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Research on the Upgrading Path of Pre-Hospital Emergency Medical Services from the Perspective of Healthy China 2030

Yaxiong Liu

Department of Management, Taiyuan University, Taiyuan 030032, Shanxi, China

Abstract: Under the strategic background of Healthy China 2030, this paper conducts a systematic study on the policy-driven upgrading path of pre-hospital emergency medical services. Combined with practical cases of pre-hospital emergency services in various regions, this paper sorts out the core concepts of pre-hospital emergency services and the key policy points of Healthy China 2030. It deeply discusses the mechanism of policies on the allocation of pre-hospital emergency resources and the improvement of service quality, and reveals the internal logic of policy-driven development of pre-hospital emergency services. A policy-oriented framework for the upgrading of pre-hospital emergency services is proposed, which specifically covers three dimensions: resource integration and sharing, information system construction, and talent training and team building. Finally, the study puts forward targeted countermeasures to improve the policy system related to pre-hospital first aid, and defines the optimization direction of future research, so as to provide referable theoretical basis and practical guidance for the upgrading of pre-hospital emergency services under the background of Healthy China construction.

Keywords: Healthy China 2030; Pre-hospital emergency medical services; Policy-driven; Resource allocation; Service quality

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1. Introduction

With the further implementation of the Healthy China 2030 strategy, pre-hospital emergency medical services, as the frontline of medical care and emergency rescue, are closely related to people's life and health. The Healthy China 2030 Plan Outline calls for improving the pre-hospital emergency system, ushering in policy-supported high-quality development for this sector. China's pre-hospital emergency services now face both opportunities and challenges. Accelerated urbanization, aging population and frequent public health emergencies raise higher demands for emergency capabilities, while emerging technologies like 5G, AI and IoT fuel its digital upgrading. It is urgent to solve problems such as unbalanced resource distribution, slow response and uneven service quality, and build a modern pre-hospital emergency system in line with

national policies. Based on the Healthy China 2030 strategy and policy orientation, this paper explores ways to optimize pre-hospital emergency services. By sorting out policies and practical experiences, it establishes an upgrading system involving resources, information, talents and policies, offering theoretical and practical support for its standardized, intelligent and coordinated development.

2. Core connotation of pre-hospital first aid from the perspective of healthy China 2030

The *Healthy China 2030 Planning Outline* clearly includes the construction of pre-hospital emergency service system into the national strategy, proposing to build a city and countryside-covered emergency network by 2030. In terms of emergency resource allocation, it requires one ambulance per 50,000 people, with priority on the construction of emergency stations in rural and remote areas [1]. In terms of service capacity building, it emphasizes the establishment of a unified dispatch and command system to achieve the goal of emergency response time of 10 minutes in urban areas and 15 minutes in rural areas. In terms of information construction, it promotes the application of 5G, Internet of Things and other technologies in the emergency field to build an intelligent first-aid platform. In terms of emergency personnel training, it requires no less than 20 emergency physicians per 100,000 people by 2025, and improves the professional level of practitioners through continuing education [2].

Pre-hospital first aid refers to the emergency medical treatment for critically ill patients outside medical institutions, whose core characteristics include three key links: rapid response, on-site treatment and transfer monitoring. The pre-hospital emergency system is a networked service system composed of emergency communication command centers, emergency stations and transport tools, aiming to provide professional medical intervention within the "golden hour" for patients with sudden diseases or accidental injuries. From the perspective of operation process, pre-hospital first aid covers standardized procedures such as alarm dispatch, on-site assessment, basic life support, trauma treatment, drug intervention and medical monitoring [3,4].

China's *Administrative Measures for Pre-Hospital Medical First Aid* clearly stipulates that pre-hospital emergency services shall follow the transfer principle of "nearest, urgent, professional needs and patients' willingness" [5]. Modern pre-hospital first aid has evolved from simple transfer services to a comprehensive treatment system including telemedicine guidance, mobile ICU monitoring and other advanced life support technologies. With the application of 5G technology and intelligent equipment, pre-hospital first aid is gradually realizing real-time data transmission and remote consultation of "treatment upon admission". This seamless connection mode between pre-hospital and in-hospital has significantly improved the success rate of first aid.

As an important part of the medical emergency system, the definition of pre-hospital first aid includes three key dimensions, as shown in **Table 1**.

Table 1. Analysis of core elements in the definition of pre-hospital first aid

Key links of pre-hospital first aid	Core characteristics	Operation points	Technical support
Rapid response	High timeliness	Optimized alarm dispatch	5G communication technology
On-site treatment	Professional medical intervention	Basic life support	Intelligent medical equipment
Transfer monitoring	Seamless connection	Continuous medical monitoring	Mobile ICU equipment

In terms of rapid response, the timeliness requirement meets the "golden hour" standard, relying on 5G communication technology to optimize alarm dispatch. The on-site treatment link emphasizes professional medical intervention, including standardized procedures such as basic life support and trauma treatment, equipped with intelligent medical equipment to improve treatment effect. The transfer monitoring link focuses on seamless connection between pre-hospital and in-hospital, realizing continuous medical monitoring through mobile ICU equipment, and finally forming a first-aid mode of "treatment upon admission". These elements together constitute the complete definition framework of modern pre-hospital emergency services.

In recent years, various regions have formed a variety of practical experiences with regional characteristics. For example, Shanghai has realized 3-kilometer coverage of emergency radius through the "emergency sub-station + ambulance team" mode, and the grid layout of emergency stations has shortened the average response time to less than 12 minutes. Shenzhen uses big data analysis to optimize the layout of emergency resources, and the "5G + intelligent first aid" system realizes real-time data sharing between ambulances and hospitals, reducing in-hospital preparation time by 40%. Nanning's "Emergency Volunteer Training Program" has trained 12,000 community first responders, significantly improving the bystander rescue rate. Shenyang Emergency Center has established an "emergency-first aid integration" mechanism, controlling the handover time of critically ill patients within 5 minutes. Practice shows that digital transformation, participation of social forces, optimal resource allocation and multi-department collaboration are the key elements to improve the efficiency of emergency services [6].

3. Impact of policy-driven on the upgrading of pre-hospital emergency services

Policy guidance plays a key role in improving the quality of pre-hospital emergency services. By formulating emergency response time standards, standardizing emergency operation procedures, and establishing a quality evaluation system, it provides a clear direction for improving service quality.

The *Healthy China 2030 Planning Outline* clearly requires that the average emergency response time should not exceed 15 minutes by 2030, which directly promotes local emergency centers to optimize dispatch processes and add emergency stations [7]. In terms of information construction, policies encourage the application of new technologies such as 5G and Internet of Things. For example, Shenzhen has built an intelligent first-aid system to realize real-time positioning of emergency vehicles and remote transmission of patients' vital signs, significantly improving emergency efficiency. In terms of quality supervision, many regions have established a performance appraisal mechanism for emergency services, incorporating indicators such as first-aid success rate and patient satisfaction into the appraisal system, forming a driving force for continuous improvement. In policy formulation, it is necessary to combine local reality, balance standardization and differentiation, ensure basic service quality, and encourage local innovation.

Human resource allocation is the core link of pre-hospital emergency service upgrading, showing a professional and standardized development trend driven by policies. According to the policy requirements of Healthy China 2030, local emergency centers have generally established a four-in-one professional team allocation mode of "emergency physician-nurse-driver-dispatcher", in which the ratio of emergency physicians to nurses reaches the standard configuration of 1:1.5.

Taking Shenzhen as an example, through the "Special Program for Pre-Hospital Emergency Personnel", 328 new emergency physicians were added in three years, an increase of 42% compared with before the

policy implementation. The application of digital dispatch system has significantly improved the efficiency of human resource utilization. For example, Shanghai Emergency Center has shortened the personnel response time to less than 90 seconds through the intelligent scheduling system. However, regional differences still exist, with the shortage of emergency personnel in the central and western regions reaching 23–35%, which prompts the policy formulation to particularly emphasize the establishment of talent assistance mechanisms and remote training systems between the east and west. It is worth noting that the application of 5G mobile emergency units is changing the traditional human resource allocation mode, realizing the mobile workstation configuration of "one physician with multiple nurses", expanding the service radius of a single emergency unit by 1.8 times.

4. Paths for upgrading pre-hospital emergency services

Guided by the Healthy China 2030 strategy, the upgrading of pre-hospital emergency services should build a four-dimensional collaborative development framework from policy guidance, resource integration to technological innovation and talent support. Fully implement the requirements of improving the emergency network in the *Healthy China 2030 Planning Outline*, and include emergency services in the key projects of regional health planning [8].

In terms of resource integration, establish a three-level network layout of "central station-sub-station-emergency point" to achieve full coverage of the 15-minute emergency circle. In terms of technological innovation, promote the application of 5G and Internet of Things technologies in emergency command systems. In terms of talent training, establish a trinity training system of theoretical training, simulation drills and actual combat assessment, focusing on improving the ability to deal with acute diseases such as myocardial infarction, stroke and trauma. Driven by both policy and technological innovation, the traditional first-aid mode will be transformed into an intelligent, standardized and coordinated modern emergency service system.

4.1. Continuously improve the resource integration and sharing mode

The core of resource integration and sharing is to break the information islands and resource barriers in traditional emergency services [9]. Through the establishment of a regional emergency resource collaboration platform, cross-institutional allocation and sharing of ambulances, medical equipment, professionals and other elements can be realized.

Taking Shenzhen's emergency information system as an example, the system integrates resources from 56 emergency network hospitals in the city, realizing real-time positioning of ambulances, sharing of patient information and visual query of hospital beds. In terms of human resource sharing, establish a rotation training mechanism for emergency doctors and emergency physicians to improve the comprehensive treatment ability of emergency personnel. In terms of equipment resource sharing, the distributed management mode of "center-station" can be adopted, setting up 3–5 emergency equipment sharing centers in the region, and realizing intelligent dispatch of key equipment such as AED and ventilators through Internet of Things technology. In terms of data sharing, it is necessary to build unified data standards and interface specifications to realize the interconnection of 120 dispatch systems, hospital information systems and public health platforms. This resource integration model can significantly improve the efficiency of emergency resource utilization.

4.2. Continuously improve the informatization level

Informatization construction is a key path to improve the efficiency and quality of pre-hospital emergency services. By building an intelligent first-aid system, further improve the real-time monitoring and dynamic allocation of emergency resources and improve the emergency response speed [10]. Establish a unified information management platform integrating GPS positioning, electronic medical records and remote consultation [11].

Through the establishment of pre-hospital emergency information system, the intelligent dispatch of ambulances, medical staff and medical equipment will be gradually realized, shortening the average response time [12]. The application of 5G technology has further promoted the development of mobile emergency hospitals, enabling emergency personnel to transmit patients' vital sign data in real time through high-definition video and obtain professional guidance from rear hospitals. At the same time, big data analysis technology can be used to optimize the layout of emergency stations, predict the peak of emergency demand according to historical call data, and realize accurate resource allocation. These information-based means not only improve the efficiency of first aid, but also provide a scientific decision-making basis for policy makers.

4.3. Continuously improve the professional quality of the emergency team

In the process of upgrading pre-hospital emergency services, personnel training and continuing education are the key links to improve the professional ability of the emergency team [13]. Emergency personnel need to receive standardized training courses including basic life support, advanced cardiovascular life support, trauma first aid, etc., with no less than 40 hours of training per year.

On the one hand, a combined mode of emergency training base and mobile training vehicle can be established, and a mixed training method of online theoretical assessment and offline practical drills can be adopted to achieve 100% coverage of skill training for emergency personnel [14]. On the other hand, in terms of continuing education, a systematic and standardized training system is an important way to effectively improve the professional quality and service ability of emergency personnel. Through the implementation of credit system management, emergency personnel are required to complete certain continuing education credits every quarter, covering new first-aid technologies, equipment operation and psychological intervention. A tutorial training system can also be established to select outstanding emergency personnel to participate in international certification training and cultivate a group of first-aid trainers with international standards.

4.4. Continuously improve the relevant policy system

Improving the policy system requires collaborative promotion from two levels: top-level design and local practice. In terms of top-level design, a policy framework with the *Healthy China 2030 Planning Outline* as the core should be established to further clarify the strategic positioning of pre-hospital emergency services in the public health system [15].

Specifically, it is necessary to formulate national unified pre-hospital emergency service standards, including key indicators such as emergency response time, equipment allocation standards and personnel qualification requirements. At the same time, a cross-departmental policy coordination mechanism should be established to integrate resources from health, finance, transportation and other departments to form policy synergy. At the local practice level, it is suggested to learn from the digital transformation experience of Shanghai, Shenzhen and other places, and include the application of new technologies such as 5G and

artificial intelligence into the scope of policy support. The policy system should also include a dynamic evaluation mechanism, regularly conduct third-party evaluation on the upgrading effect of pre-hospital emergency services in various regions, and take the evaluation results as an important basis for policy adjustment. In addition, it is necessary to improve the supporting financial security policies and set up special funds to support the renewal of emergency equipment and talent training. The design of the policy system should pay attention to differentiation, and formulate step-by-step promotion plans according to the development level of different regions to ensure the operability of the policy.

5. Conclusion

From the perspective of the Healthy China 2030 strategy, this paper comprehensively explores the improvement paths of pre-hospital emergency medical services driven by policies and draws the following core conclusions. First, policy guidance serves as the core driving force for the upgrading of pre-hospital emergency services. Policy goals set in the Healthy China 2030 Plan Outline concerning resource allocation standards, response time requirements and quality evaluation systems define the direction for its standardized development, which has been fully verified by practical experience in Shanghai, Shenzhen and other regions. Second, resource integration, information system construction and talent training are three key approaches to improve pre-hospital emergency services. Building a three-level emergency network to realize full coverage of the 15-minute emergency rescue circle, promoting in-depth application of 5G and IoT in emergency command systems, and establishing standardized regular training mechanisms for emergency staff can jointly elevate overall emergency service capacity. Third, a sound policy system is the fundamental guarantee for the sustainable development of pre-hospital emergency services. Joint efforts should be made in top-level design and local implementation to formulate unified national service standards, cross-departmental coordination mechanisms, dynamic evaluation systems and differentiated implementation strategies. In the future, with the steady advancement of the Healthy China 2030 strategy, China's pre-hospital emergency services will develop in an intelligent, standardized and coordinated manner. Widely applied digital technologies will shorten emergency response time, standardized systems will comprehensively improve service quality, and multi-party cooperation mechanisms will effectively solve resource shortages. The policies and optimization paths proposed in this study can provide references for local emergency system construction, and help build more efficient, equitable and accessible life-saving service channels.

Disclosure statement

The author declares no conflict of interest.

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