

Intelligence Information Intervention in Emergency Management of Emergencies: The Case of the “7.20 Zhengzhou Rainstorm”

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Abstract

Public emergencies can be divided into four categories: natural disasters, accidents and disasters, public health and social security. This paper discusses government countermeasures and measures in natural disaster emergency management, public health emergency management and information intervention management, and summarises and analyses them. In July 2021, a significant rainstorm and flooding disaster occurred in Zhengzhou, causing substantial damage to the area and attracting national attention. However, the development of emergency management and intelligence intervention in emergencies has gradually become chaotic, with problems such as “slow updates”, “one-sided reporting” and “low quality”; this has put massive pressure on the handling of intelligence information and online public opinion. Therefore, it is of great theoretical value and practical significance to explore the management of information interventions in emergency management of emergencies.

Taking the “Zhengzhou 7.20” incident as the object of study, this paper uses literature analysis and case study methods to explore the shortcomings of the Zhengzhou municipal government in emergency management and information intervention, as well as the serious social losses and negative social impacts caused by the incident. The paper uses crisis theory, life cycle theory, coordination theory and membrane technology to analyse the emergency management and information intervention in this emergency. In response to the problems encountered in the Zhengzhou incident and the reasons for the shortcomings of information intervention in emergency management, corresponding suggestions and countermeasures for improvement are put forward. Moreover, suggestions and model diagrams are given on how to build a perfect information system, hoping to provide some reference values for better-solving emergency events in the future.

Keywords: emergencies, emergency management, intelligence information intervention, natural disasters, public health

1. Introduction

Outbreaks hit society hard. Since the 21st century, public health emergencies such as the SARS virus, Influenza A (H1N1) and MERS virus have been frequent worldwide. The outbreak of the new crown epidemic has dealt a severe blow to societies and economies around the world. China is a disaster-prone country, including public health events and natural disasters. The impact and damage caused by these emergencies in some parts of China are also immeasurable, posing a severe threat to the safety of people’s lives and property. Examples include natural disasters such as the Tangshan earthquake in Hebei Province, the Wenchuan earthquake in Sichuan Province and the heavy rainfall in Zhengzhou, Henan Province. Against the background of these events, China’s emergency management and intelligence and information intervention efforts are still facing enormous challenges (Zhang, 2012). In response, China has increased its focus on emergency management and has gradually established and developed a local emergency management system and intelligence information intervention system for emergencies.

Emergency management of emergencies is very complex and involves a wide range of issues. Many Chinese scholars have conducted specific research and discussions on this issue, including laws and regulations, coordination mechanisms, plan implementation, relevant institutions, scientific and technological support and network prevention, and have achieved the achievement of the results of further research, making a tremendous contribution to the establishment and improvement of emergency management and intelligence and information intervention for emergencies in line with China's national conditions (Lu et al., 2019). However, due to China's late start in establishing an emergency management system, awareness of prevention in this area is weak and adequate precautions are not taken before many natural disaster events occur to prevent significant social impacts caused by emergencies in a timely and effective manner (Chen et al., 2022). The emergency handling of the "Zhengzhou 7.20" incident was both a natural disaster emergency and a public health emergency, revealing the shortcomings of these two aspects of emergency response and demonstrating that one incident is often multiple by nature and should be studied from many aspects and analysed. The local government and people did not pay enough attention to this before the incident. At the same time, there is a lack of coordination mechanisms for social participation, an absence of government coordination mechanisms when emergencies strike, and a lack of rational staff leadership and arrangements at critical times (Li et al., 2022). Also, China's intelligence information intervention mechanism is not well developed, and there is a lack of clarity among all relevant departments regarding the techniques of intelligence information intervention. A complete intelligence information system has not been established, and information is incomplete, uncoordinated, untimely and unscientific. Finally, people lack the relevant knowledge to make efficient precautions against emergencies. The authorities have also not conducted a proper professional assessment of personnel, the degree of specialisation of those engaged in the relevant work is low, there is a lack of detailed analysis and use of intelligence information, and intelligence information intervention is not effectively done. By contrast, globally, many countries have established emergency management systems earlier (Cao et al., 2020). For example, the United States set up a system related to emergency management in 1979 (Sylves, 2019) and one of the most natural disaster-prone countries in the world, Japan, also has a relatively complete emergency management system (Nazarov, 2011). In addition, countries such as Australia and Canada have also established corresponding systems.

Intelligence intervention in emergency management involves a comprehensive knowledge of public health, public administration, decision-making, administration, emergency response and Intelligence, and requires the collaboration of multiple parties to complete a management activity (Bullock et al., 2017). Intelligence information intervention in emergency management, supported by big data, consists of intelligence collection, intelligence processing, intelligence organisation, intelligence analysis and evaluation to provide intelligence support for emergency monitoring, risk assessment, handling and post-event rescue (Bragazzi et al., 2020). This article analyses the problems and causes of the Zhengzhou incident and constructs a model diagram of the intelligence system for the weaknesses of the intelligence intervention system in emergency management in China. The model follows the path of "analysis and evaluation - disposal and action - monitoring and summary - analysis and evaluation again", clearly illustrating how to build a complete intelligence intervention system and how to use technology to deal with the impact of emergencies and minimise harm in the event of emergency management.

This paper analyses the practical process, measures taken and effects of intelligence intervention in emergency management in Zhengzhou, summarises the experience, identifies problems and makes proposals to provide theoretical and practical support for the intervention of intelligence information in emergency management in future emergencies.

2. Theory Application Based on Literature Review

This chapter examines the literature and theoretical applications of emergency management and intelligence information intervention in emergency incidents, providing an in-depth analysis and discussion of the "Zhengzhou 7.20" incident and laying the foundation for a model of intelligence information intervention.

2.1 Emergency Management of Emergencies

The theory of emergency management of emergencies is derived from the crisis management theory (Farazmand, 2014). The American expert Steven Fink develops a comprehensive summary and overview of crisis management by defining it. His PPRR model—Pre-crisis Prevention, Pre-crisis Preparation, Crisis Outbreak Response, and Crisis End Response (Xue et al., 2022)—was the first model of crisis management to be popularized. The new 4R model-Reduction, Readiness, Response and Recovery (Becken et al., 2013) is a valuable guide to building an emergency management system for public health emergencies.

After an emergency incident has occurred, managers have to apply scientific and efficient measures to respond to the emergency (David et al., 2013). Emergency management should fall under the heading of risk management, and responding to and addressing risk is the main issue to be addressed in emergency management (Haffajee et al., 2014). Effective communication between the government and the public is an important influencing factor in

emergency management, and decision-makers should establish good communication with the community and the public to gain broad public support and participation after an outbreak (Comfort, 2007).

As time continues to evolve, life cycle theory is increasingly used in dealing with emergencies in the natural world and can provide vital theoretical guidance for emergencies (Han et al., 2012). In an emergency, the three phases are pre-breakout (emergency warning), mid-breakout (emergency response) and post-breakout (emergency recovery), which correspond to the stages of life cycle theory: formation, growth and maturity, and decline. This theory can guide the government's decision-making in emergency management of specific emergencies so that a scientific and rational approach can be taken to deal with different events.

In addition, synergy theory can also be applied to the emergency management of emergency events. Synergy theory emphasises that open systems are composed of several different kinds of subsystems and that when the equilibrium of an opened system is disturbed, energy is exchanged between the subsystems and between the subsystems and the outside of the system. On this basis, the previous disequilibrium is altered through synergy within and outside the system, and a synergistic effect is created as a result. The synergy theory can be applied to emergency management of public health emergencies, where government departments are equivalent to the subsystems within the system in the synergy theory, and societal forces such as businesses, media and communities are equal to the subsystems outside the system, working together to respond to public health emergencies (Dou et al., 2012).

2.2 Intelligence Information Intervention Management

The current literature on intelligence interventions in emergencies is not extensive and the relevant practical content is limited. Herbert Simon proposed a decision theory in the 1930s and 1940s that divided the decision-making process into four stages: intelligence, design, selection and implementation (Campitelli et al., 2010). Intelligence is critical to decision-making in an incident, and there are three stages in an emergency: before, when, and after. Intelligence is essential to decision-making in an emergency event before and after an event where intelligence information is monitored to assess the risks that exist and may exist, develop corresponding decisions and implement them (Luo et al., 2020). The ability to intervene with intelligence information is an indication of the importance of emergency management capabilities, the accuracy of intelligence information in emergencies has a significant relationship with the science of emergency decision-making, and it is necessary to conduct scientific analysis of intelligence systems for critical emergencies (Zhu et al., 2022). In addition, some scholars believe that the application of information technology in improving diagnostic accuracy, early detection, ensuring the safety of health care providers, reducing workload, saving time and costs, and drug discovery can reduce the loss of society in emergency management and that the government should provide financial support to facilitate the construction of information technology (Ahrens et al., 2006).

Based on the 'hexagonal elasticity theory', a hexagonal social equilibrium diagram can be formed from six equilateral triangles. As illustrated in Figure 1, this diagram shows the various elements of society, each of which is closely linked and inseparable. In an emergency, the presence of the government, the media and the relevant departments are equivalent to the various subsystems existing in this hexagon, and failure on the part of one of them may cause more severe harm. Therefore, when an emergency comes, each party must do its job and cooperate to ensure that the tasks are carried out in an orderly manner to the greatest extent possible.

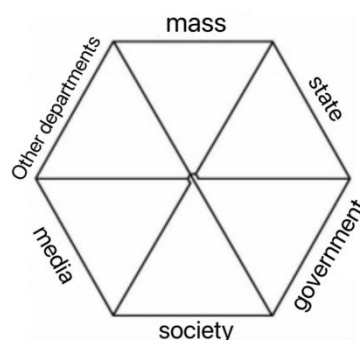


Figure 1. Hexagonal social equilibrium diagram

Humanity is constantly transforming society through economic and technological developments in the world, and in the process, various risks emerge that will gradually dominate. The “membrane technology theory” has

also been used in the context of intelligence interventions in emergency management (Nunes et al., 2001). A new form of “social membrane” has emerged with modern technology, based on the development of science and technology and artificial intelligence, to create a complete, filtered membrane system for monitoring and warning about different social risks (Peter et al., 2009). In addition, the establishment of a complete membrane technology platform, which identifies data from social risk information that may cause or has caused social unrest, allows the social membrane to “instantly perceive” risk information, which provides a basis for filtering safety information and communicating danger information, enabling the development of intelligence and risk management strategies.

3. Problem Analysis

This chapter discusses the problems and causes of this incident in seven specific areas to provide an efficient reference for emergency management and intelligence information interventions in emergencies.

3.1 Unscientific Infrastructure Planning

Local demand for infrastructure is rising due to economic development and rising living standards, and the continued rise in income from tourism and services has indirectly boosted local investment in infrastructure development in subordinate areas. However, infrastructure development in urban areas is mainly biased towards cultural squares and traffic roads near tourist attractions, and some rural areas lack detailed construction plans for infrastructure development.

Zhengzhou’s infrastructure is still not appropriately addressed, and only a minority of the planned investment of over 50 billion in sponge city projects is related to the actual sponge city (Guo et al., 2023). In addition, the Zhengzhou 7.20 incident resulted in severe waterlogging on local roads, an ageing drainage system and low flood protection standards for urban rivers, which are incapable of combating urban flooding caused by heavy precipitation (Zhao et al., 2022).

3.2 Late Warning Information

The importance and development of crisis early warning is essential, as an accurate forecast can reduce the damage caused by natural hazards while minimising losses to society and people (Grasso and Singh, 2011). However, the history of crisis early warning in China is relatively short, the level of attention needs to be increased, and natural disaster early warning and monitoring technologies have not been efficiently promoted and applied. The lack of effective communication and coordination between local departments in their operations and the low level of sharing of resources, information and technology has led to a lack of unity of pace between departments when floods occur, exacerbating the negative impact of the disaster. Although specialised management departments such as the Flood Control and Drought Control Department have been established, the equipment and technology of the early warning agencies of these institutions are not advanced, especially for monitoring and warning of disasters caused by force majeure are weak, as well as paying less attention to some common natural disasters and neglecting research on the management of low occurrence natural disasters.

3.3 Deficient Coordination Mechanisms

After flooding, local governments set up county flood and drought control headquarters in emergency management bureaus. However, some township areas and relevant departments often set up flood control and emergency command structures according to their needs, typically in the form of ad hoc working groups. Although this is flexible and better able to respond to emergencies, it lacks authority and professionalism, and the lack of expertise and experience of some members can lead to mistakes, which makes it hard to promote subsequent disaster relief and emergency management work. Consequently, governments must anticipate possible outcomes and apply their knowledge and applications beforehand to manage emergencies well (Somers et al., 2009).

3.4 Weak Crisis Awareness in Society

In most cases, local people are the ones who are directly affected and threatened by floods. They can protect themselves during floods and even rescue others if they have a strong sense of social crisis, disaster preparedness and the ability to save themselves in the event of a disaster, which can minimise the loss of life and property caused by floods (Kitagawa, 2016).

Firstly, the government should focus on awareness and training for all groups on crisis awareness development. The Internet is rapidly developing as many disaster preparedness and evacuation campaigns are conducted through online operators, making it difficult for older people to learn relevant disaster self-rescue methods through the Internet. In addition, the government’s crisis prevention campaigns for students in local schools are only theoretical and lack practical experience, and more practice opportunities should be provided. Lastly, some government officials are not acting as good role models and should lead by example in disseminating knowledge. Therefore, the government should strengthen its crisis awareness, increase its efforts to publicise relevant social

crises and raise awareness of public risks and natural disasters among the population.

3.5 Lack of Logistical Mechanisms

The lack of the necessary human, material and financial support caused inefficiencies in rescue and relief efforts when the flooding occurred.

The first is the lack of training of professional staff. The government did not focus on training highly qualified and experienced rescue teams with extensive expertise, and the logistical support mechanism was weak (Lu, 2023). On the day of the incident, many people relied on the internet to call for help, which was not effectively addressed, with rescue teams arriving slowly, waiting up to an hour for rescue on Metro Line 5, and a very disorganised rescue effort that even resulted in a stampede (Zhao et al., 2022).

A second issue was the untimely support in terms of emergency supplies. Emergency supplies are stocked by the government quarterly every year. However, the number of emergency supplies available at the time was only the bare minimum, resulting in most supermarkets being emptied of supplies. Moreover, the water and electricity outages caused by the heavy rains caused severe hardship to many people who were stranded (Li et al., 2022).

The last is inadequate financial support. The necessary emergency earmarked funds given by the local finance bureau are low each year, the purchase and stocking of emergency supplies are prepared at a lower standard, and financial support may only be available for general emergencies. For major incidents, applications or reliance on donations can only be made on the instructions of the emergency command.

3.6 Inadequate Related Laws and Regulations

The Law of the People's Republic of China on Emergency Response is not yet well-developed in terms of intelligence work, which only mentions the need to strengthen cooperation between various departments concerning Intelligence, not refining the intelligence work and lacking some relevant laws, regulations, etc. (Zhe et al., 2016). Furthermore, many provincial and regional governments have not formulated systems and management methods linked to emergency management intelligence interventions, etc. Only in a few local normative documents are explicit provisions for reporting, channelling and collecting information on emergencies made. Nevertheless, some key elements are missing from these working methods. For example, there is no mention of the methodology and process of intelligence intervention in emergencies, the implementation of responsibilities and other statuses for a detailed description. As a result, there is limited information transfer between departments in natural disaster emergencies and lagging decisions in flood control commands.

3.7 Lack of Intelligence Awareness

Most intelligence participants and policymakers in China presently have very vague understandings of intelligence information, and their perceptions of intelligence work are limited to the presentation and publication of intelligence rather than paying much attention to the quality of information, which has led to problems such as low quality and poor timeliness of intelligence information. Especially in the modern context of excessive growth in the quantity of information, the stagnation of information quality is prominent (Qiu et al., 2018).

Policymakers play an influential role in emergency management by taking responsibility for events when emergencies strike and doing so promptly. Instead of making empirical mistakes, they must enhance information awareness, process and use intelligence in a timely and rational manner, and safeguard the scientific and accurate nature of intelligence and information work.

4. Model Building

4.1 Model for Intelligence Information Intervention

By sorting out the government, in this article, we have developed a 'governmental perspective on the pathway model of intelligence information intervention in emergency management', as demonstrated in Figure 2. The model follows the path of "analysis and evaluation - disposal and action - monitoring and summary - analysis and evaluation again", with "analysis and evaluation" as the beginning of the disposal process. It is the starting point for learning from the experience of the incident and developing policies that will be translated into concrete actions. In the event of actual changes, action measures need to be adjusted dynamically, and behaviour needs to be monitored to ensure that it is implemented effectively. Monitoring is also necessary to review the situation, comparing the information from the 'analysis and research' of the decision and the 'action' of the action to identify differences and shortcomings and to form a reference for future similar incidents. Meanwhile, supervision is also needed to review and synthesise the decision information from the 'analysis and evaluation' and the behavioural information from the 'disposal and action' to compare the differences, find out the shortcomings and form the experience to provide reference information for similar incidents in the future.

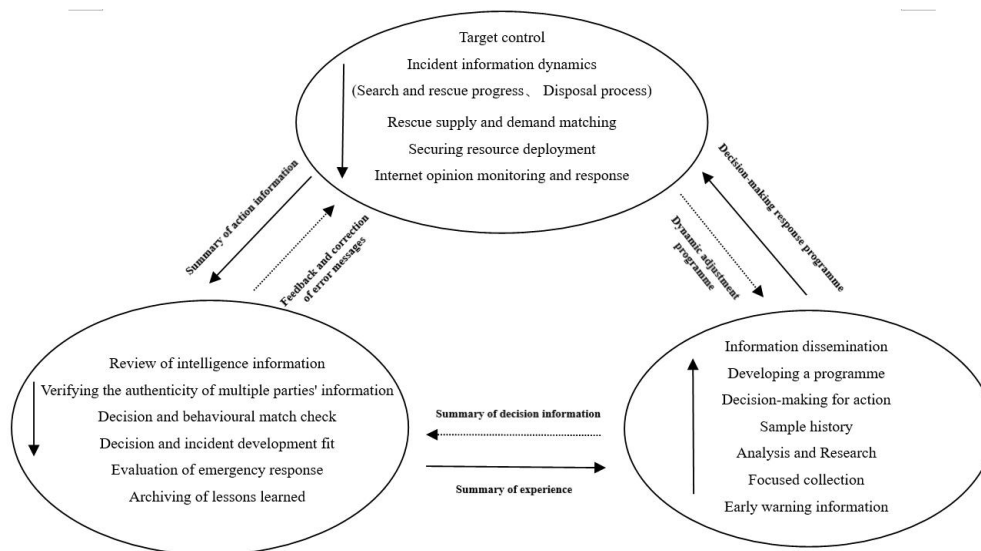


Figure 2. Government perspective on the pathway model of intelligence information involvement in emergency management

Through the model, the critical information steps required are sorted out. Combined with the gaps in intelligence intervention mentioned in the previous section, more needs to be done in terms of legal support, intelligence information awareness, the efficient connection between the three ends of the spectrum, intelligence information dissemination and big data information technology for information to flow smoothly in the model and be effective in aiding emergency management. These aspects are explored in detail in the following model support modules.

4.2 Model Support

The construction of a complete model of intelligence information intervention requires establishing model support, with specific measures developed in the following six detailed aspects to illustrate how to maximise the role of intelligence information intervention in emergency management of emergencies.

4.2.1 Improve Relevant Laws and Regulations

Improve laws and regulations to provide a legal basis for intelligence information intervention. Local emergency plans do not focus on updating, and intelligence work laws and regulations are not sound. Therefore, the emergency plan for emergency events should be revised promptly in line with the actual situation, the preparation of which should also comply with the relevant legal and regulatory requirements to ensure its legality. Moreover, emergency management of public emergencies is highly professional in that it is carried out jointly with the health and medical sector as the core and with the coordination of multiple departments. Emergency personnel should have a high reserve of professional knowledge, the preparation of emergency plans for public emergencies should be combined with the actual situation in the region, and emergency plans suitable for the local area should be developed (Chen et al., 2019). Finally, the regular evaluation of emergency plans for public emergencies should be strengthened to ensure the scientificity and feasibility of emergency plans.

4.2.2 Intelligence Information Education

Strengthen intelligence information education and awareness. Against the background of the global COVID-19 epidemic, countries should take stock of their shortcomings and strengthen the importance of intelligence and information interventions in emergency management (Khan et al., 2018). Zhengzhou should learn from this experience, clarify the information transfer process, strengthen monitoring and early warning, and adhere to the principle of “early detection, early reporting, and early disposal”. A sound reporting system for emergencies should be developed, and scientific and feasible solutions should be proposed to minimise losses. Moreover, an information-sharing mechanism should be established among all departments in the province to strengthen information exchange and data sharing among them.

Local authorities should strengthen the popularisation of science and education on emergency management of the emergency and raise the public’s awareness of the worries and the rule of law through the publicity of typical cases at home and abroad. At the same time, the government should promote prevention and control knowledge to community residents through various platforms and the media to enhance the public’s comprehensive quality in responding to public health emergencies together.

4.2.3 Establish Intelligence Mechanisms

Establish an intelligence information circulation mechanism for internal communication and external supervision by the government. To establish and improve the joint prevention and control mechanism between local departments, more communication should be strengthened between the departments concerned, and an external regulatory body should also be available to guide and supervise their work to ensure that intelligence information is correct and scientific to direct the smooth implementation of rescue and emergency response and other work. In addition, set up an intelligence team for emergencies to command emergency disposal work. Each department should define its role in the overall emergency intelligence intervention management, clarify its responsibilities and tasks, and be able to respond quickly by deploying professional staff to form an intelligence information intervention working group to work according to the established emergency plan and complete their respective tasks quickly and efficiently (Gao & Yu, 2020).

Social forces such as enterprises and community residents are also an element of joint prevention and control in emergency management, engaging the public in emergency response and giving full play to their strengths to enhance local emergency management and intelligence intervention management capabilities (Lanfranchi & Ireson, 2009).

4.2.4 Accelerate Intelligence Supply

Accelerate the system of supplying intelligence information to stakeholders such as the public and the media. In an emergency incident, the government's strengthening of the guidance and management of public opinion plays an incredibly vital role in emergency management (Zhu et al., 2022).

- The local government should strengthen the establishment of a sound information dissemination mechanism, which should make information about the incident open and transparent so that people can fully understand the nature of the incident and the degree of harm it may cause, and to a certain extent, build up a defence mentality for the public.
- In the face of an increasingly networked society, the media is a communication bridge between the government and the public. The government should fully utilize various network platforms and new media to make good publicity and guidance to the public, as the media is a bridge between the government and the public. At the same time, the government should strengthen internet control in online public opinion and enhance online information management to alleviate the trepidation caused by the incident to people.
- Relevant departments should pay attention to urgent news released online in real-time and respond to and deal with issues of public interest timely.
- Awareness of responsibility on the part of the media should be raised, and a strict regulatory mechanism should be implemented for the media sector. The media should be responsible for the information they release, and those responsible for publishing incorrect information should be immediately pursued and punished. By guiding and managing public opinion on the Internet, the government can improve its emergency management capacity for public health emergencies (Vigoda, 2002).

4.2.5 Advance Intelligence Reform

Promote the reform of the material reserve supply system of the intelligence system. In the aftermath of an emergency, material reserves directly affect the overall effectiveness of emergency management, which is why it is particularly important to strengthen the emergency material security system. Local governments should learn from the severe shortage of supplies in the flood disaster and set up dedicated health and medical supplies departments, draw up a resource reserve plan and stockpile sufficient medical supplies (WHO, 2007). Local governments should establish an information-sharing system to improve emergency management material deployment capabilities and ensure a dynamic balance of emergency supplies in the province. Funding should also be allocated for upgrading medical equipment in local hospitals according to their circumstances, and the stockpile inventory should be regularly evaluated and updated to strengthen dynamic management.

4.2.6 Build the Intelligence Information Platform

Use big data and modern network infrastructure to build an intelligent information management platform. Local governments and departments should establish transparent and accurate information-sharing mechanisms and information-sharing platforms, making full use of network big data, 5G communication and other technologies to achieve resource-sharing and smooth interaction. Each department should be the first to release relevant information and share information according to their work (Munawar et al., 2020). Most importantly, routine drills for emergency management of public health emergencies and natural disasters should be strengthened to enhance the collaboration between different departments and to accumulate valuable experience, identify shortcomings and improve them in practice to enhance efficiency in the face of public emergencies (Li et al.,

2022).

5. Conclusion

Zhengzhou's handling of this flooding event has been remarkably effective, containing the flooding event across the province to a certain extent, minimising the damage caused by the flooding event and providing experience and lessons for public emergencies in China. However, many aspects still need to be improved, such as the preparation of emergency plans, inter-departmental joint prevention and control, strategic stockpiling of medical supplies and management of online public opinion. The provincial government needs to improve the local emergency management system and intelligence information system for public emergencies according to the relevant national policies and regulations and boost its capacity to address emergency response to public emergencies.

By examining multiple theories such as the crisis management theory, synergy theory and life cycle theory, this paper summarises the experiences that Zhengzhou should learn from when facing emergencies on this occasion, drawing on the emergency management experiences of countries around the world and combining them with the practice of flooding events in Zhengzhou. Hopefully, this will effectively raise the capacity of local emergency management and intelligence information intervening, and provide a valid reference for the government, alerting all departments to do their jobs well, strengthening the establishment of emergency management and intelligence structure, and allowing governments at all levels to take timely and effective measures to respond to subsequent emergencies and maximise the reduction of losses caused by emergencies.

As this article is mainly an analytical study of existing literature and policies and regulations issued by the government, the investigation of front-line work is not deep enough, so many deficiencies still exist. Moreover, as the geographical location, management style and population distribution of different regions differ, the emergency response methods for emergencies vary. The suggestions provided in this paper are for reference only that may not be suitable for all types of emergencies and should be individually analysed on a case-by-case basis to establish a sound emergency management and intelligence information management system.

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