

# Exploration and Practical Research on the Construction Model of the Emergency Care System Based on the Concept of “Linkage”

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**Abstract:** Against the backdrop of continuous social development and growing public health demands, the efficiency and scientific nature of the emergency care system are of paramount importance. This paper focuses on researching the construction of an emergency care system based on the concept of “linkage”, delving into its theoretical foundations, exploring innovative construction models, and analyzing practical cases. The study indicates that an emergency care system under the “linkage” concept can effectively integrate resources and enhance efficiency, providing new insights for improving the construction of the emergency care system. It aims to promote the development of the emergency care system towards a more scientific, efficient, and collaborative direction.

**Keywords:** Linkage concept; Emergency care system; Construction model; Practical cases

**Online publication:** Feb 10, 2026

## 1. Introduction

The emergency rescue system serves as a critical line of defense in safeguarding public life and health, with its operational efficiency and treatment capabilities directly influencing the survival chances and recovery outcomes of patients in critical situations <sup>[1]</sup>. As society progresses and emergencies diversify, the traditional emergency rescue system has gradually revealed numerous issues when dealing with complex scenarios, such as poor information dissemination, irrational resource allocation, and weak coordination among various stages. The introduction of the “linkage” concept provides a new direction for optimizing and upgrading the emergency rescue system. By fostering close collaboration and resource sharing among multiple departments and entities, barriers within the traditional emergency rescue system can be broken down, enabling seamless integration of emergency procedures and significantly enhancing the overall effectiveness of the emergency rescue system, which is of great significance in meeting the growing demand for social emergency rescue.

## **2. Theoretical basis**

### **2.1. The concept of “linkage”**

“Linkage” refers to a close collaborative working mechanism formed among multiple entities or departments through information sharing, resource integration, and coordinated actions to achieve common goals <sup>[2]</sup>. In the field of emergency rescue, “linkage” encompasses various entities such as emergency command centers, medical institutions, fire departments, public security departments, and transportation departments. During the emergency rescue process, each entity, under unified command and dispatch, fully leverages its professional strengths to jointly accomplish emergency rescue tasks. For example, in the rescue operations for major traffic accidents, the public security department is responsible for maintaining on-site order and directing traffic, the fire department is in charge of demolition and rescue operations, and the medical department takes care of treating the injured. Through an efficient linkage mechanism among these departments, the rescue work can proceed in an orderly manner. This linkage mechanism can prevent the duplication of resource allocation and the mutual shirking of responsibilities, thereby improving emergency response efficiency and securing precious treatment time for patients <sup>[3]</sup>.

### **2.2. Theories related to emergency medical systems**

The emergency medical system is a complex system that encompasses multiple elements, including the layout of emergency medical stations, the allocation of emergency medical personnel, the provision of emergency medical equipment and supplies, the transmission of emergency medical information, and the standardization of emergency medical procedures. The time window theory emphasizes that during the emergency medical process, there exists an optimal time interval from the onset of a patient’s condition to the receipt of effective treatment. For instance, the golden treatment window for patients with acute myocardial infarction is within 120 minutes after onset. Timely and effective treatment within this time window can significantly improve the patient’s survival rate and quality of recovery, as demonstrated in the research conducted by Xia Weichao and others <sup>[4]</sup>. The tiered treatment theory categorizes the rescue process into different levels based on the severity and urgency of the patient’s condition, ranging from on-site emergency care, treatment during transportation, to specialized care within hospitals. Each level has corresponding treatment measures and responsible entities to ensure that patients receive reasonable and orderly treatment. These theories provide a scientific basis for the construction and operation of emergency medical systems <sup>[5]</sup>.

### **2.3. Overview of emergency medical service systems at home and abroad**

In foreign countries, many developed nations have established relatively comprehensive emergency medical service systems. Taking the United States as an example, its emergency medical service system relies on advanced information technology to achieve real-time information sharing among emergency command centers, medical institutions, and emergency stations. Emergency responders undergo rigorous professional training and possess extensive emergency experience and skills. Meanwhile, the U.S. emergency medical service system emphasizes the cultivation of community emergency response capabilities by conducting community emergency training to enhance the public’s self-rescue and mutual-rescue abilities. Furthermore, the implementation of e-emergency medical services in the north-central region of the United States has greatly promoted the development of telemedicine services <sup>[6,7]</sup>. Germany’s emergency medical service system, on the other hand, is renowned for its efficient air rescue operations. Helicopter rescues can swiftly reach accident scenes in emergencies, providing timely medical assistance to patients <sup>[8]</sup>. Domestically, after years of development, the emergency medical service

system has achieved remarkable results. Currently, most cities in China have established an emergency network centered around the 120 emergency command center, covering all areas of the cities. However, compared with developed countries, China's emergency medical service system still has certain gaps in terms of resource allocation, information technology construction, and personnel quality. For instance, the layout of emergency stations in some regions is unreasonable, leading to longer emergency response times; there is a shortage of emergency responders, and their professional levels vary; and the emergency information system still has deficiencies in data sharing and collaborative work<sup>[9]</sup>.

### **3. Exploration of the construction model for an emergency medical system based on the concept of “linkage”**

#### **3.1. Overall architecture design**

The overall architecture of the emergency medical system based on the concept of “linkage” centers around a unified command and dispatch center, connecting various stages such as pre-hospital emergency care, in-hospital treatment, and rehabilitation. The command and dispatch center, functioning as the brain of the entire emergency medical system, is responsible for receiving emergency information, allocating emergency resources, and coordinating work among various departments<sup>[10]</sup>. The pre-hospital emergency care stage involves emergency stations, emergency vehicles, and emergency personnel, who are responsible for providing initial treatment and transporting patients from accident scenes. The in-hospital treatment stage is composed of medical institutions at various levels, which provide professional medical treatment based on patients' conditions<sup>[11]</sup>. The rehabilitation stage offers rehabilitation therapy and guidance to patients, helping them restore their physical functions. Within this architecture, real-time information transmission and sharing among different stages are achieved through an information-sharing platform, ensuring the continuity and efficiency of emergency medical work. For instance, when emergency personnel provide treatment to patients at the scene, they can transmit real-time information such as patients' conditions and vital signs to in-hospital treatment personnel via the information-sharing platform, enabling in-hospital personnel to prepare for treatment in advance and secure more treatment time for patients.

#### **3.2. Linkage mechanism among various links of the emergency medical service system**

##### **3.2.1. Unified dispatch and coordination by the dispatch and command center**

The dispatch and command center plays a pivotal role in coordinating and orchestrating the emergency medical service system. Upon receiving an emergency call, dispatchers swiftly locate the patient's position using the Geographic Information System (GIS) and reasonably allocate emergency vehicles and personnel based on the distribution of surrounding emergency medical resources<sup>[12]</sup>. Meanwhile, dispatchers maintain close communication with on-site emergency responders and medical institutions, promptly grasping rescue progress and changes in the patient's condition, and coordinating resources from all parties to ensure the smooth progress of rescue operations. In response to large-scale emergencies, the dispatch and command center can swiftly integrate forces from various sources, formulate scientific and reasonable rescue plans, and achieve optimal resource allocation<sup>[13]</sup>.

##### **3.2.2. Close collaboration between pre-hospital emergency care and in-hospital treatment**

Close collaboration between pre-hospital emergency care and in-hospital treatment is crucial for improving the

success rate of emergency medical services. After providing initial treatment to patients at the scene, pre-hospital emergency responders promptly transmit information such as the patient's condition, vital signs, and examination results to in-hospital treatment personnel through an information-sharing platform. Based on this information, in-hospital treatment personnel prepare for surgeries in advance and allocate medical resources accordingly. When patients arrive at the hospital, they can swiftly enter the treatment process, achieving seamless integration. This close collaboration effectively shortens the treatment time for patients and enhances treatment outcomes <sup>[14,15]</sup>.

### **3.2.3. Follow-up and support in the rehabilitation phase**

The rehabilitation phase is a crucial component of the emergency care system, playing a significant role in the recovery of patients and the improvement of their quality of life. After patients have completed in-hospital treatment, rehabilitation institutions promptly intervene in their rehabilitation therapy through collaboration with medical institutions. Medical institutions provide feedback on patients' conditions and treatment progress to rehabilitation institutions, which then develop personalized rehabilitation plans based on the specific circumstances of each patient. These plans offer services such as rehabilitation training and psychological counseling. Through follow-up and support in the rehabilitation phase, patients can be assisted in restoring their physical functions as quickly as possible and returning to normal life <sup>[16]</sup>.

## **3.3. Innovation and characteristics of the construction model for the emergency care system**

### **3.3.1. Multidisciplinary integration and functional reorganization**

The emergency care system based on the concept of "interconnection" breaks down traditional disciplinary boundaries, achieving multidisciplinary integration and functional reorganization. The emergency care process involves multiple disciplines, including medicine, information technology, transportation, and psychology. Through multidisciplinary collaboration, the advantages of each discipline are integrated to provide comprehensive emergency care services for patients. In the construction of emergency care information systems, IT professionals collaborate with medical experts to develop information platforms that meet the needs of emergency care, enabling rapid transmission and sharing of emergency care information. In terms of psychological intervention for patients, psychology experts work with healthcare professionals to provide psychological support and counseling, helping patients overcome psychological barriers <sup>[17]</sup>.

### **3.3.2. Flexible design for emergency reservation and transition between normal and emergency situations**

Taking into account the uncertainty of emergencies and the special needs of emergency rescue, the construction model of the emergency medical system adopts a flexible design that incorporates emergency reservation and the transition between normal and emergency situations. During normal times, emergency medical resources are allocated and operated according to routine requirements; when an emergency occurs, reserved emergency resources can be rapidly activated to facilitate the transition from normal to emergency operations. In hospital construction, a certain proportion of emergency wards and medical equipment are reserved, enabling these resources to be quickly put into use during public health emergencies. Meanwhile, comprehensive plans for transitioning between normal and emergency situations are developed, clearly defining the responsibilities and workflows of each department under emergency conditions to ensure the efficient operation of the emergency

medical system in different states <sup>[18]</sup>.

### **3.3.3. Efficient coordination of command, dispatch, and logistical support**

Efficient coordination of command, dispatch, and logistical support is crucial for the smooth operation of the emergency medical system. The command and dispatch center is not only responsible for scheduling emergency medical resources but also for coordinating logistical support. In the event of an emergency, the command and dispatch center can swiftly organize procurement, transportation, and storage of supplies to ensure the timely provision of emergency medical materials. Simultaneously, it coordinates with transportation departments to guarantee the rapid passage of emergency vehicles and with power and communication departments to ensure uninterrupted power and communication for emergency medical work. Through efficient coordination, a solid foundation is provided for the smooth implementation of emergency medical efforts <sup>[19]</sup>.

## **4. Practical cases**

### **4.1. The 120 emergency medical service system construction project in the “Greater Sanya” area of Hainan**

Guided by the concept of “linkage”, the 120 Emergency Medical Service System Construction Project in the “Greater Sanya” area of Hainan has established an integrated emergency medical service system. This project has integrated emergency medical resources from regions such as Sanya, Lingshui, Baoting, and Ledong, establishing a unified command and dispatch center. Through information technology construction, real-time sharing and unified dispatching of emergency medical information have been achieved. In terms of pre-hospital emergency care, the layout of emergency stations has been optimized, equipped with advanced emergency medical equipment and professional emergency medical personnel. Simultaneously, coordination with medical institutions has been strengthened, establishing green channels to ensure timely and effective treatment for patients. In the rehabilitation phase, cooperation with rehabilitation institutions has been established to provide rehabilitation services for patients. After the implementation of this project, emergency response times have been significantly shortened, and the success rate of emergency care has notably increased <sup>[20]</sup>.

### **4.2. Phase II of Jinjiang campus of west China hospital, Sichuan University (National emergency medical rescue base project)**

The Phase II of Jinjiang Campus of West China Hospital, Sichuan University (National Emergency Medical Rescue Base Project) fully embodies the concept of “linkage” during its construction. This project has established an emergency medical service system that integrates functions such as command and dispatch, medical treatment, emergency training, and material reserves. In terms of command and dispatch, an intelligent command center has been established to achieve real-time monitoring and dispatch of emergency medical resources. In terms of medical treatment, we have integrated the superior disciplinary resources of hospitals and formed multidisciplinary emergency rescue teams capable of providing comprehensive medical care to patients. Meanwhile, we have strengthened collaboration with surrounding medical institutions, fire departments, public security, and other departments, establishing a coordinated rescue mechanism. In terms of emergency training, we have conducted training programs tailored to different groups, such as emergency responders and community residents, enhancing public awareness and skills in emergency response. Regarding material reserves, a comprehensive material

reserve system has been established to ensure the timely supply of emergency medical supplies in the event of an emergency. The completion of this project has enhanced emergency rescue capabilities within the region and played a crucial role in safeguarding the lives and health of the people<sup>[21]</sup>.

## 5. Conclusion

The emergency medical system construction model based on the concept of “linkage” demonstrates significant advantages in improving emergency response efficiency and treatment outcomes by integrating resources from multiple aspects and optimizing collaborative mechanisms across various stages. However, in the process of promoting and applying this model, challenges such as inconsistent standards for information sharing and difficulties in resource integration in some regions remain. In the future, it is necessary to further strengthen standardization efforts, enhance collaboration among regions and departments, and continuously improve the emergency medical system based on the concept of “linkage” to better meet increasingly complex and diverse emergency needs and provide a more solid and reliable guarantee for the lives and health of the public.

## Disclosure statement

The author declares no conflict of interest.

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