and circumstances, a large proportion of senior citizens live with their children. In most households, the elderly are the primary caregivers of school-going children. They also play a significant role in managing household duties, including taking children to and from school, supervising children's learning after school, and grocery shopping. Before the lockdown, during their spare time, elderly individuals often took part in square dancing, physical exercise, and meeting up with friends for leisure. Physical and face-to-face activities were especially crucial for millions of elderly individuals living alone in their hometowns without the support of their children after their children had moved to other cities for work.

When the lockdown order began in late January, all activities (that used to be offline and physical) were moved online. Understandably, household-related and leisure activities have mostly been moved to online channels using apps. Moving online was a massive challenge for the elderly, as most did not know how to do shop, receive food deliveries, operate video chat, and other activities online.

Grandpa Jin described what happened on January 23 when his son and daughter-in-law told him about the lockdown.

> "As our residential community went online due to the lockdown, this started a series of problems for me, including a disruption to my daily household duty – grocery shopping. Since it was not safe to go out, they recommended that we buy online. Within 20 min, my daughter-in-law had purchased everything on an e-market website. In less than two hours, a delivery man arrived with the goods and texted us that he had left the goods in the management office. I was very curious about how it was possible in such a short time! To be honest, I felt very depressed, as I was out of touch with society, and I was feeling useless."

Apart from online grocery shopping, another challenge that seniors met was online communication becoming the only option for social activities. The situation was exacerbated by the fact that all of China was supposed to be celebrating Chinese New Year during the lockdown period. Chinese people have a long history of having family reunions and visiting relatives and friends during Chinese New Year. Although most young people currently use WeChat to conduct online visits, seniors still prefer to meet face-to-face out of respect. Grandma Xiao told us about her difficulties in transitioning to online socialization.

> "Others told me that I could use WeChat to have a video chat with my ex-neighbors. But I couldn't because I did not have their WeChat account information. Additionally, during the Chinese New Year, my son showed me how to give red envelopes to my grandchildren via WeChat virtually, but I was still afraid I would make a mistake and transfer money to the wrong person. To be safe, I wrote down the steps on my notebook…Even so, a digital red envelope is just not the same!"

### *4.2. Young and middle-aged individuals' multifaceted challenges with working from home*

Although young and middle-aged individuals had few problems using smartphones and various apps, they met other challenges. One challenge in particular was having to move their work online and working from home. While working adults are familiar with using technologies in their work, having to set up and manage their work entirely online was a struggle felt by many. First, online communication was less effective and efficient, especially in the Chinese business culture, where face-to-face meetings are preferred. Online discussion requires more time and effort, as claimed by Mr. Xiao, a programmer:

> "I didn't expect so much trouble moving my work online. When I tried to perform task assignment, group discussion, and brainstorming, they became extremely cumbersome. It was a lot easier to discuss face-to-face. Doing this online, we had to find and use new applications that both of us have no prior experience in using. And it got worse when we had a group of 15 programmers in the same meeting…."

Second, distractions at home while trying to work was another problem. Many working adults are also parents of young children. During the quarantine, these working adults had to work, take care of young children, and assist with housework simultaneously in a setting that was not ideal. Work efficiency dramatically decreased. Ms. Zhang and Mr. Duan, both professionals working from home, shared their experiences:

"Neither my husband's parents nor my parents live with us. Since we no longer can send our daughter to childcare, we had to juggle working, cooking, educating and parenting our child at the same time. It was extremely difficult. I had never felt so busy and distracted at my work before the lockdown. There were many occasions where I had to lock the door so that my daughter would not come into the room crying when I had important business meetings" (Ms. Zhang).

"When working from home, because of the constant need to attend to other matters, I felt like I had to spend additional time (after office

hours) on work. I felt exhausted and depressed due to the inefficiency of working online. In many instances, I would constantly check for updates about the crisis.… there is a sea of news about the pandemic, and there are different claims and even contradictory statements" (Mr. Duan).

### 4.3. Children's learning-at-home challenges

During the lockdown period, China's Ministry of Education estimated that more than two hundred and twenty million school-going children participated in home-based learning. Children also found moving all their daily activities online frustrating. Their everyday lives went from primarily studying and playing at school to participating in events online in a confined space at home. Unlike in-person classes at school, children lack supervision when taking online courses, especially when their parents are working in the next room. At the same time, grandparents did not help with the e-learning model. As Mrs. Li, a mother, explained,

> "My son is a first-grader. He was attending online school in the morning. He would do homework in the afternoon on his own. I could only check my son's homework in the evening after I got off work. I could see that he made a lot of mistakes in his work. He later admitted that he couldn't focus, as he would often wander off and play online games."

The other challenge many children faced was the constant need to have entertainment, as they became bored quickly and wanted to be out of the house doing physical activities. Entertaining young children at home for the entire day was extremely challenging for parents, as they could source entertainment activities only from the Internet. As elaborated by Ms. Li,

> "The children got bored very quickly, as they are used to different types of activities, including outdoor exercises and playing with friends. I needed to source interesting educational games for my son. Much to my surprise, there were loads of digital learning platforms that children could use and play. Those learning activities were extremely valuable to me and helped entertain my son."

As children switched to online entertainment sources, they began watching cartoons and movies and playing games to entertain themselves. When asked how many hours he spent watching online programs, Mr. Xiao, a high school student, told us,

> "Apart from attending online courses, doing homework, eating and sleeping, I spent the rest of the time online; that's easily 4 h a day, which is much more than usual."
> "I am a senior in high school. The college entrance examination is in four months. I know studying is important, but I just couldn't help wandering around online surfing for fun things."

### 4.4. Adapting behavior to online life using emerging technologies

For citizens, responding to travel bans, school closures, and lockdowns as part of the social distancing strategy deployed by almost all infected countries required adapting their lives to emerging online technologies to maintain some semblance of normality. Commercial organizations developed software and apps to support remote work, living, and online education.

Despite the best efforts by companies to respond swiftly to making the transitions, many gaps were not addressed, which is understandable, given the lack of turn-around time. One of the issues encountered was the last mile delivery issue. Indeed, delivery workers became even more important during the lockdown and were unsung heroes, risking their health to deliver essential goods.

On March 19, Time Weekly, (2020) featured Mr. Gao, a delivery driver, on the magazine cover due to his "remarkable sense of commitment." As reported in the article, "these delivery drivers are risking their health to keep China running during the Coronavirus pandemic." In an interview with Hubei TV (2020), Mr. Zeng, a resident of a community in Wuhan, said,

> "My wife, a doctor, has been treating COVID-19 patients and has not come back home for weeks. I have two kids; one is two years old, and the other is five. They miss their mom and often cry and ask for mom. As I waited anxiously, I wanted to do something to contribute to the effort. And that was why, as a delivery driver, I did what I did. Given my knowledge of e-commerce, I helped my fellow residents use e-commerce apps."

As the lockdown continued, an increasing number of volunteers posted recorded videos online to share their professional knowledge. Additionally, as reported by Time Weekly, the delivery man Mr. Gao recorded microvideos of his daily delivery routine and posted them online (Quick Hand App), which was aimed at reducing fears of contracting the virus through delivery goods. As Ms. Liu, a community worker, shared,

> "It is safe to receive deliveries. As a start, all residents entering the residential community will have their temperature taken and their movements recorded. When a driver arrives at the community, the management officer will take his temperature and his contact details. The delivery driver will leave the package (after disinfection) at a collection point (with a pick-up schedule to avoid overcrowding), where the recipient will be informed via WeChat and have the package picked-up later without having any physical contact with the delivery person."

Residents, from elderly to young and middle-aged individuals to children, gradually adapted to online life. As Grandpa Chen, an elderly man living alone, said,

> "My daughter and her family planned to celebrate the Chinese New Year in Wuhan. However, due to the shutdown of the city, they could not come back. Since I did not have a WeChat account, Mr. Zhang, a community worker, offered to help me chat with my daughter's family using his phone. He was very patient and showed me 10 times how to operate it on my own phone; I finally learned it. I was very grateful for his help."

Mr. Jin, who works in an educational consulting company, described his own adaptation experience,

> "Ninety-nine percent of the messages on my WeChat group are about the pandemic. It made me nervous and anxious. We would receive reminders on WeChat from the residential management office to remind us to stay at home, wear a mask, maintain social distance, and wash our hands regularly. Some of the messages would refute rumors, such as that consuming alcohol, garlic, and Shuanghuanglian (a traditional Chinese medicine) could eliminate the virus. Gradually, I was not anxious anymore and calmed down."

Mr. Xiao, a junior high school student, said,

> "Now our courses are all microcourses, which only last 10 min. Then, we do some practices. Teachers ask us to write down every word of the microcourses in our notes. I can concentrate on the courses and the practices."

After less than three months, citywide lockdowns and other extreme measures appeared to be effective in curbing the spread of COVID-19 in China, at least according to Chinese health officials, who announced on March 12 that the country had passed the peak of the coronavirus pandemic. They reported no new cases of the virus the same day, which was the lowest number since China began publicly releasing confirmed cases. At the same time, the number of confirmed cases of COVID-19 across the world was skyrocketing.

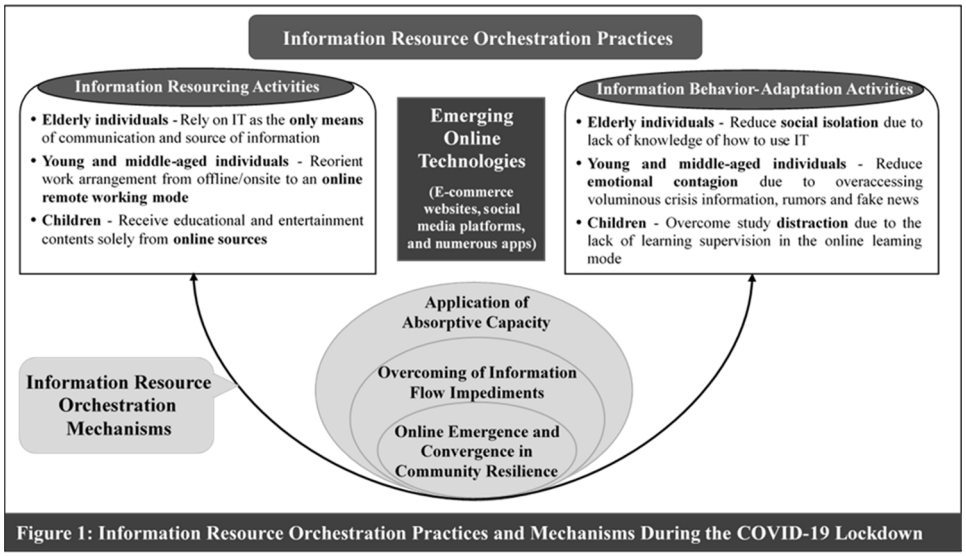


**Fig. 1.** Information Resource Orchestration Practices and Mechanisms During The COVID-19 Lockdown.

## 5. Case analysis

In analyzing the case, we observed that the sudden lockdown posed great challenges for all citizens, from elderly individuals to young and middle-aged individuals to children. To adapt to the new online life, information resource orchestration activities emerged as the lockdown progressed. Information resource orchestration activities include primarily two aspects: information resourcing and behavioral adaptation to novel online technologies. Correspondingly, we were able to identify three orchestrating mechanisms that enabled the residents to overcome challenges encountered during the lockdown (see Fig. 1).

### 5.1. Information resourcing activities

Disasters always introduce the threat of a massive information flow breakdown (Day et al., 2009) due to damaged infrastructure, a dearth of equipment and technology inefficiencies, and problems with the content and flow of information (Roy et al., 2020). Therefore, to survive a disaster and maintain daily life, the people affected have to resource information and essentially seek new media (Rahmi et al., 2019) to access information. In recent years, evidence has indicated that with the development of information technology, social media has replaced traditional media and become the major source of information in disasters (Tim, Pan, Ractham, & Kaewkitipong, 2017).

Understandably, the COVID-19 pandemic is different than natural disasters, as it does not create physical destruction; rather, its visibility creates fear and uncertainty. In a lockdown, residents' primary goals for information resourcing differ from those of people whose lives and health have been threatened by natural disasters (Allen, 2011; Wilson, 1999). In a natural disaster response, information resourcing behavior emphasizes obtaining rescue information (Pan et al., 2012), while people under lockdown seek media that offers updated information on the outbreak and self-protection knowledge and facilitates communication, shopping, work and study. By resourcing information for different needs (Westbrook, 2009), people have switched their life anchors from offline to online to adapt to the social distancing strategy. People of different age groups vary in their approaches and challenges in resourcing information (Chowdhury, Gibb, & Landoni, 2011).

As shown in our case, after the lockdown, elderly individuals' face-to-face communication was abruptly suspended. They had to find new sources of information, relying mostly on social media apps, WeChat in this case, as the only means of communication and source of information. On the other hand, working professionals had to reorient their work arrangements from offline and on-site to an online remote working mode with the support of Ding Talk and other collaborative office software. At the same time, working parents had to juggle multiple demands for their attention from other aspects of family life. Finally, children had to learn to access and work with educational and entertainment content solely from online sources, e.g., microcourses and iQIYI, a well-known video streaming website in China.

### 5.2. Information behavior adaptation activities

Disasters create circumstances under which people are forced to adapt (Lachlan, Spence, Lin, Najarian, & Del Greco, 2016). Behavioral adaptation to information sources is a component of adaptation to disaster situations. After discovering the proper information sources to continue with their lives, people have to adapt to technologies when using the information (Allen et al., 2011). In particular, the emergence of myriad online technologies has introduced substantial challenges for people to learn to use them quickly, especially in the case of digital migrants (Kesharwani, 2020) or those who face technology divides (Leung et al., 2012).

In our study, although a large number of alternative media sources were available for people under lockdown to access information, at the beginning of the lockdown, residents lacked knowledge about how to use them and had to adapt quickly. In particular, the lifestyles of the elderly had centered mostly around the physical world before the lockdown, and these individuals had never experienced a lockdown situation in their lives. In other words, with the sudden change in circumstances, the elderly not only had to resource information but also had to adapt to new online technologies.

While online communication apps were available, the elderly lacked knowledge of how to use these social apps for communication. To adapt to the lockdown, elderly individuals had to learn how to use these apps to *reduce their social isolation*. In contrast, young and middle-aged individuals were more familiar with most apps and could rapidly master the use of collaborative office software and adapt to online work. Their challenge lay in the frustration of coping with a sea of information, which was mostly rumors and fake news that did not help to *reduce emotional contagion* in any way (Hwang, Jani, & Jeong, 2013; Karunakaran, Reddy, & Spence, 2013). Students who were digital natives (Kesharwani, 2020) could master most of the technology apps, including those they used for learning and entertainment purposes. Their challenge, however, was being able to *overcome study distractions* when using an iPad or laptop to take online courses due to the lure of

other online entertainment apps and content.

### 5.3. Information resource orchestration mechanisms

In the facilitation of information resource orchestration, in addition to information resourcing and information behavior adaptation activities, three orchestration mechanisms were identified: online emergence and convergence in community resilience, the overcoming of information flow impediments, and the application of absorptive capacity.

(1) *Online emergence and convergence in community resilience*. This mechanism facilitated residents under lockdown in overcoming various information challenges highlighted in the study. For example, despite the availability of various apps for people to adapt to online life, it was important that support was available (provided out of kindness and solidarity) to people who were not technically savvy.

The emergence of both offline and online groups (of individuals) further led to convergence (Tim et al., 2017), which allowed online volunteers to publicly weigh information about what was happening and what to do and to organize practical collective activity (Tim et al., 2018). Therefore, as an effective orchestration mechanism, online emergence and convergence made indispensable offline resources available and functioned as a supplemental resource to perform online activity.

Crisis situations can often inspire adaptive collaboration among the public (Oh, Agrawal, & Rao, 2013). In this study, we observed that a number of committed individuals and groups emerged both online and offline to voluntarily help build residential community resilience. Individuals such as Mr. Gao came forward online and recorded short videos to educate people and reduce fear about the possibility of becoming infected through deliveries. Many online volunteer groups (that emerged online) included “private citizens who work together in pursuit of collective goals relevant to actual or potential disasters but whose organization has not yet become institutionalized” (Stallings & Quarantelli, 1985). As the lockdown progressed, we also observed that the emergence of community workers helped the elderly transition to a digital life by assisting them within residential communities (in an offline setting).

(2) *Overcoming information flow impediments*. An inadequate stream of information was the major information impediment that residents faced under lockdown. According to Day, Junglas and Silva (2009), an inadequate stream of information occurs when individuals have too little or too much information. Emergent individuals and groups online helped residents overcome information flow impediments by *sourcing existing information*, *processing information*, and *denoising information* before presenting information to the residents who were struggling with being underinformed or being overloaded with information. In this way, residents of different age groups with various information needs were in a better situation to receive proper information to facilitate their adaptation during the lockdown period (Niemelä, Huotari, & Kortelainen, 2012).

As shown in the case study, young and middle-aged individuals were willing to teach elderly people to use various apps for communication. Community workers processed information by scheduling residents’ pick-up times and informing residents through WeChat groups. Online volunteers emerged to share their scientific knowledge to refute rumors and disseminate accurate information to denoise information. These activities of sourcing, processing and denoising information aided people in overcoming shortages or overloads of information.

(3) *Application of absorptive capacity*. By overcoming information flow impediments, residents under lockdown were able to access all the information they needed. With ample information flowing among residents, various apps and offline resources were used by emergent online individuals and groups. After information was resourced, consolidated and put into use for different aspects of their lives, residents were able to incorporate the acquired information into their existing knowledge base for future use (Karunakaran et al., 2013; Spink & Cole, 2006; Wilson, 2000). This information use process required residents to apply their *absorptive capacity* to use their existing knowledge base to adsorb newly acquired information directly and assimilate information into their individual knowledge (Huang, Pan, & Liu, 2017).

In this case study, we observed that when residents acquired essential information and faced different information behavior challenges, they applied their absorptive capacity to use information and adapt to new behavior. For instance, the elderly, despite the initial struggle, were able to communicate with their relatives and friends online without much hindrance after learning from young and middle-aged individuals who taught them to use the technologies. Young and middle-aged individuals were less anxious, as rumors and fake news were refuted by governments, communities and voluntary individuals and groups. Students learned to overcome distractions and concentrate on their studies once microcourses and hard-copy exercises began to be used.

## 6. Discussion

We conducted a case study with six Chinese families and learned about their lockdown experiences. Specifically, we investigated the information behaviors exhibited by elderly, young and middle-aged individuals and children during the lockdown. Our findings reveal their information resource orchestration practices (information resourcing activities and behavioral adaptation activities) and their orchestrating mechanisms. The mechanisms included online emergence and convergence in community resilience, the overcoming of information flow impediments, and the application of absorptive capacity.

### 6.1. Theoretical implications

First and foremost, we examine the information behavior of people under lockdown and respond to the call for studying information behavior in global health crises and during lockdowns by Xie, He, Mercer et al. (2015). Existing studies have studied information behavior during natural disasters and lacked attention to information behavior in health crises. However, the features of health crises differ from those of natural disasters, which will lead to different information behaviors. During the health crisis, a city must manage two tasks—dealing with the sudden large number of sick people and keeping city life as normal as possible for everyone else (World Health Organization., 2009). Studies have not paid attention to how to maintain a normal life during a health crisis, such as the lockdown situation. Furthermore, information behavior during natural disasters focuses more attention on information seeking and sharing to survive the disasters. In contrast, information behavior during lockdowns emphasizes adaption to maintain a normal life.

Second, by elucidating the three mechanisms that support people to adapt to a lockdown situation, we further contribute to the literature on information use. The use of information is a critical dimension of information behavior (Wilson, 2000). However, extant studies on information behavior have concentrated on information seeking, but there is a dearth of information use studies (Spink & Cole, 2006). By using information, individuals integrate newly acquired information into their existing knowledge bases. In our study, we learned that information resourcing activities do not guarantee that individuals will be good at using the information without needing to adapt. Residents affected by disasters resource, process, and incorporate disaster-relevant information effectively into their existing knowledge base (Yang & Hsieh, 2013). To adapt, residents learn to use emerging online technologies and process an overwhelming amount of information before this information becomes useful (Spink & Cole, 2006). The three orchestrating mechanisms played critical roles in information use during the lockdown. They served as a foundation for overcoming information flow impediments by providing essential information, reducing

information overload, and facilitating people's mastery of information technology.

### 6.2. Implications for practice

This study also has some practical implications. First, we documented information behavior under a lockdown in a rare global pandemic. The three orchestrating mechanisms identified provide references for people under lockdowns to ease information impediments, properly access essential information, and use information to maintain a normal life. Relevant institutes, communities, and governments should consider issuing applicable policies to encourage the online emergence and convergence of volunteers (Leidner et al., 2009). In addition, volunteer individuals and groups should further explore information flow impediments and commit to improving them by providing essential information, denoising information, and helping people learn to use information technology.

Second, our study points to the importance of stakeholders, who are required to collaborate to overcome information impediments and help people learn to use information technology. Collaboration between diversified stakeholders is necessary. Various stakeholders have to collaborate with other organizations and individuals to respond to crises. Information impediments are one of the most challenging aspects of collaborative disaster responses (Karunakaran et al., 2013). For instance, stakeholders are required to form close partnerships with each other to identify information impediments and integrate information from different stakeholders for their needs. They need to commit to form and continuously improve communication channels and information processing approaches, e.g., including experts and developing information systems.

Third, our findings provide insights for people in other countries and regions under lockdowns to adapt to online life. As countries and regions vary in terms of culture, family structure, development, and the adoption of online technologies, our findings may not be generalizable and therefore require conditional applications to other countries and regions. For instance, China's recent development of e-commerce and Fintech has given strong support to case families during the lockdown. This finding is applicable only to countries such as China, which has strongly adopted Fintech, but not in the case of European countries, where paper checks are still prevalent.

## 7. Conclusion

The COVID-19 pandemic is an unprecedented global pandemic. More than two million people from 209 countries, areas, and territories have been infected with the virus. Billions of people, although safe, have been impacted significantly in all aspects of life. The lockdown strategies that have been utilized by governments force residents to stay at home and rely on living life virtually. The way people conduct their daily lives changes overnight, and people must adapt to their new lifestyles. Through the investigation of six Chinese families under lockdown, the study illuminates their information resourcing activities, information behavior adaptation activities, and three supporting mechanisms.

As a response to the call to study information behavior during a global health crisis and lockdowns (Xie et al., 2020), this study contributes to the development of information behavior theory by elucidating individual information resource orchestration practices and mechanisms during a health emergency. Future research could compare different information behaviors in different countries during a global health crisis.

## Declaration of Competing Interest

None.

## Acknowledgments

This work was supported by the National Natural Science Foundation of China [grant number 71529001, 71972023, 71472019, 71632003].

## Appendix A. Interview Guide

| No. | Interview Subjects | Elderly Individuals | Young and Middle-aged Individuals | Children | Number of Interviewees | Interview Questions |
|---|---|---|---|---|---|---|
| 1 | Jin Family | **Four:**<br>Providing care for children and performing household duties | **Two:**<br>Both working in the education sector | **Two:**<br>Young children | 8 | What were your major activities before the lockdown?<br>What are your major activities during the lockdown? |
| 2 | Li Family | **Two:**<br>Providing care for children and performing household duties | **Two:**<br>One working in the education sector, and the other working in the real estate sector | **One:**<br>Primary school student | 5 | What are the information challenges you have faced?<br>How do you access the information you need? |
| 3 | Xiao Family | **Four:**<br>Providing care for children and performing household duties | **Two:**<br>One working in the ICT sector, and the other working in the health care sector | **One:**<br>Junior high school student | 7 | Are there any challenges you have had in accessing and using the information? What are they?<br>What are the pros and cons of coping with the challenges? |
| 4 | Duan Family | **Two:**<br>Providing care for children and performing household duties | **Two:**<br>One working in consulting, and the other working in the manufacturing sector | **One:**<br>High school student | 5 | Have you ever obtained support from others to cope with the challenges? What type of support? |
| 5 | Zhang Family | —— | **Two:**<br>One working in the engineering sector, and the other working in the manufacturing sector | **One:**<br>Primary school Student | 3 | How did this support help you overcome the challenges?<br>How would you describe your current feelings and situation regarding overcoming the challenges? |
| 6 | Chen Family | **One:**<br>Living alone | —— | —— | 1 | |
| 7 | Community workers | —— | **Three:**<br>Mr. Zhang<br>Mr. Xu<br>Ms. Liu<br>Ms. Zhou | —— | 4 | What were your major responsibilities before the lockdown?<br>What are your major responsibilities during the lockdown?<br>What are the major information challenges that residents have during the lockdown?<br>What are the measures you have taken to |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | support residents to overcome the challenges?<br>How would you evaluate residents' adaptation to the lockdown? |
| 8 | Online emergent individuals | —— | **Four:**<br>Mr. Wang, a delivery man<br>Mr. Deng, a volunteer to maintain order at Kunming airport<br>Ms. Jiang, a volunteer to measure and record villagers' temperatures<br>Mr. Lin (Weibo username), a volunteer to collect and send medicines to COVID-19 patients in Wuhan | —— | 4 | What do you do during the lockdown?<br>Why did you decide to do this?<br>How did you come up with the idea?<br>What are the major contributions you have made to help residents adapt to the lockdown?<br>How would you evaluate residents' adaptation to the lockdown? |

## References


Allen, D. (2011). Information behavior and decision making in time-constrained practice: A dual-processing perspective. *Journal of the American Society for Information Science and Technology, 62*(11), 2165–2181.

Allen, D., Given, L. M., Burnett, G., & Karanasios, S. (2019). Information behavior and information practices: A special issue for research on people's engagement with technology. *Journal of the Association for Information Science and Technology, 70*(12), 1299–1301.

Allen, D., Karanasios, S., & Slavova, M. (2011). Working with activity theory: Context, technology, and information behavior. *Journal of the American Society for Information Science and Technology, 62*(4), 776–788.

Ayatollahi, H., Bath, P. A., & Goodacre, S. (2013). Information needs of clinicians and non-clinicians in the emergency department: A qualitative study. *Health Information and Libraries Journal, 30*(3), 191–200.

Baert, C., Meuleman, M., Debruyne, M., & Wright, M. (2016). Portfolio entrepreneurship and resource orchestration. *Strategic Entrepreneurship Journal, 10*(4), 346–370.

Chen, R., Sharman, R., Chakravarti, N., Rao, H. R., & Upadhyaya, S. J. (2008). Emergency response information system interoperability: Development of chemical incident response data model. *Journal of the Association for Information Systems, 9*(3), 200–230.

Chirico, F., Sirmon, D. G., Sciascia, S., & Mazzola, P. (2011). Resource orchestration in family firms: Investigating how entrepreneurial orientation, generational involvement, and participative strategy affect performance. *Strategic Entrepreneurship Journal, 5*(4), 307–326.

Chowdhury, S., Gibb, F., & Landoni, M. (2011). Uncertainty in information seeking and retrieval: A study in an academic environment. *Information Processing & Management, 47*(2), 157–175.

Cui, M., Pan, S. L., Newell, S., & Cui, L. (2017). Strategy, resource orchestration and e-commerce enabled social innovation in rural China. *The Journal of Strategic Information Systems, 26*, 3–21.

Daramola, A. Y., Oni, O. T., Ogundele, O., & Adesanya, A. (2016). Adaptive capacity and coping response strategies to natural disasters: A study in Nigeria. *International Journal of Disaster Risk Reduction, 15*, 132–147.

Day, J. M., Junglas, I., & Silva, L. (2009). Information flow impediments in disaster relief supply chains. *Journal of the Association for Information Systems, 10*(8), 1.

Eisenhardt, K. M. (1989). Building theories from case study research. *The Academy of Management Review, 14*(4), 532–550.

Given, L. M., Willson, R., Albrecht, L., & Scott, S. D. (2016). *Information in crisis: Health & technology-related information behaviors of parents in emergency departments. ASIST' 16 Proceedings of the 79th ASIS&T Annual Meeting: Creating Knowledge, Enhancing Lives Through Information & Technology*, *53*, 1–10 1.

Huang, J. S., Pan, S. L., & Liu, J. (2017). Boundary permeability and online–offline hybrid organization: A case study of Suning, China. *Information & Management, 54*(3), 304–316.

Hubei, T. V. (2020). *Communities carry out "zero contact" group purchase.* http://news.-hbtv.com.cn/p/1786636.html. 2020-02-18. Accessed 13 April 2020.

Hwang, Y. H., Jani, D., & Jeong, H. K. (2013). Analyzing international tourists' functional information needs: A comparative analysis of inquiries in an on-line travel forum. *Journal of Business Research, 66*(6), 700–705.

Johnson, K. B., Unertl, K. M., Chen, Q., Lorenzi, N. M., Nian, H., Bailey, J., et al. (2011). Health information exchange usage in emergency departments and clinics: The who, what, and why. *Journal of the American Medical Informatics Association, 18*(5), 690–697.

Karunakaran, A., Reddy, M. C., & Spence, P. R. (2013). Toward a model of collaborative information behavior in organizations. *Journal of the American Society for Information Science and Technology, 64*(12), 2437–2451.

Kesharwani, A. (2020). Do (how) digital natives adopt a new technology differently than digital immigrants? A longitudinal study. *Information & Management, 57*(2), 103170.

Lachlan, K. A., Spence, P. R., Lin, X., Najarian, K., & Del Greco, M. (2016). Social media and crisis management: Cerc, search strategies, and twitter content. *Computers in Human Behavior, 54*(January), 647–652.

Lai, C. H., & Tang, T. (2018). From information behaviors to disaster preparedness: Navigating individuals' general and disaster curation in US, China, and Australia. *Computers in Human Behavior, 88*, 37–46.

Leidner, D. E., Pan, G., & Pan, S. L. (2009). The role of IT in crisis response: Lessons from the SARS and Asian Tsunami disasters. *The Journal of Strategic Information Systems, 18*(2), 80–99.

Leung, R., Tang, C., Haddad, S., Mcgrenere, J., Graf, P., & Ingriany, V. (2012). How older adults learn to use mobile devices: Survey and field investigations. *ACM Transactions on Accessible Computing (TACCESS), 4*(3), 1–33.

Niemelä, R., Huotari, M. L., & Kortelainen, T. (2012). Enactment and use of information and the media among older adults. *Library & Information Science Research, 34*(3), 212–219.

Oh, O., Agrawal, M., & Rao, H. R. (2013). Community intelligence and social media services: A rumor theoretic analysis of tweets during social crises. *MIS Quarterly, 37*(2), 407–426.

Pan, S. L., & Tan, B. (2011). Demystifying case research: A structured–Pragmatic–Situational (SPS) approach to conducting case studies. *Information and Organization, 21*(3), 161–176.

Pan, S. L., Pan, G., & Leidner, D. (2012). Crisis response information networks. *Journal of the Association for Information Systems, 13*, 31–56.

Pang, N., & Ng, J. (2016). Twittering the little India riot: Audience responses, information behavior and the use of emotive cues. *Computers in Human Behavior, 54*(January), 607–619.

Pang, N., Karanasios, S., & Anwar, M. (2019). Exploring the information worlds of older persons during disasters. *Journal of the Association for Information Science and Technology, 0*(0), 1–13.

Pettigrew, K. E., Fidel, R., & Bruce, H. (2001). Conceptual frameworks in information behavior. In M. E. Williams (Vol. Ed.), *Annual review of information science and technology: 43–78*. Medford, NJ: Information Today.

Rahmi, R., Joho, H., & Shirai, T. (2019). An analysis of natural disaster-related information-seeking behavior using temporal stages. *Journal of the Association for Information Science and Technology, 70*(7), 715–728.

Roy, K. C., Hasan, S., Sadri, A., & Cebrian, M. (2020). Understanding the efficiency of social media based crisis communication during hurricane sandy. *International Journal of Information Systems. 52*(2).

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage: Breadth, depth, and life cycle effects. *Journal of Management, 37*(5), 1390–1412.

Son, J. B., Lee, H. K., Jin, S., & Lee, J. T. (2019). "Content features of tweets for effective communication during disaters: A media synchronicity theory perspective". *International Journal of Information Management, 45*, 56–68.

Spink, A., & Cole, C. (2006). Human information behavior: Integrating diverse approaches and information use. *Journal of the American Society for Information Science and Technology, 57*(1), 25–35.

Stallings, R., & Quarantelli, E. (1985). Emergent citizen groups and emergency management. *Public Administration Review, 45*, 93–100.

Strauss, A. L., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Thousand Oaks, CA: Sage.

Tim, Y., Pan, S. L., Ractham, P., & Kaewkitipong, L. (2017). Digitally enabled disaster response: The emergence of social media as boundary objects in a flooding disaster. *Information Systems Journal, 27*(2), 197–232.

Tim, Y., Pan, S. L., Bahri, S., & Fauzi, A. (2018). "Digitally enabled affordances for community-driven environmental movement in rural Malaysia". *Information Systems Journal, 28*(1), 48–75.

Time Weekly (2020). *When the world stops—What to know and do about global pandemic—Gao ZhiXiao, 32, a delivery driver who has continued working as the virus spread across China*.

Van de Walle, B. A., & Turoff, M. (2007). Emergency response information systems: Emerging trends and technologies. *Communications of the ACM, 50*(3), 29–31.

Westbrook, L. (2009). Crisis information concerns: Information needs of domestic violence survivors. *Information Processing & Management, 45*(1), 98–114.

Wilson, T. (1999). Exploring models of information behavior: The uncertainty' project. *Information Processing & Management, 35*(6), 839–849.

Wilson, T. D. (2000). Human information behavior. *Informing science, 3*(2), 49–56.

Wilson, T. D. (2010). Fifty years of information behavior research. *Bulletin of the American Society for Information Science and Technology, 36*(3), 27–34.

World Health Organization (2009). *Cities and public health crises: Report of the international consultation, 29-30 October 2008, Lyon, France (No. WHO/HSE/IHR/LYON/2009.5)*. World Health Organization.

Xie, B., He, D., Mercer, T., Wang, Y., Wu, D., Fleischmann, K. R., et al. (2020). Global health crises are also information crises: A call to action. *Journal of the Association for Information Science and Technology*.

Yang, T. K., & Hsieh, M. H. (2013). Case analysis of capability deployment in crisis prevention and response. *International Journal of Information Systems. 33*(2), 408–412.

Yin, R. K. (2009). *Case study research: Design and methods.* Thousand Oaks: Sage Publications.

Zhao, D. T., Wang, F., Wei, J. C., & Liang, L. (2013). Public reaction to information release for crisis discourse by organization: Integration of online comments. *International Journal of Information Systems. 33*(2), 485–495.